Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater

Volume 2: Background Documentation for the Development of Tier 1 Environmental Action Levels

Appendix 1: Detailed Lookup Tables

Hawai‘i Edition

Prepared by:

Hawai‘i Department of Health
Environmental Management Division
919 Ala Moana Blvd, Room 206
Honolulu, Hawai‘i 96814

Fall 2011
(revised January 2012 to correct TPH toxicity factors; see Chapter 6)

Contacts:
Roger Brewer
Hawai'i Department of Health
Environmental Management Division
Hazard Evaluation and Emergency Response
Telephone: 1-808-586-4249
E-mail: roger.brewer@doh.hawaii.gov
http://hawaii.gov/health/environmental/hazard/index.html

OR
Roxanne Kwan
Hawai'i Department of Health
Environmental Management Division
Solid and Hazard Waste Branch
Telephone: 1-808-586-4226
E-mail: roxanne.kwan@doh.hawaii.gov

DISCLAIMER

This document, *Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater* (Fall 2011), is a technical report prepared by staff of the Hawai'i Department of Health (HDOH), Environmental Management Division. The document updates and replaces the document *Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater* (Interim Final, March 2009 and interim updates).

The document provides guidance for identification and evaluation of environmental hazards associated with contaminated soil and groundwater. The Environmental Action Levels (EALs) 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 environmental risk 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 substances must be reported to the HDOH.

The information presented in this document is not final action. HDOH 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 areas associated with HDOH. HDOH may elect 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. Please send comments, edits, etc. in writing to the above contact. This document is not copyrighted. Copies may be freely made and distributed. It is cautioned, however, that reference to the action 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 ACTION LEVELS

APPENDICES

1 DEVELOPMENT OF TIER 1 LOOKUP TABLES

2 SUMMARY OF HUMAN HEALTH RISK-BASED EQUATIONS AND DEFAULT INPUT PARAMETER VALUES; USEPA REGIONAL SCREENING LEVELS USER'S GUIDE (JUNE 2011, TEXT ONLY)

3 RELEVANT PORTIONS OF *USER'S GUIDE FOR THE JOHNSON AND ETTINGER (1991) MODEL FOR SUBSURFACE VAPOR INTRUSION INTO BUILDINGS;* SENSITIVITY ANALYSIS OF *JOHNSON AND ETTINGER (1991) MODEL*

4 EXAMPLE PRINTOUTS OF INDOOR AIR IMPACT MODELS

5 DEVELOPMENT OF SOIL LEACHING SCREENING LEVELS

6 SUPPLEMENTAL REFERENCES FOR PETROLEUM

7 DETERMINATION OF GROUNDWATER UTILITY (SEPTEMBER 19, 1995)

8 SUPPLEMENTAL TECHNICAL GUIDANCE DOCUMENTS

9 UPDATES TO 2009 EHE GUIDANEC

GLOSSARY OF TERMS

AWQC: Aquatic Water Quality Criteria
CCC: Criterion for Continuous Concentration
CCM: Criterion for Maximum Concentration
EPA: Environmental Protection Agency
ESL: Environmental Screening Level
FVC: Final Chronic Value
HIDOH: Hawai'i Department of Health
HH: Human Health-consumption of aquatic organisms
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: Preliminary Remediation Goals
RBSL: Risk-Based Screening Level
RSL: Regional Screening Level
RWQCB: Regional Water Quality Control Board
TPH: Total Petroleum Hydrocarbons
USEPA: U.S. Environmental Protection Agency
USDOE: U.S. Department of Energy

APPENDIX 1

DEVELOPMENT OF TIER 1 LOOKUP TABLES

[Refer to Appendix 9 for summary of most recent updates]

APPENDIX 1
DEVELOPMENT OF TIER 1 LOOKUP TABLES

Table of Contents

1 DEVELOPMENT OF TIER 1 LOOKUP TABLES 1-6

1.1 INTRODUCTION 1-6
1.2 EXAMPLE SELECTION OF TIER 1 EALS FOR TETRACHLOROETHYLENE 1-8
1.3 TOXICITY FACTORS AND PHYSIOCHEMICAL CONSTANTS 1-9
1.4 CUMULATIVE RISK 1-10

2 BACKGROUND AND USE OF VAPOR INTRUSION MODELS 2-12

2.1 BACKGROUND 2-12
2.2 VAPOR INTRUSION MODEL PARAMETERS 2-13
2.2.1 Target Risks 2-13
2.2.2 Assumed Building Parameters 2-13
2.2.3 Assumed Vapor Flux 2-14
2.2.4 Assumed IA:SG Attenuation Factors 2-14

3 INDOOR AIR AND SOIL GAS ACTION LEVELS 3-17

3.1 INTRODUCTION 3-17
3.2 INDOOR AIR ACTION LEVELS 3-17
3.3 SOIL GAS ACTION LEVELS 3-18

4 SOIL ACTION LEVELS 4-21

4.1 INTRODUCTION – SELECTION OF TIER 1 SOIL EALS 4-21
4.2 SOIL ACTION LEVELS FOR DIRECT-EXPOSURE CONCERNS 4-22
4.2.1 Direct Exposure Models and Assumptions 4-22
4.2.2 Target Risks 4-23
4.2.3 Exposed or Potentially Exposed Soils 4-25
4.2.4 Isolated Soils 4-25
4.2.5 Soil Saturation Levels 4-26
4.3 SOIL ACTION LEVELS FOR POTENTIAL VAPOR INTRUSION CONCERNS 4-28
4.4 SOIL ACTION LEVELS FOR LEACHING HAZARDS 4-30
4.5 SOIL CEILING LEVELS FOR GROSS CONTAMINATION CONCERNS 4-33
4.6 SOIL ACTION LEVELS FOR TERRESTRIAL ECOTOXICTY 4-34

5 GROUNDWATER AND SURFACE WATER ACTION LEVELS 5-1

5.1 INTRODUCTION 5-1
5.2 ACTION LEVELS FOR DRINKING WATER (TOXICITY) 5-2
5.3 ACTION LEVELS FOR AQUATIC HABITAT PROTECTION 5-3
5.3.1 Basis of Action Levels 5-3
5.3.2 Surface Water Aquatic Habitat Goals 5-3
5.3.3 Groundwater Action levels for Aquatic Habitat Impacts 5-5
5.4 GROUNDWATER ACTION LEVELS FOR POTENTIAL VAPOR INTRUSION CONCERNS 5-6
5.4.1 Vapor Intrusion Model Parameters 5-6
5.4.2 Adjustment of Action levels 5-8
5.5 WATER CEILING LEVELS FOR GROSS CONTAMINATION CONCERNS 5-8
5.6 OTHER GROUNDWATER ACTION LEVELS 5-10

6 SOIL, SOIL GAS AND GROUNDWATER ACTION LEVELS FOR TPH 6-1

6.1 INTRODUCTION 6-1
6.2 TPH CARBON RANGE MAKEUP OF FUELS AND FUEL VAPORS 6-2
6.2.1 Gasolines 6-3
6.2.2 Middle Distillates 6-4
6.2.3 Residual Fuels Distillates 6-6
6.3 CARBON RANGE TPH TOXICITY FACTORS AND PHYSIOCHEMICAL CONSTANTS 6-7
6.4 TPH ACTION LEVELS FOR INDOOR AIR AND SOIL GAS 6-8
6.5 TPH ACTION LEVELS FOR SOIL 6-9
6.5.1 TPH (gasolines, middle distillates) 6-9
6.5.2 TPH (residual fuels) 6-10
6.6 TPH ACTION LEVELS FOR GROUNDWATER 6-12
6.7 ADDITIONAL TARGET INDICATOR COMPOUNDS 6-12
6.8 ETHANOL 6-14

7 OTHER ISSUES 7-3

7.1 BACKGROUND CONCENTRATIONS 7-3
7.2 LABORATORY REPORTING LEVELS 7-4
7.3 REPORTING OF SOIL DATA 7-4
7.4 ADDITIONAL SOIL PARAMETERS 7-5
7.5 DEGRADATION TO DAUGHTER PRODUCTS 7-5

8 REFERENCES 8-1

FIGURES

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

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

3 FUEL TYPES VERSUS CARBON RANGE COMPOSITION.

DETAILED ACTION LEVEL TABLES

A-1. SOIL ACTION LEVELS (POTENTIALLY IMPACTED GROUNDWATER IS A CURRENT OR POTENTIAL DRINKING WATER RESOURCE; SURFACE WATER BODY IS NOT LOCATED WITHIN 150M OF RELEASE SITE)

A-2. SOIL ACTION LEVELS (POTENTIALLY IMPACTED GROUNDWATER IS A CURRENT OR POTENTIAL DRINKING WATER RESOURCE; SURFACE WATER BODY IS LOCATED WITHIN 150M OF RELEASE SITE)

B-1. SOIL ACTION LEVELS (POTENTIALLY IMPACTED GROUNDWATER IS NOT A CURRENT OR POTENTIAL DRINKING WATER RESOURCE; SURFACE WATER BODY IS NOT LOCATED WITHIN 150M OF RELEASE SITE)

B-2. SOIL ACTION LEVELS (POTENTIALLY IMPACTED GROUNDWATER IS NOT A CURRENT OR POTENTIAL DRINKING WATER RESOURCE; SURFACE WATER BODY IS LOCATED WITHIN 150M OF RELEASE SITE)

C-1A. GROUNDWATER ACTION LEVELS FOR EVALUATION OF POTENTIAL VAPOR INTRUSION HAZARDS (VOLATILE CHEMICALS ONLY)

C-1B. SOIL ACTION LEVELS FOR EVALUATION OF POTENTIAL VAPOR INTRUSION HAZARDS (VOLATILE CHEMICALS ONLY)

C-2. SHALLOW SOIL GAS ACTION LEVELS FOR EVALUATION OF POTENTIAL VAPOR INTRUSION HAZARDS (VOLATILE CHEMICALS ONLY)

C-3. INDOOR AIR ACTION LEVELS (VOLATILE CHEMICALS ONLY)

D-1A. GROUNDWATER ACTION LEVELS (GROUNDWATER IS A CURRENT OR POTENTIAL DRINKING WATER RESOURCE) (SURFACE WATER BODY IS LOCATED WITHIN 150M OF RELEASE SITE)

D-1B. GROUNDWATER ACTION LEVELS (GROUNDWATER IS A CURRENT OR POTENTIAL DRINKING WATER RESOURCE) (SURFACE WATER BODY IS NOT LOCATED WITHIN 150M OF RELEASE SITE)

D-1C. GROUNDWATER ACTION LEVELS (GROUNDWATER IS NOT A CURRENT OR POTENTIAL DRINKING WATER RESOURCE) (SURFACE WATER BODY IS LOCATED WITHIN 150M OF RELEASE SITE)

D-1D. GROUNDWATER ACTION LEVELS (GROUNDWATER IS NOT A CURRENT OR POTENTIAL DRINKING WATER RESOURCE) (SURFACE WATER BODY IS LOCATED WITHIN 150M OF RELEASE SITE)

D-2A. SURFACE WATER ACTION LEVELS FRESH WATER HABITATS

D-2B. SURFACE WATER ACTION LEVELS MARINE HABITATS

D-2C. SURFACE WATER ACTION LEVELS ESTUARY HABITATS

D-3A. FINAL DRINKING WATER ACTION LEVELS FOR HUMAN TOXICITY.

D-3B RISK-BASED ACTION LEVELS FOR TAPWATER

D-4A. SUMMARY OF AQUATIC HABITAT GOALS

D-4B. SUMMARY OF SELECTED CHRONIC AQUATIC HABITAT GOALS

D-4C. SUMMARY OF SELECTED ACUTE AQUATIC HABITAT GOALS

D-4D. SUMMARY OF HAWAI'I CHRONIC AND ACUTE SURFACE WATER (AQUATIC HABITAT) STANDARDS

D-4E. SUMMARY OF USEPA AND OTHER PUBLISHED AQUATIC HABITAT GOALS

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

D-5. CALIFORNIA AGRICULTURAL WATER QUALITY GOALS

E. SOIL ACTION LEVELS FOR LEACHING CONCERNS

F-1. CRITERIA FOR ASSIGNMENT OF SOIL GROSS CONTAMINATION ACTION LEVELS

F-2. GROSS CONTAMINATION ACTION LEVELS FOR EXPOSED OR POTENTIALLY EXPOSED SOIL

F-3. GROSS CONTAMINATION ACTION LEVELS FOR DEEP OR OTHERWISE ISOLATED SOILS

G-1. GROUNDWATER GROSS CONTAMINATION GROSS CONTAMINATION ACTION LEVELS (GROUNDWATER IS A CURRENT OR POTENTIAL SOURCE OF DRINKING WATER)

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

G-3. SURFACE WATER GROSS CONTAMINATION ACTION LEVELS (SURFACE WATER IS A CURRENT OR POTENTIAL SOURCE OF DRINKING WATER)

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

H. PHYSIO-CHEMICAL AND TOXICITY CONSTANTS USED IN MODELS

I-1. DIRECT-EXPOSURE ACTION LEVELS, UNRESTRICTED LAND USE SCENARIO

I-2. DIRECT-EXPOSURE ACTION LEVELS, COMMERCIAL/INDUSTRIAL LAND USE SCENARIO

I-3. DIRECT-EXPOSURE ACTION LEVELS, CONSTRUCTION/TRENCH WORKER EXPOSURE SCENARIO

J. TARGET ORGANS AND CHRONIC HEALTH EFFECTS

K. BACKGROUND CONCENTRATIONS OF METALS IN SOIL

L. SOIL ACTION LEVELS FOR TERRESTRIAL ECOTOXICTY CONCERNS

1

Development of Tier 1 Lookup Tables

1.1 Introduction

This appendix describes the compilation and development of action levels for contaminants in indoor air, soil gas, soil, surface water and groundwater that was used to generate the final, Tier 1 Environmental Action Levels (Tier 1 EALs) presented in Volume 1. The action levels in general reflect guidance published by other sources that was directly referenced or modified for use in Hawai‘i. Reference documents include publications of the US Environmental Protection Agency and a number of individual states, as well as guidance from Canada and Europe.

Action levels for the following environmental concerns are presented (refer also to Figure 1):

Indoor Air and Soil Gas:

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

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 against gross contamination concerns (free product, odors, etc.) and general resource degradation.

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.

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.

Action levels are organized with respect to groundwater utility and threat to surface water bodies:

[1]GROUNDWATER UTILITY	[2]LOCATION OF NEAREST SURFACE WATER BODY	
	>150m From Release Site	**≤ 150m From Release site**
Current or Potential Source of Drinking Water	Soil: Table A-1 Groundwater: Table D-1b	Soil: Table A-2 Groundwater: Table D-1a
NOT a Current or Potential Source of Drinking Water	Soil: Table B-1 Groundwater: Table D-1d	Soil: Table B-2 Groundwater: Table D-1c

1. Based on location of site with respect to UIC line and Aquifer Identification and Classification technical reports (see Appendix 7).
2. Location of downgradient edge of release site from nearest surface water body. Use of groundwater action levels for sites <150m from a surface water body may be necessary if plume is suspected to have moved into this area.

Tables A and B summarize individual action levels complied for soil overlying groundwater for the environmental concerns noted above. Table C summarizes soil, groundwater and soil gas action levels complied specifically for vapor intrusion and indoor-air impact concerns. Action levels for groundwater and surface water are summarized in the Table D series. Tables E, F, G and I summarize action levels for leaching, gross contamination and direct exposure. Table J summarizes potential chronic health effects posed by the chemicals listed. Table K summarizes background metal concentrations for soil. Table H summarizes physiochemical parameter values and toxicity factors used in models.

A common thread between contaminated soil and groundwater is the potential for the intrusion of volatile contaminants into existing or overlying homes and buildings. Chapter 2 provides a brief overview of vapor intrusion hazards and the models used to develop associated action levels. Chapter 3 discusses vapor intrusion action levels for indoor air and shallow (e.g., subslab) soil gas. A discussion of action levels compiled for soil is then provided in Chapter 3. A detailed discussion of action levels compiled for surface water and groundwater is provided in Chapter 2.

Specific action levels developed for Total Petroleum Hydrocarbon (TPH) are discussed in Chapter 5. This includes an overview of the chemistry and toxicity of the non-specific, aliphatic and aromatic hydrocarbon compounds that make up the overwhelming majority mass of petroleum fuels and vapors associated with these fuels.

As discussed in Volume 1, analysis and evaluation of TPH in conjunction with targeted, individual petroleum compounds such as benzene is required at petroleum-release sites. Contrary to past beliefs, the combined TPH compounds will drive risk posed by petroleum contamination at many sites, rather than individual chemicals like benzene or naphthalene. Risk is based on a combination of toxicity and mass. While the latter may be more toxic on a relative scale, the overwhelming mass of otherwise less toxic, non-specific, aliphatic and aromatic compounds can ultimately pose a greater risk to human health and the environment.

Other issues pertinent to the lookup tables are discussed in Chapter 7. This includes background concentrations of trace metals in soils, laboratory reporting limits, wet-weight versus dry-weight reporting of soil data, evaluation of salt-impacted soils and the consideration of degradation daughter products for some chemicals.

1.2 Example Selection of Tier 1 EALs for Tetrachloroethylene

Figure 2 illustrates the selection of final Tier 1 soil and groundwater EALs for the chemical tetrachloroethylene (PCE). The example assumes impacts to exposed or potentially exposed soils under an unrestricted (e.g., residential) land-use scenario. Groundwater immediately underlying the site is assumed to be a potential source of drinking water. A surface water body is assumed to be located within 150m of the release site. This scenario places the site under Table A-1 of the Tier 1 lookup tables (refer to Section 1.1).

The Tier 1 EAL for PCE in shallow soil is selected as the lowest of the individual action levels for Direct Exposure (0.56 mg/kg), Vapor Intrusion (0.09 mg/kg), Gross Contamination (230 mg/kg) and Groundwater Protection (leaching concerns, (0.62 mg/kg)). The final soil EAL for PCE is the lowest of the individual action levels, or 0.09 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 EAL in groundwater is similar (refer to Figure 2). Individual action levels for Drinking Water (5.0 ug/L), Vapor Intrusion (180 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 action level for drinking water concerns drives potential risks and is selected as the Tier 1 EAL (5.0 ug/L).

Selection of EALs for PCE in deep soils is similar. For deep soils, however, potential impacts to terrestrial biota are not considered, the direct-exposure action 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 action 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 and B (soil) and Table D (groundwater) of this appendix. As can be seen from a review of these tables, the selection of final, Tier 1 EALs 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 EALs in Table A-1). Final EALs 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 EALs 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 EAL in Table A-1). For chemicals that have particularly strong odors, selection of EALs may be driven in part by gross contamination concerns ("ceiling levels", e.g., see Total Petroleum Hydrocarbons (TPH) EALs in Table B-2). The consideration of gross contamination becomes especially important in the selection of alternative action levels for relatively immobile chemicals in isolated, deep soils (e.g., refer to Tables F-3).

1.3 Toxicity Factors and Physiochemical Constants

Toxicity factors and physiochemical constants used in the soil, tapwater and vapor intrusion models for risk to human health are taken directly from the June 2011 USEPA Regional Screening Levels (RSLs) guidance except as noted below (USEPA 2011). The USEPA Region IX Preliminary Remediation Goals (PRGs) used route-to-route extrapolation to develop interim inhalation toxicity factors for chemical where studies specific to this pathway were not available or inadequate to develop toxicity factors. This approach is excluded in the 2011 USEPA RSLs. The guidance instead calls for a case-by-case review of this issue by local toxicologists. It is the opinion of the HEER office toxicologists of HDOH that use of route-to-route extrapolation to estimate interim toxicity factors for chemicals where published factors are lacking is appropriate, especially for volatile chemicals. Chemicals where this approach was used are noted in the footnotes of Table H.

Several contaminants included in the HDOH EALs are not listed in the USEPA RSLs (e.g., TPH). In these cases alternative sources were referred to for compilation of toxicity factors and physiochemical constants. Chemicals that fall in this category and references used to compile toxicity factors and constants are discussed in the footnotes of Table H.

1.4 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 target health risks and exposure assumptions (exposure frequency and duration, ingestion and inhalation rates, etc.) and target risk levels. This allows the action levels to be used without the need to evaluate cumulative risk in cases where up to three carcinogens and five noncarcinogens with similar systemic health effects are present.

Exposure assumptions used to develop direct-exposure and indoor-air action levels primarily reflect parameter values presented in USEPA risk assessment guidance for Superfund sites (refer to USEPA 2011). Alternative, and in some cases less conservative, exposure assumptions are presented in the USEPA technical document *Exposure Factors Handbook* (USEPA 2011c), among other examples. For example, recommended inhalation rates for residents are 11.3 m^3/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 action levels presented in this appendix (Section 4). 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 action levels for unrestricted ("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).

The use of alternative exposure assumptions in a more "site-specific" risk assessment could result in an increase of direct-exposure action 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 action levels presented in this appendix and the soil EALs 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 Regional Screening Levels (RSLs) for soil were developed based on a chemical-specific, target Hazard Quotient of 1.0 (USEPA 2011). To account for potential cumulative effects, the USEPA RSLs for soil are adjusted to a target Hazard Quotient of 0.2 for use in the EAL lookup tables, unless otherwise noted in Section 4 (see also Table I series). 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 action 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 EALs is provided in Table J of this appendix. Risk-based action levels for drinking water (tapwater) are based on a target Hazard Quotient of 1.0 and do not take into account potential cumulative health risks (refer to Section 4.2).

A Hazard Quotient of 1.0 was used for calculation of risk-based action levels for Total Petroleum Hydrocarbons (TPH, see Section 6 and Appendix 6). 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 action 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 EALs. Conservative target risk goals and exposure assumptions used to develop the action levels further reduce this concern. Methods to quantitatively assess synergistic effects have not been fully developed.

2

Background and Use of Vapor Intrusion Models

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 action levels (USEPA 2002). 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 and later updates to the vapor intrusion spreadsheets developed by USEPA allowed direct input of soil gas data (e.g., 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.

2.2 Vapor Intrusion Model Parameters

Soil gas, soil and groundwater action levels for potential vapor intrusion hazards were generated using a computer spreadsheet model published by the U.S Environmental Protection Agency, as discussed in the following, media-specific sections (available online, USEPA 2003a and updates). 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 action 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.

2.2.1 Target Risks

Human exposure assumptions were set equal to assumptions used in the USEPA RSLs. Action 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 (1.0 for TPH, see Section 6). For consistency purposes, default physio-chemical constants included in the original, USEPA vapor intrusion models were replaced with constants used in the USEPA RSL models if different (refer to Table H and Appendix 4).

2.2.2 Assumed Building Parameters

Default building characteristics presented in the USEPA spreadsheet guidance were used in the models (see Appendices 3 and 4). The thickness of the building floor slab was assumed to be 15 cm. For both unrestricted ("residential") land use and commercial/industrial exposure scenarios, the models assume a small, one-thousand square foot (9.61m x 9.61m), one-story building (ceiling height of 2.44 meters) situated on mono-slab concrete base (total indoor air volume approximately 225m^3). 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. The guidance default value of 1mm was used for the assumed perimeter crack width.

Default indoor-air exchange rates of one-time per hour for residences and two-times per hour for commercial/industrial buildings (directly input into the model; see Appendix 4). This assumption is based guidance developed for Mediterranean climates published by California EPA (RWQCBSF 2005; prepared by the same author as this HDOH

guidance). Based on the input building design and volume, this generates an indoor air exchange rate of 62,594 cm^3/sec (225 m^3/hour) for a residential home model and twice that for a commercial building (see Appendix 4). The California guidance reflects a comparison of risk assessment guidance published by the City of Oakland (Oakland 2000) and comments received during a state-mandated, university peer review of an earlier edition of the vapor intrusion guidance (RWQCBSF 2003). The indoor air exchange rates are assumed to be applicable and in most likely conservative for the tropical climate of Hawai‘i, where buildings are not heated and windows at homes are often left open year round.

2.2.3 Assumed Vapor Flux

USEPA vapor intrusion guidance recommends a default, vapor flux rate (Qsoil) through a building floor of four liters per minute (USEPA 2003a). This was generated in the vapor intrusion models by inputting “Sand” as the soil type for Layer A soil type a value of 40g/cm-s^2 for the parameter “Soil-Building Pressure Differential,” with the latter reflecting an assumed, lower pressure in the building. This generates a vapor flux rate through the building slab of 67 cm^3/second or four liters per minute (0.24 m^3/hour) for the approximately 100m^2 floor space. **(Note that a vapor flux rate of 4L/minute per 100m^2 floor space should be maintained for site-specific models where a larger building size is used.)**

The vapor flux rate and the vapor intrusion models in general are highly sensitive to the permeability of vadose-zone soil immediately beneath the floor of the building. The input soil type for Layer A is one of the most critical model parameters. This is because the permeability of this zone controls the volume of air (and soil gas) that can be convectively pulled up through the floor and into the building. The soil beneath most buildings is engineered, silty or sandy fill with moderate to high vapor permeability. This is incorporated into the models by included a 15 cm thick layer of highly permeable sand immediately beneath the building slab (Layer A). **Note that it is critical to include this subslab layer of vapor-permeable fill in all site-specific, vapor intrusion models.** Use of the native soil type at the subject site (e.g., more clay rich and less permeable) is not appropriate, since this may not be the soil used for structural fill immediately beneath the slab. Modifications to this assumption must be approved by HDOH on a site-by-site basis.

2.2.4 Assumed IA:SG Attenuation Factors

The modeled Indoor Air Exchange Rates and Vapor Flux Rates discussed above generate Indoor Air:Subslab Soil Gas attenuation factors (AF) of approximately 0.001 (1/1,000) and 0.0005 (1/2,000) for unrestricted (“residential”) and commercial/industrial building

scenarios, respectively. These AFs apply to vapors in the fill material immediately beneath the floor of an existing or hypothetical, future building. The AF values are considered appropriate for use in all areas of Hawai‘i. Actual indoor air exchange rates and vapor flux rates may vary at individual sites, but the attenuation factors ultimately assumed are considered to be reasonably representative of and protective of potential vapor intrusion hazards in Hawai‘i.

This is a critical parameter in all of the vapor intrusion models. The attenuation factors are identical to those developed for use in the San Francisco Bay area by a regional office of California EPA (RWQCBSF 2005, prepared by the same author as this HDOH guidance). Associated soil, soil gas and groundwater screening levels developed by that agency are also very similar to those presented in this guidance. The AF values are not simply the outcome of a modeling exercise. The California vapor intrusion guidance and vapor intrusion screening levels was developed over a period of six years (1999-2005), through a combination of modeling, consideration of climatic and building design and ventilation factors specific to Mediterranean climates, consideration of typical geology and groundwater conditions, dozens meetings and workshops with other agencies, consultants and stakeholders across the state and a legally required peer review of the vapor intrusion guidance by the University of California (RWQCBSF 2003) and numerous discussions with Paul Johnson and Robbie Ettinger (whose models form the basis of the USEPA guidance) as well as other experts familiar with vapor intrusion hazards in warmer climates.

The final soil gas and groundwater screening levels also reflect calibration of the vapor intrusion models to soil gas and groundwater field data at sites throughout the San Francisco Bay area. (Soil gas data are recommended for sites where a significant amount, e.g., $>10m^3$, of contaminated soil is to be left in place.) Similarly derived action levels presented in this HDOH guidance have likewise held up well for use in Hawai‘i. It is important to remember that one of the primary intents of the action levels is to quickly screen out low-risk sites where further investigation would be wasteful so that resources can be focused on high-risk sites where significant vapor intrusions hazards may indeed exist.

More conservative attenuation factors used for colder areas of the mainland US (e.g., 1/100 or even 1/20), where building are heated for much of the year and in general more poorly ventilated, are not considered to be applicable. In many cases buildings with HVAC systems in Hawai‘i are in fact over-pressured due to air conditioning, which minimizes or even negates potential vapor intrusion hazards. (A quick check is to open the front door of a building and see if air blows out or is pulled in.) Factors such as inadequate HVAC fresh air intakes, elevator shafts and windy conditions, etc., can, however, cause buildings (or at least some parts of buildings) to become under-pressured. Although the overall risk is lower than for buildings on the mainland, these conditions

could lead to potential vapor intrusion hazards if soil or groundwater underlying a building is contaminated with chlorinated solvents or petroleum fuels.

3

Indoor Air and Soil Gas Action levels

3.1 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 action 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 - indoor air:soil gas 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 action level. A summary of these steps is provided below.

A more detailed discussion of the model is provided in Appendix 3. Soil gas-to-indoor air attenuation factors are not significantly dependent on the target volatile chemical. As discussed in Section 2, the input Layer A soil type and Soil-Building Pressure Differential was designed to generate a vapor flux rate (Qsoil) of four liters per minute (67 cm^3/second or 0.24 m^3/hour). An indoor air exchange rate of one-time per hour is assumed in the residential home model (see Appendix 4; 62,594 cm^3/sec or 225 m^3/hour). This generates an Indoor Air:Subslab Soil Gas attenuation factor of approximately 0.001 (1/1,000) and 0.0005 (1/2,000) for unrestricted ("residential") and commercial/industrial building scenarios, respectively. Soil gas action levels for vapor intrusion hazards are presented in Table C-2. Indoor air action levels are presented in Table C-3.

3.2 Indoor Air Action levels

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

Carcinogens:

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

Noncarcinogens:

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

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 C-3. A target excess cancer risk was of 10^{-6} was used for carcinogenic VOCs. A noncancer, target Hazard Quotient of 0.2 was used for all chemicals except TPH, where a hazard Quotient of 1.0 was used (refer also to Section 6). 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).

3.3 Soil Gas Action 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 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 (see discussion in Section 2). 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 action levels (C_{sg}) are subsequently calculated as:

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

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

Note that soil-gas action 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 EAL document as available.

4

Soil Action levels

4.1 Introduction – Selection of Tier 1 Soil EALs

The final Tier 1 EAL for soil presented in Volume 1 of this guidance represents the lowest of a chemicals action level for direct-exposure and vapor intrusion, leaching and the chemicals maximum ceiling level (nuisance concerns etc.). The final, Tier 1 EALs presented in the Volume 1 summary tables are based on an assumption that contaminated soil is now or at some time in the future could be exposed at the ground surface *and* that no restrictions are placed on future use of the property.

Direct exposure, vapor intrusion and gross contamination action levels are compiled and presented for both unrestricted ("residential") and commercial/industrial land use scenarios. Alternative action levels are also presented for "deep" or otherwise isolated soils that are not likely to be exposed at the ground surface in the future. Only the action levels for unrestricted ("residential") exposure concerns were carried forward for consideration in compilation of final, Tier 1 EALs, however, (refer to Table A and B series). Alternative action levels can be incorporated into a site-specific *Environmental Hazard Evaluation* as needed (refer to Chapter 4 in Volume 1).

The use of published, soil action levels for terrestrial ecotoxicty that were included in earlier editions of the EHE guidance was discontinued in the 2011 update of the guidance. These primarily applied to trace metals. A background metals study carried out in 2010 and 2011 revealed that the natural, background concentrations of several trace metals were above the published screening levels for potential ecotoxicity. This is in part due to a reliance on laboratory testing of soils with freshly applied and highly bioavailable solutions of trace metals to develop ecotoxicty action levels. The naturally occurring trace metals in the volcanic soils of Hawai'i are, in contrast, generally tightly bound to iron hydroxides and other metal complexes and not significantly bioavailable to flora or fauna. As discussed in Section 4.6, a site-specific ecological evaluation is now recommended where sensitive, terrestrial habitats could be threatened by anthropogenic contaminants in soil.

4.2 Soil Action levels for Direct-Exposure Concerns

4.2.1 Direct Exposure Models and Assumptions

Direct exposure soil action levels for unrestricted land use (referred to in previous editions as "residential"), commercial/industrial-only land use and construction/trench worker exposure are presented in Tables I-1 through I-3, respectively. A summary of the models and assumptions used to develop the direct-exposure action levels for soil is provided in Appendix 2. Action levels for the Unrestricted Land Use category are based on a standard, residential exposure scenario (refer to Appendix 2). The action levels are considered to be adequate for residential housing, schools, day care and medical facilities, parks and similar sites with sensitive land use. The action levels are intended to be protective of residents and workers who may be exposed to chemicals in exposed soils on regular basis via incidental ingestion, dermal absorption, and inhalation of vapors and particulate matter.

The direct-exposure action levels closely follow the approach used to develop the USEPA Regional Screening Levels, with the exceptions noted below (RSLs; USEPA 2011). Direct-exposure soil action levels generated for the Unrestricted Land Use category are consistently more stringent (lower) than action levels developed for the commercial/industrial and construction/trench worker exposure scenarios. This is due to the longer, assumed exposure duration (years) and frequency (days per year) as well as the presence of young children in comparison to the latter two scenarios (see Appendix 2). Action levels for construction and trench workers take precedence over action levels based on residential and/or commercial/industrial exposure scenarios if lower. This is indeed the case for several chemicals that in pose an increased risk via inhalation of dust particles, including a number of trace metals as well as some volatile compounds (see Table I-2).

Preliminary Remediation Goals (PRGs) previously published USEPA Region IX included a hybrid, direct-exposure action level for total chromium in soil based on an assumed 1:6 ratio of Cr VI (highly toxic) to Cr III (minimally toxic) (USEPA 2004a). This is not included in the recently published, USEPA *Regional Screening Levels* (USEPA 2011) and is not included in the 2011 update to the HDOH EALs. The soil action level for total chromium is instead based on an assumed natural background concentration of 500 mg/kg, based primarily based on data for soils developed over basaltic bedrock (refer to Table K). If the reported concentration of total chromium in soil exceeds 500 mg/kg then an additional evaluation of background concentrations in the area should be carried out and/or chromium in the soil should be speciated into Cr III and Cr VI and data compared to action levels for these compounds. Note that background concentrations of total chromium in soils developed over caprock can be lower than 100

mg/kg. If a release of chromium VI is suspected at a site then chromium should be speciated and evaluated, even if total chromium concentrations do not exceed the default action level of 500 mg/kg.

4.2.2 Target Risks

Direct-exposure soil action levels for contaminants that pose carcinogenic health concerns are based on an excess cancer risk of 10^{-6} (one-in-a-million), except as noted below. This follows the approach used in the USEPA RSLs. Action levels for contaminants that pose noncarcinogenic health concerns are based on a target Hazard Quotient of 0.2 unless otherwise noted. The USEPA RSLs for noncancer concerns are in contrast based on a target Hazard Quotient of 1.0, with a stipulation that cumulative health risks should be estimated at sites where multiple contaminants with similar, chronic health effects are present. In reality this is almost never done. A target Hazard Quotient of 0.2 is used in this guidance to take into account upfront the potential presence of up to five contaminants with the same chronic target health effects at a given site. The incorporation of conservative, target health risks for both cancer and noncancer concerns the direct-exposure action levels relieves the need to calculate cumulative health risks at the majority of sites where contaminated soil is identified.

Due to the short, assumed exposure duration for **construction/trench workers**, direct-exposure action levels for nonvolatile chemicals are based on a target excess cancer risk of 10^{-5} (see Appendix 2). Due to low confidence in the vapor emission model for this scenario, however, an excess cancer risk of 10^{-6} was retained for carcinogenic VOCs (see Table I-3). A more conservative vapor emission factor is also incorporated into the direct-exposure models for construction and trench workers to reflect poor air flow in trench and other construction environments (see Appendix 2).

Other exceptions to the default target risk of 10^{-6} include direct-exposure action levels for PAHs and PCBs. 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. A target excess cancer risk of 10^{-5} was therefore used to help screen out low-risk sites and identify sites with potentially significant levels of PAHs above typical urban background levels. 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 0.2 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 I-1).

A target Hazard Quotient of 1.0 was used to develop risk-based screening levels for **TPH**. Nonspecific compounds collectively reported under "TPH" dominate the total mass of petroleum in soil, as well as water, soil gas and indoor air (refer to Appendix 6). Use of a target HQ of 1.0 is therefore justified.

A target excess cancer risk of 10^{-5} was used for **Technical Chlordane**. This is was done to reflect the cumulative inclusion of multiple chemicals (i.e., chlordane isomers, heptachlor, heptachlor epoxide) as a single concentration in the Technical Chlordane laboratory analysis, as well as the toxicity factors used in the models (see discussion in Volume 1). A target noncancer Hazard Quotient of 1.0 was used to reflect the common sole occurrence of Technical Chlordane in the absence of other contaminants (used as a termiticide around and beneath older buildings).

A target excess cancer risk of 10^{-4} was used for **aldrin and dieldrin** was used to reflect low confidence in cancer slope factors and the potency of these chemicals (see update notes in Appendix 9). A target noncancer Hazard Quotient of 0.5 was used to reflect the common co-occurrence of these two chemicals in the absence of other contaminants (aldrin used as a termiticide around and beneath older buildings, with dieldrin a breakdown product).

A target excess cancer risk of 10^{-4} was used for **hexavalent chromium** in order to reflect natural background concentrations of this chemical in soil and groundwater (see groundwater technical memo in Appendix 8). Confidence in the cancer-based toxicity factors is also low.

Separate guidance has been prepared for **arsenic** ((HDOH 2011b) and **dioxins** (HDOH 2010) in soil. Soil action levels presented in the respective technical memorandums are incorporated into the I-series tables of Appendix 1.

A target noncancer Hazard Quotient of 1.0 was used to generate soil action levels for **thallium** due to the potential for natural, background levels of thallium to exceed the unadjusted, direct-exposure action level (Tier 1 action level 0.78 mg/kg). Naturally

occurring thallium in iron-rich, volcanic soils is expected to be tightly bound to the soil and not significantly bioavailable. This is not considered in the direct-exposure models. The potential for a release of highly bioavailable, thallium salts at a site should be evaluated in cases where the Tier 1 action level is exceeded. Based on limited data, natural background levels of thallium in soil could approach 15 mg/kg (HDOH 2011a).

4.2.3 Exposed or Potentially Exposed Soils

Direct-exposure soil action levels for unrestricted ("residential") land use (Table I-1) and commercial/industrial land use (Table I-2) are based on an assumption that the soil is, or at some time in the future could be, exposed at the ground surface where regular exposure of residents or workers could occur (refer to Section 2.4 in Volume 1). Equations and exposure assumptions used in each scenario are summarized in Appendix 2. For residential properties, it is assumed that soil within three meters (approximately ten feet) of the ground surface could be exposed at the ground surface at some time in the future. For commercial/industrial properties, it is assumed that soil within one meter of the ground surface could be exposed. This should be reviewed on a site-by-site basis and provisions for long-term management of deeper or otherwise isolated soil made as necessary. As discussed in the next section, risk-based soil action levels for construction/trench workers take precedence over action levels for unrestricted or commercial/industrial land use if lower (refer to next section).

4.2.4 Isolated Soils

By default, soils are assumed to be "isolated" if they are greater than three meters below ground surface in a residential setting and one meter in a commercial/industrial setting (refer to previous section and Section 2.4 of Volume 1). Direct-exposure action levels for deep or otherwise isolated soils are based on the potential exposure of construction and utility workers to contaminants in soil (Table I-3). A summary of exposure assumptions used to generate the action levels is provided in Appendix 2. The exposure assumptions are based on guidance presented in the USEPA *Exposure Factor handbook* (USEPA 2011c), trench-worker risk assessment guidance developed by the Massachusetts Department of Environmental Protection (MADEP 1994), general direct-exposure assumptions included in the USEPA RSL document, and professional judgment (see Appendix 2, Table 1). As discussed above, action 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.

As can been seen in Table I-2, soil action levels for construction/trench workers are lower than action levels generated for commercial/industrial exposure for chromium VI and cobalt under the construction and trench worker scenario. Action levels for these chemicals are more stringent under the construction/trench worker exposure scenario than under the commercial/industrial exposure scenario (see Table I-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 Table I-2, commercial/industrial land use direct-exposure action levels for these chemicals are replaced with construction/trench worker action levels for use in the lookup tables if less stringent.

4.2.5 Soil Saturation Levels

For chemicals that are liquids under ambient conditions, upper limits for soil direct-exposure action levels are set at the chemicals theoretical soil saturation limit or "Csat" (refer to Appendix 2, 2011). As discussed below, soil action levels for volatile chemicals are only valid if they are below the chemicals Csat concentration. Csat concentrations represent an upper limit to the applicability of the soil screening level Volatilization Factor (VF) model because a basic principle of the model (Henry's law) does not apply when contaminants are present in free phase (USEPA 1996a, 2002, 2004a, 2011). VF-based inhalation soil screening levels are reliable only if they are at or below Csat. This is discussed in more detail below.

The soil saturation limit represents the point at which additional contaminant mass can no longer be sorbed to soil particles (primarily organic carbon but also clays) or dissolved into soil moisture. Above this concentration it is assumed that free product (e.g., "LNAPL") will be present in the soil. This is critical for volatile, organic compounds (VOCs). Above Csat, the USEPA direct-exposure model is no longer technically viable for prediction of vapor emissions to outdoor air and subsequent direct exposure risks posed by inhalation.

This is because vapor emissions are estimated based on the concentration of the contaminant in soil moisture in the absence of free product (e.g., nonaqueous-phase liquid or "LNAPL"). The model first estimates the dissolved-phase concentration of a contaminant in soil based on the input total soil concentration and the contaminants estimated soil:water equilibrium partitioning coefficient or "Kd" value (i.e., ratio of sorbed mass to dissolved-phase mass, generally calculated as the contaminants sorption coefficient or "koc" times the known or estimated concentration of organic carbon in the soil; refer to Appendix 2). The model then estimates the concentration of the chemical in soil gas (vapor phase) by comparison of the estimated concentration in the soil moisture to the contaminants air:water equilibrium coefficient (Henry's Law constant). Fick's

law is then used to estimate the vapor emission rate of the contaminant at the ground surface.

When Csat is exceeded, the assumed presence of free product violates the use of only the Henry's Law constant used to estimate the concentration of the chemical in soil gas and subsequently the vapor emission rate at the ground surface. As noted in USEPA risk assessment guidance, the direct-exposure model is no longer valid above this concentration (USEPA 1996a, 2002, 2004b, 2011). Csat is used to set maximum direct-exposure action levels for volatile contaminants in the USEPA RSLs (USEPA 2011) and in past publications of the USEPA Region IX Preliminary Remediation Goals (USEPA 2004a).

Soil gas data can be used to estimate vapor emission from soil where Csat concentrations of a volatile chemical are exceeded, although direct-exposure models that allow input of soil gas data have not been published (in preparation by HEER office). Vapor flux at the surface in the presence of free product can also be modeled mathematically. A model to do this is presented in Appendix A of the USEPA vapor intrusion guidance (USEPA 2004b, see Appendix 4). This is incorporated into the USEPA vapor intrusion model but has yet to be included in USEPA direct exposure models for soil (e.g., USEPA 2011; see below). As discussed above for direct-exposure models, the USEPA vapor intrusion model incorporates a chemicals Henry's Law constant to estimate the concentration of the chemical in soil gas up to Csat. When a residual phase is present, the vapor concentration is independent of the soil concentration but proportional to the mole fraction of the individual component of the residual phase mixture. At this point, the vapor intrusion model numerically estimates the equilibrium vapor concentration of the chemical in soil gas for a series of time-steps. For each time-step, the mass of each constituent that is volatilized is calculated using Raoult's law and the appropriate mole fraction. At the end of each time-step, the total mass lost is subtracted from the initial mass and the mole fractions are recomputed for the next time-step to take into account mass balanced over time. Refer to the USEPA vapor intrusion guidance for additional information.

The 1996 and 2002 editions of USEPA's *Soil Screening Levels* guidance make an apparently error in the conclusion that the emission flux from soil to air for a chemical reaches a plateau when chemicals Csat concentration in soil has been reached (USEPA 1996a, 2002, "Soil Saturation Limit"). This error is repeated in the recently published USEPA *Regional Screening Levels* guidance (USEPA 2011). Each document mistakenly states that Csat represents the concentration *at which soil pore air is saturated with the target contaminant*. This is not the case. As noted above, Csat represents the concentration of the chemical in soil in which the *sorbed- and dissolved-phases* are saturated. Saturation of these phases in the soil does *not* necessarily indicate that the vapor phase of the chemical has reached its maximum, nor that the vapor flux rate at the

surface has reached a maximum. The concentration of a chemical in soil gas at a soil concentration of Csat merely reflects equilibrium conditions with the chemical in soil moisture at the chemicals solubility limit. Saturation of the vapor phase will only occur in the presence of free product in the soil, when the gas phase reaches equilibrium with the *Nonaqueous Phase Liquid* or "NAPL." The concentration of the chemical in the vapor phase at this point is likely to be significantly higher than at the point that the soil moisture has reached the solubility limit of the chemical. This is why the Henry's Law Constant-dependent, vapor flux model incorporated into most soil action level models (including the one used in this guidance) is only valid in the absence of free product in the soil (i.e., concentration of chemical in soil <Csat). This is also the case frequently observed in soil gas studies, where the concentration of a volatile chemical in soil gas increases significantly in the presence of free product.

The direct exposure soil action level of 200 mg/kg for lead in residential soil is based on 50% of 2011 residential USEPA RSL of 400 mg/kg (USEPA 2011). The current RSL is intended to reflect a target blood level in children of 10 ug/dl. The reduced, Tier 1 EAL reflects recent USEPA publications that recommend a more stringent, target blood level of 5 ug/dl (USEPA 2011b).

4.3 Soil Action levels for Potential Vapor Intrusion Concerns

Soil action levels for the evaluation of potential vapor intrusion concerns are presented in Table C-1b. As discussed in Chapter 4, the use of soil gas data and action levels to evaluate this concern is preferred. Vapor intrusion action levels were calculated for both unrestricted ("residential") and commercial/industrial land-use exposure scenarios. Only the action levels for unrestricted land use were carried forward for consideration in compilation of final, Tier 1 EALs (refer to Table A and B series).

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

The spreadsheet is based on a model presented in the paper *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 action levels for this document are included in Appendix 4. A more detailed discussion of models is provided in Section 2.4 for correlative groundwater action 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 action levels generated with the model were adjusted upwards by a factor of ten (see Table C-1b). Collection of soil gas data and concurrent use of soil gas action 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 an action level (or calculate risk).

The same action levels developed for shallow soils should be applied to deep soils for initial, screening surfaces. While conservative, the parameter for depth to impacted soil does not significantly control calculated action levels for soils within five to ten meters of the ground surface. As discussed in Volume 1, the collection of soil gas data is preferred over the use of models for more detailed evaluations of vapor intrusion hazards.

4.4 Soil Action levels for Leaching Hazards

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

The majority of the action 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 action level (ug/L).

The term DAF is defined for the purposes of the model as the concentration of the contaminant in soil (in mg/kg) divided by the concentration of the contaminant in groundwater (in mg/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 based on a combined use of the computer applications SESOIL and AT123D. These applications model the leaching of chemicals from the vadose zone and subsequent mixing of 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 the majority of developed areas in Hawai‘i). This is assumed to also be adequate for higher rainfall areas, although a site-specific evaluation may be required for large (e.g., > one-half acre) areas of contaminated soil with persistent and highly mobile chemicals. 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 volatilization 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), action levels developed using the SESOIL-derived algorithm are similar to action 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 action 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) and site-specific, SPLP soil batch test carried out by consultants and HDOH between 2005 and 2011 (see Fall 2011 update memo in Appendix 9) suggested 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.

More recent site data, including laboratory batch test leaching data, suggest that chemicals with sorption coefficients as low as 5,000 cm^3/g are likewise essentially immobile in soil (see notes in Appendix 9 summary of updates). This was therefore selected as the koc cutoff for reference to the theoretical soil saturation level as the action level for leaching if higher than the action level generated by use of the SESOIL algorithm (refer to Table E). The equation and assumptions used to calculate the saturation levels is presented and discussed in Appendix 2. The HDOH document *Use of laboratory batch tests to evaluate potential leaching of contaminants from soil* (HDOH 2007) provides guidance for calculation of site-specific sorption coefficients and evaluation of potential leaching hazards.

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 H 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 action 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 action 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 4.2.3 in Volume 1).

Leaching based soil action 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 2002):

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

where: C_{soil} = Soil action level for leaching concerns (mg/kg);
C_{water} = Target dissolved-phase concentration of chemical (mg/L);
Koc = Sorption coefficient (L/Kg);
foc = fraction organic carbon in soil (g/g);
θ_w = water-filled porosity (L_{water}/L_{soil});
θ_a = air-filled porosity (L_{air}/L_{soil});
H' = Dimensionless Henry's Number constant ("unitless");
p_b = Soil bulk density (Kg/L);
DAF = Dilution/Attenuation Factor [(mg/kg)/(mg/L)].

This model can be used to back calculate 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 action levels for perchlorate of 3.6 ug/L for drinking water resources and 600 ug/L for non-drinking water resources (refer to Tables D-1a and D-1b), leaching based soil action 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 2002). This yielded final soil action levels for leaching concerns for perchlorate of 0.007 mg/kg and 1.2 mg/kg (refer to Table E). Laboratory-based tests are recommended for more site-specific analysis of potential leaching of perchlorate from soil (refer to Chapter 4 in Volume 1).

4.5 Soil Ceiling Levels for Gross Contamination Concerns

Ceiling levels for gross contamination concerns are presented in each of the EAL summary tables for soil. These action 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 F series of this appendix. Only the gross contamination action levels for shallow, exposed soils are carried forward for consideration in the Tier 1 EALs (refer to Table A and B series). Alternative action levels for isolated or deeper soils are provided for reference in site-specific Environmental Hazard Evaluations as needed.

Odor Thresholds presented in the Table F 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 F-2 and F-3). This provides a relative ranking of chemicals for potential nuisance concerns. As summarized in F-2 (shallow soils) and F-3 (deep soils), ceiling levels were then selected based a comparison of a chemicals vapor pressure and odor index to a table of generic action levels (Tables F-1). For chemicals that are liquids under ambient conditions, the final ceiling level was selected as the lowest of the generic level from Table F-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.

4.6 Soil Action levels for Terrestrial Ecotoxicty

Soil action levels for the protection of terrestrial flora and fauna were included in 2009 and earlier edition of the HEER office EALs. The action levels were taken directly from guidance developed by the Ontario Ministry of Environment and Energy (MOEE 1996). Action levels were available for heavy metals and a small number of high-molecular-weight organic compounds and pesticides. Action levels for both unrestricted ("residential") and commercial/industrial land use scenarios were presented, although only the unrestricted land use action levels are considered in the Tier 1 EALs. Alternative action levels for commercial/industrial land use were provided for reference in site-specific Environmental Hazard Evaluations as needed.

Direct inclusion of the soil ecotoxicty action levels was discontinued in the Fall 2011 edition of the EALs. This was due to low confidence for use in volcanic soils, including higher-than-normal background concentration of metals in Hawaiian soils in comparison to areas on mainland where the ecotoxicity action levels were developed. Trace metals in the volcanic soils tend to be tightly bound to iron hydroxides and other minerals and not significantly available for uptake into plants. A site specific, ecological risk assessment is now recommended at sites where significant anthropogenic contamination is identified and sensitive, terrestrial ecological habitats could be threatened (see Volume 1, Section 4.2).

5

Groundwater and Surface Water Action levels

5.1 Introduction

Action levels for groundwater are summarized in the "D" series of tables at the end of this appendix. A discuss of individual concerns considered in the action levels is provided in this Chapter and summarized below. For the purpose of developing Tier 1 action levels, it is assumed that all groundwater could at some point in time potentially discharge to a body of surface water. 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).

A summary of environmental concerns incorporated into groundwater action levels for different site scenarios is provided in Table 2-1. The final groundwater action level for sites that threaten drinking water resources reflects the lowest of a chemicals screening level for drinking water toxicity, aquatic habitat protection (discharges to surface water), indoor-air impacts (volatile chemicals only) and a "ceiling level" for tastes & odors or other nuisance concerns (Tables D-1a and D-1b). The final groundwater EAL for sites that do not threaten drinking water resources (Tables D-1c and D-1d) reflects the lowest of a chemicals screening level for the same set of environmental concerns with the exception of the drinking water component and use of less stringent ceiling level.

As discussed below, groundwater action levels for potential discharges to aquatic habitats consider chronic surface water quality goals for sites within 150m of a surface water body and acute goals for sites >150m from a surface water body. Although not used for groundwater action levels, HDOH standards for the potential bioaccumulation of contaminants in aquatic organisms and subsequent consumption of the organisms by

humans must be used to evaluate actual impacts to a body of surface water. A summary of these standards is provided in Table D-3f for reference.

5.2 Action levels for Drinking Water (Toxicity)

A summary of drinking water standards and guidelines used in this document is provided in Table D-2. Action levels for drinking water intended to address human toxicity were generally selected based on the following order of preference:

- Hawai‘i DOH Maximum Contaminant Level
- USPEPA Primary Maximum Contaminant Level;
- Risk-based goal based on USEPA Region IX tap water model.

HDOH and/or USPEPA Primary Maximum Contaminant Level (MCLs) are available for approximately half of the chemicals listed in the lookup tables (HDOH 2002; USEPA 2006). 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.

For chemicals where Primary MCLs have not been promulgated, a tapwater model presented in the USEPA *Regional Screening Levels* (RSL) document (USEPA 2011) was used to calculate alternative drinking water goals (Table D-4). Toxicity factors and physiochemical constants published in the 2011 USEPA RSLs were used to develop the action levels with the exceptions noted in Table H (refer to Section 1.3). The action levels are based on a target excess cancer risk of 10^{-6} and a target Hazard Quotient for noncancer concerns of 1.0. Note that the noncancer action levels in particular may not be adequate to address potential cumulative risks concerns. The need to evaluate cumulative risks should be determined on a site-by-site basis (refer to Chapter 4 of Volume 1).

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. Equations for the USEPA RSLs for tapwater are included in Appendix 2. 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 if lower than toxicity-based goals. For example, the USEPA Primary MCL for xylenes is 10,000 ug/L. The USEPA Secondary MCL for xylenes is only 20

ug/L, however. The latter value should be (and is) used as the groundwater action level for drinking water concerns. This is discussed under ceiling levels for groundwater (see Section 5.5).

5.3 Action levels for Aquatic Habitat Protection

5.3.1 Basis of Action Levels

Groundwater action levels for the protection of aquatic habitats are based on the goal that concentrations of contaminants in groundwater should meet chronic surface water goals at the point that the groundwater discharges into a body of surface water. Dilution of contaminated groundwater as it mixes with surface water is not considered under a Tier 1 assessment. In accordance with this approach, chronic surface water goals are incorporated into groundwater action levels for sites (or groundwater plumes) located within 150m of a surface water body. For more inland sites, acute surface water goals are referred to. As a default under Tier 1, the lowest of freshwater versus saltwater goals are used. The prioritization and selection of these goals is described below.

5.3.2 Surface Water Aquatic Habitat Goals

A summary of aquatic habitat goals considered for use in this document is provided in Tables D-3a and D-3b. Separate goals were compiled for freshwater and saltwater habitats. The goals should be compared to dissolved-phase chemical concentrations unless otherwise instructed by HDOH. Final goals were selected based on the following order of preference and availability:

Chronic Aquatic Habitat Goals:

- Hawai'i Chronic Surface Water Standard;
- USEPA CCC;
- Lowest of USEPA Ecotox AWQC and FVC Threshold Value (or Tier II value if no AWQC or FVC);
- 50% USEPA Chronic LOEL;
- USDOE Chronic PRG;
- 50% MOEE Chronic AWQC or LOEL;
- 10% Hawai'i Acute Surface Water Standard
- 10% USEPA CMC (or 10% Acute LOEL if no CMC);
- 10% MOEE Acute AWQC or LOEL;

- Representative NOEC or EC0 selected from USEPA ECOTOX database;
- 50% representative LOEC or EC50 selected from USEPA ECOTOX database;
- 10% representative LC0 selected from USEPA ECOTOX database;
- 5% representative LC50 selected from USEPA ECOTOX database;
- Toxicity-based drinking water goal.

Acute Aquatic habitat Goals:

- Hawai'i Acute Surface Water Standard;
- USEPA CMC;
- MOEE Acute AWQC or LOEL;
- Representative LC0 selected from USEPA ECOTOX database;
- 50% representative LC50 selected from USEPA ECOTOX database;
- Chronic habitat goal;
- Toxicity-based drinking water goal.

Abbreviations:
AWQC: Aquatic Water Quality Criteria
CCC: Criterion for Continuous Concentration
CMC: Criterion for Maximum Concentration
ECOTOX: USEPA ecotoxicity database
ECXX: Chronic Effects Concentration (XX percentile effected)
EPA: Environmental Protection Agency
FVC: Final Chronic Value
LCXX: Acute Lethal Concentration (XXth percentile effected)
LOEL: Lowest observed effects level
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)

For chemicals where promulgated standards and chronic, *No Observed Effect Levels* or the equivalent were not available, alternative goals were selected and modified as noted (refer also to Table D-3a and Table D-3e). The USDOE internet-based *Risk Assessment Information System* (RAIS) provides a good summary of USEPA and various state aquatic habitat goals and was referred to for several pesticides and explosives-related compounds (USDOE 2006). The USEPA ECOTOX database of ecotoxicity studies was referred to for chemicals with no published aquatic habitat goals (USEPA 2008b). Emphasis was placed 96 hour-duration aquatic animal studies (48 hours for daphnia studies). Modification factors in general followed recommendations and methods provided in the USEPA Great Lakes water quality initiative guidance (USEPA 1995).

Goals provided in each reference are generally based on dissolved-phase concentrations of the chemicals in water.

Chronic surface water goals were compiled for all of the chemicals listed in the lookup tables (Table D-3a). Acute goals were available for approximately 75% of the chemicals listed (Table D-3b). Chronic goals were substituted as acute goals when the latter were not available and in some cases adjusted upwards. Freshwater goals were similarly substituted for saltwater ("marine") goals if the latter were not available and vise versa. 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).

Chronic and acute surface water standards specific to Hawai'i are presented in the Hawai'I Administrative Rules, Title 11, Chapter 54, Section 11-54-04: Basic Water Quality Criteria (HDOH 2004). The primary source of USEPA aquatic habitat goals was the California EPA document A Compilation of Water Quality Goals (RWQCBCV 2007). Other sources referenced to include: USEPA's Ecotox Thresholds (USEPA 2008b), USEPA's National Recommended Water Quality Criteria (USEPA 2006), 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).

Surface water standards for potential bioaccumulation of chemicals in aquatic organisms and subsequent human consumption of these organisms are presented in Table D-3f. Both Hawai'i and Federal standards are given.

5.3.3 Groundwater Action levels for Aquatic Habitat Impacts

For the purposes of this document, it is assumed that groundwater could discharge into an estuary environment (tidally influenced portions of creeks, rivers, streams, etc.). Tier 1 goals for aquatic habitat protection are therefore based on the lowest of the goals for saltwater versus freshwater environments. For settings where this is not appropriate, target surface water goals and correlative groundwater goals can be adjusted on a site-specific basis under a Tier 2 or Tier 3 assessment.

Dilution of groundwater upon discharge to surface water was not considered in the selection of groundwater action 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 action

levels. Adjustment of the final groundwater action 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 4.3).

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 reported natural background concentrations of this metal in groundwater (up to >100 ug/L). Background concentrations of boron, copper, lead, mercury, selenium, thallium and zinc among other metals may also exceed groundwater action levels presented in the lookup tables. This issue should be evaluated on a site-by-site basis where necessary.

Surface water standards for potential bioaccumulation of chemicals in aquatic organisms and subsequent human consumption of these organisms were not considered in the selection of groundwater action levels for potential aquatic habitat impacts. Use of these standards would be excessively conservative at the large number of relatively small sites overseen by HDOH. Consideration of the standards may be appropriate for sites where the discharge of large plumes of impacted groundwater threatens long-term impacts to important aquatic habitats. This should be evaluated on a site-by-site basis.

5.4 Groundwater Action levels for Potential Vapor Intrusion Concerns

5.4.1 Vapor Intrusion Model Parameters

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

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

For the purposes of this document, the vadose-zone soil profile overlying groundwater 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 fill material commonly placed beneath the slabs of new buildings. "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 a low to moderate permeability vadose-zone soil profile, due to capillary fringe height constraints.

This vadose-zone profile is similar to the profile for coastal sediments in many areas of Hawai‘i. *It is important to understand, however, that the profile itself is not necessarily intended to mimic the profile at a subject site.* The primary objective of the input, model profile is instead intended to approximate concentrations of VOCs observed in shallow (e.g., subslab) soil gas over contaminated groundwater, based on comparisons of groundwater and soil gas data in the field. The modeled soil profile is considered to reasonably replicate groundwater and soil gas observations in the field under most site conditions, even if the input soil types and layers do not match actual field conditions.

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 in development of the RSLs (USEPA 2011). 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.

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 action 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 action level. The values presented do not represent actual modeled concentrations and should be ignored.

5.4.2 Adjustment of Action 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, action levels generated by the model were adjusted upwards by a factor of ten (refer to Table C-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.

5.5 Water Ceiling Levels for Gross Contamination Concerns

Ceiling levels based on gross contamination concerns for surface water and groundwater are summarized in the Table G 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 G-1 and G-4, after MADEP 1994). Taste and odor thresholds for drinking water were selected in the following order of preference and availability:

- Hawai‘i DOH Secondary MCLs;
- USEPA EPA 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 2007);
- Odor thresholds presented in Massachusetts DEP (MADEP 1994) and Ontario MOEE (MOEE 1996) guidance documents and other published reports (e.g., Young et al 1996).

Hawai‘i drinking water regulations reference USEPA Secondary MCLs for a short list of chemicals (HDOH 2002). USEPA and California DHS secondary MCLs and taste and odor thresholds were taken from the CalEPA document *A Compilation of Water Quality Goals* (RWQCBCV 2007).

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 G-2 and G-4). Nuisance thresholds are intended to reflect the concentration at which a chemical in water poses unacceptable odor problems or sheens.

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 2007) 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 G-1 and G-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 action levels only). The potential for an adverse buildup of contaminants in sediment over time through long-term discharges of contaminated groundwater should be evaluated on a case-by-case basis (e.g., sorption and buildup of dissolved-phase petroleum onto organic material in sediment over time).

The nuisance threshold for MTBE 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 action level for MTBE in surface water. Assuming a dilution factor of ten yields the odor threshold of 1,800 ug/L for groundwater.

5.6 Other Groundwater Action levels

Additional action 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 2007). The SNARL goals largely duplicate risk-based action levels for drinking water presented in Table D-3. Agricultural Water Quality goals for 12 metals are provided in Table D-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 action 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 EAL document.

TABLE 5-1. Environmental Concerns Considered in Groundwater Action Levels.

Category	Drinking Water Toxicity	Drinking Water Taste and Odors	Vapor Emissions To Indoor Air	Discharges To Surface Water (Chronic Goals)	Discharges To Surface Water (Acute Goals)	Surface Water Impact Ceiling Levels
Table A-1 Source of Drinking Water; NOT Within 150m of Surface Water Body	X	X	X	X	X	X
Table A-2 Source of Drinking Water; Within 150m of Surface Water Body	X	X	X		X	X
Table B-1 NOT A Source of Drinking Water; NOT Within 150m of Surface Water Body			X	X	X	X
Table B-2 NOT A Source of Drinking Water; Within 150m of Surface Water Body			X		X	X

6

Soil, Soil Gas and Groundwater Action Levels for TPH

6.1 Introduction

Petroleum is a complex mixture of hundreds of different compounds composed of hydrogen and carbon (i.e., "hydrocarbon" compounds). The carbon range makeup of common petroleum fuels is noted in Figure 3. Non-specific, aliphatic and aromatic compounds collectively reported as Total Petroleum Hydrocarbons or “TPH” make up the overwhelming majority of the hydrocarbon mass in fuels and in vapors emitted from fuels (discussed below, see also Appendix 6). Individual, “indicator” compounds such as benzene, toluene, ethylbenzene and xylenes (BTEX) as well as naphthalene and other targeted polyaromatic hydrocarbons (PAHs) only make up a small percentage of the total mass in fuels and in vapors.

Testing and evaluation of the TPH component of petroleum-contaminated soil and groundwater and in associated soil gas in addition to targeted, individual compounds is therefore important. A summary of target analytes for petroleum in soil gas, soil and water in addition to TPH and with respect to different fuel types is provided in Table 6-1. In many cases the TPH component of the contamination will drive risk to human health and the environment over the minority fraction represented by individual BTEX and PAH compounds.

The development of risk-based action levels for Total Petroleum Hydrocarbons (TPH) in soil, soil gas and groundwater is described below. 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). Middle distillates include common diesel fuel, kerosene and jet fuels such as JP-8. The action levels are based on the assumed carbon range makeup of fuel types and associated

vapors in conjunction with carbon range-specific toxicity factors published by USEPA and Massachusetts, among other agencies.

Several published documents were available to select a default, carbon range makeup of different fuel types (e.g., TPHWG 1998, MADEP 1997, 2003). Published data on the carbon range makeup and toxicity of vapors associated with petroleum fuels are limited. In 2011, the HEER office carried out a soil gas study of key, petroleum-contaminated sites in Hawai‘i to help fill this data gap and update the EHE guidance and associated TPH EALs. The results of that study are summarized below and presented in Appendix 6.

Not surprisingly, and as described below and in Appendix 6, vapors are strongly biased toward lighter-end aliphatic compounds in comparison to the parent fuel type. Significant vapors were identified at both gasoline and middle distillate release sites. Gasoline is routinely considered to be “volatile” and a potential vapor intrusion hazard. As is obvious by their distinctive smell, middle distillates such as diesel fuel are also volatile and can pose vapor intrusion hazards if present at high enough concentrations and mass in soil and groundwater.

Sections 7 and 9 of the HEER office *Technical Guidance Manual* describes laboratory methods for testing of TPH in soil, water and soil gas contaminated with petroleum fuels. Detailed carbon range analysis of the aliphatic and aromatic makeup of the TPH component of the petroleum and development of site-specific, TPH action levels can be carried out as needed as an alternative to the action levels published in this guidance (see Volume 1). This is not anticipated to be necessary or cost-beneficial at most sites, however. An exception might be the need for more detailed carbon range data for soil gas at sites where reported concentrations of TPH exceed the Tier 1 action levels be less than a factor of three, the approximate magnitude that site-specific action levels might be increased over the default action level.

As discussed in the Volume 1, the use of EALs as final “cleanup levels” for petroleum-related compounds that are known to be highly biodegradable may be unnecessarily conservative. This is especially true 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 (e.g., refer to HDOH 2007).

6.2 TPH Carbon Range Makeup of Fuels and Fuel Vapors

A summary of the selected, default carbon range TPH makeup of fuels and fuel vapors is provided in Table 6-2. This was used in combination with carbon range toxicity factors published by USEPA and other agencies to developed risk-based action levels for TPH in

indoor air, soil gas, soil and groundwater. A detailed summary of data collected as part of the HEER office 2011 soil vapor study is provided in Appendix 6.

A detailed review of the chemistry and carbon range makeup of different petroleum fuel types is presented in guidance published by the Total Petroleum Hydrocarbon working Group (TPHWG 1998). Summaries have also been published by several states, including Massachusetts (MADEP 1997, 2003) and Indiana (IDEM 2010). A brief overview is provided below, with a focus on gasoline, #2 diesel fuel and residual fuels such as motor oil.

6.2.1 Gasolines

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 (TPHWG 1998). Based on information published by the State of Indiana, a relative TPH carbon range makeup of gasoline fuels (not including BTEX, naphthalene and other individual, targeted compounds) of 45% C5-C8 aliphatics, 12% C9-C12 aliphatics and 43% C9-C12 aromatics was selected for development of TPHgasoline action levels for soil and groundwater (see Table 6-2a). Separately targeted, individual such as BTEX and naphthalene generally do not make up more than 5% of gasoline fuels in Hawai‘i. Other compounds such as MTBE are not added in significant quantities.

An assumed TPH carbon range makeup of vapors associated with gasolines of 99% C5-C8 aliphatics, 0.5% C9-C12 aliphatics and 0.5% C9-C10 aromatics was selected for development of TPHgasoline soil gas action levels (see Table 6-2b). This was based on vapor data for locally purchased gasoline tested by HDOH, published information (e.g., BioVapor 2010) and site-specific data collected during the 2011 HEER office study (see Appendix 6). Vapors associated with fresh gasoline are dominated by C2-C4 aliphatics and C5-C8 aliphatics, with only a minor component (<5%) of BTEX and non-specific aromatic compounds (see Appendix 6). Vapors associated with weathered fuel, as is the case at most gasoline-release sites, are dominated by C5-C8 aliphatics with little to no C2-C4 aliphatics remaining and again a relatively minor component of BTEX and non-specific aromatic compounds (see Appendix 6; may differ on the mainland due to local gasoline formulations). The C2-C4 aliphatics primarily pose explosion hazards. Chronic toxicity factors have not been developed for these compounds.

The ratio of TPH to benzene in soil gas at gasoline-contaminated sites is typically less than 500:1, with the ratio lower ratio (i.e., increased proportion of benzene) at fresh release sites and higher ratio at more weathered sites (i.e., preferential loss of benzene).

6.2.2 Middle Distillates

Middle distillates (e.g., kerosene, diesel fuel, home heating fuel, JP-8 jet fuel, etc.) are characterized by a wider variety of straight, branched and cyclic alkanes, polynuclear aromatic hydrocarbons (PAHs, especially naphthalene an methylnaphthalenes) and heterocyclic compounds with carbon ranges of approximately C9 to C25. A small component of C5-C8 aliphatics and BTEX aromatics is also present.

Diesel #2 was selected as the most representative fuel for this petroleum type due to its more widespread use in comparison to other fuels. (JP-8 jet fuel is essentially diesel fuel with an increased component of lighter-end compounds.) Based on guidance published by the State of Indiana (IDEM 2010), an assumed, carbon range makeup for Diesel #2 fuel of 0.4% C5-C8 aliphatics, 35.2% C9-C12 aliphatics, 42.5% C19 and greater aliphatics, 14.2% C9-C12 aromatics and 7.7% C13 and higher aromatics was selected for development of soil and groundwater TPH action levels (see Table 6-2a). This is in line with the carbon range makeup of individual chemicals in diesel fuel published by the TPH Working Group (TPHWG 1998).

Selection of a default, carbon range makeup of vapors associated with middle distillates is less straight forward than for gasolines. Published data regarding the specific, carbon range makeup of vapors associated with diesel fuel and other middle distillates is lacking. Vapor headspace chromatograms have been published by a few private entities, however (e.g. Hayes 2007, NCFS 2011). Not surprising given the chemical makeup of middle distillate fuels, the chromatograms suggest a dominance of C12 and greater aliphatic compounds in vapors associated with these fuels, with an accompanying significant amount of C5-C8 aliphatics. The increased presence of the latter in vapor in part reflects the preferential release of lighter-end and more volatile aliphatic compounds from the fuels. Elevated C5-C8 aliphatics in the vapor could also reflect degradation of longer-chain compounds. The USGS has documented the latter in groundwater for a diesel release site they have been monitoring since the 1980s (Chaplain et al, 2002). Aromatic compounds, including BTEX and naphthalene make up only a small amount of the total mass of vapor-phase compounds.

Commercial laboratories are only able to reliably report up to C12 aliphatics and C10 aromatics in soil gas samples collected in summa canisters (e.g., see Hayes 2007). This is because longer-chain vapor compounds tend to condense on the inside of the canisters stick and are not extracted when a aliquot is removed for testing. This in turn means that the soil gas samples collected in summa canisters at middle distillate release sites could significantly under report the total concentration of TPH present in the soil gas and subsequently under represent the potential vapor intrusion hazard posed by the contamination.

In order to address this potential concern HDOH collected TO-17 sorbent tube soil gas samples at five key petroleum sites as part of its 2011 study. The TO-17 samples allowed full capture and extraction of the full range of petroleum compounds present in the soil gas. The samples were collected by drawing a fixed volume of soil gas (e.g., 50ml) through a narrow tube filed with a carbon-based sorbent material (see Appendix 6). Summa canister samples were also collected at the sites for comparison. The laboratory extracts and measures the mass of targeted VOCs captured by the sorbent material. Dividing this by the volume of soil gas (or air) drawn through the tube yields the original concentration of the individual VOC in the soil gas.

Soil gas data collected by HDOH at several middle distillate release sites in Hawai‘i revealed wide variations in the ratio of C5-C8 and C9-C12+ aliphatic compounds between and even within sites (see Appendix 6). In some cases C9-C12+ aliphatics dominated, in agreement with published chromatograms for headspace samples over diesel fuel (e.g. Hayes 2007, NCFS 2011). In other cases C5-C8 aliphatics dominated. This may have been in part due to mixing of vapors with nearby gasoline releases and/or the breakdown of longer-chain aliphatics into shorter chain aliphatics at more weather sites. Vapor samples collected over fresh fuels were likewise mixed (see Appendix 6), although it is suspected that the fuel associated with the sample that reported a higher proportion of C5-C8 aliphatics may have been excessively warmed in the sun prior to collection of the vapor sample. The distinct presence of C9-C12+ aliphatics in the soil gas samples, however, clearly distinguishes sites with middle distillate contamination from gasoline-release sites.

Based on the results of the HEER office study, an assumed TPH carbon range makeup of vapors associated with middle distillate fuels of 25% C5-C8 aliphatics, 75% C9-C12+ aliphatics and 0% C9-C10 aromatics was selected for development of TPH soil gas action levels (see Table 6-2b and Appendix 6). This reflects the worst-case sample collected at diesel-release site and is considered to be conservative, given that the toxicity of longer-chain aliphatics is assumed to be six times greater than shorter-chain aliphatics (see Table 6-3). An assumed dominance of C9-C12+ aliphatic compounds in middle distillate vapors is consistent with published chromatograms for headspace samples over diesel fuel noted above (e.g. Hayes 2007, NCFS 2011). A high percentage of C12+ aliphatics and C10+ aromatics was not, however, identified in the middle distillate sites investigated even this was predicted by the published chromatograms (maximum 13%, see Appendix 6). This may reflect the fact that the chromatograms reflect vapors collected over fresh fuels.

Small amounts of BTEX and naphthalene were reported in vapor samples collected over fresh fuel. Benzene, naphthalene and other aromatic compounds were present in only trace amounts in soil gas samples collected at targeted middle distillate release sites, however (generally <0.1%). The ratio of TPH to benzene was typically greater than

1,000:1 and in some cases over 10,000:1. Non-specific aliphatics clearly drove vapor intrusion risks at these sites over individual compounds such as benzene and naphthalene. Testing for only the latter in the soil gas samples would have significantly underestimated the vapor intrusion risk.

6.2.3 Residual Fuels Distillates

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. Published data on the specific, aliphatic and aromatic makeup of the TPH fraction of residual fuels after subtracting individual, targeted PAH compounds was not identified for use in this guidance but is expected to vary widely between different products and wastes.

For the purposes of this guidance, and as a conservative measure for risk-based action levels, a TPH carbon range composition of 75% C19+ aliphatics and 25% C17+ aromatics was assumed for estimation of a TPH reference dose for residual fuels and subsequent calculation of risk-based action levels (see Table 6-2a). This is based on the aliphatic-aromatic makeup of lubricating and motor oil presented in Table 13 of the TPH Working group guidance (TPHWG 1998). Testing for targeted, individual PAHs in addition to TPH at residual fuel release sits is critical. Motor oil that has been heated to high temperatures can, however, contain a significant proportion of carcinogenic, PAH compounds. Significant amounts of PAHs (e.g., naphthalene) could also be present at former gas manufacturing plants, asphalt production facilities, other sites where PAHs made up a significant proportion of the petroleum product released.

For the purposes of this guidance the makeup of vapors associated with heavy fuels was assumed to be identical to middle distillate vapors, with 25% C5-C8 aliphatics, 75% C9-C12 aliphatics and 0% C9-C10 aromatics (see Table 6-2b). The HEER office study did not include the review or collection of soil gas samples at sites contaminated with heavy petroleum fuels or products (e.g., Bunker C fuel oil). Vapor-phase compounds are expected to be dominated by C9-C12+ aliphatics, with little to no BTEX. As is suspected for some middle distillates sites, C5-C8 and even C9-C12 aliphatics could be present as breakdown products of longer-chain hydrocarbon compounds. Naphthalene may be a concern at manufacture gas plant (MGP) sites. The TPH fraction of soil and groundwater contaminated with residual fuels is only likely to pose significant vapor intrusion hazards if gross contamination is situated immediately beneath building floors, especially in comparison to gasoline- and even diesel-contaminated sites (with the exception of MGP site). Methane buildup may also be a concern at heavy fuel release sites.

Mineral oils used in electrical transformers are highly refined, fractions of crude oil with little to no chemical additives (EPRI 1998). The oils are dominated by C9-C30 aliphatics (approximately 85%) with a less amount of non-specific, aromatic compounds (approximately 15%) and overlap the carbon ranges discussed for middle distillates and residual fuels (see Figure 3). The volatile component of mineral oils is significantly lower than that found in middle distillates. The viscosity of the oils is also significantly greater. Carcinogenic PAHs such as benzo(a)pyrene are not present in detectable amounts. Releases of mineral oils from electrical transformers are relatively small in comparison to releases of diesel fuels and contamination is generally limited.

6.3 Carbon Range TPH Toxicity Factors and Physiochemical Constants

Carbon range toxicity factors published by Massachusetts (MADEP 2003) and more recently by the USEPA (USEPA 2009) were used to calculate weighted inhalation and oral toxicity factors for each of the three noted TPH categories, based on the assumed aliphatic and aromatic makeup of each category. A summary of toxicity factors selected for the each of the targeted carbon ranges is provided in Table 6.3. The following equations were used to calculate weighted Reference Concentrations and Reference Doses (see ODEQ 2003):

Weighted RfC (ug/m^3) =

$$\frac{1}{\left[\left(\frac{(\text{Fraction}\,C5\cdot 8\,\text{aliphatics})}{C5\cdot 8\,\text{aliphatics}\,\text{RfC}}\right)+\left(\frac{\text{Fraction}\,C9\cdot 12+\text{aliphatics}}{C9\cdot 12+\text{aliphatics}\,\text{RfC}}\right)+\left(\frac{\text{Fraction}\,C9\cdot 10+\text{aromatics}}{C9\cdot 10\,\text{aromatics}+\text{RfC}}\right)\right]}$$

Weighted RfD (mg/kg-day) =

$$\frac{1}{\left[\left(\frac{(\text{Fraction}\,C5\cdot 8\,\text{aliphatics})}{C5\cdot 8\,\text{aliphatics}\,\text{RfD}}\right)+\left(\frac{\text{Fraction}\,C9\cdot 12+\text{aliphatics}}{C9\cdot 12+\text{aliphatics}\,\text{RfD}}\right)+\left(\frac{\text{Fraction}\,C19+\text{aliphatics}}{C19+\text{aliphatics}\,\text{RfD}}\right)+\left(\frac{\text{Fraction}\,C9\cdot 10+\text{aromatics}}{C9\cdot 10\,\text{aromatics}+\text{RfD}}\right)\right]}$$

As noted in Table 6-4, weighted, oral Reference Doses of 0.03, 0.02 and 0.12 mg/kg-day were calculated for TPHgasolines, TPHmiddle distillates and TPHresidual fuels, respectively, based on the assumed carbon range makeup of the petroleum products. Weighted, inhalation Reference Concentrations of 571 ug/m^3 and 126 ug/m^3 were calculated for TPHgasolines and TPHmiddle distillates, respectively.

Default physiochemical constant values for TPH categories used in previous editions of the guidance were retained for use in the action level models (see Table H). The constants are based primarily on guidance published by Massachusetts DEP (MADEP 1997, 2002). As summarized below and in Appendix 1, these toxicity factors and physiochemical constants were used to develop soil gas, soil and groundwater TPH action levels. Risk-based action levels for TPH are based on a target, noncancer hazard quotient of 1.0. This is based on an assumption that TPH represents the primary noncancer risk posed by petroleum-contaminated soil, soil gas and groundwater due to the overwhelming mass of hydrocarbon compounds included in the analysis (see Section 1.4 and Appendix 6).

6.4 TPH Action Levels for Indoor Air and Soil Gas

Preliminary, risk-based action levels for TPHgasolines and TPH middle distillates in indoor air and soil gas as were calculated in the same manner as done for other volatile chemicals but with the use of a target, noncancer Hazard Quotient of 1.0 (see above and equations in Appendix 2). An indoor action level of 600 ug/m^3 was calculated for TPHgasolines. An indoor action level of 130 ug/m^3 was calculated for TPHmiddle distillates. Soil gas action levels were calculated using the default, Indoor Air:Soil Gas attenuation factors discussed in Section 2 (Residential: 1/1,000, Commercial/Industrial: 1/2,000). This generates residential soil gas action levels of 600,000 ug/m^3 for TPHgasolines and 130,000 ug/m^3 for TPHmiddle distillates (Table 6-5; soil gas action levels for carbon ranges also provided).

Petroleum release sites often contain a mix of fuels. Vapors in soil gas could likewise be a mix of several fuel types. Applying soil gas (and indoor air) action levels for gasolines versus middle distillate fuels is therefore not straightforward. *For the purposes of this guidance and for initial screening of petroleum-contaminated sites, the more conservative indoor air and soil gas action levels calculated for TPHmiddle distillates were selected for inclusion in the lookup tables for TPHgasolines (see Tables C-2 and C-3).* The same action levels should be applied to petroleum vapors associated with residual fuels. This can be re-evaluated on a site-specific basis as needed by the collection of carbon range data for soil gas and calculation of site-specific action levels, or use of the TPHg soil gas action levels noted in Table 5b if laboratory data confirm that the carbon range makeup of the vapors is similar to that presented in Table 6-2b for gasolines. Note also that the TPH indoor air action levels could be below ambient background levels for indoor and outdoor air, due to the use of petroleum-based cleaners, auto exhaust, etc.

The soil gas action levels likewise do not take into account an expected reduction in concentration and associated risk over time due to biodegradation. This is also true for risk-based, TPH soil action levels presented in the Table I series. This can be evaluated on a site-specific basis as needed.

The collection and evaluation of soil gas samples at sites impacted with impacted with residual fuels is warranted where heavy contamination is to be left in place (see HDOH 2007). Soil gas action levels for vapors associated with TPHmiddle distillates should be applied in the absence of soil gas carbon range data. This will help to rule out potential vapor intrusion hazards and ensure that other sources of petroleum contamination were not missed.

6.5 TPH Action levels for Soil

6.5.1 TPH (gasolines, middle distillates)

Risk-based, direct-exposure action levels for TPHgasolines and TPHmiddle distillates in soil can be calculated in the same manner as done for individual chemicals, using the toxicity factors noted above and physiochemical constants noted in Table H (see Chapter 4). The model calculated residential direct-exposure soil action levels of 250 mg/kg and 210 mg/kg using this approach. These action levels are excessively conservative, in that they do not address biodegradation of TPH in soil over time, especially soil exposed at the surface. In order to address this issue upfront and for the purpose of this guidance, the final, residential direct-exposure soil action level for both TPHg and TPHmd was set to 500 mg/kg, similar to action levels in past editions of this guidance (see Table I-1).

As discussed in Chapter 4, maximum, direct-exposure action levels for volatile liquids in soil are normally set equal to the contaminants theoretical soil saturation level or Csat. This represents the concentration above which the contaminant can no longer be sorbed to soil particles (e.g., organic carbon or clay) or dissolved into the soil moisture (e.g., solubility limits reached). Above this concentration, free product will be present in the soil. This is important because the USEPA model used to calculate action levels for direct-exposure hazards is not valid above the Csat concentration for volatile chemicals (refer to Section 4.2.5). Maximum, direct-exposure action levels for volatile liquids in soil are therefore in general set to the chemical Csat concentration (e.g., refer to xylene action levels in Table I series).

This approach was used to establish Csat and maximum direct-exposure action levels for TPHgasolines (4,500 mg/kg; e.g., refer to Table I series). For TPH as middle distillates (e.g., diesel) the theoretical Csat concentration is much lower – 150mg/kg. This is due to the assumed, lower solubility of diesel and related middle distillate fuels (5 mg/L vs 150 mg/L for TPHg, refer to Table H). Confidence in the Csat value of 150 mg/kg is low, however, and this value is considered to be excessively conservative for use as a maximum, direct exposure action level. The use of alternative approaches to evaluate direct-exposure hazards posed by TPHmd and other volatile contaminants in soil is

currently being evaluated (e.g., using soil gas rather than soil data). For the purposes of this document, it is assumed that the gross contamination action level for TPHmd of 500 mg/kg is adequate for protection of direct-exposure hazards posed by TPHmd. This value was used as an alternative Csat action level for TPHmd in the Table I series. Residual fuels are not considered to pose significant vapor emission hazards other than the potential generation of methane and related explosion hazards (refer to Volume 1).

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 action level for TPH as gasolines and middle distillates (see Tables E and H). The soil action level calculated for leaching of TPH from soil and protection of groundwater that is a source of drinking water (rounded to 100 mg/kg) is coincidental with action levels presented in other technical documents prepared by local regulatory agencies in California (e.g., RWQCBSF 1990; RWQCBLA 1996). Similarly, the soil action level calculated for leaching of TPH from soil and protection of groundwater that could discharge into a body of surface water (rounded to 400 mg/kg (gasolines) and 500 mg/kg (middle distillates)) is coincidental with the action level developed for use in the CalEPA Board Order for the San Francisco Airport (RWQCB SF 1999a).

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 F series). Based on calculated “odor indexes”, a shallow soil ceiling level of 100 mg/kg was selected for unrestricted (“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).

6.5.2 TPH (residual fuels)

Risk-based, direct-exposure action levels for TPH as residual fuels were calculated in the same manner as done for individual chemicals, using the toxicity factors and physiochemical constants noted earlier. The action levels developed incorporate the Particulate Emission Factor used by USEPA to calculate RSLs for nonvolatile contaminants (USEPA 2011, refer to Appendix 2). Risk-based action levels for TPHrf in drinking water and soil were then developed in the same manner as done for other chemicals (Table D-3 and Table I series, respectively). As discussed in Volume 1, testing for individual, target indicator compounds is also recommended for soil and groundwater contaminated by heavy fuels (e.g., PAHs, heavy metals, etc.).

Individual PAHs are likely to drive health risks posed by soils contaminated with residual fuels. The non-specific, TPH fraction of the petroleum may, however, pose gross contamination concerns even in the absence of significant PAHs. 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 exposed or potentially exposed soils in unrestricted ("residential") and commercial/industrial land use scenarios, respectively (see Table F series). The MADEP ceiling level of 5,000 mg/kg was selected for isolated or otherwise deep soils.

The Massachusetts DEP did not develop specific action levels for leaching of heavy hydrocarbons from soil (refer to C19-C36 carbon range summary in Appendix 6). 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 action level of 1,000 mg/kg for protection of drinking water resources (RWQCBLA 1996). This action level was adopted for use in this document (refer to Table E). The target TPH action 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 action 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 action level 1,000 mg/kg was retained for this purpose (see Table E, refer also to Section 4.4).

The toxicity of mineral oils is relatively low and much less than that assumed for middle distillates. The volatile component of mineral oils is significantly lower than that found in middle distillates. The viscosity of the oils is significantly greater. Significant vapor emissions from soil and groundwater contaminated with mineral oil are not anticipated. For the purpose of this guidance and in order to address potential gross contamination concerns, a mineral oil TPH action level of 5,000 mg/kg is recommended for exposed soils or soils within three feet of the ground surface. For deeper soils an action level of 25,000 mg/kg is recommended. Refer also to the HEER office 2007 guidance for the long-term management of petroleum-contaminated sites (HDOH 2007). These action levels are not specifically called out in the EAL lookup tables.

6.6 TPH Action 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, 460 ug/L for diesel and 84,000 ug/L for residual fuels were developed using on the USEPA RSL tapwater model and the above-noted toxicity factors (refer to Table F-3). (Note that the action level for residual fuels is likely to exceed the solubility in water, generally <5 mg/L) Action 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 action 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 2007) was referred to as a substitute secondary MCL for all categories of TPH (see Table G-1). This takes precedence over the toxicity-based action level for selection of a final drinking water action level (see Tables D-1a and D-1b).

For the protection of aquatic life, an action level of 500 ug/L was selected for TPH-gasoline in freshwater and 3,700 ug/L in saltwater (see Table D-4b). A single action level of 640 ug/L was selected for TPH-diesel and TPH-residual fuels in both freshwater and saltwater. The freshwater action 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 action 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 action level of 5,000 ug/L for TPH (all categories) noted in the Table G 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 2001) 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 G 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 action levels are intended to highlight the potential presence of free product on groundwater.

6.7 Additional Target Indicator Compounds

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 EALs should be used in conjunction with EALs 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 action 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. Action levels for these chemicals are included in the lookup tables.

6.8 Ethanol

Gasoline formulations are anticipated to include an increasing proportion of ethanol in the near future. Soil, soil gas, indoor air and groundwater action levels for ethanol have therefore been added to the EAL 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 action levels are therefore based only on nuisance and gross contamination concerns. "Ceiling Levels" for these concerns are presented in Tables F (soil and indoor air) and I (groundwater and surface water). The final action level for each of the groundwater categories is based on an "Upper Limit" of 50 mg/L (Table G series, see also Tables D-1a and F-1b). The final soil action level presented in each of the soil categories of 45 mg/kg is based on the protection of groundwater to the noted target groundwater action level (Table E, see also Table A and B series). The leaching based action 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 action 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 action level of 19,200 ug/m^3 (10 ppmv) is based on the published odor threshold potential for ethanol (Table F series, see also Table C-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.

Table 6-1. Target analytes for petroleum contaminated media (see also Section 9 of the HEER office Technical Guidance Manual; HDOH 2009).

Petroleum Product	**Media**	**Recommended Target Analytes**
Gasolines	Soil	TPH, BTEX, naphthalene, MTBE and appropriate additives and breakdown products (e.g., DBA, TBA, lead, ethanol, etc.)
	Soil Vapor	Same as soil plus volatile additives and methane
	Groundwater	Same as soil
Middle Distillates (diesel, kerosene, Stoddard solvent, heating fuels, jet fuel, etc.)	Soil	TPH, BTEX, naphthalene, and methylnaphthalenes (1- and 2-)
	Soil Vapor	TPH, BTEX, naphthalene, and methane
	Groundwater	Same as soil
Residual Fuels (lube oils, hydraulic oils, transformer oils, Fuel Oil #6/Bunker C, waste oil, etc.)	Soil	TPH, *VOCs, naphthalene, methylnaphthalenes (1- and 2-), the remaining 16 priority pollutant PAHs, PCBs, and heavy metals unless otherwise justified
	Soil Vapor	TPH, BTEX, naphthalene, and methane
	Groundwater	same as soil

*VOCs include BTEX and chlorinated solvent compounds

Table 6-2a. Default carbon range makeup of TPH in petroleum fuels (after IDEM 2010).

Carbon Range	**[1]TPH$_{gasoline}$**	**[1]TPH$_{diesel}$**	**[2]TPH$_{resfuels}$**
C5-C8 aliphatics	45%	0.4%	0%
C9-C18 aliphatics	12%	35.2%	0%
C19+ aliphatics	0%	42.6%	75%
C9-C16 aromatics	43%	21.8%	25%

1. Indiana Department of Environmental management (IDEM 2010).
2. Massachusetts DEP (MADEP 1997).

Table 6-2b. Default carbon range makeup of TPH in petroleum fuel vapors.

Carbon Range	**[1]TPH$_{gasoline}$**	**[1]TPH$_{diesel}$**
C5-C8 aliphatics	99%	25%
C9-C18 aliphatics	0.5%	75%
C9-C16 aromatics	0.5%	0%

1. Based on HDOH soil as study and published information (see Appendix 6).

Table 6-3. Selected toxicity factors of for individual carbon range fractions.

Carbon Range	**RfD$_{0ral}$ (mg/kg-day)**	**RfC (ug/m^3)**
C5-C8 aliphatics	[b]0.04	[a]600
C9-C18 aliphatics	[a]0.01	[a]100
C19+ aliphatics	[a]3.0	[c]nv
C9+ aromatics	[a]0.03	[a]100

a. USEPA 2009; b. MADEP 2003; c. Not significantly volatile. C17+ aromatics not considered separately.

Table 6-4. Weighted TPH toxicity factors for fuels and fuel vapors.

Carbon Range	**RfD$_{0ral}$ (mg/kg-day)**	**RfC (ug/m^3)**
TPH$_{gasolines}$	0.03	571
TPH$_{middle\ distillates}$	0.02	126
TPH$_{residual\ fuels}$	0.12	-

Table 6-5a. Indoor Air and Soil Gas Carbon Range action levels.

	[1]Indoor Air		[1]Subslab Soil Gas	
Carbon Range	**Residential (ug/m^3)**	**Commercial/ Industrial (ug/m^3)**	**Residential (ug/m^3)**	**Commercial/ Industrial (ug/m^3)**
C5-C8 aliphatics	630	880	630,000	1,800,000
C9-C18 aliphatics	100	150	100,000	290,000
C19+ aliphatics	-	-	-	-
C9+ aromatics	100	150	100,000	290,000

1. Based on a noncancer Hazard Quotient of 1.0. Calculate cumulative risk if used to evaluate site-specific carbon range data for soil gas.

Table 6-5b Indoor Air and Soil Gas TPH action levels.

	Indoor Air		Subslab Soil Gas	
Carbon Range	**Residential (ug/m^3)**	**Commercial/ Industrial (ug/m^3)**	**Residential (ug/m^3)**	**Commercial/ Industrial (ug/m^3)**
$TPH_{gasolines}$	600	870	600,000	1,700,000
[1]$TPH_{middle\ distillates}$	130	330	130,000	370,000
[2]$TPH_{residual\ fuels}$	-	-	-	-

1. TPHmiddle distillate indoor air and soil gas action levels used as Tier 1 TPHgasoline action levels in final EAL tables due to potential for mixed fuel releases at sites. See Section 6.4.

2. Use TPHmiddle distillate indoor air and soil gas action levels sites contaminated with residual fuels.

7

Other Issues

7.1 Background Concentrations

EALs should be replaced with the natural background concentration of the chemical if the background value is higher. Table K presents a summary of natural, background metals for soils in Hawai‘i based on a study and compilation of existing data carried out in 2011 (focus on volcanic soils; HDOH 2011). Naturally occurring, background concentrations of metals in soil exceed risk-based action levels in some cases. This is especially true for arsenic, but can also occur for heavy metal such as thallium, vanadium and other metals associated with soils developed over basaltic bedrock (compare direct-exposure action levels in Table I-1 to background levels in Table K). The 2011 report includes additional a summary of previous background metal documents published by the Air Force (USAF 2005) and Navy (USN 2006) environmental programs in Hawai‘i. A summary of background concentrations of metals in various soil types on the mainland US has been published by the University of California (UCR 1996) and Lawrence Berkeley National Laboratory (LBNL 2002).

The risk-based action level for arsenic for soils in an unrestricted (“residential”) land use scenario is 0.42 mg/kg (refer to Table I-1). This purely risk-based action level is based on an assumed bioavailability of arsenic in soil of 100%. This is unrealistic for most soils and especially iron-rich, volcanic soils in Hawai’i, since arsenic will tightly bind to iron in sold and not be available for uptake if the soil is incidentally ingested (see HDOH 2011b). Background concentrations of arsenic in soils in Hawai‘i typically range from 5 mg/kg to 24 mg/kg (see above references). A default, upperbound background concentration of 24 mg/kg arsenic is incorporated into the lookup tables (Table K; see also Table A and B series). Soils with total arsenic that exceed this concentration should be tested for bioaccessible arsenic (see HDOH 2011b). Upper threshold values of arsenic in soil can approach 40 to 50 mg/kg, especially in discrete samples. Concentrations of arsenic in soil tend to be higher in soils associated with silicic volcanic rocks (not present in Hawai’i) and hydrothermally altered rocks (e.g., UCR 1996, LBNL 2002).

Background concentrations of total chromium in soil developed over basaltic bedrock can exceed several hundred ppm and in some areas up to several thousand ppm (HDOH 2011a). An upperbound, total chromium concentration of 1,100 mg/kg was selected to help to screen out sites where releases of chromium used as a screening can be assumed (see Table K; applies to volcanic soils). Note that background concentrations of total chromium in soils developed over caprock can be lower than 100 mg/kg. If a release of chromium VI is suspected then chromium should be speciated and evaluated even if total chromium concentrations do not exceed this action level.

Available background soil data for thallium suggest that this metal is generally no detectable in the volcanic soils of Hawai'i (<0.25 mg/kg). Data are lacking, however, with only ten samples referenced in the 2011 HEER office study (HEER 2011a). Thallium was reported at 12 to 15 mg/kg in two samples, however. No anthropogenic source is known at these two sample sites. Nonetheless, a default background concentration of 0.25 mg/kg was selected for consideration in the Tier 1 EALs due to the high toxicity of thallium salts and the associated low action level for potential direct exposure hazards (e.g., 0.78 mg/kg for residential exposure scenarios). The potential release of thallium salts should be evaluated at sites where the reported level of thallium in soil exceeds this concentration. It is reasonable to assume that the thallium is naturally occurring and non-toxic for reported concentrations in soil between 0.25 and 15 mg/kg when there is no reason to suspect a release of thallium salts.

7.2 Laboratory Reporting Levels

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 EALs presented in this document when higher.

7.3 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 EALs 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 2011c). Comparison of wet-weight data to direct-exposure action level would technically require adjustment of the direct-exposure action 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 action levels. Existing wet-weight soil data may not necessarily need to be adjusted prior to comparison to the EALs 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.)

7.4 Additional Soil Parameters

For surface soils, action 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 action 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.)

7.5 Degradation to Daughter Products

Consideration of the degradation of a chemical to more toxic daughter products, such as the breakdown of tetrachloroethylene (PCE) to vinyl chloride, is an important part of site investigations. Degradation can be significant at sites where groundwater is contaminated with both chlorinated solvents and petroleum fuels (e.g., resulting from the past use of stoddard solvent at a dry cleaning facility). Elevated levels of trichloroethylene, dichloroethylene and/or vinyl chloride at a PCE-release site generally indicate the presence of co-mingled petroleum contamination and the need to test for petroleum-related compounds refer to Figure 2-4 in Volume 1).

Tier 1 lookup tables generated by the Massachusetts Department of Environmental Protection (MADEP) and other 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). MADEP reduces the initially derived action levels for parent compounds to reflect the action 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.

Degradation to potentially more toxic daughter products is not directly considered in the Tier 1 EALs presented in this guidance document. While the need to monitor for degradation byproducts is well founded, HDOH feels that the MADEP approach is excessively conservative and not reflective of the wide range of conditions at different sites. As an alternative, HDOH recommends that soil and groundwater samples be tested for both parent and daughter products. HDOH also strongly recommends the collection of soil gas data at sites where initial soil or groundwater data suggests that volatile contaminants could pose potential vapor intrusion hazards (refer to Section 2.0 and Volume 1, Section 4.4, as well as the HEER *Technical Guidance Manual*).

8

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.

AHC, 2004, Material Safety Data Sheet - Gasolines, All Grades (January 8, 2004): Amerada Hess Corporation, MSDS No. 9950, http://www.jdm-inc.com/files/Gasoline%20(conventional).pdf

ATSDR, 2001, 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.

CCME, 2002, Canadian Environmental Quality Guidelines: Canadian Council of Ministers of the Environment, http://www.ccme.ca/

Chaplin, B. P., Delin, G. N., Baker, R. J. and M. A. Lahvis, 2002, Long-Term Evolution of Biodegradation and Volatilization Rates in a Crude Oil-Contaminated Aquifer: Bioremediation Journal,6:3, p237-255. http://dx.doi.org/10.1080/10889860290777594

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

EPRI, 1998, Chemicals-Physical Characteristics of Mineral Insulating Oils and Environmental Risk Analysis: Electric Power Research Institute, August 1998, Technical Briefing TB111083, www.epri.com.

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).

HDOH, 2002, Rules Relating to Potable Water Systems: Hawai'i Department of Health, Safe Drinking Water Branch, HAR Title 11, Chapter 20, November 2002.

HDOH, 2004, Water Quality Standards: Hawai'i Department of Health, Clean Water Branch, HAR Title 11, Chapter 24, August 2004.

HDOH, 2007, *Use of laboratory batch tests to evaluate potential leaching of contaminants from soil* (April 2007): Hawai‘i Department of Health, Office of Hazard Evaluation and Emergency Response, http://www.hawaii.gov/health/environmental/hazard/eal2005.html

HDOH, 2010, Update to Soil Action Levels for TEQ Dioxins and Recommended Soil Management Practices (June 2010): Hawai'i Department of Health, Office of Hazard Evaluation and Emergency Response, http://www.hawaiidoh.org/

HDOH, 2011a, Hawaiian Islands Soil Metal Background Evaluation Report: Hawai'i Department of Health, Office of Hazard Evaluation and Emergency Response, September 2011 (draft), prepared by AECOM.

HDOH, 2011b, Update to Soil Action Levels for inorganic Arsenic and Recommended Soil Management Practices (November 25, 2011): Hawai'i Department of Health,

Office of Hazard Evaluation and Emergency Response, http://www.hawaiidoh.org/

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.

IDEM, 2010, Risk Integrated System of Closure, Technical Resource Guidance Document: Indiana Department of Environmental Management, June 2010.

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, http://mass.gov/dep/cleanup/laws/policies.htm#02-411.

MADEP, 2003, Updated Petroleum Hydrocarbon Fraction Toxicity Values for the VPH/EPH/EPH Methodology: Massachusetts Department of Environmental Protection, Bureau of Waste Site Cleanup, November 2003, http://mass.gov/dep/cleanup/laws/policies.htm#02-411.

MDEQ, 2006, Aquatic Habitat Water Quality Standards: Michigan Department of Environmental Quality, www.michigan.gov/deq/0,1607,7-135-3313_3686_3728-11383--,00.html

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.

NCFS, 2011, Ignitable Liquids Database: National Center for Forensic Science (accessed October 2011), http://ilrc.ucf.edu/

NLM, 2008a, *Hazardous Substances Database*: National Library of Medicine (Toxnet), http://toxnet.nlm.nih.gov/.

NLM, 2008b, ChemIDPlus Advanced: National Library of Medicine, http://chem.sis.nlm.nih.gov/chemidplus/

NOAA, 2008, Screening Quick Reference Tables: NOAA O&R Report 08-1, Seattle, WA, Office of Response and Restoration Division, National Oceanic and Atmospheric Administration, http://response.restoration.noaa.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.

Oregon DEQ, 2003, Risk-Based Decision Making for the Remediation of Petroleum-Contaminated Sites, Oregon Department of Environmental Quality, Environmental Cleanup and Tanks Program, September 2003, http://www.deq.state.or.us/lq/rbdm.htm

RWQCBCV, 2007, *A Compilation of Water Quality Goals*: California Environmental Protection Agency, Regional Water Quality Control Board, Central Valley Region (August 2007),

http://www.waterboards.ca.gov/centralvalley/water_issues/water_quality_standards_limits/water_quality_goals/index.shtml

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, 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/EAL.htm.

TPHWG, 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.

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

UKSAC, 1999, Guidelines for managing water quality impacts within UK European marine sites: UK Marine SAC Project (October 1999); prepared by Cole, S., Codling, I.D., Parr, W. and T. Zabel, http://www.ukmarinesac.org.uk/

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

USAF, 2005, *Base-wide Ambient Metals Study, Hickam Air Force Base, O'ahu, Hawai'i* (August 26, 2005): US Air Force, 15th Airlift Wing, Environmental Restoration Program.

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

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.

USDOE, 2006, *Risk Assessment Information System* (RAIS): U.S. Department of Energy, Oak Ridge National Laboratory, Environmental Sciences Division, http://rais.ornl.gov/homepage/benchmark.shtml

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;
http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=20563

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, 2002, *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites*: U.S. Environmental Protection Agency, Solid Waste and Emergency Response, OSWER 9355.4-24, December 2002,
http://www.epa.gov/superfund/resources/soil/ssg_main.pdf

USEPA, 2004a, *Preliminary Remediation Goals*: U.S. Environmental Protection Agency, Region IX, October 2004.

USEPA, 2004b, *User's Guide for Subsurface Vapor Intrusion into Buildings*: U.S. Environmental Protection Agency Office of Emergency and Remedial Response, February 2004, www.epa.gov/oerrpage/superfund/.

USEPA, 2006, National Recommended Water Quality Criteria: U.S. Environmental Protection Agency, Office of Water,
http://www.epa.gov/waterscience/criteria/nrwqc-2006.pdf

USEPA, 2008a, U.S. Environmental Protection Agency, Title 40, Code of Federal Regulations, Parts 141 [Primary MCLs] and 143 [Secondary MCLs],
http://www.epa.gov/safewater/contaminants/index.html.

USEPA, 2008b, ECOTOX database: U.S. Environmental Protection Agency, Office of Research and Development, National Health and Environmental Effects Research Laboratory, Mid-Continent Ecology Division, http://cfpub.epa.gov/ecotox/.

USEPA, 2011a, Screening Levels for Chemical Contaminants: U.S. Environmental Protection Agency, June 2011, prepared by Oak Ridge National Laboratories, http://www.epa.gov/region09/waste/sfund/prg/

USEPA, 2011b, National Program Manager Guidance (Lead Risk Reduction Program): U.S. Environmental Protection Agency, Office of Chemical Safety and Pollution Prevention, Final FY 2012, EPA-740-B-11-001, http://www.epa.gov/planandbudget/annualplan/FY12_OCSPP_NPM_Gdnce.pdf

USEPA, 2011c, *Exposure Factors Handbook*: U.S. Environmental Protection Agency, Office of Research and Development. September 2011, EPA/600/R-090/052F www.epa.gov

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

USN, 2006, *Environmental Background Analysis of Metals in Soil at Navy O'ahu Facilities, O'ahu, Hawai'i* (June 6, 2006): Department of the Navy, Naval Facilities Engineering Command, Hawaii.

UTDEQ, 2008, Utah Test and Training Range Hazardous Waste Permit (February 13, 2003): State of Utah, Department of Environmental Quality, Division of Solid and Hazardous Waste, http://www.hazardouswaste.utah.gov/HWBranch/CFFSection/Adobe/UTTRpermit/Attach10.pdf

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.

Young, W.F., Horth, H., Crane, R., Ogden, T. and M. Arnott, 1996, Taste and Odor Threshold Concentrations of Potential Water Contaminants: Water Resources, Vol. 30, No. 2, pp. 331-340.

Zakikhani, M., Dortch, M. and J. Gerald, 2002, *Compilation of Physical and Chemical Properties and Toxicity Benchmarks for Military Range Compounds* (September 2002): US Army Corps of Engineers; Technical Report ERDC/EL TR-02-27, http://el.erdc.usace.army.mil/arams/databases.html

FIGURES

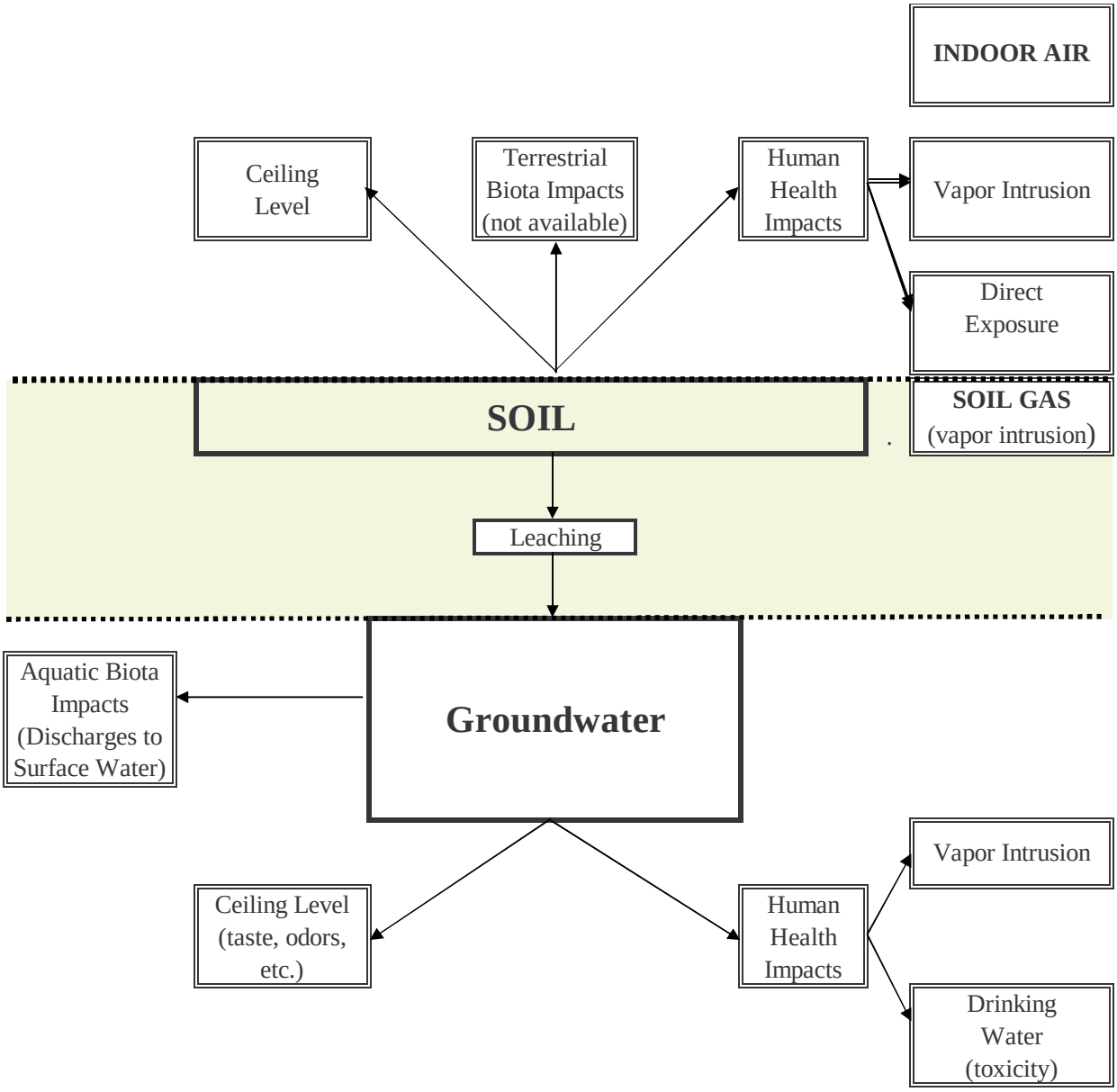

Figure 1. Summary of environmental hazards considered in action levels. Additional site-specific considerations include groundwater beneficial use, depth to impacted soil, soil type and land use. Evaluation of environmental hazards not shown requires site-specific assessment.

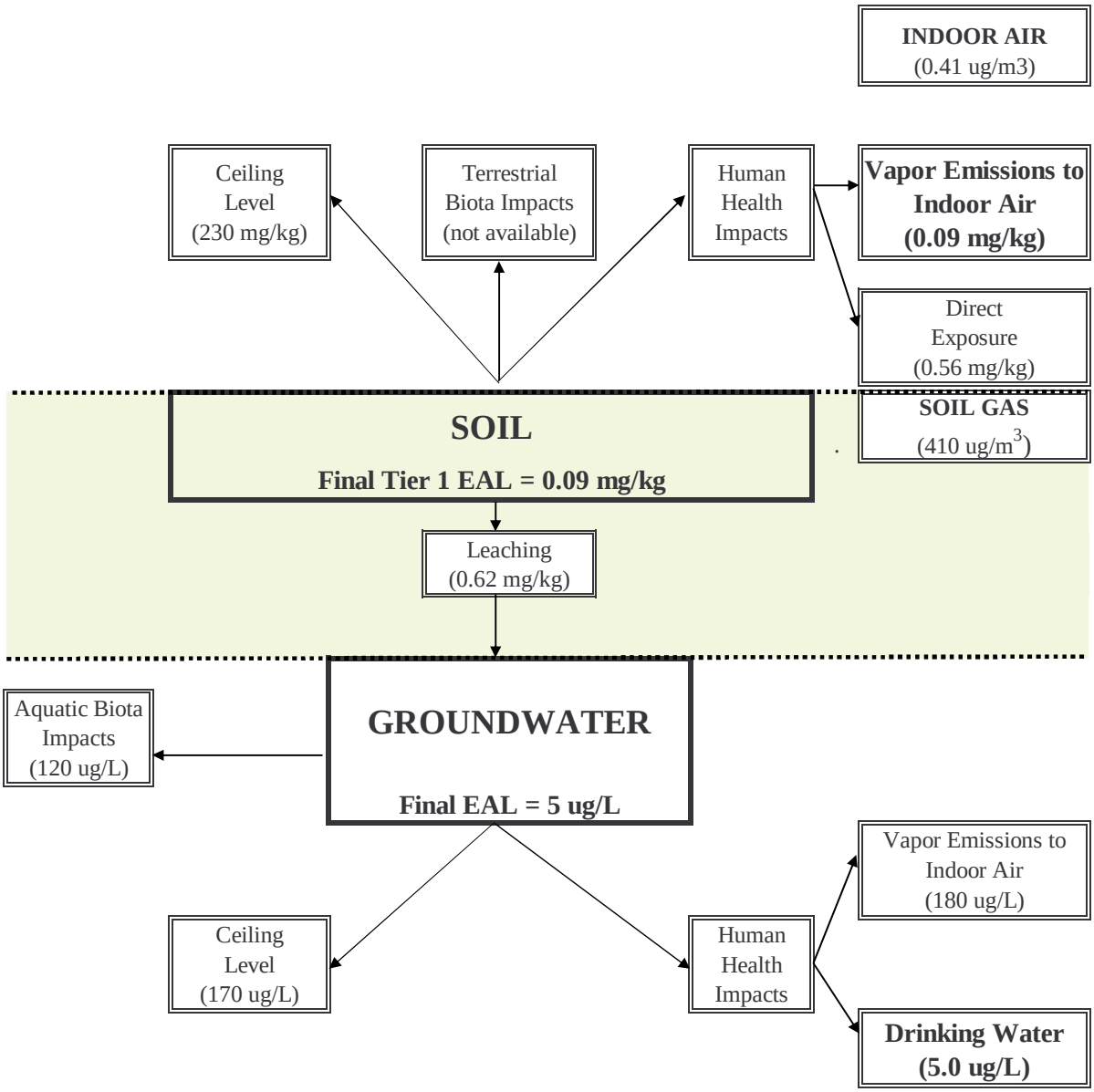

Figure 2. Summary of individual action levels used to select final, Tier 1 EALs for tetrachloroethylene in soils situated within ten feet of the ground surface and in groundwater that is a current or potential source of drinking water; based on a residential land-use scenario. Final EALs presented in Volume 1 summary tables are the lowest of the individual action levels. Vapor intrusion concerns drive selection of the final soil Tier 1 EAL (0.09 mg/kg). For groundwater, drinking water toxicity concerns drive selection of final Tier 1 EAL (5.0 ug/L).

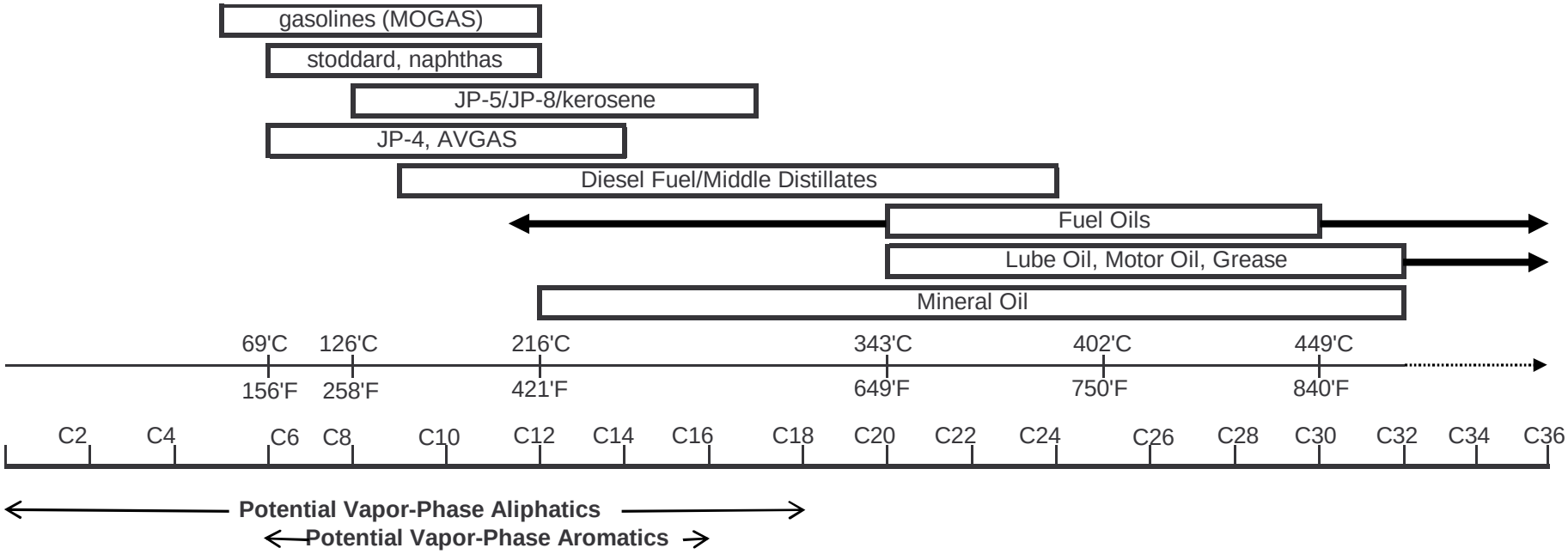

Figure 3. Fuel types versus carbon range composition.

DETAILED ACTION LEVEL TABLES

TABLE A-1. SOIL ACTION LEVELS
(Potentially impacted groundwater IS a current or potential drinking water resource; Surface water body IS NOT located within 150m of release site)

	(mg/kg)							
						[1]Human Health		Leaching & Groundwater Protection
CHEMICAL PARAMETER	Final EAL	Basis	[1]Gross Contamination (Odors, etc.) Table F-2	Terrestrial Ecotoxicity Table L	Background Table K	Direct Exposure Table I-1	Vapor Intrusion Into Buildings Table C-1b	Drinking Water Resource Table E
ACENAPHTHENE	1.2E+02	Vapor Intrusion	1.0E+03	site-specific		6.2E+02	1.2E+02	1.2E+02
ACENAPHTHYLENE	1.0E+02	Groundwater Protection	5.0E+02	site-specific		3.2E+02	(Use soil gas)	1.0E+02
ACETONE	1.0E+00	Groundwater Protection	5.0E+02	site-specific		1.2E+04	1.4E+04	1.0E+00
ALDRIN	9.2E-01	Direct Exposure	1.0E+03	site-specific		9.2E-01		8.4E+00
AMETRYN	1.1E+01	Groundwater Protection	5.0E+02	site-specific		1.1E+02		1.1E+01
AMINO,2- DINITROTOLUENE,4,6-	3.4E+00	Groundwater Protection	5.0E+02	site-specific		3.1E+01		3.4E+00
AMINO,4- DINITROTOLUENE,2,6-	3.4E+00	Groundwater Protection	5.0E+02	site-specific		3.1E+01		3.4E+00
ANTHRACENE	4.3E+00	Vapor Intrusion	5.0E+02	site-specific		3.3E+03	4.3E+00	5.9E+01
ANTIMONY	2.4E+00	Background	1.0E+03	site-specific	2.4E+00	1.6E+00		(Use batch test)
ARSENIC	2.4E+01	Background	1.0E+03	site-specific	2.4E+01	2.3E+01		(Use batch test)
ATRAZINE	1.1E-01	Groundwater Protection	5.0E+02	site-specific		2.1E+00		1.1E-01
BARIUM	1.0E+03	Ceiling Value	1.0E+03	site-specific	6.9E+02	3.1E+03		(Use batch test)
BENZENE	3.0E-01	Groundwater Protection	5.0E+02	site-specific		1.1E+00	6.7E-01	3.0E-01
BENZO(a)ANTHRACENE	1.5E+00	Direct Exposure	5.0E+02	site-specific		1.5E+00		1.0E+01
BENZO(a)PYRENE	1.5E-01	Direct Exposure	5.0E+02	site-specific		1.5E-01		2.0E+01
BENZO(b)FLUORANTHENE	1.5E+00	Direct Exposure	5.0E+02	site-specific		1.5E+00		9.2E+00
BENZO(g,h,i)PERYLENE	3.5E+01	Groundwater Protection	5.0E+02	site-specific		4.6E+02		3.5E+01
BENZO(k)FLUORANTHENE	1.5E+01	Direct Exposure	5.0E+02	site-specific		1.5E+01		3.9E+01
BERYLLIUM	3.1E+01	Direct Exposure	1.0E+03	site-specific	3.0E+00	3.1E+01		(Use batch test)
BIPHENYL, 1,1-	1.0E+01	Direct Exposure	5.0E+02	site-specific		1.0E+01	(Use soil gas)	2.1E+02
BIS(2-CHLOROETHYL)ETHER	6.4E-05	Groundwater Protection	5.0E+02	site-specific		2.1E-01	4.5E-03	6.4E-05
BIS(2-CHLOROISOPROPYL)ETHER	3.5E-03	Groundwater Protection	5.0E+02	site-specific		3.3E+00	(Use soil gas)	3.5E-03
BIS(2-ETHYLHEXYL)PHTHALATE	3.5E+01	Direct Exposure	5.0E+02	site-specific		3.5E+01		1.9E+02
BORON	1.0E+02	Ceiling Value	1.0E+02	site-specific		3.1E+03		(Use batch test)
BROMODICHLOROMETHANE	2.2E-03	Groundwater Protection	9.3E+02	site-specific		2.8E-01	1.4E-02	2.2E-03
BROMOFORM	6.9E-01	Groundwater Protection	5.0E+02	site-specific		6.1E+01		6.9E-01
BROMOMETHANE	2.2E-01	Vapor Intrusion	5.0E+02	site-specific		1.6E+00	2.2E-01	3.6E-01
CADMIUM	1.4E+01	Direct Exposure	1.0E+03	site-specific	2.3E+00	1.4E+01		(Use batch test)
CARBON TETRACHLORIDE	8.7E-02	Vapor Intrusion	4.5E+02	site-specific		6.2E-01	8.7E-02	8.7E-01
CHLORDANE (TECHNICAL)	1.6E+01	Direct Exposure	1.0E+03	site-specific		1.6E+01		2.9E+01
CHLOROANILINE, p-	6.3E-03	Groundwater Protection	1.0E+03	site-specific		2.4E+00		6.3E-03
CHLOROBENZENE	2.2E+00	Vapor Intrusion	5.0E+02	site-specific		5.9E+01	2.2E+00	2.9E+00
CHLOROETHANE	1.1E+00	Groundwater Protection	5.0E+02	site-specific		2.1E+03	4.5E+02	1.1E+00
CHLOROFORM	2.3E-02	Vapor Intrusion	5.0E+02	site-specific		3.0E-01	2.3E-02	2.0E+00
CHLOROMETHANE	1.0E-01	Groundwater Protection	1.0E+02	site-specific		1.7E+00	2.9E-01	1.0E-01
CHLOROPHENOL, 2-	9.2E-03	Groundwater Protection	1.0E+02	site-specific		6.7E+01	1.5E+01	9.2E-03
CHROMIUM (Total)	1.1E+03	Background	-	site-specific	1.1E+03			(Use batch test)
CHROMIUM III	1.0E+03	Ceiling Value	1.0E+03	site-specific		2.3E+04		(Use batch test)
CHROMIUM VI	2.9E+01	Direct Exposure	1.0E+03	site-specific		2.9E+01		(Use batch test)
CHRYSENE	3.0E+01	Groundwater Protection	1.0E+03	site-specific		1.5E+02		3.0E+01
COBALT	8.0E+01	Background	1.0E+03	site-specific	8.0E+01	4.7E+00		(Use batch test)
COPPER	6.3E+02	Direct Exposure	1.0E+03	site-specific	2.5E+02	6.3E+02		(Use batch test)
CYANIDE (Free)	1.0E+02	Ceiling Value	1.0E+02	site-specific		3.1E+02	(Use soil gas)	(Use batch test)
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	9.0E-03	Groundwater Protection	5.0E+02	site-specific		5.5E+00		9.0E-03

TABLE A-1. SOIL ACTION LEVELS
(Potentially impacted groundwater IS a current or potential drinking water resource; Surface water body IS NOT located within 150m of release site)

	(mg/kg)							
						[1]Human Health		Leaching & Groundwater Protection
CHEMICAL PARAMETER	Final EAL	Basis	[1]Gross Contamination (Odors, etc.) Table F-2	Terrestrial Ecotoxicity Table L	Background Table K	Direct Exposure Table I-1	Vapor Intrusion Into Buildings Table C-1b	Drinking Water Resource Table E
DALAPON	1.1E-01	Groundwater Protection	5.0E+02	site-specific		3.7E+02		1.1E-01
DIBENZO(a,h)ANTHTRACENE	1.5E-01	Direct Exposure	5.0E+02	site-specific		1.5E-01		1.2E+01
DIBROMO,1,2- CHLOROPROPANE,3-	9.0E-04	Groundwater Protection	5.0E+02	site-specific		5.7E-03	(Use soil gas)	9.0E-04
DIBROMOCHLOROMETHANE	1.6E-03	Groundwater Protection	1.0E+02	site-specific		7.8E-01	2.2E-02	1.6E-03
DIBROMOETHANE, 1,2-	3.7E-04	Groundwater Protection	5.0E+02	site-specific		3.2E-02	8.7E-04	3.7E-04
DICHLOROBENZENE, 1,2-	7.5E-01	Groundwater Protection	1.9E+02	site-specific		1.9E+02	8.9E+00	7.5E-01
DICHLOROBENZENE, 1,3-	5.7E-01	Groundwater Protection	1.0E+02	site-specific		1.9E+02	(Use soil gas)	5.7E-01
DICHLOROBENZENE, 1,4-	4.7E-02	Vapor Intrusion	5.0E+02	site-specific		2.5E+00	4.7E-02	3.9E-01
DICHLOROBENZIDINE, 3,3-	7.9E-02	Groundwater Protection	5.0E+02	site-specific		1.1E+00		7.9E-02
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.0E+00	Direct Exposure	5.0E+02	site-specific		2.0E+00		6.3E+01
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.4E+00	Direct Exposure	5.0E+02	site-specific		1.4E+00		2.8E+01
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.7E+00	Direct Exposure	1.0E+03	site-specific		1.7E+00		5.6E+00
DICHLOROETHANE, 1,1-	9.7E-02	Groundwater Protection	5.0E+02	site-specific		3.3E+00	3.3E-01	9.7E-02
DICHLOROETHANE, 1,2-	2.1E-03	Groundwater Protection	5.0E+02	site-specific		4.4E-01	2.0E-02	2.1E-03
DICHLOROETHYLENE, 1,1-	1.2E+00	Groundwater Protection	5.0E+02	site-specific		4.9E+01	8.9E+00	1.2E+00
DICHLOROETHYLENE, Cis 1,2-	3.1E-01	Vapor Intrusion	1.0E+02	site-specific		3.5E+00	3.1E-01	2.3E+00
DICHLOROETHYLENE, Trans 1,2-	2.7E+00	Vapor Intrusion	5.0E+02	site-specific		2.2E+01	2.7E+00	6.4E+00
DICHLOROPHENOL, 2,4-	2.5E-02	Groundwater Protection	5.0E+02	site-specific		3.7E+01		2.5E-02
DICHLOROPHENOXYACETIC ACID (2,4-D)	3.4E-01	Groundwater Protection	5.0E+02	site-specific		1.4E+02		3.4E-01
DICHLOROPROPANE, 1,2-	5.2E-02	Vapor Intrusion	1.0E+02	site-specific		8.9E-01	5.2E-02	1.4E-01
DICHLOROPROPENE, 1,3-	1.5E-02	Groundwater Protection	5.0E+02	site-specific		1.7E+00	1.3E-01	1.5E-02
DIELDRIN	1.5E+00	Direct Exposure	1.0E+03	site-specific		1.5E+00		3.0E+01
DIETHYLPHTHALATE	1.6E+01	Groundwater Protection	5.0E+02	site-specific		9.8E+03		1.6E+01
DIMETHYLPHENOL, 2,4-	9.9E+00	Groundwater Protection	1.0E+02	site-specific		2.4E+02	1.1E+03	9.9E+00
DIMETHYLPHTHALATE	2.2E+01	Groundwater Protection	5.0E+02	site-specific		1.2E+05		2.2E+01
DINITROBENZENE, 1,3-	2.1E-01	Groundwater Protection	5.0E+02	site-specific		1.2E+00		2.1E-01
DINITROPHENOL, 2,4-	5.6E+00	Groundwater Protection	5.0E+02	site-specific		2.4E+01		5.6E+00
DINITROTOLUENE, 2,4- (2,4-DNT)	2.1E-02	Groundwater Protection	5.0E+02	site-specific		1.6E+00		2.1E-02
DINITROTOLUENE, 2,6- (2,6-DNT)	3.6E+00	Groundwater Protection	5.0E+02	site-specific		1.2E+01		3.6E+00
DIOXANE, 1,4-	3.1E-04	Groundwater Protection	5.0E+02	site-specific		4.9E+00		3.1E-04
DIOXINS (TEQ)	2.4E-04	Direct Exposure	1.0E+03	site-specific	2.0E-05	2.4E-04		1.8E-01
DIURON	1.3E+00	Groundwater Protection	5.0E+02	site-specific		2.4E+01		1.3E+00
ENDOSULFAN	1.8E+01	Groundwater Protection	5.0E+02	site-specific		7.3E+01		1.8E+01
ENDRIN	3.7E+00	Direct Exposure	5.0E+02	site-specific		3.7E+00		3.0E+01
ETHANOL	4.5E+00	Groundwater Protection	5.0E+02	site-specific				4.5E+00
ETHYLBENZENE	3.7E+00	Groundwater Protection	4.8E+02	site-specific		5.5E+01	2.1E+01	3.7E+00
FLUORANTHENE	4.6E+02	Direct Exposure	5.0E+02	site-specific		4.6E+02		1.2E+03
FLUORENE	1.0E+02	Vapor Intrusion	5.0E+02	site-specific		4.4E+02	1.0E+02	3.7E+02
GLYPHOSATE	1.0E-01	Groundwater Protection	5.0E+02	site-specific		1.2E+03		1.0E-01
HEPTACHLOR	1.1E-01	Direct Exposure	1.0E+03	site-specific		1.1E-01		4.5E+01
HEPTACHLOR EPOXIDE	5.3E-02	Direct Exposure	1.0E+03	site-specific		5.3E-02		1.2E+01
HEXACHLOROBENZENE	3.0E-01	Direct Exposure	5.0E+02	site-specific		3.0E-01		1.0E+00
HEXACHLOROBUTADIENE	1.8E-01	Groundwater Protection	5.0E+02	site-specific		6.2E+00		1.8E-01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	7.5E-02	Groundwater Protection	5.0E+02	site-specific		5.2E-01		7.5E-02
HEXACHLOROETHANE	2.7E-01	Groundwater Protection	5.0E+02	site-specific		1.2E+01		2.7E-01

TABLE A-1. SOIL ACTION LEVELS
(Potentially impacted groundwater IS a current or potential drinking water resource; Surface water body IS NOT located within 150m of release site)

	(mg/kg)							
						[1]Human Health		Leaching & Groundwater Protection
CHEMICAL PARAMETER	Final EAL	Basis	[1]Gross Contamination (Odors, etc.) Table F-2	Terrestrial Ecotoxicity Table L	Background Table K	Direct Exposure Table I-1	Vapor Intrusion Into Buildings Table C-1b	Drinking Water Resource Table E
HEXAZINONE	2.6E+01	Groundwater Protection	5.0E+02	site-specific		4.0E+02		2.6E+01
INDENO(1,2,3-cd)PYRENE	1.5E+00	Direct Exposure	5.0E+02	site-specific		1.5E+00		3.0E+01
ISOPHORONE	7.7E-01	Groundwater Protection	5.0E+02	site-specific		5.1E+02		7.7E-01
LEAD	2.0E+02	Direct Exposure	1.0E+03	site-specific	7.3E+01	2.0E+02		(Use batch test)
MERCURY	4.7E+00	Direct Exposure	5.0E+02	site-specific	7.2E-01	4.7E+00	(Use soil gas)	(Use batch test)
METHOXYCHLOR	1.6E+01	Groundwater Protection	5.0E+02	site-specific		6.1E+01		1.6E+01
METHYL ETHYL KETONE	7.7E+00	Groundwater Protection	5.0E+02	site-specific		5.6E+03	2.2E+03	7.7E+00
METHYL ISOBUTYL KETONE	5.0E-01	Groundwater Protection	1.0E+02	site-specific		1.1E+03	1.3E+03	5.0E-01
METHYL MERCURY	1.6E+00	Direct Exposure	1.0E+02	site-specific		1.6E+00		(Use batch test)
METHYL TERT BUTYL ETHER	2.8E-02	Groundwater Protection	1.0E+02	site-specific		4.4E+01	2.0E+00	2.8E-02
METHYLENE CHLORIDE	1.1E-01	Groundwater Protection	5.0E+02	site-specific		1.1E+01	1.1E+00	1.1E-01
METHYLNAPHTHALENE, 1-	1.8E+00	Groundwater Protection	5.0E+02	site-specific		9.8E+01	2.6E+01	1.8E+00
METHYLNAPHTHALENE, 2-	4.1E+00	Groundwater Protection	5.0E+02	site-specific		4.7E+01	2.8E+01	4.1E+00
MOLYBDENUM	7.8E+01	Direct Exposure	1.0E+03	site-specific	4.0E+00	7.8E+01		(Use batch test)
NAPHTHALENE	4.4E+00	Groundwater Protection	5.0E+02	site-specific		2.8E+01	4.5E+00	4.4E+00
NICKEL	7.6E+02	Direct Exposure	1.0E+03	site-specific	4.1E+02	7.6E+02		(Use batch test)
NITROBENZENE	4.6E-03	Groundwater Protection	5.0E+02	site-specific		4.8E+00	(Use soil gas)	4.6E-03
NITROGLYCERIN	7.0E-02	Groundwater Protection	5.0E+02	site-specific		1.2E+00		7.0E-02
NITROTOLUENE, 2-	3.8E-03	Groundwater Protection	5.0E+02	site-specific		1.9E+00	(Use soil gas)	3.8E-03
NITROTOLUENE, 3-	7.3E+00	Groundwater Protection	5.0E+02	site-specific		2.5E+02	(Use soil gas)	7.3E+00
NITROTOLUENE, 4-	2.5E-01	Groundwater Protection	5.0E+02	site-specific		3.0E+01		2.5E-01
PENTACHLOROPHENOL	8.2E-01	Groundwater Protection	5.0E+02	site-specific		8.9E-01		8.2E-01
PENTAERYTHRITOLTETRANITRATE (PETN)	4.2E-01	Groundwater Protection	5.0E+02	site-specific		2.4E+01		4.2E-01
PERCHLORATE	7.0E-03	Groundwater Protection	1.0E+03	site-specific		1.1E+01		7.0E-03
PHENANTHRENE	4.4E+02	Direct Exposure	5.0E+02	site-specific		4.4E+02	(Use soil gas)	5.7E+02
PHENOL	1.6E-01	Groundwater Protection	5.0E+02	site-specific		3.7E+03		1.6E-01
POLYCHLORINATED BIPHENYLS (PCBs)	1.1E+00	Direct Exposure	5.0E+02	site-specific		1.1E+00		6.3E+00
PROPICONAZOLE	6.6E+01	Groundwater Protection	5.0E+02	site-specific		1.6E+02		6.6E+01
PYRENE	4.4E+01	Vapor Intrusion	5.0E+02	site-specific		3.4E+02	4.4E+01	6.1E+02
SELENIUM	7.8E+01	Direct Exposure	1.0E+03	site-specific	7.1E+00	7.8E+01		(Use batch test)
SILVER	7.8E+01	Direct Exposure	1.0E+03	site-specific	1.5E+00	7.8E+01		(Use batch test)
SIMAZINE	9.8E-02	Groundwater Protection	5.0E+02	site-specific		4.0E+00		9.8E-02
STYRENE	9.1E-01	Groundwater Protection	5.0E+02	site-specific		8.7E+02	4.5E+02	9.1E-01
TERBACIL	3.9E+00	Groundwater Protection	5.0E+02	site-specific		1.6E+02		3.9E+00
tert-BUTYL ALCOHOL	2.8E-02	Groundwater Protection	1.0E+02	site-specific		8.1E+01	(Use soil gas)	2.8E-02
TETRACHLOROETHANE, 1,1,1,2-	1.5E-02	Groundwater Protection	1.0E+02	site-specific		1.9E+00	(Use soil gas)	1.5E-02
TETRACHLOROETHANE, 1,1,2,2-	1.2E-03	Groundwater Protection	5.0E+02	site-specific		5.7E-01	9.0E-03	1.2E-03
TETRACHLOROETHYLENE	8.8E-02	Vapor Intrusion	1.7E+02	site-specific		5.6E-01	8.8E-02	6.2E-01
TETRACHLOROPHENOL, 2,3,4,6-	4.9E+00	Groundwater Protection	5.0E+02	site-specific		3.7E+02		4.9E+00
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	1.6E+02	Groundwater Protection	5.0E+02	site-specific		7.7E+02		1.6E+02
THALLIUM	7.8E-01	Direct Exposure	1.0E+03	site-specific	2.5E-01	7.8E-01		(Use batch test)
TOLUENE	3.2E+00	Groundwater Protection	5.0E+02	site-specific		8.2E+02	8.2E+02	3.2E+00
TOXAPHENE	4.4E-01	Direct Exposure	5.0E+02	site-specific		4.4E-01		2.5E+02
TPH (gasolines)	1.0E+02	Ceiling Value	1.0E+02	site-specific		5.0E+02	(Use soil gas)	1.0E+02
TPH (middle distillates)	1.0E+02	Groundwater Protection	5.0E+02	site-specific		5.0E+02	(Use soil gas)	1.0E+02

TABLE A-1. SOIL ACTION LEVELS
(Potentially impacted groundwater IS a current or potential drinking water resource; Surface water body IS NOT located within 150m of release site)

	(mg/kg)							
						[1]Human Health		Leaching & Groundwater Protection
CHEMICAL PARAMETER	Final EAL	Basis	[1]Gross Contamination (Odors, etc.) Table F-2	Terrestrial Ecotoxicity Table L	Background Table K	Direct Exposure Table I-1	Vapor Intrusion Into Buildings Table C-1b	Drinking Water Resource Table E
TPH (residual fuels)	5.0E+02	Ceiling Value	5.0E+02	site-specific		9.4E+03		1.0E+03
TRICHLOROBENZENE, 1,2,4-	9.8E-02	Vapor Intrusion	5.0E+02	site-specific		6.6E+00	9.8E-02	1.6E+01
TRICHLOROETHANE, 1,1,1-	2.3E+01	Groundwater Protection	5.0E+02	site-specific		6.4E+02	2.2E+02	2.3E+01
TRICHLOROETHANE, 1,1,2-	8.9E-03	Vapor Intrusion	1.0E+02	site-specific		3.2E-01	8.9E-03	7.6E-02
TRICHLOROETHYLENE	2.6E-01	Vapor Intrusion	5.0E+02	site-specific		2.8E+00	2.6E-01	3.5E-01
TRICHLOROPHENOL, 2,4,5-	2.9E+01	Groundwater Protection	1.0E+02	site-specific		1.2E+03		2.9E+01
TRICHLOROPHENOL, 2,4,6-	1.8E+00	Groundwater Protection	5.0E+02	site-specific		1.2E+01		1.8E+00
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	6.5E+00	Groundwater Protection	1.0E+03	site-specific		1.2E+02		6.5E+00
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	8.7E-01	Groundwater Protection	5.0E+02	site-specific		9.8E+01		8.7E-01
TRICHLOROPROPANE, 1,2,3-	1.3E-03	Direct Exposure	1.0E+02	site-specific		1.3E-03	(Use soil gas)	1.1E-02
TRICHLOROPROPENE, 1,2,3-	1.2E-01	Direct Exposure	1.0E+02	site-specific		1.2E-01	(Use soil gas)	1.2E-01
TRIFLURALIN	2.4E+01	Groundwater Protection	1.0E+02	site-specific		6.3E+01		2.4E+01
TRINITROBENZENE, 1,3,5-	3.9E+01	Groundwater Protection	5.0E+02	site-specific		4.5E+02		3.9E+01
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.9E+01	Direct Exposure	5.0E+02	site-specific		4.9E+01		1.1E+02
TRINITROTOLUENE, 2,4,6- (TNT)	1.0E+00	Groundwater Protection	5.0E+02	site-specific		7.2E+00		1.0E+00
VANADIUM	7.7E+02	Background	1.0E+03	site-specific	7.7E+02	7.8E+01		(Use batch test)
VINYL CHLORIDE	7.2E-02	Direct Exposure	5.0E+02	site-specific		7.2E-02	1.2E-01	3.4E-01
XYLENES	2.1E+00	Groundwater Protection	3.9E+02	site-specific		1.2E+02	4.5E+01	2.1E+00
ZINC	1.0E+03	Ceiling Value	1.0E+03	site-specific	3.5E+02	4.7E+03		(Use batch test)
Electrical Conductivity (mS/cm, USEPA Method 120.1 MOD)	2.0	-	-	-		-	-	-
Sodium Adsorption Ratio	5.0	-	-	-		-	-	-

Notes:

1. Based on unrestricted current or future land use. Considered adequate for residential housing, schools, medical facilities, day-care centers, parks and other sensitive uses.

Final Environmental Action Level is lowest of gross contamination, ecotoxicity, direct-exposure, vapor intrusion and leaching action levels.
Assumes soil pH 5.0 to 9.0.
Soil data should be reported on dry-weight basis (see Chapter 7).
TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.

TABLE A-2. SOIL ACTION LEVELS
(Potentially impacted groundwater IS a current or potential drinking water resource; Surface water body IS located within 150m of release site)

	(mg/kg)							
						[1]Human Health		Leaching & Groundwater Protection
CHEMICAL PARAMETER	Final EAL	Basis	[1]Gross Contamination (Odors, etc.) Table F-2	Terrestrial Ecotoxicity Table L	Background Table K	Direct Exposure Table I-1	Vapor Intrusion Into Buildings Table C-1b	Drinking Water Resource Table E
ACENAPHTHENE	1.2E+02	Vapor Intrusion	1.0E+03	site-specific		6.2E+02	1.2E+02	1.2E+02
ACENAPHTHYLENE	1.3E+01	Groundwater Protection	5.0E+02	site-specific		3.2E+02	(Use soil gas)	1.3E+01
ACETONE	1.0E+00	Groundwater Protection	5.0E+02	site-specific		1.2E+04	1.4E+04	1.0E+00
ALDRIN	9.2E-01	Direct Exposure	1.0E+03	site-specific		9.2E-01		8.4E+00
AMETRYN	1.1E+00	Groundwater Protection	5.0E+02	site-specific		1.1E+02		1.1E+00
AMINO,2- DINITROTOLUENE,4,6-	7.0E-01	Groundwater Protection	5.0E+02	site-specific		3.1E+01		7.0E-01
AMINO,4- DINITROTOLUENE,2,6-	7.0E-01	Groundwater Protection	5.0E+02	site-specific		3.1E+01		7.0E-01
ANTHRACENE	4.3E+00	Vapor Intrusion	5.0E+02	site-specific		3.3E+03	4.3E+00	4.3E+00
ANTIMONY	2.4E+00	Background	1.0E+03	site-specific	2.4E+00	1.6E+00		(Use batch test)
ARSENIC	2.4E+01	Background	1.0E+03	site-specific	2.4E+01	2.3E+01		(Use batch test)
ATRAZINE	1.1E-01	Groundwater Protection	5.0E+02	site-specific		2.1E+00		1.1E-01
BARIUM	1.0E+03	Ceiling Value	1.0E+03	site-specific	6.9E+02	3.1E+03		(Use batch test)
BENZENE	3.0E-01	Groundwater Protection	5.0E+02	site-specific		1.1E+00	6.7E-01	3.0E-01
BENZO(a)ANTHRACENE	1.5E+00	Direct Exposure	5.0E+02	site-specific		1.5E+00		1.0E+01
BENZO(a)PYRENE	1.5E-01	Direct Exposure	5.0E+02	site-specific		1.5E-01		5.7E+00
BENZO(b)FLUORANTHENE	1.5E+00	Direct Exposure	5.0E+02	site-specific		1.5E+00		9.2E+00
BENZO(g,h,i)PERYLENE	2.7E+01	Groundwater Protection	5.0E+02	site-specific		4.6E+02		2.7E+01
BENZO(k)FLUORANTHENE	1.5E+01	Direct Exposure	5.0E+02	site-specific		1.5E+01		3.9E+01
BERYLLIUM	3.1E+01	Direct Exposure	1.0E+03	site-specific	3.0E+00	3.1E+01		(Use batch test)
BIPHENYL, 1,1-	1.0E+01	Direct Exposure	5.0E+02	site-specific		1.0E+01	(Use soil gas)	2.1E+02
BIS(2-CHLOROETHYL)ETHER	6.4E-05	Groundwater Protection	5.0E+02	site-specific		2.1E-01	4.5E-03	6.4E-05
BIS(2-CHLOROISOPROPYL)ETHER	3.5E-03	Groundwater Protection	5.0E+02	site-specific		3.3E+00	(Use soil gas)	3.5E-03
BIS(2-ETHYLHEXYL)PHTHALATE	3.5E+01	Direct Exposure	5.0E+02	site-specific		3.5E+01		1.9E+02
BORON	1.0E+02	Ceiling Value	1.0E+02	site-specific		3.1E+03		(Use batch test)
BROMODICHLOROMETHANE	2.2E-03	Groundwater Protection	9.3E+02	site-specific		2.8E-01	1.4E-02	2.2E-03
BROMOFORM	6.9E-01	Groundwater Protection	5.0E+02	site-specific		6.1E+01		6.9E-01
BROMOMETHANE	2.2E-01	Vapor Intrusion	5.0E+02	site-specific		1.6E+00	2.2E-01	3.6E-01
CADMIUM	1.4E+01	Direct Exposure	1.0E+03	site-specific	2.3E+00	1.4E+01		(Use batch test)
CARBON TETRACHLORIDE	8.7E-02	Vapor Intrusion	4.5E+02	site-specific		6.2E-01	8.7E-02	8.7E-01
CHLORDANE (TECHNICAL)	1.6E+01	Direct Exposure	1.0E+03	site-specific		1.6E+01		2.9E+01
CHLOROANILINE, p-	6.3E-03	Groundwater Protection	1.0E+03	site-specific		2.4E+00		6.3E-03
CHLOROBENZENE	1.5E+00	Groundwater Protection	5.0E+02	site-specific		5.9E+01	2.2E+00	1.5E+00
CHLOROETHANE	1.1E+00	Groundwater Protection	5.0E+02	site-specific		2.1E+03	4.5E+02	1.1E+00
CHLOROFORM	2.3E-02	Vapor Intrusion	5.0E+02	site-specific		3.0E-01	2.3E-02	2.0E+00
CHLOROMETHANE	1.0E-01	Groundwater Protection	1.0E+02	site-specific		1.7E+00	2.9E-01	1.0E-01
CHLOROPHENOL, 2-	9.2E-03	Groundwater Protection	1.0E+02	site-specific		6.7E+01	1.5E+01	9.2E-03
CHROMIUM (Total)	1.1E+03	Background	-	site-specific	1.1E+03			(Use batch test)
CHROMIUM III	1.0E+03	Ceiling Value	1.0E+03	site-specific		2.3E+04		(Use batch test)
CHROMIUM VI	2.9E+01	Direct Exposure	1.0E+03	site-specific		2.9E+01		(Use batch test)
CHRYSENE	1.0E+01	Groundwater Protection	1.0E+03	site-specific		1.5E+02		1.0E+01
COBALT	8.0E+01	Background	1.0E+03	site-specific	8.0E+01	4.7E+00		(Use batch test)
COPPER	6.3E+02	Direct Exposure	1.0E+03	site-specific	2.5E+02	6.3E+02		(Use batch test)
CYANIDE (Free)	1.0E+02	Ceiling Value	1.0E+02	site-specific		3.1E+02	(Use soil gas)	(Use batch test)
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	9.0E-03	Groundwater Protection	5.0E+02	site-specific		5.5E+00		9.0E-03
DALAPON	1.1E-01	Groundwater Protection	5.0E+02	site-specific		3.7E+02		1.1E-01
DIBENZO(a,h)ANTHTRACENE	1.5E-01	Direct Exposure	5.0E+02	site-specific		1.5E-01		1.2E+01

TABLE A-2. SOIL ACTION LEVELS
(Potentially impacted groundwater IS a current or potential drinking water resource; Surface water body IS located within 150m of release site)

	(mg/kg)							
						[1]Human Health		Leaching & Groundwater Protection
CHEMICAL PARAMETER	Final EAL	Basis	[1]Gross Contamination (Odors, etc.) Table F-2	Terrestrial Ecotoxicity Table L	Background Table K	Direct Exposure Table I-1	Vapor Intrusion Into Buildings Table C-1b	Drinking Water Resource Table E
DIBROMO,1,2- CHLOROPROPANE,3-	9.0E-04	Groundwater Protection	5.0E+02	site-specific		5.7E-03	(Use soil gas)	9.0E-04
DIBROMOCHLOROMETHANE	1.6E-03	Groundwater Protection	1.0E+02	site-specific		7.8E-01	2.2E-02	1.6E-03
DIBROMOETHANE, 1,2-	3.7E-04	Groundwater Protection	5.0E+02	site-specific		3.2E-02	8.7E-04	3.7E-04
DICHLOROBENZENE, 1,2-	7.5E-01	Groundwater Protection	1.9E+02	site-specific		1.9E+02	8.9E+00	7.5E-01
DICHLOROBENZENE, 1,3-	5.7E-01	Groundwater Protection	1.0E+02	site-specific		1.9E+02	(Use soil gas)	5.7E-01
DICHLOROBENZENE, 1,4-	4.7E-02	Vapor Intrusion	5.0E+02	site-specific		2.5E+00	4.7E-02	3.9E-01
DICHLOROBENZIDINE, 3,3-	7.9E-02	Groundwater Protection	5.0E+02	site-specific		1.1E+00		7.9E-02
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.0E+00	Direct Exposure	5.0E+02	site-specific		2.0E+00		6.3E+01
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.4E+00	Direct Exposure	5.0E+02	site-specific		1.4E+00		2.8E+01
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.7E+00	Direct Exposure	1.0E+03	site-specific		1.7E+00		5.6E+00
DICHLOROETHANE, 1,1-	9.7E-02	Groundwater Protection	5.0E+02	site-specific		3.3E+00	3.3E-01	9.7E-02
DICHLOROETHANE, 1,2-	2.1E-03	Groundwater Protection	5.0E+02	site-specific		4.4E-01	2.0E-02	2.1E-03
DICHLOROETHYLENE, 1,1-	1.2E+00	Groundwater Protection	5.0E+02	site-specific		4.9E+01	8.9E+00	1.2E+00
DICHLOROETHYLENE, Cis 1,2-	3.1E-01	Vapor Intrusion	1.0E+02	site-specific		3.5E+00	3.1E-01	2.3E+00
DICHLOROETHYLENE, Trans 1,2-	2.7E+00	Vapor Intrusion	5.0E+02	site-specific		2.2E+01	2.7E+00	6.4E+00
DICHLOROPHENOL, 2,4-	2.5E-02	Groundwater Protection	5.0E+02	site-specific		3.7E+01		2.5E-02
DICHLOROPHENOXYACETIC ACID (2,4-D)	2.0E-01	Groundwater Protection	5.0E+02	site-specific		1.4E+02		2.0E-01
DICHLOROPROPANE, 1,2-	5.2E-02	Vapor Intrusion	1.0E+02	site-specific		8.9E-01	5.2E-02	1.4E-01
DICHLOROPROPENE, 1,3-	1.5E-02	Groundwater Protection	5.0E+02	site-specific		1.7E+00	1.3E-01	1.5E-02
DIELDRIN	1.5E+00	Direct Exposure	1.0E+03	site-specific		1.5E+00		3.0E+01
DIETHYLPHTHALATE	2.6E-02	Groundwater Protection	5.0E+02	site-specific		9.8E+03		2.6E-02
DIMETHYLPHENOL, 2,4-	9.0E+00	Groundwater Protection	1.0E+02	site-specific		2.4E+02	1.1E+03	9.0E+00
DIMETHYLPHTHALATE	3.5E-02	Groundwater Protection	5.0E+02	site-specific		1.2E+05		3.5E-02
DINITROBENZENE, 1,3-	2.1E-01	Groundwater Protection	5.0E+02	site-specific		1.2E+00		2.1E-01
DINITROPHENOL, 2,4-	5.6E+00	Groundwater Protection	5.0E+02	site-specific		2.4E+01		5.6E+00
DINITROTOLUENE, 2,4- (2,4-DNT)	2.1E-02	Groundwater Protection	5.0E+02	site-specific		1.6E+00		2.1E-02
DINITROTOLUENE, 2,6- (2,6-DNT)	3.6E+00	Groundwater Protection	5.0E+02	site-specific		1.2E+01		3.6E+00
DIOXANE, 1,4-	3.1E-04	Groundwater Protection	5.0E+02	site-specific		4.9E+00		3.1E-04
DIOXINS (TEQ)	2.4E-04	Direct Exposure	1.0E+03	site-specific	2.0E-05	2.4E-04		1.8E-01
DIURON	1.1E+00	Groundwater Protection	5.0E+02	site-specific		2.4E+01		1.1E+00
ENDOSULFAN	1.8E+01	Groundwater Protection	5.0E+02	site-specific		7.3E+01		1.8E+01
ENDRIN	3.7E+00	Direct Exposure	5.0E+02	site-specific		3.7E+00		3.0E+01
ETHANOL	4.5E+00	Groundwater Protection	5.0E+02	site-specific				4.5E+00
ETHYLBENZENE	3.7E+00	Groundwater Protection	4.8E+02	site-specific		5.5E+01	2.1E+01	3.7E+00
FLUORANTHENE	8.7E+01	Groundwater Protection	5.0E+02	site-specific		4.6E+02		8.7E+01
FLUORENE	1.0E+02	Vapor Intrusion	5.0E+02	site-specific		4.4E+02	1.0E+02	1.0E+02
GLYPHOSATE	1.1E-02	Groundwater Protection	5.0E+02	site-specific		1.2E+03		1.1E-02
HEPTACHLOR	1.1E-01	Direct Exposure	1.0E+03	site-specific		1.1E-01		4.5E+01
HEPTACHLOR EPOXIDE	5.3E-02	Direct Exposure	1.0E+03	site-specific		5.3E-02		1.2E+01
HEXACHLOROBENZENE	3.0E-01	Direct Exposure	5.0E+02	site-specific		3.0E-01		1.0E+00
HEXACHLOROBUTADIENE	1.8E-01	Groundwater Protection	5.0E+02	site-specific		6.2E+00		1.8E-01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	3.7E-02	Groundwater Protection	5.0E+02	site-specific		5.2E-01		3.7E-02
HEXACHLOROETHANE	2.7E-01	Groundwater Protection	5.0E+02	site-specific		1.2E+01		2.7E-01
HEXAZINONE	2.6E+01	Groundwater Protection	5.0E+02	site-specific		4.0E+02		2.6E+01
INDENO(1,2,3-cd)PYRENE	1.5E+00	Direct Exposure	5.0E+02	site-specific		1.5E+00		3.0E+01
ISOPHORONE	7.7E-01	Groundwater Protection	5.0E+02	site-specific		5.1E+02		7.7E-01

TABLE A-2. SOIL ACTION LEVELS
(Potentially impacted groundwater IS a current or potential drinking water resource; Surface water body IS located within 150m of release site)

	(mg/kg)							
						[1]Human Health		Leaching & Groundwater Protection
CHEMICAL PARAMETER	Final EAL	Basis	[1]Gross Contamination (Odors, etc.) Table F-2	Terrestrial Ecotoxicity Table L	Background Table K	Direct Exposure Table I-1	Vapor Intrusion Into Buildings Table C-1b	Drinking Water Resource Table E
LEAD	2.0E+02	Direct Exposure	1.0E+03	site-specific	7.3E+01	2.0E+02		(Use batch test)
MERCURY	4.7E+00	Direct Exposure	5.0E+02	site-specific	7.2E-01	4.7E+00	(Use soil gas)	(Use batch test)
METHOXYCHLOR	1.6E+01	Groundwater Protection	5.0E+02	site-specific		6.1E+01		1.6E+01
METHYL ETHYL KETONE	7.7E+00	Groundwater Protection	5.0E+02	site-specific		5.6E+03	2.2E+03	7.7E+00
METHYL ISOBUTYL KETONE	5.0E-01	Groundwater Protection	1.0E+02	site-specific		1.1E+03	1.3E+03	5.0E-01
METHYL MERCURY	1.6E+00	Direct Exposure	1.0E+02	site-specific		1.6E+00		(Use batch test)
METHYL TERT BUTYL ETHER	2.8E-02	Groundwater Protection	1.0E+02	site-specific		4.4E+01	2.0E+00	2.8E-02
METHYLENE CHLORIDE	1.1E-01	Groundwater Protection	5.0E+02	site-specific		1.1E+01	1.1E+00	1.1E-01
METHYLNAPHTHALENE, 1-	7.9E-01	Groundwater Protection	5.0E+02	site-specific		9.8E+01	2.6E+01	7.9E-01
METHYLNAPHTHALENE, 2-	8.7E-01	Groundwater Protection	5.0E+02	site-specific		4.7E+01	2.8E+01	8.7E-01
MOLYBDENUM	7.8E+01	Direct Exposure	1.0E+03	site-specific	4.0E+00	7.8E+01		(Use batch test)
NAPHTHALENE	4.4E+00	Groundwater Protection	5.0E+02	site-specific		2.8E+01	4.5E+00	4.4E+00
NICKEL	7.6E+02	Direct Exposure	1.0E+03	site-specific	4.1E+02	7.6E+02		(Use batch test)
NITROBENZENE	4.6E-03	Groundwater Protection	5.0E+02	site-specific		4.8E+00	(Use soil gas)	4.6E-03
NITROGLYCERIN	7.0E-02	Groundwater Protection	5.0E+02	site-specific		1.2E+00		7.0E-02
NITROTOLUENE, 2-	3.8E-03	Groundwater Protection	5.0E+02	site-specific		1.9E+00	(Use soil gas)	3.8E-03
NITROTOLUENE, 3-	7.3E+00	Groundwater Protection	5.0E+02	site-specific		2.5E+02	(Use soil gas)	7.3E+00
NITROTOLUENE, 4-	2.5E-01	Groundwater Protection	5.0E+02	site-specific		3.0E+01		2.5E-01
PENTACHLOROPHENOL	8.2E-01	Groundwater Protection	5.0E+02	site-specific		8.9E-01		8.2E-01
PENTAERYTHRITOLTETRANITRATE (PETN)	4.2E-01	Groundwater Protection	5.0E+02	site-specific		2.4E+01		4.2E-01
PERCHLORATE	7.0E-03	Groundwater Protection	1.0E+03	site-specific		1.1E+01		7.0E-03
PHENANTHRENE	6.9E+01	Groundwater Protection	5.0E+02	site-specific		4.4E+02	(Use soil gas)	6.9E+01
PHENOL	1.6E-01	Groundwater Protection	5.0E+02	site-specific		3.7E+03		1.6E-01
POLYCHLORINATED BIPHENYLS (PCBs)	1.1E+00	Direct Exposure	5.0E+02	site-specific		1.1E+00		6.3E+00
PROPICONAZOLE	6.6E+00	Groundwater Protection	5.0E+02	site-specific		1.6E+02		6.6E+00
PYRENE	4.4E+01	Vapor Intrusion	5.0E+02	site-specific		3.4E+02	4.4E+01	4.4E+01
SELENIUM	7.8E+01	Direct Exposure	1.0E+03	site-specific	7.1E+00	7.8E+01		(Use batch test)
SILVER	7.8E+01	Direct Exposure	1.0E+03	site-specific	1.5E+00	7.8E+01		(Use batch test)
SIMAZINE	4.9E-02	Groundwater Protection	5.0E+02	site-specific		4.0E+00		4.9E-02
STYRENE	9.1E-01	Groundwater Protection	5.0E+02	site-specific		8.7E+02	4.5E+02	9.1E-01
TERBACIL	3.9E+00	Groundwater Protection	5.0E+02	site-specific		1.6E+02		3.9E+00
tert-BUTYL ALCOHOL	2.8E-02	Groundwater Protection	1.0E+02	site-specific		8.1E+01	(Use soil gas)	2.8E-02
TETRACHLOROETHANE, 1,1,1,2-	1.5E-02	Groundwater Protection	1.0E+02	site-specific		1.9E+00	(Use soil gas)	1.5E-02
TETRACHLOROETHANE, 1,1,2,2-	1.2E-03	Groundwater Protection	5.0E+02	site-specific		5.7E-01	9.0E-03	1.2E-03
TETRACHLOROETHYLENE	8.8E-02	Vapor Intrusion	1.7E+02	site-specific		5.6E-01	8.8E-02	6.2E-01
TETRACHLOROPHENOL, 2,3,4,6-	5.9E-01	Groundwater Protection	5.0E+02	site-specific		3.7E+02		5.9E-01
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	2.9E+01	Groundwater Protection	5.0E+02	site-specific		7.7E+02		2.9E+01
THALLIUM	7.8E-01	Direct Exposure	1.0E+03	site-specific	2.5E-01	7.8E-01		(Use batch test)
TOLUENE	3.2E+00	Groundwater Protection	5.0E+02	site-specific		8.2E+02	8.2E+02	3.2E+00
TOXAPHENE	4.4E-01	Direct Exposure	5.0E+02	site-specific		4.4E-01		2.5E+02
TPH (gasolines)	1.0E+02	Ceiling Value	1.0E+02	site-specific		5.0E+02	(Use soil gas)	1.0E+02
TPH (middle distillates)	1.0E+02	Groundwater Protection	5.0E+02	site-specific		5.0E+02	(Use soil gas)	1.0E+02
TPH (residual fuels)	5.0E+02	Ceiling Value	5.0E+02	site-specific		9.4E+03		1.0E+03
TRICHLOROBENZENE, 1,2,4-	9.8E-02	Vapor Intrusion	5.0E+02	site-specific		6.6E+00	9.8E-02	5.8E+00
TRICHLOROETHANE, 1,1,1-	7.0E+00	Groundwater Protection	5.0E+02	site-specific		6.4E+02	2.2E+02	7.0E+00
TRICHLOROETHANE, 1,1,2-	8.9E-03	Vapor Intrusion	1.0E+02	site-specific		3.2E-01	8.9E-03	7.6E-02

TABLE A-2. SOIL ACTION LEVELS
(Potentially impacted groundwater IS a current or potential drinking water resource; Surface water body IS located within 150m of release site)

	(mg/kg)							
						[1]Human Health		Leaching & Groundwater Protection
CHEMICAL PARAMETER	Final EAL	Basis	[1]Gross Contamination (Odors, etc.) Table F-2	Terrestrial Ecotoxicity Table L	Background Table K	Direct Exposure Table I-1	Vapor Intrusion Into Buildings Table C-1b	Drinking Water Resource Table E
TRICHLOROETHYLENE	2.6E-01	Vapor Intrusion	5.0E+02	site-specific		2.8E+00	2.6E-01	3.5E-01
TRICHLOROPHENOL, 2,4,5-	3.2E+00	Groundwater Protection	1.0E+02	site-specific		1.2E+03		3.2E+00
TRICHLOROPHENOL, 2,4,6-	1.8E+00	Groundwater Protection	5.0E+02	site-specific		1.2E+01		1.8E+00
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	6.5E+00	Groundwater Protection	1.0E+03	site-specific		1.2E+02		6.5E+00
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	8.7E-01	Groundwater Protection	5.0E+02	site-specific		9.8E+01		8.7E-01
TRICHLOROPROPANE, 1,2,3-	1.3E-03	Direct Exposure	1.0E+02	site-specific		1.3E-03	(Use soil gas)	1.1E-02
TRICHLOROPROPENE, 1,2,3-	1.2E-01	Direct Exposure	1.0E+02	site-specific		1.2E-01	(Use soil gas)	1.2E-01
TRIFLURALIN	2.4E+01	Groundwater Protection	1.0E+02	site-specific		6.3E+01		2.4E+01
TRINITROBENZENE, 1,3,5-	8.4E+00	Groundwater Protection	5.0E+02	site-specific		4.5E+02		8.4E+00
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.9E+01	Direct Exposure	5.0E+02	site-specific		4.9E+01		1.1E+02
TRINITROTOLUENE, 2,4,6- (TNT)	1.0E+00	Groundwater Protection	5.0E+02	site-specific		7.2E+00		1.0E+00
VANADIUM	7.7E+02	Background	1.0E+03	site-specific	7.7E+02	7.8E+01		(Use batch test)
VINYL CHLORIDE	7.2E-02	Direct Exposure	5.0E+02	site-specific		7.2E-02	1.2E-01	3.4E-01
XYLENES	2.1E+00	Groundwater Protection	3.9E+02	site-specific		1.2E+02	4.5E+01	2.1E+00
ZINC	1.0E+03	Ceiling Value	1.0E+03	site-specific	3.5E+02	4.7E+03		(Use batch test)
Electrical Conductivity (mS/cm, USEPA Method 120.1 MOD)	4.0	-	-	-	-	-	-	-
Sodium Adsorption Ratio	12	-	-	-	-	-	-	-

Notes:

1. Based on unrestricted current or future land use. Considered adequate for residential housing, schools, medical facilities, day-care centers, parks and other sensitive uses.

Final Environmental Action Level is lowest of gross contamination, ecotoxicity, direct-exposure, vapor intrusion and leaching action levels.
Assumes soil pH 5.0 to 9.0.
Soil data should be reported on dry-weight basis (see Chapter 7).
TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.

TABLE B-1. SOIL ACTION LEVELS
(Potentially impacted groundwater IS NOT a current or potential drinking water resource; Surface water body IS NOT located within 150m of release site)

	(mg/kg)							
						[1]Human Health		Leaching & Groundwater Protection
CHEMICAL PARAMETER	Final EAL	Basis	[1]Gross Contamination (Odors, etc.) Table F-2	Terrestrial Ecotoxicity Table L	Background Table K	Direct Exposure Table I-1	Vapor Intrusion Into Buildings Table C-1b	NON-Drinking Water Resource Table E
ACENAPHTHENE	1.2E+02	Vapor Intrusion	1.0E+03	site-specific		6.2E+02	1.2E+02	1.7E+02
ACENAPHTHYLENE	1.3E+02	Groundwater Protection	5.0E+02	site-specific		3.2E+02	(Use soil gas)	1.3E+02
ACETONE	1.0E+00	Groundwater Protection	5.0E+02	site-specific		1.2E+04	1.4E+04	1.0E+00
ALDRIN	9.2E-01	Direct Exposure	1.0E+03	site-specific		9.2E-01		1.8E+01
AMETRYN	1.1E+01	Groundwater Protection	5.0E+02	site-specific		1.1E+02		1.1E+01
AMINO,2- DINITROTOLUENE,4,6-	7.0E+00	Groundwater Protection	5.0E+02	site-specific		3.1E+01		7.0E+00
AMINO,4- DINITROTOLUENE,2,6-	7.0E+00	Groundwater Protection	5.0E+02	site-specific		3.1E+01		7.0E+00
ANTHRACENE	4.3E+00	Vapor Intrusion	5.0E+02	site-specific		3.3E+03	4.3E+00	5.9E+01
ANTIMONY	2.4E+00	Background	1.0E+03	site-specific	2.4E+00	1.6E+00		(Use batch test)
ARSENIC	2.4E+01	Background	1.0E+03	site-specific	2.4E+01	2.3E+01		(Use batch test)
ATRAZINE	2.1E+00	Direct Exposure	5.0E+02	site-specific		2.1E+00		1.3E+01
BARIUM	1.0E+03	Ceiling Value	1.0E+03	site-specific	6.9E+02	3.1E+03		(Use batch test)
BENZENE	6.7E-01	Vapor Intrusion	5.0E+02	site-specific		1.1E+00	6.7E-01	1.0E+02
BENZO(a)ANTHRACENE	1.5E+00	Direct Exposure	5.0E+02	site-specific		1.5E+00		1.4E+02
BENZO(a)PYRENE	1.5E-01	Direct Exposure	5.0E+02	site-specific		1.5E-01		7.9E+01
BENZO(b)FLUORANTHENE	1.5E+00	Direct Exposure	5.0E+02	site-specific		1.5E+00		7.5E+01
BENZO(g,h,i)PERYLENE	3.5E+01	Groundwater Protection	5.0E+02	site-specific		4.6E+02		3.5E+01
BENZO(k)FLUORANTHENE	1.5E+01	Direct Exposure	5.0E+02	site-specific		1.5E+01		3.9E+01
BERYLLIUM	3.1E+01	Direct Exposure	1.0E+03	site-specific	3.0E+00	3.1E+01		(Use batch test)
BIPHENYL, 1,1-	1.0E+01	Direct Exposure	5.0E+02	site-specific		1.0E+01	(Use soil gas)	2.1E+02
BIS(2-CHLOROETHYL)ETHER	4.5E-03	Vapor Intrusion	5.0E+02	site-specific		2.1E-01	4.5E-03	7.2E-01
BIS(2-CHLOROISOPROPYL)ETHER	3.3E+00	Direct Exposure	5.0E+02	site-specific		3.3E+00	(Use soil gas)	3.5E+01
BIS(2-ETHYLHEXYL)PHTHALATE	3.5E+01	Direct Exposure	5.0E+02	site-specific		3.5E+01		6.4E+02
BORON	1.0E+02	Ceiling Value	1.0E+02	site-specific		3.1E+03		(Use batch test)
BROMODICHLOROMETHANE	1.4E-02	Vapor Intrusion	9.3E+02	site-specific		2.8E-01	1.4E-02	1.8E+00
BROMOFORM	4.4E+01	Groundwater Protection	5.0E+02	site-specific		6.1E+01		4.4E+01
BROMOMETHANE	2.2E-01	Vapor Intrusion	5.0E+02	site-specific		1.6E+00	2.2E-01	1.9E+01
CADMIUM	1.4E+01	Direct Exposure	1.0E+03	site-specific	2.3E+00	1.4E+01		(Use batch test)
CARBON TETRACHLORIDE	8.7E-02	Vapor Intrusion	4.5E+02	site-specific		6.2E-01	8.7E-02	1.7E+01
CHLORDANE (TECHNICAL)	1.6E+01	Direct Exposure	1.0E+03	site-specific		1.6E+01		2.9E+01
CHLOROANILINE, p-	9.4E-02	Groundwater Protection	1.0E+03	site-specific		2.4E+00		9.4E-02
CHLOROBENZENE	2.2E+00	Vapor Intrusion	5.0E+02	site-specific		5.9E+01	2.2E+00	9.4E+00
CHLOROETHANE	1.1E+01	Groundwater Protection	5.0E+02	site-specific		2.1E+03	4.5E+02	1.1E+01
CHLOROFORM	2.3E-02	Vapor Intrusion	5.0E+02	site-specific		3.0E-01	2.3E-02	2.6E+00
CHLOROMETHANE	2.9E-01	Vapor Intrusion	1.0E+02	site-specific		1.7E+00	2.9E-01	2.1E+01
CHLOROPHENOL, 2-	9.2E-02	Groundwater Protection	1.0E+02	site-specific		6.7E+01	1.5E+01	9.2E-02
CHROMIUM (Total)	1.1E+03	Background	-	site-specific	1.1E+03			(Use batch test)
CHROMIUM III	1.0E+03	Ceiling Value	1.0E+03	site-specific		2.3E+04		(Use batch test)
CHROMIUM VI	2.9E+01	Direct Exposure	1.0E+03	site-specific		2.9E+01		(Use batch test)
CHRYSENE	3.0E+01	Groundwater Protection	1.0E+03	site-specific		1.5E+02		3.0E+01
COBALT	8.0E+01	Background	1.0E+03	site-specific	8.0E+01	4.7E+00		(Use batch test)
COPPER	6.3E+02	Direct Exposure	1.0E+03	site-specific	2.5E+02	6.3E+02		(Use batch test)
CYANIDE (Free)	1.0E+02	Ceiling Value	1.0E+02	site-specific		3.1E+02	(Use soil gas)	(Use batch test)
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	5.5E+00	Direct Exposure	5.0E+02	site-specific		5.5E+00		2.1E+01
DALAPON	1.6E+00	Groundwater Protection	5.0E+02	site-specific		3.7E+02		1.6E+00

TABLE B-1. SOIL ACTION LEVELS
(Potentially impacted groundwater IS NOT a current or potential drinking water resource; Surface water body IS NOT located within 150m of release site)

	(mg/kg)							
						[1]Human Health		Leaching & Groundwater Protection
CHEMICAL PARAMETER	Final EAL	Basis	[1]Gross Contamination (Odors, etc.) Table F-2	Terrestrial Ecotoxicity Table L	Background Table K	Direct Exposure Table I-1	Vapor Intrusion Into Buildings Table C-1b	NON-Drinking Water Resource Table E
DIBENZO(a,h)ANTHTRACENE	1.5E-01	Direct Exposure	5.0E+02	site-specific		1.5E-01		1.6E+02
DIBROMO,1,2- CHLOROPROPANE,3-	9.0E-04	Groundwater Protection	5.0E+02	site-specific		5.7E-03	(Use soil gas)	9.0E-04
DIBROMOCHLOROMETHANE	2.2E-02	Vapor Intrusion	1.0E+02	site-specific		7.8E-01	2.2E-02	3.4E+00
DIBROMOETHANE, 1,2-	8.7E-04	Vapor Intrusion	5.0E+02	site-specific		3.2E-02	8.7E-04	1.5E-01
DICHLOROBENZENE, 1,2-	7.5E+00	Groundwater Protection	1.9E+02	site-specific		1.9E+02	8.9E+00	7.5E+00
DICHLOROBENZENE, 1,3-	4.2E+01	Groundwater Protection	1.0E+02	site-specific		1.9E+02	(Use soil gas)	4.2E+01
DICHLOROBENZENE, 1,4-	4.7E-02	Vapor Intrusion	5.0E+02	site-specific		2.5E+00	4.7E-02	8.5E+00
DICHLOROBENZIDINE, 3,3-	1.1E+00	Direct Exposure	5.0E+02	site-specific		1.1E+00		1.3E+02
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.0E+00	Direct Exposure	5.0E+02	site-specific		2.0E+00		6.3E+01
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.4E+00	Direct Exposure	5.0E+02	site-specific		1.4E+00		2.8E+01
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.7E+00	Direct Exposure	1.0E+03	site-specific		1.7E+00		5.6E+00
DICHLOROETHANE, 1,1-	3.3E-01	Vapor Intrusion	5.0E+02	site-specific		3.3E+00	3.3E-01	1.9E+00
DICHLOROETHANE, 1,2-	2.0E-02	Vapor Intrusion	5.0E+02	site-specific		4.4E-01	2.0E-02	2.2E+00
DICHLOROETHYLENE, 1,1-	8.9E+00	Vapor Intrusion	5.0E+02	site-specific		4.9E+01	8.9E+00	6.7E+02
DICHLOROETHYLENE, Cis 1,2-	3.1E-01	Vapor Intrusion	1.0E+02	site-specific		3.5E+00	3.1E-01	3.5E+01
DICHLOROETHYLENE, Trans 1,2-	2.7E+00	Vapor Intrusion	5.0E+02	site-specific		2.2E+01	2.7E+00	1.7E+02
DICHLOROPHENOL, 2,4-	2.5E-01	Groundwater Protection	5.0E+02	site-specific		3.7E+01		2.5E-01
DICHLOROPHENOXYACETIC ACID (2,4-D)	9.8E-01	Groundwater Protection	5.0E+02	site-specific		1.4E+02		9.8E-01
DICHLOROPROPANE, 1,2-	5.2E-02	Vapor Intrusion	1.0E+02	site-specific		8.9E-01	5.2E-02	2.8E+00
DICHLOROPROPENE, 1,3-	1.3E-01	Vapor Intrusion	5.0E+02	site-specific		1.7E+00	1.3E-01	9.0E+00
DIELDRIN	1.5E+00	Direct Exposure	1.0E+03	site-specific		1.5E+00		3.0E+01
DIETHYLPHTHALATE	1.6E+01	Groundwater Protection	5.0E+02	site-specific		9.8E+03		1.6E+01
DIMETHYLPHENOL, 2,4-	2.2E+01	Groundwater Protection	1.0E+02	site-specific		2.4E+02	1.1E+03	2.2E+01
DIMETHYLPHTHALATE	2.2E+01	Groundwater Protection	5.0E+02	site-specific		1.2E+05		2.2E+01
DINITROBENZENE, 1,3-	1.2E+00	Direct Exposure	5.0E+02	site-specific		1.2E+00		6.4E+00
DINITROPHENOL, 2,4-	1.8E+01	Groundwater Protection	5.0E+02	site-specific		2.4E+01		1.8E+01
DINITROTOLUENE, 2,4- (2,4-DNT)	1.6E+00	Direct Exposure	5.0E+02	site-specific		1.6E+00		1.1E+01
DINITROTOLUENE, 2,6- (2,6-DNT)	1.1E+01	Groundwater Protection	5.0E+02	site-specific		1.2E+01		1.1E+01
DIOXANE, 1,4-	4.9E+00	Direct Exposure	5.0E+02	site-specific		4.9E+00		2.3E+01
DIOXINS (TEQ)	2.4E-04	Direct Exposure	1.0E+03	site-specific	2.0E-05	2.4E-04		1.8E-01
DIURON	3.6E+00	Groundwater Protection	5.0E+02	site-specific		2.4E+01		3.6E+00
ENDOSULFAN	1.8E+01	Groundwater Protection	5.0E+02	site-specific		7.3E+01		1.8E+01
ENDRIN	3.7E+00	Direct Exposure	5.0E+02	site-specific		3.7E+00		3.0E+01
ETHANOL	4.5E+00	Groundwater Protection	5.0E+02	site-specific				4.5E+00
ETHYLBENZENE	2.1E+01	Vapor Intrusion	4.8E+02	site-specific		5.5E+01	2.1E+01	3.7E+01
FLUORANTHENE	4.6E+02	Direct Exposure	5.0E+02	site-specific		4.6E+02		1.2E+03
FLUORENE	1.0E+02	Vapor Intrusion	5.0E+02	site-specific		4.4E+02	1.0E+02	4.6E+02
GLYPHOSATE	1.0E-01	Groundwater Protection	5.0E+02	site-specific		1.2E+03		1.0E-01
HEPTACHLOR	1.1E-01	Direct Exposure	1.0E+03	site-specific		1.1E-01		4.5E+01
HEPTACHLOR EPOXIDE	5.3E-02	Direct Exposure	1.0E+03	site-specific		5.3E-02		1.2E+01
HEXACHLOROBENZENE	3.0E-01	Direct Exposure	5.0E+02	site-specific		3.0E-01		3.2E+00
HEXACHLOROBUTADIENE	2.2E+00	Groundwater Protection	5.0E+02	site-specific		6.2E+00		2.2E+00
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	7.5E-02	Groundwater Protection	5.0E+02	site-specific		5.2E-01		7.5E-02
HEXACHLOROETHANE	5.7E+00	Groundwater Protection	5.0E+02	site-specific		1.2E+01		5.7E+00
HEXAZINONE	4.0E+02	Direct Exposure	5.0E+02	site-specific		4.0E+02		1.1E+03

TABLE B-1. SOIL ACTION LEVELS
(Potentially impacted groundwater IS NOT a current or potential drinking water resource; Surface water body IS NOT located within 150m of release site)

	(mg/kg)							
						[1]Human Health		Leaching & Groundwater Protection
CHEMICAL PARAMETER	Final EAL	Basis	[1]Gross Contamination (Odors, etc.) Table F-2	Terrestrial Ecotoxicity Table L	Background Table K	Direct Exposure Table I-1	Vapor Intrusion Into Buildings Table C-1b	NON-Drinking Water Resource Table E
INDENO(1,2,3-cd)PYRENE	1.5E+00	Direct Exposure	5.0E+02	site-specific		1.5E+00		3.1E+01
ISOPHORONE	4.7E+01	Groundwater Protection	5.0E+02	site-specific		5.1E+02		4.7E+01
LEAD	2.0E+02	Direct Exposure	1.0E+03	site-specific	7.3E+01	2.0E+02		(Use batch test)
MERCURY	4.7E+00	Direct Exposure	5.0E+02	site-specific	7.2E-01	4.7E+00	(Use soil gas)	(Use batch test)
METHOXYCHLOR	1.6E+01	Groundwater Protection	5.0E+02	site-specific		6.1E+01		1.6E+01
METHYL ETHYL KETONE	1.5E+01	Groundwater Protection	5.0E+02	site-specific		5.6E+03	2.2E+03	1.5E+01
METHYL ISOBUTYL KETONE	5.0E-01	Groundwater Protection	1.0E+02	site-specific		1.1E+03	1.3E+03	5.0E-01
METHYL MERCURY	1.6E+00	Direct Exposure	1.0E+02	site-specific		1.6E+00		(Use batch test)
METHYL TERT BUTYL ETHER	2.0E+00	Vapor Intrusion	1.0E+02	site-specific		4.4E+01	2.0E+00	1.0E+01
METHYLENE CHLORIDE	1.1E+00	Vapor Intrusion	5.0E+02	site-specific		1.1E+01	1.1E+00	9.2E+01
METHYLNAPHTHALENE, 1-	2.6E+01	Vapor Intrusion	5.0E+02	site-specific		9.8E+01	2.6E+01	3.8E+01
METHYLNAPHTHALENE, 2-	2.8E+01	Vapor Intrusion	5.0E+02	site-specific		4.7E+01	2.8E+01	4.1E+01
MOLYBDENUM	7.8E+01	Direct Exposure	1.0E+03	site-specific	4.0E+00	7.8E+01		(Use batch test)
NAPHTHALENE	4.5E+00	Vapor Intrusion	5.0E+02	site-specific		2.8E+01	4.5E+00	5.4E+01
NICKEL	7.6E+02	Direct Exposure	1.0E+03	site-specific	4.1E+02	7.6E+02		(Use batch test)
NITROBENZENE	4.8E+00	Direct Exposure	5.0E+02	site-specific		4.8E+00	(Use soil gas)	7.5E+01
NITROGLYCERIN	1.2E+00	Direct Exposure	5.0E+02	site-specific		1.2E+00		2.7E+00
NITROTOLUENE, 2-	1.9E+00	Direct Exposure	5.0E+02	site-specific		1.9E+00	(Use soil gas)	4.6E+02
NITROTOLUENE, 3-	2.3E+02	Groundwater Protection	5.0E+02	site-specific		2.5E+02	(Use soil gas)	2.3E+02
NITROTOLUENE, 4-	3.0E+01	Direct Exposure	5.0E+02	site-specific		3.0E+01		2.0E+02
PENTACHLOROPHENOL	8.9E-01	Direct Exposure	5.0E+02	site-specific		8.9E-01		1.1E+01
PENTAERYTHRITOLTETRANITRATE (PETN)	2.4E+01	Direct Exposure	5.0E+02	site-specific		2.4E+01		5.4E+02
PERCHLORATE	1.2E+00	Groundwater Protection	1.0E+03	site-specific		1.1E+01		1.2E+00
PHENANTHRENE	4.4E+02	Direct Exposure	5.0E+02	site-specific		4.4E+02	(Use soil gas)	7.0E+02
PHENOL	1.1E+02	Groundwater Protection	5.0E+02	site-specific		3.7E+03		1.1E+02
POLYCHLORINATED BIPHENYLS (PCBs)	1.1E+00	Direct Exposure	5.0E+02	site-specific		1.1E+00		1.1E+01
PROPICONAZOLE	6.6E+01	Groundwater Protection	5.0E+02	site-specific		1.6E+02		6.6E+01
PYRENE	4.4E+01	Vapor Intrusion	5.0E+02	site-specific		3.4E+02	4.4E+01	6.1E+02
SELENIUM	7.8E+01	Direct Exposure	1.0E+03	site-specific	7.1E+00	7.8E+01		(Use batch test)
SILVER	7.8E+01	Direct Exposure	1.0E+03	site-specific	1.5E+00	7.8E+01		(Use batch test)
SIMAZINE	2.4E-01	Groundwater Protection	5.0E+02	site-specific		4.0E+00		2.4E-01
STYRENE	2.9E+00	Groundwater Protection	5.0E+02	site-specific		8.7E+02	4.5E+02	2.9E+00
TERBACIL	1.6E+02	Direct Exposure	5.0E+02	site-specific		1.6E+02		1.9E+02
tert-BUTYL ALCOHOL	8.1E+01	Direct Exposure	1.0E+02	site-specific		8.1E+01	(Use soil gas)	3.1E+02
TETRACHLOROETHANE, 1,1,1,2-	1.9E+00	Direct Exposure	1.0E+02	site-specific		1.9E+00	(Use soil gas)	9.1E+01
TETRACHLOROETHANE, 1,1,2,2-	9.0E-03	Vapor Intrusion	5.0E+02	site-specific		5.7E-01	9.0E-03	3.7E+00
TETRACHLOROETHYLENE	8.8E-02	Vapor Intrusion	1.7E+02	site-specific		5.6E-01	8.8E-02	2.2E+01
TETRACHLOROPHENOL, 2,3,4,6-	4.9E+00	Groundwater Protection	5.0E+02	site-specific		3.7E+02		4.9E+00
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	1.7E+02	Groundwater Protection	5.0E+02	site-specific		7.7E+02		1.7E+02
THALLIUM	7.8E-01	Direct Exposure	1.0E+03	site-specific	2.5E-01	7.8E-01		(Use batch test)
TOLUENE	3.2E+01	Groundwater Protection	5.0E+02	site-specific		8.2E+02	8.2E+02	3.2E+01
TOXAPHENE	4.4E-01	Direct Exposure	5.0E+02	site-specific		4.4E-01		2.5E+02
TPH (gasolines)	1.0E+02	Ceiling Value	1.0E+02	site-specific		5.0E+02	(Use soil gas)	2.0E+03
TPH (middle distillates)	5.0E+02	Ceiling Value	5.0E+02	site-specific		5.0E+02	(Use soil gas)	5.0E+03
TPH (residual fuels)	5.0E+02	Ceiling Value	5.0E+02	site-specific		9.4E+03		5.0E+03

TABLE B-1. SOIL ACTION LEVELS
(Potentially impacted groundwater IS NOT a current or potential drinking water resource; Surface water body IS NOT located within 150m of release site)

	(mg/kg)							
						[1]Human Health		Leaching & Groundwater Protection
CHEMICAL PARAMETER	Final EAL	Basis	[1]Gross Contamination (Odors, etc.) Table F-2	Terrestrial Ecotoxicity Table L	Background Table K	Direct Exposure Table I-1	Vapor Intrusion Into Buildings Table C-1b	NON-Drinking Water Resource Table E
TRICHLOROBENZENE, 1,2,4-	9.8E-02	Vapor Intrusion	5.0E+02	site-specific		6.6E+00	9.8E-02	3.7E+01
TRICHLOROETHANE, 1,1,1-	2.2E+02	Vapor Intrusion	5.0E+02	site-specific		6.4E+02	2.2E+02	6.8E+02
TRICHLOROETHANE, 1,1,2-	8.9E-03	Vapor Intrusion	1.0E+02	site-specific		3.2E-01	8.9E-03	1.6E+00
TRICHLOROETHYLENE	2.6E-01	Vapor Intrusion	5.0E+02	site-specific		2.8E+00	2.6E-01	4.3E+01
TRICHLOROPHENOL, 2,4,5-	2.9E+01	Groundwater Protection	1.0E+02	site-specific		1.2E+03		2.9E+01
TRICHLOROPHENOL, 2,4,6-	1.2E+01	Direct Exposure	5.0E+02	site-specific		1.2E+01		1.4E+02
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	1.2E+01	Groundwater Protection	1.0E+03	site-specific		1.2E+02		1.2E+01
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	8.7E-01	Groundwater Protection	5.0E+02	site-specific		9.8E+01		8.7E-01
TRICHLOROPROPANE, 1,2,3-	1.3E-03	Direct Exposure	1.0E+02	site-specific		1.3E-03	(Use soil gas)	2.5E+00
TRICHLOROPROPENE, 1,2,3-	1.2E-01	Direct Exposure	1.0E+02	site-specific		1.2E-01	(Use soil gas)	1.2E-01
TRIFLURALIN	5.4E+01	Groundwater Protection	1.0E+02	site-specific		6.3E+01		5.4E+01
TRINITROBENZENE, 1,3,5-	3.9E+01	Groundwater Protection	5.0E+02	site-specific		4.5E+02		3.9E+01
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.9E+01	Direct Exposure	5.0E+02	site-specific		4.9E+01		1.1E+02
TRINITROTOLUENE, 2,4,6- (TNT)	7.2E+00	Direct Exposure	5.0E+02	site-specific		7.2E+00		2.7E+02
VANADIUM	7.7E+02	Background	1.0E+03	site-specific	7.7E+02	7.8E+01		(Use batch test)
VINYL CHLORIDE	7.2E-02	Direct Exposure	5.0E+02	site-specific		7.2E-02	1.2E-01	1.1E+01
XYLENES	4.5E+01	Vapor Intrusion	3.9E+02	site-specific		1.2E+02	4.5E+01	1.1E+02
ZINC	1.0E+03	Ceiling Value	1.0E+03	site-specific	3.5E+02	4.7E+03		(Use batch test)
Electrical Conductivity (mS/cm, USEPA Method 120.1 MOD)	2.0	-	-	-	-	-	-	-
Sodium Adsorption Ratio	5.0	-	-	-	-	-	-	-

Notes:

1. Based on unrestricted current or future land use. Considered adequate for residential housing, schools, medical facilities, day-care centers, parks and other sensitive uses.

Final Environmental Action Level is lowest of gross contamination, ecotoxicity, direct-exposure, vapor intrusion and leaching action levels.
Assumes soil pH 5.0 to 9.0.
Soil data should be reported on dry-weight basis (see Chapter 7).
TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.

TABLE B-2. SOIL ACTION LEVELS
(Potentially impacted groundwater IS NOT a current or potential drinking water resource; Surface water body IS located within 150m of release site)

	(mg/kg)							
						[1]Human Health		Leaching & Groundwater Protection
CHEMICAL PARAMETER	Final EAL	Basis	[1]Gross Contamination (Odors, etc.) Table F-2	Terrestrial Ecotoxicity Table L	Background Table K	Direct Exposure Table I-1	Vapor Intrusion Into Buildings Table C-1b	NON-Drinking Water Resource Table E
ACENAPHTHENE	1.2E+02	Vapor Intrusion	1.0E+03	site-specific		6.2E+02	1.2E+02	1.2E+02
ACENAPHTHYLENE	1.3E+01	Groundwater Protection	5.0E+02	site-specific		3.2E+02	(Use soil gas)	1.3E+01
ACETONE	1.0E+00	Groundwater Protection	5.0E+02	site-specific		1.2E+04	1.4E+04	1.0E+00
ALDRIN	9.2E-01	Direct Exposure	1.0E+03	site-specific		9.2E-01		8.4E+00
AMETRYN	1.1E+00	Groundwater Protection	5.0E+02	site-specific		1.1E+02		1.1E+00
AMINO,2- DINITROTOLUENE,4,6-	7.0E-01	Groundwater Protection	5.0E+02	site-specific		3.1E+01		7.0E-01
AMINO,4- DINITROTOLUENE,2,6-	7.0E-01	Groundwater Protection	5.0E+02	site-specific		3.1E+01		7.0E-01
ANTHRACENE	4.3E+00	Vapor Intrusion	5.0E+02	site-specific		3.3E+03	4.3E+00	4.3E+00
ANTIMONY	2.4E+00	Background	1.0E+03	site-specific	2.4E+00	1.6E+00		(Use batch test)
ARSENIC	2.4E+01	Background	1.0E+03	site-specific	2.4E+01	2.3E+01		(Use batch test)
ATRAZINE	4.5E-01	Groundwater Protection	5.0E+02	site-specific		2.1E+00		4.5E-01
BARIUM	1.0E+03	Ceiling Value	1.0E+03	site-specific	6.9E+02	3.1E+03		(Use batch test)
BENZENE	6.7E-01	Vapor Intrusion	5.0E+02	site-specific		1.1E+00	6.7E-01	2.7E+00
BENZO(a)ANTHRACENE	1.5E+00	Direct Exposure	5.0E+02	site-specific		1.5E+00		1.0E+01
BENZO(a)PYRENE	1.5E-01	Direct Exposure	5.0E+02	site-specific		1.5E-01		5.7E+00
BENZO(b)FLUORANTHENE	1.5E+00	Direct Exposure	5.0E+02	site-specific		1.5E+00		7.5E+01
BENZO(g,h,i)PERYLENE	2.7E+01	Groundwater Protection	5.0E+02	site-specific		4.6E+02		2.7E+01
BENZO(k)FLUORANTHENE	1.5E+01	Direct Exposure	5.0E+02	site-specific		1.5E+01		3.9E+01
BERYLLIUM	3.1E+01	Direct Exposure	1.0E+03	site-specific	3.0E+00	3.1E+01		(Use batch test)
BIPHENYL, 1,1-	1.0E+01	Direct Exposure	5.0E+02	site-specific		1.0E+01	(Use soil gas)	2.1E+02
BIS(2-CHLOROETHYL)ETHER	4.5E-03	Vapor Intrusion	5.0E+02	site-specific		2.1E-01	4.5E-03	3.3E-01
BIS(2-CHLOROISOPROPYL)ETHER	6.6E-01	Groundwater Protection	5.0E+02	site-specific		3.3E+00	(Use soil gas)	6.6E-01
BIS(2-ETHYLHEXYL)PHTHALATE	3.5E+01	Direct Exposure	5.0E+02	site-specific		3.5E+01		6.4E+02
BORON	1.0E+02	Ceiling Value	1.0E+02	site-specific		3.1E+03		(Use batch test)
BROMODICHLOROMETHANE	1.4E-02	Vapor Intrusion	9.3E+02	site-specific		2.8E-01	1.4E-02	1.8E+00
BROMOFORM	2.8E+01	Groundwater Protection	5.0E+02	site-specific		6.1E+01		2.8E+01
BROMOMETHANE	2.2E-01	Vapor Intrusion	5.0E+02	site-specific		1.6E+00	2.2E-01	6.6E+00
CADMIUM	1.4E+01	Direct Exposure	1.0E+03	site-specific	2.3E+00	1.4E+01		(Use batch test)
CARBON TETRACHLORIDE	8.7E-02	Vapor Intrusion	4.5E+02	site-specific		6.2E-01	8.7E-02	1.7E+00
CHLORDANE (TECHNICAL)	1.6E+01	Direct Exposure	1.0E+03	site-specific		1.6E+01		2.9E+01
CHLOROANILINE, p-	9.4E-02	Groundwater Protection	1.0E+03	site-specific		2.4E+00		9.4E-02
CHLOROBENZENE	1.5E+00	Groundwater Protection	5.0E+02	site-specific		5.9E+01	2.2E+00	1.5E+00
CHLOROETHANE	1.1E+01	Groundwater Protection	5.0E+02	site-specific		2.1E+03	4.5E+02	1.1E+01
CHLOROFORM	2.3E-02	Vapor Intrusion	5.0E+02	site-specific		3.0E-01	2.3E-02	2.6E+00
CHLOROMETHANE	2.9E-01	Vapor Intrusion	1.0E+02	site-specific		1.7E+00	2.9E-01	2.1E+01
CHLOROPHENOL, 2-	9.2E-02	Groundwater Protection	1.0E+02	site-specific		6.7E+01	1.5E+01	9.2E-02
CHROMIUM (Total)	1.1E+03	Background	-	site-specific	1.1E+03			(Use batch test)
CHROMIUM III	1.0E+03	Ceiling Value	1.0E+03	site-specific		2.3E+04		(Use batch test)
CHROMIUM VI	2.9E+01	Direct Exposure	1.0E+03	site-specific		2.9E+01		(Use batch test)
CHRYSENE	1.0E+01	Groundwater Protection	1.0E+03	site-specific		1.5E+02		1.0E+01
COBALT	8.0E+01	Background	1.0E+03	site-specific	8.0E+01	4.7E+00		(Use batch test)
COPPER	6.3E+02	Direct Exposure	1.0E+03	site-specific	2.5E+02	6.3E+02		(Use batch test)
CYANIDE (Free)	1.0E+02	Ceiling Value	1.0E+02	site-specific		3.1E+02	(Use soil gas)	(Use batch test)
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	2.8E+00	Groundwater Protection	5.0E+02	site-specific		5.5E+00		2.8E+00
DALAPON	1.6E-01	Groundwater Protection	5.0E+02	site-specific		3.7E+02		1.6E-01

TABLE B-2. SOIL ACTION LEVELS
(Potentially impacted groundwater IS NOT a current or potential drinking water resource; Surface water body IS located within 150m of release site)

	(mg/kg)							
						[1]Human Health		Leaching & Groundwater Protection
CHEMICAL PARAMETER	Final EAL	Basis	[1]Gross Contamination (Odors, etc.) Table F-2	Terrestrial Ecotoxicity Table L	Background Table K	Direct Exposure Table I-1	Vapor Intrusion Into Buildings Table C-1b	NON-Drinking Water Resource Table E
DIBENZO(a,h)ANTHTRACENE	1.5E-01	Direct Exposure	5.0E+02	site-specific		1.5E-01		1.6E+02
DIBROMO,1,2- CHLOROPROPANE,3-	9.0E-04	Groundwater Protection	5.0E+02	site-specific		5.7E-03	(Use soil gas)	9.0E-04
DIBROMOCHLOROMETHANE	2.2E-02	Vapor Intrusion	1.0E+02	site-specific		7.8E-01	2.2E-02	3.4E+00
DIBROMOETHANE, 1,2-	8.7E-04	Vapor Intrusion	5.0E+02	site-specific		3.2E-02	8.7E-04	1.5E-01
DICHLOROBENZENE, 1,2-	1.1E+00	Groundwater Protection	1.9E+02	site-specific		1.9E+02	8.9E+00	1.1E+00
DICHLOROBENZENE, 1,3-	7.4E+00	Groundwater Protection	1.0E+02	site-specific		1.9E+02	(Use soil gas)	7.4E+00
DICHLOROBENZENE, 1,4-	4.7E-02	Vapor Intrusion	5.0E+02	site-specific		2.5E+00	4.7E-02	1.2E+00
DICHLOROBENZIDINE, 3,3-	1.1E+00	Direct Exposure	5.0E+02	site-specific		1.1E+00		1.3E+02
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.0E+00	Direct Exposure	5.0E+02	site-specific		2.0E+00		6.3E+01
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.4E+00	Direct Exposure	5.0E+02	site-specific		1.4E+00		2.8E+01
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.7E+00	Direct Exposure	1.0E+03	site-specific		1.7E+00		5.6E+00
DICHLOROETHANE, 1,1-	3.3E-01	Vapor Intrusion	5.0E+02	site-specific		3.3E+00	3.3E-01	1.9E+00
DICHLOROETHANE, 1,2-	2.0E-02	Vapor Intrusion	5.0E+02	site-specific		4.4E-01	2.0E-02	2.2E+00
DICHLOROETHYLENE, 1,1-	4.3E+00	Groundwater Protection	5.0E+02	site-specific		4.9E+01	8.9E+00	4.3E+00
DICHLOROETHYLENE, Cis 1,2-	3.1E-01	Vapor Intrusion	1.0E+02	site-specific		3.5E+00	3.1E-01	1.9E+01
DICHLOROETHYLENE, Trans 1,2-	2.7E+00	Vapor Intrusion	5.0E+02	site-specific		2.2E+01	2.7E+00	3.8E+01
DICHLOROPHENOL, 2,4-	2.5E-01	Groundwater Protection	5.0E+02	site-specific		3.7E+01		2.5E-01
DICHLOROPHENOXYACETIC ACID (2,4-D)	2.0E-01	Groundwater Protection	5.0E+02	site-specific		1.4E+02		2.0E-01
DICHLOROPROPANE, 1,2-	5.2E-02	Vapor Intrusion	1.0E+02	site-specific		8.9E-01	5.2E-02	2.8E+00
DICHLOROPROPENE, 1,3-	1.3E-01	Vapor Intrusion	5.0E+02	site-specific		1.7E+00	1.3E-01	4.2E+00
DIELDRIN	1.5E+00	Direct Exposure	1.0E+03	site-specific		1.5E+00		3.0E+01
DIETHYLPHTHALATE	2.6E-02	Groundwater Protection	5.0E+02	site-specific		9.8E+03		2.6E-02
DIMETHYLPHENOL, 2,4-	9.0E+00	Groundwater Protection	1.0E+02	site-specific		2.4E+02	1.1E+03	9.0E+00
DIMETHYLPHTHALATE	3.5E-02	Groundwater Protection	5.0E+02	site-specific		1.2E+05		3.5E-02
DINITROBENZENE, 1,3-	1.2E+00	Direct Exposure	5.0E+02	site-specific		1.2E+00		1.8E+00
DINITROPHENOL, 2,4-	5.7E+00	Groundwater Protection	5.0E+02	site-specific		2.4E+01		5.7E+00
DINITROTOLUENE, 2,4- (2,4-DNT)	1.6E+00	Direct Exposure	5.0E+02	site-specific		1.6E+00		4.3E+00
DINITROTOLUENE, 2,6- (2,6-DNT)	4.3E+00	Groundwater Protection	5.0E+02	site-specific		1.2E+01		4.3E+00
DIOXANE, 1,4-	4.9E+00	Direct Exposure	5.0E+02	site-specific		4.9E+00		2.3E+01
DIOXINS (TEQ)	2.4E-04	Direct Exposure	1.0E+03	site-specific	2.0E-05	2.4E-04		1.8E-01
DIURON	1.1E+00	Groundwater Protection	5.0E+02	site-specific		2.4E+01		1.1E+00
ENDOSULFAN	1.8E+01	Groundwater Protection	5.0E+02	site-specific		7.3E+01		1.8E+01
ENDRIN	3.7E+00	Direct Exposure	5.0E+02	site-specific		3.7E+00		3.0E+01
ETHANOL	4.5E+00	Groundwater Protection	5.0E+02	site-specific				4.5E+00
ETHYLBENZENE	2.1E+01	Vapor Intrusion	4.8E+02	site-specific		5.5E+01	2.1E+01	3.6E+01
FLUORANTHENE	8.7E+01	Groundwater Protection	5.0E+02	site-specific		4.6E+02		8.7E+01
FLUORENE	1.0E+02	Vapor Intrusion	5.0E+02	site-specific		4.4E+02	1.0E+02	1.0E+02
GLYPHOSATE	1.1E-02	Groundwater Protection	5.0E+02	site-specific		1.2E+03		1.1E-02
HEPTACHLOR	1.1E-01	Direct Exposure	1.0E+03	site-specific		1.1E-01		4.5E+01
HEPTACHLOR EPOXIDE	5.3E-02	Direct Exposure	1.0E+03	site-specific		5.3E-02		1.2E+01
HEXACHLOROBENZENE	3.0E-01	Direct Exposure	5.0E+02	site-specific		3.0E-01		3.2E+00
HEXACHLOROBUTADIENE	9.5E-01	Groundwater Protection	5.0E+02	site-specific		6.2E+00		9.5E-01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	3.7E-02	Groundwater Protection	5.0E+02	site-specific		5.2E-01		3.7E-02
HEXACHLOROETHANE	6.8E-01	Groundwater Protection	5.0E+02	site-specific		1.2E+01		6.8E-01
HEXAZINONE	1.1E+02	Groundwater Protection	5.0E+02	site-specific		4.0E+02		1.1E+02

TABLE B-2. SOIL ACTION LEVELS
(Potentially impacted groundwater IS NOT a current or potential drinking water resource; Surface water body IS located within 150m of release site)

	(mg/kg)							
						[1]Human Health		Leaching & Groundwater Protection
CHEMICAL PARAMETER	Final EAL	Basis	[1]Gross Contamination (Odors, etc.) Table F-2	Terrestrial Ecotoxicity Table L	Background Table K	Direct Exposure Table I-1	Vapor Intrusion Into Buildings Table C-1b	NON-Drinking Water Resource Table E
INDENO(1,2,3-cd)PYRENE	1.5E+00	Direct Exposure	5.0E+02	site-specific		1.5E+00		3.1E+01
ISOPHORONE	1.4E+00	Groundwater Protection	5.0E+02	site-specific		5.1E+02		1.4E+00
LEAD	2.0E+02	Direct Exposure	1.0E+03	site-specific	7.3E+01	2.0E+02		(Use batch test)
MERCURY	4.7E+00	Direct Exposure	5.0E+02	site-specific	7.2E-01	4.7E+00	(Use soil gas)	(Use batch test)
METHOXYCHLOR	1.6E+01	Groundwater Protection	5.0E+02	site-specific		6.1E+01		1.6E+01
METHYL ETHYL KETONE	1.5E+01	Groundwater Protection	5.0E+02	site-specific		5.6E+03	2.2E+03	1.5E+01
METHYL ISOBUTYL KETONE	5.0E-01	Groundwater Protection	1.0E+02	site-specific		1.1E+03	1.3E+03	5.0E-01
METHYL MERCURY	1.6E+00	Direct Exposure	1.0E+02	site-specific		1.6E+00		(Use batch test)
METHYL TERT BUTYL ETHER	2.0E+00	Vapor Intrusion	1.0E+02	site-specific		4.4E+01	2.0E+00	1.0E+01
METHYLENE CHLORIDE	1.1E+00	Vapor Intrusion	5.0E+02	site-specific		1.1E+01	1.1E+00	5.1E+01
METHYLNAPHTHALENE, 1-	7.9E-01	Groundwater Protection	5.0E+02	site-specific		9.8E+01	2.6E+01	7.9E-01
METHYLNAPHTHALENE, 2-	8.7E-01	Groundwater Protection	5.0E+02	site-specific		4.7E+01	2.8E+01	8.7E-01
MOLYBDENUM	7.8E+01	Direct Exposure	1.0E+03	site-specific	4.0E+00	7.8E+01		(Use batch test)
NAPHTHALENE	4.5E+00	Vapor Intrusion	5.0E+02	site-specific		2.8E+01	4.5E+00	6.2E+00
NICKEL	7.6E+02	Direct Exposure	1.0E+03	site-specific	4.1E+02	7.6E+02		(Use batch test)
NITROBENZENE	2.3E+00	Groundwater Protection	5.0E+02	site-specific		4.8E+00	(Use soil gas)	2.3E+00
NITROGLYCERIN	1.2E+00	Direct Exposure	5.0E+02	site-specific		1.2E+00		2.7E+00
NITROTOLUENE, 2-	1.9E+00	Direct Exposure	5.0E+02	site-specific		1.9E+00	(Use soil gas)	6.2E+01
NITROTOLUENE, 3-	2.3E+01	Groundwater Protection	5.0E+02	site-specific		2.5E+02	(Use soil gas)	2.3E+01
NITROTOLUENE, 4-	3.0E+01	Direct Exposure	5.0E+02	site-specific		3.0E+01		9.6E+01
PENTACHLOROPHENOL	8.9E-01	Direct Exposure	5.0E+02	site-specific		8.9E-01		6.5E+00
PENTAERYTHRITOLTETRANITRATE (PETN)	2.4E+01	Direct Exposure	5.0E+02	site-specific		2.4E+01		5.4E+02
PERCHLORATE	1.2E+00	Groundwater Protection	1.0E+03	site-specific		1.1E+01		1.2E+00
PHENANTHRENE	6.9E+01	Groundwater Protection	5.0E+02	site-specific		4.4E+02	(Use soil gas)	6.9E+01
PHENOL	4.0E+01	Groundwater Protection	5.0E+02	site-specific		3.7E+03		4.0E+01
POLYCHLORINATED BIPHENYLS (PCBs)	1.1E+00	Direct Exposure	5.0E+02	site-specific		1.1E+00		6.3E+00
PROPICONAZOLE	6.6E+00	Groundwater Protection	5.0E+02	site-specific		1.6E+02		6.6E+00
PYRENE	4.4E+01	Vapor Intrusion	5.0E+02	site-specific		3.4E+02	4.4E+01	4.4E+01
SELENIUM	7.8E+01	Direct Exposure	1.0E+03	site-specific	7.1E+00	7.8E+01		(Use batch test)
SILVER	7.8E+01	Direct Exposure	1.0E+03	site-specific	1.5E+00	7.8E+01		(Use batch test)
SIMAZINE	4.9E-02	Groundwater Protection	5.0E+02	site-specific		4.0E+00		4.9E-02
STYRENE	2.9E+00	Groundwater Protection	5.0E+02	site-specific		8.7E+02	4.5E+02	2.9E+00
TERBACIL	1.9E+01	Groundwater Protection	5.0E+02	site-specific		1.6E+02		1.9E+01
tert-BUTYL ALCOHOL	8.1E+01	Direct Exposure	1.0E+02	site-specific		8.1E+01	(Use soil gas)	1.1E+02
TETRACHLOROETHANE, 1,1,1,2-	1.9E+00	Direct Exposure	1.0E+02	site-specific		1.9E+00	(Use soil gas)	9.1E+00
TETRACHLOROETHANE, 1,1,2,2-	9.0E-03	Vapor Intrusion	5.0E+02	site-specific		5.7E-01	9.0E-03	3.7E+00
TETRACHLOROETHYLENE	8.8E-02	Vapor Intrusion	1.7E+02	site-specific		5.6E-01	8.8E-02	1.5E+01
TETRACHLOROPHENOL, 2,3,4,6-	5.9E-01	Groundwater Protection	5.0E+02	site-specific		3.7E+02		5.9E-01
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	2.9E+01	Groundwater Protection	5.0E+02	site-specific		7.7E+02		2.9E+01
THALLIUM	7.8E-01	Direct Exposure	1.0E+03	site-specific	2.5E-01	7.8E-01		(Use batch test)
TOLUENE	1.0E+01	Groundwater Protection	5.0E+02	site-specific		8.2E+02	8.2E+02	1.0E+01
TOXAPHENE	4.4E-01	Direct Exposure	5.0E+02	site-specific		4.4E-01		2.5E+02
TPH (gasolines)	1.0E+02	Ceiling Value	1.0E+02	site-specific		5.0E+02	(Use soil gas)	4.0E+02
TPH (middle distillates)	5.0E+02	Ceiling Value	5.0E+02	site-specific		5.0E+02	(Use soil gas)	5.0E+02
TPH (residual fuels)	5.0E+02	Ceiling Value	5.0E+02	site-specific		9.4E+03		1.0E+03

TABLE B-2. SOIL ACTION LEVELS
(Potentially impacted groundwater IS NOT a current or potential drinking water resource; Surface water body IS located within 150m of release site)

	(mg/kg)							
						[1]Human Health		Leaching & Groundwater Protection
CHEMICAL PARAMETER	Final EAL	Basis	[1]Gross Contamination (Odors, etc.) Table F-2	Terrestrial Ecotoxicity Table L	Background Table K	Direct Exposure Table I-1	Vapor Intrusion Into Buildings Table C-1b	NON-Drinking Water Resource Table E
TRICHLOROBENZENE, 1,2,4-	9.8E-02	Vapor Intrusion	5.0E+02	site-specific		6.6E+00	9.8E-02	5.8E+00
TRICHLOROETHANE, 1,1,1-	7.0E+00	Groundwater Protection	5.0E+02	site-specific		6.4E+02	2.2E+02	7.0E+00
TRICHLOROETHANE, 1,1,2-	8.9E-03	Vapor Intrusion	1.0E+02	site-specific		3.2E-01	8.9E-03	1.6E+00
TRICHLOROETHYLENE	2.6E-01	Vapor Intrusion	5.0E+02	site-specific		2.8E+00	2.6E-01	2.5E+01
TRICHLOROPHENOL, 2,4,5-	3.2E+00	Groundwater Protection	1.0E+02	site-specific		1.2E+03		3.2E+00
TRICHLOROPHENOL, 2,4,6-	1.2E+01	Direct Exposure	5.0E+02	site-specific		1.2E+01		1.4E+02
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	1.2E+01	Groundwater Protection	1.0E+03	site-specific		1.2E+02		1.2E+01
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	8.7E-01	Groundwater Protection	5.0E+02	site-specific		9.8E+01		8.7E-01
TRICHLOROPROPANE, 1,2,3-	1.3E-03	Direct Exposure	1.0E+02	site-specific		1.3E-03	(Use soil gas)	2.5E-01
TRICHLOROPROPENE, 1,2,3-	1.2E-01	Direct Exposure	1.0E+02	site-specific		1.2E-01	(Use soil gas)	1.2E-01
TRIFLURALIN	5.4E+01	Groundwater Protection	1.0E+02	site-specific		6.3E+01		5.4E+01
TRINITROBENZENE, 1,3,5-	8.4E+00	Groundwater Protection	5.0E+02	site-specific		4.5E+02		8.4E+00
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.9E+01	Direct Exposure	5.0E+02	site-specific		4.9E+01		1.1E+02
TRINITROTOLUENE, 2,4,6- (TNT)	7.2E+00	Direct Exposure	5.0E+02	site-specific		7.2E+00		6.1E+01
VANADIUM	7.7E+02	Background	1.0E+03	site-specific	7.7E+02	7.8E+01		(Use batch test)
VINYL CHLORIDE	7.2E-02	Direct Exposure	5.0E+02	site-specific		7.2E-02	1.2E-01	1.1E+01
XYLENES	1.1E+01	Groundwater Protection	3.9E+02	site-specific		1.2E+02	4.5E+01	1.1E+01
ZINC	1.0E+03	Ceiling Value	1.0E+03	site-specific	3.5E+02	4.7E+03		(Use batch test)
Electrical Conductivity (mS/cm, USEPA Method 120.1 MOD)	4.0	-	-	-	-	-	-	-
Sodium Adsorption Ratio	12	-	-	-	-	-	-	-

Notes:

1. Based on unrestricted current or future land use. Considered adequate for residential housing, schools, medical facilities, day-care centers, parks and other sensitive uses.

Final Environmental Action Level is lowest of gross contamination, ecotoxicity, direct-exposure, vapor intrusion and leaching action levels.
Assumes soil pH 5.0 to 9.0.
Soil data should be reported on dry-weight basis (see Chapter 7).
TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.

TABLE C-1a. GROUNDWATER ACTION LEVELS FOR EVALUATION OF POTENTIAL VAPOR INTRUSION HAZARDS (volatile chemicals only)

CHEMICAL PARAMETER	Physical State		[1,3]Unrestricted Land Use (ug/L)	Commercial/ Industrial Land Use Only (ug/L)
#ACENAPHTHENE	V	S	3.9E+03	3.9E+03
ACENAPHTHYLENE	V	S	(Use soil gas)	(Use soil gas)
#ACETONE	V	L	5.6E+08	1.0E+09
ALDRIN	NV	S		
AMETRYN	NV	S		
AMINO,2- DINITROTOLUENE,4,6-	NV	S		
AMINO,4- DINITROTOLUENE,2,6-	NV	S		
#ANTHRACENE	V	S	4.3E+01	4.3E+01
ANTIMONY	NV	S		
ARSENIC	NV	S		
ATRAZINE	NV	S		
BARIUM	NV	S		
#BENZENE	V	L	1.9E+03	6.5E+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	(Use soil gas)	(Use soil gas)
BIS(2-CHLOROETHYL)ETHER	V	L	1.3E+02	4.5E+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	9.8E+01	3.3E+02
BROMOFORM	NV	S		
BROMOMETHANE	V	G	4.6E+02	1.3E+03
CADMIUM	NV	S		
CARBON TETRACHLORIDE	V	L	9.8E+01	3.3E+02
CHLORDANE (TECHNICAL)	NV	S		
CHLOROANILINE, p-	NV	S		
CHLOROBENZENE	V	L	1.2E+04	3.4E+04
CHLOROETHANE	V	G	5.5E+05	1.5E+06
CHLOROFORM	V	L	9.4E+01	3.1E+02
CHLOROMETHANE	V	G	3.7E+02	1.2E+03
CHLOROPHENOL, 2-	V	L	7.3E+04	2.0E+05
CHROMIUM (Total)	NV	S		
CHROMIUM III	NV	S		
CHROMIUM VI	NV	S		
CHRYSENE	NV	S		
COBALT	NV	S		
COPPER	NV	S		
CYANIDE (Free)	V	S	(Use soil gas)	(Use soil gas)
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	NV	S		
DALAPON	NV	L		
DIBENZO(a,h)ANTHTRACENE	NV	S		
DIBROMO,1,2- CHLOROPROPANE,3-	V	L	(Use soil gas)	(Use soil gas)
DIBROMOCHLOROMETHANE	V	S	3.4E+02	1.1E+03
DIBROMOETHANE, 1,2-	V	S	1.6E+01	5.3E+01
DICHLOROBENZENE, 1,2-	V	L	8.0E+04	8.0E+04
DICHLOROBENZENE, 1,3-	V	L	(Use soil gas)	(Use soil gas)
DICHLOROBENZENE, 1,4-	V	S	3.8E+02	1.3E+03
DICHLOROBENZIDINE, 3,3-	NV	S		
DICHLORODIPHENYLDICHLOROETHANE (DDD)	NV	S		
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	NV	S		
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	NV	S		
DICHLOROETHANE, 1,1-	V	L	9.4E+02	3.1E+03

TABLE C-1a. GROUNDWATER ACTION LEVELS FOR EVALUATION OF POTENTIAL VAPOR INTRUSION HAZARDS (volatile chemicals only)

CHEMICAL PARAMETER	Physical State		[1,3]Unrestricted Land Use (ug/L)	Commercial/ Industrial Land Use Only (ug/L)
DICHLOROETHANE, 1,2-	V	L	1.6E+02	5.3E+02
DICHLOROETHYLENE, 1,1-	V	L	6.4E+03	1.8E+04
DICHLOROETHYLENE, Cis 1,2-	V	L	1.1E+03	3.1E+03
DICHLOROETHYLENE, Trans 1,2-	V	L	5.0E+03	1.4E+04
DICHLOROPHENOL, 2,4-	NV	S		
DICHLOROPHENOXYACETIC ACID (2,4-D)	NV	S		
DICHLOROPROPANE, 1,2-	V	L	2.6E+02	8.9E+02
DICHLOROPROPENE, 1,3-	V	L	5.5E+02	1.9E+03
DIELDRIN	NV	S		
DIETHYLPHTHALATE	NV	S		
#DIMETHYLPHENOL, 2,4-	V	S	1.5E+06	4.2E+06
DIMETHYLPHTHALATE	NV	S		
DINITROBENZENE, 1,3-	NV	S		
DINITROPHENOL, 2,4-	NV	S		
DINITROTOLUENE, 2,4- (2,4-DNT)	NV	S		
DINITROTOLUENE, 2,6- (2,6-DNT)	NV	S		
DIOXANE, 1,4-	NV	L		
DIOXINS (TEQ)	NV	S		
DIURON	NV	S		
ENDOSULFAN	NV	S		
ENDRIN	NV	S		
ETHANOL	NV	L		
#ETHYLBENZENE	V	L	6.6E+04	1.7E+05
FLUORANTHENE	NV	S		
#FLUORENE	V	S	1.9E+03	1.9E+03
GLYPHOSATE	NV	S		
HEPTACHLOR	NV	S		
HEPTACHLOR EPOXIDE	NV	S		
HEXACHLOROBENZENE	NV	S		
HEXACHLOROBUTADIENE	NV	S		
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	NV	S		
HEXACHLOROETHANE	NV	S		
HEXAZINONE	NV	S		
INDENO(1,2,3-cd)PYRENE	NV	S		
ISOPHORONE	NV	L		
LEAD	NV	S		
MERCURY	V	S	(Use soil gas)	(Use soil gas)
METHOXYCHLOR	NV	S		
#METHYL ETHYL KETONE	V	L	1.9E+08	2.2E+08
#METHYL ISOBUTYL KETONE	V	L	1.9E+07	1.9E+07
METHYL MERCURY	NV	S		
METHYL TERT BUTYL ETHER	V	L	2.6E+04	8.9E+04
METHYLENE CHLORIDE	V	L	3.9E+03	1.3E+04
#METHYLNAPHTHALENE, 1-	V	S	2.5E+04	2.5E+04
#METHYLNAPHTHALENE, 2-	V	S	2.5E+04	2.5E+04
MOLYBDENUM	NV	S		
#NAPHTHALENE	V	S	2.8E+04	3.1E+04
NICKEL	NV	S		
NITROBENZENE	V	L	(Use soil gas)	(Use soil gas)
NITROGLYCERIN	NV	L		
NITROTOLUENE, 2-	V	S	(Use soil gas)	(Use soil gas)
NITROTOLUENE, 3-	V	S	(Use soil gas)	(Use soil gas)
NITROTOLUENE, 4-	NV	S		
PENTACHLOROPHENOL	NV	S		
PENTAERYTHRITOLTETRANITRATE (PETN)	NV	S		
PERCHLORATE	NV	S		
PHENANTHRENE	V	S	(Use soil gas)	(Use soil gas)

TABLE C-1a. GROUNDWATER ACTION LEVELS FOR EVALUATION OF POTENTIAL VAPOR INTRUSION HAZARDS (volatile chemicals only)

CHEMICAL PARAMETER	Physical State		[1,3]Unrestricted Land Use (ug/L)	Commercial/ Industrial Land Use Only (ug/L)
PHENOL	NV	S		
POLYCHLORINATED BIPHENYLS (PCBs)	NV	S		
PROPICONAZOLE	NV	L		
#PYRENE	V	S	1.4E+02	1.4E+02
SELENIUM	NV	S		
SILVER	NV	S		
SIMAZINE	NV	S		
#STYRENE	V	L	3.1E+05	3.1E+05
TERBACIL	NV	S		
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	2.0E+02	6.9E+02
TETRACHLOROETHYLENE	V	L	1.8E+02	5.9E+02
TETRACHLOROPHENOL, 2,3,4,6-	NV	S		
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	NV	S		
THALLIUM	NV	S		
#TOLUENE	V	L	5.3E+05	5.3E+05
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		
TRICHLOROBENZENE, 1,2,4-	V	S	8.8E+02	2.9E+03
TRICHLOROETHANE, 1,1,1-	V	L	3.4E+05	9.4E+05
TRICHLOROETHANE, 1,1,2-	V	L	1.0E+02	2.9E+02
TRICHLOROETHYLENE	V	L	6.1E+02	2.1E+03
TRICHLOROPHENOL, 2,4,5-	NV	S		
TRICHLOROPHENOL, 2,4,6-	NV	S		
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	NV	S		
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	NV	S		
TRICHLOROPROPANE, 1,2,3-	V	L	(Use soil gas)	(Use soil gas)
TRICHLOROPROPENE, 1,2,3-	V	L	(Use soil gas)	(Use soil gas)
TRIFLURALIN	NV	S		
TRINITROBENZENE, 1,3,5-	NV	S		
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	NV	S		
TRINITROTOLUENE, 2,4,6- (TNT)	NV	S		
VANADIUM	NV	S		

TABLE C-1a. GROUNDWATER ACTION LEVELS FOR EVALUATION OF POTENTIAL VAPOR INTRUSION HAZARDS (volatile chemicals only)

CHEMICAL PARAMETER	Physical State		[1,3]Unrestricted Land Use (ug/L)	Commercial/ Industrial Land Use Only (ug/L)
VINYL CHLORIDE	V	G	6.2E+01	2.1E+02
#XYLENES	V	L	1.5E+05	1.6E+05
ZINC	NV	S		

Notes:

1. Based on unrestricted current or future land use. Considered adequate for residential housing, schools, medical facilities, day-care centers and other sensitive uses.
2. 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). Used to reflect general field calibration of groundwater data to soil gas data.
3. For inclusion in Tier 1 action levels, all groundwater assumed to potentially migrate under a residential area. Action levels for protection of indoor air under a residential exposure scenario carried forward for use at both residential and commercial/industrial sites (see Table D series).

Action levels calculated using spreadsheet provided with User's Guide for the USEPA vapor intrusion guidance (USEPA 2004)
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 -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, 2008).
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.

TABLE C-1b. SOIL ACTION LEVELS
FOR EVALUATION OF POTENTIAL VAPOR INTRUSION HAZARDS
(volatile chemicals only)
(Use with Soil Gas Action Levels for sites with significant VOC releases)

CHEMICAL PARAMETER	Physical State		[1]Unrestricted Land Use (mg/kg)	Commercial/ Industrial Land Use Only (mg/kg)
#ACENAPHTHENE	V	S	1.2E+02	1.2E+02
ACENAPHTHYLENE	V	S	(Use soil gas)	(Use soil gas)
#ACETONE	V	L	1.4E+04	3.2E+04
ALDRIN	NV	S		
AMETRYN	NV	S		
AMINO,2- DINITROTOLUENE,4,6-	NV	S		
AMINO,4- DINITROTOLUENE,2,6-	NV	S		
#ANTHRACENE	V	S	4.3E+00	4.3E+00
ANTIMONY	NV	S		
ARSENIC	NV	S		
ATRAZINE	NV	S		
BARIUM	NV	S		
#BENZENE	V	L	6.7E-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	4.5E-03	1.4E-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	1.4E-02	3.9E-02
BROMOFORM	NV	S		
BROMOMETHANE	V	G	2.2E-01	5.2E-01
CADMIUM	NV	S		
CARBON TETRACHLORIDE	V	L	8.7E-02	2.4E-01
CHLORDANE (TECHNICAL)	NV	S		
CHLOROANILINE, p-	NV	S		
CHLOROBENZENE	V	L	2.2E+00	5.2E+00
CHLOROETHANE	V	G	4.5E+02	1.0E+03
CHLOROFORM	V	L	2.3E-02	6.3E-02
CHLOROMETHANE	V	G	2.9E-01	8.1E-01
CHLOROPHENOL, 2-	V	L	1.5E+01	4.3E+01
CHROMIUM (Total)	NV	S		
CHROMIUM III	NV	S		
CHROMIUM VI	NV	S		
CHRYSENE	NV	S		
COBALT	NV	S		
COPPER	NV	S		
CYANIDE (Free)	V	S	(Use soil gas)	(Use soil gas)
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	NV	S		
DALAPON	NV	L		
DIBENZO(a,h)ANTHTRACENE	NV	S		
DIBROMO,1,2- CHLOROPROPANE,3-	V	L	(Use soil gas)	4.7E-04
DIBROMOCHLOROMETHANE	V	S	2.2E-02	(Use soil gas)
DIBROMOETHANE, 1,2-	V	S	8.7E-04	2.4E-03
DICHLOROBENZENE, 1,2-	V	L	8.9E+00	2.1E+01
DICHLOROBENZENE, 1,3-	V	L	(Use soil gas)	(Use soil gas)
DICHLOROBENZENE, 1,4-	V	S	4.7E-02	1.3E-01
DICHLOROBENZIDINE, 3,3-	NV	S		
DICHLORODIPHENYLDICHLOROETHANE (DDD)	NV	S		
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	NV	S		
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	NV	S		

TABLE C-1b. SOIL ACTION LEVELS
FOR EVALUATION OF POTENTIAL VAPOR INTRUSION HAZARDS
(volatile chemicals only)
(Use with Soil Gas Action Levels for sites with significant VOC releases)

CHEMICAL PARAMETER	Physical State		[1]Unrestricted Land Use (mg/kg)	Commercial/ Industrial Land Use Only (mg/kg)
DICHLOROETHANE, 1,1-	V	L	3.3E-01	9.1E-01
DICHLOROETHANE, 1,2-	V	L	2.0E-02	5.6E-02
DICHLOROETHYLENE, 1,1-	V	L	8.9E+00	2.1E+01
DICHLOROETHYLENE, Cis 1,2-	V	L	3.1E-01	7.3E-01
DICHLOROETHYLENE, Trans 1,2-	V	L	2.7E+00	6.2E+00
DICHLOROPHENOL, 2,4-	NV	S		
DICHLOROPHENOXYACETIC ACID (2,4-D)	NV	S		
DICHLOROPROPANE, 1,2-	V	L	5.2E-02	1.5E-01
DICHLOROPROPENE, 1,3-	V	L	1.3E-01	3.6E-01
DIELDRIN	NV	S		
DIETHYLPHTHALATE	NV	S		
#DIMETHYLPHENOL, 2,4-	V	S	1.1E+03	3.0E+03
DIMETHYLPHTHALATE	NV	S		
DINITROBENZENE, 1,3-	NV	S		
DINITROPHENOL, 2,4-	NV	S		
DINITROTOLUENE, 2,4- (2,4-DNT)	NV	S		
DINITROTOLUENE, 2,6- (2,6-DNT)	NV	S		
DIOXANE, 1,4-	NV	L		
DIOXINS (TEQ)	NV	S		
DIURON	NV	S		
ENDOSULFAN	NV	S		
ENDRIN	NV	S		
ETHANOL	NV	L		
#ETHYLBENZENE	V	L	2.1E+01	5.8E+01
FLUORANTHENE	NV	S		
#FLUORENE	V	S	1.0E+02	1.0E+02
GLYPHOSATE	NV	S		
HEPTACHLOR	NV	S		
HEPTACHLOR EPOXIDE	NV	S		
HEXACHLOROBENZENE	NV	S		
HEXACHLOROBUTADIENE	NV	S		
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	NV	S		
HEXACHLOROETHANE	NV	S		
HEXAZINONE	NV	S		
INDENO(1,2,3-cd)PYRENE	NV	S		
ISOPHORONE	NV	L		
LEAD	NV	S		
MERCURY	V	S	(Use soil gas)	(Use soil gas)
METHOXYCHLOR	NV	S		
#METHYL ETHYL KETONE	V	L	2.2E+03	5.2E+03
#METHYL ISOBUTYL KETONE	V	L	1.3E+03	3.1E+03
METHYL MERCURY	NV	S		
METHYL TERT BUTYL ETHER	V	L	2.0E+00	5.6E+00
METHYLENE CHLORIDE	V	L	1.1E+00	3.1E+00
#METHYLNAPHTHALENE, 1-	V	S	2.6E+01	8.3E+01
#METHYLNAPHTHALENE, 2-	V	S	2.8E+01	7.4E+01
MOLYBDENUM	NV	S		
#NAPHTHALENE	V	S	4.5E+00	1.2E+01
NICKEL	NV	S		
NITROBENZENE	V	L	(Use soil gas)	(Use soil gas)
NITROGLYCERIN	NV	L		
NITROTOLUENE, 2-	V	S	(Use soil gas)	(Use soil gas)
NITROTOLUENE, 3-	V	S	(Use soil gas)	(Use soil gas)
NITROTOLUENE, 4-	NV	S		
PENTACHLOROPHENOL	NV	S		
PENTAERYTHRITOLTETRANITRATE (PETN)	NV	S		

TABLE C-1b. SOIL ACTION LEVELS
FOR EVALUATION OF POTENTIAL VAPOR INTRUSION HAZARDS
(volatile chemicals only)
(Use with Soil Gas Action Levels for sites with significant VOC releases)

CHEMICAL PARAMETER	Physical State		[1]Unrestricted Land Use (mg/kg)	Commercial/ Industrial Land Use Only (mg/kg)
PERCHLORATE	NV	S		
PHENANTHRENE	V	S	(Use soil gas)	(Use soil gas)
PHENOL	NV	S		
POLYCHLORINATED BIPHENYLS (PCBs)	NV	S		
PROPICONAZOLE	NV	L		
#PYRENE	V	S	4.4E+01	4.4E+01
SELENIUM	NV	S		
SILVER	NV	S		
SIMAZINE	NV	S		
#STYRENE	V	L	4.5E+02	8.7E+02
TERBACIL	NV	S		
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	9.0E-03	2.5E-02
TETRACHLOROETHYLENE	V	L	8.8E-02	2.5E-01
TETRACHLOROPHENOL, 2,3,4,6-	NV	S		
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	NV	S		
THALLIUM	NV	S		
#TOLUENE	V	L	8.2E+02	8.2E+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		
TRICHLOROBENZENE, 1,2,4-	V	S	9.8E-02	3.1E-01
TRICHLOROETHANE, 1,1,1-	V	L	2.2E+02	5.2E+02
TRICHLOROETHANE, 1,1,2-	V	L	8.9E-03	2.1E-02
TRICHLOROETHYLENE	V	L	2.6E-01	7.3E-01
TRICHLOROPHENOL, 2,4,5-	NV	S		
TRICHLOROPHENOL, 2,4,6-	NV	S		
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	NV	S		
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	NV	S		
TRICHLOROPROPANE, 1,2,3-	V	L	(Use soil gas)	(Use soil gas)
TRICHLOROPROPENE, 1,2,3-	V	L	(Use soil gas)	(Use soil gas)
TRIFLURALIN	NV	S		
TRINITROBENZENE, 1,3,5-	NV	S		
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	NV	S		
TRINITROTOLUENE, 2,4,6- (TNT)	NV	S		
VANADIUM	NV	S		

TABLE C-1b. SOIL ACTION LEVELS
FOR EVALUATION OF POTENTIAL VAPOR INTRUSION HAZARDS
(volatile chemicals only)
(Use with Soil Gas Action Levels for sites with significant VOC releases)

CHEMICAL PARAMETER	Physical State		[1]Unrestricted Land Use (mg/kg)	Commercial/ Industrial Land Use Only (mg/kg)
VINYL CHLORIDE	V	G	1.2E-01	3.3E-01
#XYLENES	V	L	4.5E+01	1.0E+02
ZINC	NV	S		

Notes:

1. Based on unrestricted current or future land use. Considered adequate for residential housing, schools, medical facilities, day-care centers and other sensitive uses.

Action levels calculated using spreadsheet provided with User's Guide for the USEPA vapor intrusion guidance (USEPA 2004)
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, 2008).
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.

TABLE C-2. [1]SHALLOW SOIL GAS ACTION LEVELS FOR EVALUATION OF POTENTIAL VAPOR INTRUSION HAZARDS (volatile chemicals only)

			[2]Unrestricted Land Use			Commercial/Industrial Land Use Only		
CHEMICAL PARAMETER	Physical State		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	6.5E+06		6.5E+06	1.8E+07		1.8E+07
ALDRIN	NV	S						
AMETRYN	NV	S						
AMINO,2- DINITROTOLUENE,4,6-	NV	S						
AMINO,4- DINITROTOLUENE,2,6-	NV	S						
ANTHRACENE	V	S	2.2E+05		2.2E+05	6.1E+05		6.1E+05
ANTIMONY	NV	S						
ARSENIC	NV	S						
ATRAZINE	NV	S						
BARIUM	NV	S						
BENZENE	V	L	3.1E+02	3.1E+02	6.3E+03	1.0E+03	1.0E+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	8.3E+01	1.1E+03	8.3E+01	2.3E+02	3.6E+03	2.3E+02
BIS(2-CHLOROETHYL)ETHER	V	L	7.4E+00	7.4E+00		2.5E+01	2.5E+01	
BIS(2-CHLOROISOPROPYL)ETHER	V	L	2.4E+02	2.4E+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	6.6E+01	6.6E+01	1.5E+04	2.2E+02	2.2E+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	4.1E+02	4.1E+02	2.1E+04	1.4E+03	1.4E+03	5.8E+04
CHLORDANE (TECHNICAL)	NV	S						
CHLOROANILINE, p-	NV	S						
CHLOROBENZENE	V	L	1.0E+04		1.0E+04	2.9E+04		2.9E+04
CHLOROETHANE	V	G	2.1E+06		2.1E+06	5.8E+06		5.8E+06
CHLOROFORM	V	L	1.1E+02	1.1E+02	2.0E+04	3.6E+02	3.6E+02	5.7E+04
CHLOROMETHANE	V	G	1.4E+03	1.4E+03	1.9E+04	4.5E+03	4.5E+03	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)	V	S						
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	NV	S						
DALAPON	NV	L						
DIBENZO(a,h)ANTHTRACENE	NV	S						
DIBROMO,1,2- CHLOROPROPANE,3-	V	L	4.1E-01	4.1E-01	4.2E+01	1.4E+00	1.4E+00	1.2E+02
DIBROMOCHLOROMETHANE	V	S	1.0E+02	1.0E+02	1.5E+04	3.4E+02	3.4E+02	4.1E+04
DIBROMOETHANE, 1,2-	V	S	4.1E+00	4.1E+00	1.9E+03	1.4E+01	1.4E+01	5.3E+03

TABLE C-2. [1]SHALLOW SOIL GAS ACTION LEVELS FOR EVALUATION OF POTENTIAL VAPOR INTRUSION HAZARDS (volatile chemicals only)

CHEMICAL PARAMETER	Physical State		[2]Unrestricted Land Use			Commercial/Industrial Land Use Only		
			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)
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	2.2E+02	2.2E+02	1.7E+05	7.4E+02	7.4E+02	4.7E+05
DICHLOROBENZIDINE, 3,3-	NV	S						
DICHLORODIPHENYLDICHLOROETHANE (DDD)	NV	S						
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	NV	S						
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	NV	S						
DICHLOROETHANE, 1,1-	V	L	1.5E+03	1.5E+03	1.5E+05	5.1E+03	5.1E+03	4.1E+05
DICHLOROETHANE, 1,2-	V	L	9.4E+01	9.4E+01	1.5E+03	3.1E+02	3.1E+02	4.1E+03
DICHLOROETHYLENE, 1,1-	V	L	4.2E+04		4.2E+04	1.2E+05		1.2E+05
DICHLOROETHYLENE, Cis 1,2-	V	L	1.5E+03		1.5E+03	4.1E+03		4.1E+03
DICHLOROETHYLENE, Trans 1,2-	V	L	1.3E+04		1.3E+04	3.5E+04		3.5E+04
DICHLOROPHENOL, 2,4-	NV	S						
DICHLOROPHENOXYACETIC ACID (2,4-D)	NV	S						
DICHLOROPROPANE, 1,2-	V	L	2.4E+02	2.4E+02	8.3E+02	8.2E+02	8.2E+02	2.3E+03
DICHLOROPROPENE, 1,3-	V	L	6.1E+02	6.1E+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						
DINITROBENZENE, 1,3-	NV	S						
DINITROPHENOL, 2,4-	NV	S						
DINITROTOLUENE, 2,4- (2,4-DNT)	NV	S						
DINITROTOLUENE, 2,6- (2,6-DNT)	NV	S						
DIOXANE, 1,4-	NV	L						
DIOXINS (TEQ)	NV	S						
DIURON	NV	S						
ENDOSULFAN	NV	S						
ENDRIN	NV	S						
ETHANOL	NV	L						
ETHYLBENZENE	V	L	9.7E+02	9.7E+02	2.1E+05	3.3E+03	3.3E+03	5.8E+05
FLUORANTHENE	NV	S						
FLUORENE	V	S	2.9E+04		2.9E+04	8.2E+04		8.2E+04
GLYPHOSATE	NV	S						
HEPTACHLOR	NV	S						
HEPTACHLOR EPOXIDE	NV	S						
HEXACHLOROBENZENE	NV	S						
HEXACHLOROBUTADIENE	NV	S						
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	NV	S						
HEXACHLOROETHANE	NV	S						
HEXAZINONE	NV	S						
INDENO(1,2,3-cd)PYRENE	NV	S						
ISOPHORONE	NV	L						
LEAD	NV	S						
MERCURY	V	S	6.3E+00		6.3E+00	1.8E+01		1.8E+01
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						

TABLE C-2. [1]SHALLOW SOIL GAS ACTION LEVELS FOR EVALUATION OF POTENTIAL VAPOR INTRUSION HAZARDS (volatile chemicals only)

CHEMICAL PARAMETER	Physical State		[2]Unrestricted Land Use			Commercial/Industrial Land Use Only		
			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)
METHYL TERT BUTYL ETHER	V	L	9.4E+03	9.4E+03	6.3E+05	3.1E+04	3.1E+04	1.8E+06
METHYLENE CHLORIDE	V	L	5.2E+03	5.2E+03	2.3E+05	1.7E+04	1.7E+04	6.4E+05
METHYLNAPHTHALENE, 1-	V	S	2.9E+02	2.9E+02	5.1E+04	9.9E+02	9.9E+02	1.4E+05
METHYLNAPHTHALENE, 2-	V	S	2.9E+03		2.9E+03	8.2E+03		8.2E+03
MOLYBDENUM	NV	S						
NAPHTHALENE	V	S	7.2E+01	7.2E+01	6.3E+02	2.4E+02	2.4E+02	1.8E+03
NICKEL	NV	S						
NITROBENZENE	V	L	6.1E+01	6.1E+01	1.9E+03	2.0E+02	2.0E+02	5.3E+03
NITROGLYCERIN	NV	L						
NITROTOLUENE, 2-	V	S	3.9E+01	3.9E+01	6.6E+02	1.3E+02	1.3E+02	1.8E+03
NITROTOLUENE, 3-	V	S	1.5E+04		1.5E+04	4.1E+04		4.1E+04
NITROTOLUENE, 4-	NV	S						
PENTACHLOROPHENOL	NV	S						
PENTAERYTHRITOLTETRANITRATE (PETN)	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						
PROPICONAZOLE	NV	L						
PYRENE	V	S	2.2E+04		2.2E+04	6.1E+04		6.1E+04
SELENIUM	NV	S						
SILVER	NV	S						
SIMAZINE	NV	S						
STYRENE	V	L	2.1E+05		2.1E+05	5.8E+05		5.8E+05
TERBACIL	NV	S						
tert-BUTYL ALCOHOL	V	L	2.8E+03	2.8E+03		9.5E+03	9.5E+03	
TETRACHLOROETHANE, 1,1,1,2-	V	L	3.3E+02	3.3E+02	2.2E+04	1.1E+03	1.1E+03	6.1E+04
TETRACHLOROETHANE, 1,1,2,2-	V	L	4.2E+01	4.2E+01		1.4E+02	1.4E+02	
TETRACHLOROETHYLENE	V	L	4.1E+02	4.1E+02	5.6E+04	1.4E+03	1.4E+03	1.6E+05
TETRACHLOROPHENOL, 2,3,4,6-	NV	S						
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	NV	S						
THALLIUM	NV	S						
TOLUENE	V	L	1.0E+06		1.0E+06	2.9E+06		2.9E+06
TOXAPHENE	NV	S						
TPH (gasolines)	V	L	1.3E+05		1.3E+05	3.7E+05		3.7E+05
TPH (middle distillates)	V	L	1.3E+05		1.3E+05	3.7E+05		3.7E+05
TPH (residual fuels)	NV	L						
TRICHLOROBENZENE, 1,2,4-	V	S	2.9E+02	2.9E+02	4.2E+02	9.9E+02	9.9E+02	1.2E+03
TRICHLOROETHANE, 1,1,1-	V	L	1.0E+06		1.0E+06	2.9E+06		2.9E+06
TRICHLOROETHANE, 1,1,2-	V	L	4.2E+01	1.5E+02	4.2E+01	1.2E+02	5.1E+02	1.2E+02
TRICHLOROETHYLENE	V	L	1.2E+03	1.2E+03	2.1E+03	4.1E+03	4.1E+03	5.8E+03
TRICHLOROPHENOL, 2,4,5-	NV	S						
TRICHLOROPHENOL, 2,4,6-	NV	S						
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	NV	S						
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	NV	S						
TRICHLOROPROPANE, 1,2,3-	V	L	2.8E-01	2.8E-01	6.3E+01	9.5E-01	9.5E-01	1.8E+02
TRICHLOROPROPENE, 1,2,3-	V	L	6.3E+01		6.3E+01	1.8E+02		1.8E+02
TRIFLURALIN	NV	S						
TRINITROBENZENE, 1,3,5-	NV	S						

TABLE C-2. [1]SHALLOW SOIL GAS ACTION LEVELS FOR EVALUATION OF POTENTIAL VAPOR INTRUSION HAZARDS (volatile chemicals only)

CHEMICAL PARAMETER	Physical State		[2]Unrestricted Land Use			Commercial/Industrial Land Use Only		
			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)
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	NV	S						
TRINITROTOLUENE, 2,4,6- (TNT)	NV	S						
VANADIUM	NV	S						
VINYL CHLORIDE	V	G	5.5E+02	5.5E+02	2.1E+04	1.9E+03	1.9E+03	5.8E+04
XYLENES	V	L	2.1E+04		2.1E+04	5.8E+04		5.8E+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 immediately beneath building slab 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. Based on unrestricted current or future land use. Considered adequate for residential housing, schools, medical facilities, day-care centers and other sensitive uses.

Soil gas action 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.
Dibromochloromethane, dibromochloropropane and pyrene considered volatile for purposes of modeling (USEPA 2004, 2008).
Target cancer risk = 1E-06, Target Hazard Quotient = 0.2 for all chemicals except as noted.
Target Hazard Quotient = 1.0 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). Refer to Section 3.3.
Soil gas action levels for TPHgasolines based on action levels for TPHmiddle distillates due to potential for mixture of fuel types at release sites.
Soil gas action level for ethanol based on potential indoor air nuisance concerns (refer to Chapter 6 and Table F series).
Soil gas action levels do not address mass-balance issues. May be overly conservative for sites with low permeability soils immediately beneath a building slab or limited soil impacts and no source of VOCs in groundwater.
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 action levels. Consider other sources of VOCs in all indoor air studies.

TABLE C-3. INDOOR AIR ACTION LEVELS
(volatile chemicals only)

CHEMICAL PARAMETER	Physical State		Health-Based Action Levels: Unit Risk Factor URF $(ug/m^3)^{-1}$	Reference Concentration RfC (ug/m^3)	[1]Unrestricted Land Use: Lowest Residential (ug/m^3)	Indoor Air (carcinogens) (ug/m^3)	Indoor Air (noncarcinogens) (ug/m^3)	Commercial/Industrial Use Only: Lowest C/I (ug/m^3)	Indoor Air (carcinogens) (ug/m^3)	Indoor Air (noncarcinogens) (ug/m^3)	50% Odor Recognition Threshold (Table F-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		3.1E+04	6.5E+03		6.5E+03	9.1E+03		9.1E+03	3.09E+04
ALDRIN	NV	S									2.63E+02
AMETRYN	NV	S									-
AMINO,2- DINITROTOLUENE,4,6-	NV	S									-
AMINO,4- DINITROTOLUENE,2,6-	NV	S									-
ANTHRACENE	V	S		1.1E+03	2.2E+02		2.2E+02	3.1E+02		3.1E+02	-
ANTIMONY	NV	S									-
ARSENIC	NV	S									-
ATRAZINE	NV	S									-
BARIUM	NV	S									-
BENZENE	V	L	7.8E-06	3.0E+01	3.1E-01	3.1E-01	6.3E+00	5.2E-01	5.2E-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	2.3E-06	4.0E-01	8.3E-02	1.1E+00	8.3E-02	1.2E-01	1.8E+00	1.2E-01	6.00E+01
BIS(2-CHLOROETHYL)ETHER	V	L	3.3E-04		7.4E-03	7.4E-03		1.2E-02	1.2E-02		2.87E+02
BIS(2-CHLOROISOPROPYL)ETHER	V	L	1.0E-05	1.4E+02	2.4E-01	2.4E-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	3.7E-05	7.0E+01	6.6E-02	6.6E-02	1.5E+01	1.1E-01	1.1E-01	2.0E+01	1.10E+07
BROMOFORM	NV	S									1.35E+04
BROMOMETHANE	V	G		5.0E+00	1.0E+00		1.0E+00	1.5E+00		1.5E+00	8.00E+04
CADMIUM	NV	S									-
CARBON TETRACHLORIDE	V	L	6.0E-06	1.0E+02	4.1E-01	4.1E-01	2.1E+01	6.8E-01	6.8E-01	2.9E+01	6.30E+04
CHLORDANE (TECHNICAL)	NV	S									8.40E+00
CHLOROANILINE, p-	NV	S									-
CHLOROBENZENE	V	L		5.0E+01	1.0E+01		1.0E+01	1.5E+01		1.5E+01	1.00E+03
CHLOROETHANE	V	G		1.0E+04	2.1E+03		2.1E+03	2.9E+03		2.9E+03	3.80E+05
CHLOROFORM	V	L	2.3E-05	9.8E+01	1.1E-01	1.1E-01	2.0E+01	1.8E-01	1.8E-01	2.9E+01	4.22E+05
CHLOROMETHANE	V	G	1.8E-06	9.0E+01	1.4E+00	1.4E+00	1.9E+01	2.3E+00	2.3E+00	2.6E+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)	V	S									6.52E+02
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	NV	S									-
DALAPON	NV	L									-

TABLE C-3. INDOOR AIR ACTION LEVELS
(volatile chemicals only)

CHEMICAL PARAMETER	Physical State		Health-Based Action Levels: Unit Risk Factor URF $(ug/m^3)^{-1}$	Reference Concentration RfC (ug/m^3)	[1]Unrestricted Land Use: Lowest Residential (ug/m^3)	Indoor Air (carcinogens) (ug/m^3)	Indoor Air (noncarcinogens) (ug/m^3)	Commercial/Industrial Use Only: Lowest C/I (ug/m^3)	Indoor Air (carcinogens) (ug/m^3)	Indoor Air (noncarcinogens) (ug/m^3)	50% Odor Recognition Threshold (Table F-2) (ug/m^3)
DIBENZO(a,h)ANTHTRACENE	NV	S									-
DIBROMO,1,2- CHLOROPROPANE,3-	V	L	6.0E-03	2.0E-01	4.1E-04	4.1E-04	4.2E-02	6.8E-04	6.8E-04	5.8E-02	-
DIBROMOCHLOROMETHANE	V	S	2.4E-05	7.0E+01	1.0E-01	1.0E-01	1.5E+01	1.7E-01	1.7E-01	2.0E+01	-
DIBROMOETHANE, 1,2-	V	S	6.0E-04	9.0E+00	4.1E-03	4.1E-03	1.9E+00	6.8E-03	6.8E-03	2.6E+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	1.1E-05	8.0E+02	2.2E-01	2.2E-01	1.7E+02	3.7E-01	3.7E-01	2.3E+02	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	1.6E-06	7.0E+02	1.5E+00	1.5E+00	1.5E+02	2.6E+00	2.6E+00	2.0E+02	1.25E+05
DICHLOROETHANE, 1,2-	V	L	2.6E-05	7.0E+00	9.4E-02	9.4E-02	1.5E+00	1.6E-01	1.6E-01	2.0E+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		7.0E+00	1.5E+00		1.5E+00	2.0E+00		2.0E+00	-
DICHLOROETHYLENE, Trans 1,2-	V	L		6.0E+01	1.3E+01		1.3E+01	1.8E+01		1.8E+01	6.73E+04
DICHLOROPHENOL, 2,4-	NV	S									1.40E+03
DICHLOROPHENOXYACETIC ACID (2,4-D)	NV	S									-
DICHLOROPROPANE, 1,2-	V	L	1.0E-05	4.0E+00	2.4E-01	2.4E-01	8.3E-01	4.1E-01	4.1E-01	1.2E+00	1.19E+03
DICHLOROPROPENE, 1,3-	V	L	4.0E-06	2.0E+01	6.1E-01	6.1E-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									-
DINITROBENZENE, 1,3-	NV	S									-
DINITROPHENOL, 2,4-	NV	S									-
DINITROTOLUENE, 2,4- (2,4-DNT)	NV	S									-
DINITROTOLUENE, 2,6- (2,6-DNT)	NV	S									-
DIOXANE, 1,4-	NV	L									6.12E+05
DIOXINS (TEQ)	NV	S									-
DIURON	NV	S									-
ENDOSULFAN	NV	S									-
ENDRIN	NV	S									-
ETHANOL	NV	L									1.92E+04
ETHYLBENZENE	V	L	2.5E-06	1.0E+03	9.7E-01	9.7E-01	2.1E+02	1.6E+00	1.6E+00	2.9E+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	-
GLYPHOSATE	NV	S									-
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									-
HEXAZINONE	NV	S									-

TABLE C-3. INDOOR AIR ACTION LEVELS
(volatile chemicals only)

CHEMICAL PARAMETER	Physical State		Health-Based Action Levels: Unit Risk Factor URF (ug/m^3)$^{-1}$	Reference Concentration RfC (ug/m^3)	[1]Unrestricted Land Use: Lowest Residential (ug/m^3)	Indoor Air (carcinogens) (ug/m^3)	Indoor Air (noncarcinogens) (ug/m^3)	Commercial/Industrial Use Only: Lowest C/I (ug/m^3)	Indoor Air (carcinogens) (ug/m^3)	Indoor Air (noncarcinogens) (ug/m^3)	50% Odor Recognition Threshold (Table F-2) (ug/m^3)
INDENO(1,2,3-cd)PYRENE	NV	S									-
ISOPHORONE	NV	L									-
LEAD	NV	S									-
MERCURY	V	S		3.0E-02	6.3E-03		6.3E-03	8.8E-03		8.8E-03	-
METHOXYCHLOR	NV	S									-
METHYL ETHYL KETONE	V	L		5.0E+03	1.0E+03		1.0E+03	1.5E+03		1.5E+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	9.4E+00	9.4E+00	6.3E+02	1.6E+01	1.6E+01	8.8E+02	5.30E+02
METHYLENE CHLORIDE	V	L	4.7E-07	1.1E+03	5.2E+00	5.2E+00	2.3E+02	8.7E+00	8.7E+00	3.2E+02	5.60E+05
METHYLNAPHTHALENE, 1-	V	S	8.3E-06	2.5E+02	2.9E-01	2.9E-01	5.1E+01	4.9E-01	4.9E-01	7.2E+01	6.80E+01
METHYLNAPHTHALENE, 2-	V	S		1.4E+01	2.9E+00		2.9E+00	4.1E+00		4.1E+00	6.80E+01
MOLYBDENUM	NV	S									-
NAPHTHALENE	V	S	3.4E-05	3.0E+00	7.2E-02	7.2E-02	6.3E-01	1.2E-01	1.2E-01	8.8E-01	4.40E+02
NICKEL	NV	S									-
NITROBENZENE	V	L	4.0E-05	9.0E+00	6.1E-02	6.1E-02	1.9E+00	1.0E-01	1.0E-01	2.6E+00	-
NITROGLYCERIN	NV	L									-
NITROTOLUENE, 2-	V	S	6.3E-05	3.2E+00	3.9E-02	3.9E-02	6.6E-01	6.5E-02	6.5E-02	9.2E-01	-
NITROTOLUENE, 3-	V	S		7.0E+01	1.5E+01		1.5E+01	2.0E+01		2.0E+01	-
NITROTOLUENE, 4-	NV	S									-
PENTACHLOROPHENOL	NV	S									-
PENTAERYTHRITOLTETRANITRATE (PETN)	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									-
PROPICONAZOLE	NV	L									-
PYRENE	V	S		1.1E+02	2.2E+01		2.2E+01	3.1E+01		3.1E+01	-
SELENIUM	NV	S									-
SILVER	NV	S									-
SIMAZINE	NV	S									-
STYRENE	V	L		1.0E+03	2.1E+02		2.1E+02	2.9E+02		2.9E+02	1.36E+03
TERBACIL	NV	S									-
tert-BUTYL ALCOHOL	V	L	8.6E-07		2.8E+00	2.8E+00		4.8E+00	4.8E+00		-
TETRACHLOROETHANE, 1,1,1,2-	V	L	7.4E-06	1.1E+02	3.3E-01	3.3E-01	2.2E+01	5.5E-01	5.5E-01	3.1E+01	-
TETRACHLOROETHANE, 1,1,2,2-	V	L	5.8E-05		4.2E-02	4.2E-02		7.0E-02	7.0E-02		1.05E+04
TETRACHLOROETHYLENE	V	L	5.9E-06	2.7E+02	4.1E-01	4.1E-01	5.6E+01	6.9E-01	6.9E-01	7.9E+01	3.17E+04
TETRACHLOROPHENOL, 2,3,4,6-	NV	S									-
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	NV	S									-
THALLIUM	NV	S									-
TOLUENE	V	L		5.0E+03	1.0E+03		1.0E+03	1.5E+03		1.5E+03	3.00E+04
TOXAPHENE	NV	S									-
TPH (gasolines)	V	L		1.3E+02	1.3E+02		1.3E+02	1.8E+02		1.8E+02	1.00E+03
TPH (middle distillates)	V	L		1.3E+02	1.3E+02		1.3E+02	1.8E+02		1.8E+02	1.00E+03
TPH (residual fuels)	NV	L									-

TABLE C-3. INDOOR AIR ACTION LEVELS
(volatile chemicals only)

CHEMICAL PARAMETER	Physical State		Health-Based Action Levels: Unit Risk Factor URF $(ug/m^3)^{-1}$	Reference Concentration RfC (ug/m^3)	[1]Unrestricted Land Use: Lowest Residential (ug/m^3)	Indoor Air (carcinogens) (ug/m^3)	Indoor Air (noncarcinogens) (ug/m^3)	Commercial/Industrial Use Only: Lowest C/I (ug/m^3)	Indoor Air (carcinogens) (ug/m^3)	Indoor Air (noncarcinogens) (ug/m^3)	50% Odor Recognition Threshold (Table F-2) (ug/m^3)
TRICHLOROBENZENE, 1,2,4-	V	S	8.3E-06	2.0E+00	2.9E-01	2.9E-01	4.2E-01	4.9E-01	4.9E-01	5.8E-01	2.20E+04
TRICHLOROETHANE, 1,1,1-	V	L		5.0E+03	1.0E+03		1.0E+03	1.5E+03		1.5E+03	6.51E+04
TRICHLOROETHANE, 1,1,2-	V	L	1.6E-05	2.0E-01	4.2E-02	1.5E-01	4.2E-02	5.8E-02	2.6E-01	5.8E-02	-
TRICHLOROETHYLENE	V	L	2.0E-06	1.0E+01	1.2E+00	1.2E+00	2.1E+00	2.0E+00	2.0E+00	2.9E+00	1.36E+06
TRICHLOROPHENOL, 2,4,5-	NV	S									-
TRICHLOROPHENOL, 2,4,6-	NV	S									3.00E-01
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	NV	S									-
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	NV	S									-
TRICHLOROPROPANE, 1,2,3-	V	L	8.6E-03	3.0E-01	2.8E-04	2.8E-04	6.3E-02	4.8E-04	4.8E-04	8.8E-02	-
TRICHLOROPROPENE, 1,2,3-	V	L		3.0E-01	6.3E-02		6.3E-02	8.8E-02		8.8E-02	-
TRIFLURALIN	NV	S									-
TRINITROBENZENE, 1,3,5-	NV	S									-
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	NV	S									-
TRINITROTOLUENE, 2,4,6- (TNT)	NV	S									-
VANADIUM	NV	S									-
VINYL CHLORIDE	V	G	4.4E-06	1.0E+02	5.5E-01	5.5E-01	2.1E+01	9.3E-01	9.3E-01	2.9E+01	7.71E+05
XYLENES	V	L		1.0E+02	2.1E+01		2.1E+01	2.9E+01		2.9E+01	4.41E+02
ZINC	NV	S									-

Notes:

1. Based on unrestricted current or future land use. Considered adequate for residential housing, schools, medical facilities, day-care centers and other sensitive uses.

Target cancer risk = 1E-06, Target Hazard Quotient = 0.2 for all chemicals except as noted.
Target Hazard Quotient = 1.0 for TPH (see Appendix 1 and Appendix 9 Fall 2011 EAL update memo).
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, 2011).
Action levels calculated using spreadhseet provided with User's Guide for the USEPA vapor intrusion guidance (USEPA 2004, refer to Appendix 2 for equations and default input parameter values).
Indoor air action levels listed only for volatile chemicals included in database of referenced model spreadsheet (plus MTBE).
RfC and indoor air action levels for TPHgasolines based on RfC for TPHmiddle distillates due to potential for mixture of fuel types at release sites (see Table H and Appendix 6). Action levels may exceed ambient, background TPH in indoor and outdoor air from petroleum-based cleaners, auto exhaust, etc.
Indoor air action level for ethanol based on potential odor concerns (refer to Chapter 4 and Table F 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 F series).

TABLE D-1a. GROUNDWATER ACTION LEVELS
(Groundwater IS a current or potential drinking water resource)
(Surface water body IS located within 150 meters of release site)
(ug/l)

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Taste & Odors, etc.)	Drinking Water Toxicity	Vapor Intrusion Into Buildings	Aquatic Habitat Impacts (chronic)
			Table G-1	Table D-3a	Table C-1a	Table D-4a
ACENAPHTHENE	2.0E+01	Gross Contamination	2.0E+01	3.7E+02	3.9E+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	2.2E+04	5.6E+08	1.5E+03
ALDRIN	4.0E-03	Drinking Water Toxicity	8.5E+00	4.0E-03		1.3E-01
AMETRYN	1.5E+01	Aquatic Habitat Goal	5.0E+04	3.3E+02		1.5E+01
AMINO,2- DINITROTOLUENE,4,6-	1.5E+01	Aquatic Habitat Goal	5.0E+04	7.3E+01		1.5E+01
AMINO,4- DINITROTOLUENE,2,6-	1.5E+01	Aquatic Habitat Goal	5.0E+04	7.3E+01		1.5E+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
ATRAZINE	3.0E+00	Drinking Water Toxicity	2.0E+01	3.0E+00		1.2E+01
BARIUM	2.0E+02	Aquatic Habitat Goal	5.0E+04	2.0E+03		2.0E+02
BENZENE	5.0E+00	Drinking Water Toxicity	1.7E+02	5.0E+00	1.9E+03	4.6E+01
BENZO(a)ANTHRACENE	2.7E-02	Aquatic Habitat Goal	4.7E+00	9.2E-02		2.7E-02
BENZO(a)PYRENE	1.4E-02	Aquatic Habitat Goal	8.1E-01	2.0E-01		1.4E-02
BENZO(b)FLUORANTHENE	9.2E-02	Drinking Water Toxicity	7.5E-01	9.2E-02		9.1E+00
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	Gross Contamination	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	Gross Contamination	5.0E-01	8.3E-01	(Use soil gas)	1.4E+01
BIS(2-CHLOROETHYL)ETHER	1.2E-02	Drinking Water Toxicity	3.6E+02	1.2E-02	1.3E+02	6.1E+01
BIS(2-CHLOROISOPROPYL)ETHER	3.2E-01	Drinking Water Toxicity	3.2E+02	3.2E-01	(Use soil gas)	6.1E+01
BIS(2-ETHYLHEXYL)PHTHALATE	6.0E+00	Drinking Water Toxicity	1.4E+02	6.0E+00		3.2E+01
BORON	7.3E+03	Aquatic Habitat Goal	5.0E+04	7.3E+03		7.3E+03
BROMODICHLOROMETHANE	1.2E-01	Drinking Water Toxicity	5.0E+04	1.2E-01	9.8E+01	3.2E+03
BROMOFORM	8.0E+01	Drinking Water Toxicity	5.1E+02	8.0E+01		3.2E+03
BROMOMETHANE	8.7E+00	Drinking Water Toxicity	5.0E+04	8.7E+00	4.6E+02	1.6E+02
CADMIUM	3.0E+00	Aquatic Habitat Goal	5.0E+04	5.0E+00		3.0E+00
CARBON TETRACHLORIDE	5.0E+00	Drinking Water Toxicity	5.2E+02	5.0E+00	9.8E+01	9.8E+00
CHLORDANE (TECHNICAL)	4.0E-03	Aquatic Habitat Goal	2.5E+00	2.0E+00		4.0E-03
CHLOROANILINE, p-	3.4E-01	Drinking Water Toxicity	5.0E+04	3.4E-01		5.0E+00
CHLOROBENZENE	2.5E+01	Aquatic Habitat Goal	5.0E+01	1.0E+02	1.2E+04	2.5E+01
CHLOROETHANE	1.6E+01	Gross Contamination	1.6E+01	2.1E+04	5.5E+05	2.1E+04
CHLOROFORM	7.0E+01	Drinking Water Toxicity	2.4E+03	7.0E+01	9.4E+01	6.2E+02
CHLOROMETHANE	1.8E+00	Drinking Water Toxicity	5.0E+04	1.8E+00	3.7E+02	3.2E+03
CHLOROPHENOL, 2-	1.8E-01	Gross Contamination	1.8E-01	3.0E+01	7.3E+04	1.4E+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	1.3E+01		1.1E+01
CHRYSENE	3.5E-01	Aquatic Habitat Goal	1.0E+00	9.2E+00		3.5E-01
COBALT	3.0E+00	Aquatic Habitat Goal	5.0E+04	1.1E+01		3.0E+00
COPPER	2.9E+00	Aquatic Habitat Goal	1.0E+03	1.3E+03		2.9E+00
CYANIDE (Free)	1.0E+00	Aquatic Habitat Goal	1.7E+02	2.0E+02	(Use soil gas)	1.0E+00
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	6.1E-01	Drinking Water Toxicity	3.0E+04	6.1E-01		1.9E+02
DALAPON	2.0E+02	Drinking Water Toxicity	5.0E+04	2.0E+02		3.0E+02
DIBENZO(a,h)ANTHTRACENE	9.2E-03	Drinking Water Toxicity	5.2E-01	9.2E-03		7.5E+00

TABLE D-1a. GROUNDWATER ACTION LEVELS
(Groundwater IS a current or potential drinking water resource)
(Surface water body IS located within 150 meters of release site)
(ug/l)

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Taste & Odors, etc.) Table G-1	Drinking Water Toxicity Table D-3a	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (chronic) Table D-4a
DIBROMO,1,2- CHLOROPROPANE,3-	4.0E-02	Aquatic Habitat Goal	1.0E+01	4.0E-02	(Use soil gas)	4.0E-02
DIBROMOCHLOROMETHANE	1.6E-01	Drinking Water Toxicity	5.0E+04	1.6E-01	3.4E+02	3.2E+03
DIBROMOETHANE, 1,2-	4.0E-02	Drinking Water Toxicity	5.0E+04	4.0E-02	1.6E+01	1.4E+03
DICHLOROBENZENE, 1,2-	1.0E+01	Gross Contamination	1.0E+01	6.0E+02	8.0E+04	1.4E+01
DICHLOROBENZENE, 1,3-	5.0E+00	Gross Contamination	5.0E+00	1.8E+02	(Use soil gas)	6.5E+01
DICHLOROBENZENE, 1,4-	5.0E+00	Gross Contamination	5.0E+00	7.5E+01	3.8E+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	4.5E+01	2.8E-01		1.0E-03
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.0E-03	Aquatic Habitat Goal	2.0E+01	2.0E-01		1.0E-03
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.0E-03	Aquatic Habitat Goal	2.8E+00	2.0E-01		1.0E-03
DICHLOROETHANE, 1,1-	2.4E+00	Drinking Water Toxicity	5.0E+04	2.4E+00	9.4E+02	4.7E+01
DICHLOROETHANE, 1,2-	1.5E-01	Drinking Water Toxicity	7.0E+03	1.5E-01	1.6E+02	1.0E+04
DICHLOROETHYLENE, 1,1-	7.0E+00	Drinking Water Toxicity	1.5E+03	7.0E+00	6.4E+03	2.5E+01
DICHLOROETHYLENE, Cis 1,2-	7.0E+01	Drinking Water Toxicity	5.0E+04	7.0E+01	1.1E+03	5.9E+02
DICHLOROETHYLENE, Trans 1,2-	1.0E+02	Drinking Water Toxicity	2.6E+02	1.0E+02	5.0E+03	5.9E+02
DICHLOROPHENOL, 2,4-	3.0E-01	Gross Contamination	3.0E-01	1.1E+02		1.8E+02
DICHLOROPHENOXYACETIC ACID (2,4-D)	4.0E+01	Aquatic Habitat Goal	5.0E+04	7.0E+01		4.0E+01
DICHLOROPROPANE, 1,2-	5.0E+00	Drinking Water Toxicity	1.0E+01	5.0E+00	2.6E+02	1.5E+03
DICHLOROPROPENE, 1,3-	4.3E-01	Drinking Water Toxicity	5.0E+04	4.3E-01	5.5E+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	1.2E+02	1.5E+06	1.1E+02
DIMETHYLPHTHALATE	1.5E+00	Aquatic Habitat Goal	5.0E+04	3.7E+05		1.5E+00
DINITROBENZENE, 1,3-	3.7E+00	Drinking Water Toxicity	5.0E+04	3.7E+00		3.0E+01
DINITROPHENOL, 2,4-	7.3E+01	Drinking Water Toxicity	5.0E+04	7.3E+01		7.5E+01
DINITROTOLUENE, 2,4- (2,4-DNT)	2.2E-01	Drinking Water Toxicity	5.0E+04	2.2E-01		4.4E+01
DINITROTOLUENE, 2,6- (2,6-DNT)	3.7E+01	Drinking Water Toxicity	5.0E+04	3.7E+01		4.4E+01
DIOXANE, 1,4-	6.7E-01	Drinking Water Toxicity	5.0E+04	6.7E-01		3.4E+05
DIOXINS (TEQ)	5.0E-06	Aquatic Habitat Goal	6.0E-02	3.0E-05		5.0E-06
DIURON	6.0E+01	Aquatic Habitat Goal	2.1E+04	7.3E+01		6.0E+01
ENDOSULFAN	8.7E-03	Aquatic Habitat Goal	2.3E+02	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	Gross Contamination	5.0E+04			
ETHYLBENZENE	3.0E+01	Gross Contamination	3.0E+01	7.0E+02	6.6E+04	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
GLYPHOSATE	6.5E+01	Aquatic Habitat Goal	5.0E+04	7.0E+02		6.5E+01
HEPTACHLOR	3.6E-03	Aquatic Habitat Goal	2.0E+01	4.0E-01		3.6E-03
HEPTACHLOR EPOXIDE	3.6E-03	Aquatic Habitat Goal	1.0E+02	2.0E-01		3.6E-03
HEXACHLOROBENZENE	1.0E+00	Drinking Water Toxicity	3.1E+00	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	4.0E+03	2.0E-01		8.0E-02
HEXACHLOROETHANE	4.8E+00	Drinking Water Toxicity	1.0E+01	4.8E+00		1.2E+01
HEXAZINONE	1.2E+03	Drinking Water Toxicity	5.0E+04	1.2E+03		5.0E+03
INDENO(1,2,3-cd)PYRENE	9.2E-02	Drinking Water Toxicity	9.5E-02	9.2E-02		4.3E+00
ISOPHORONE	7.1E+01	Drinking Water Toxicity	5.0E+04	7.1E+01		1.3E+02

TABLE D-1a. GROUNDWATER ACTION LEVELS
(Groundwater IS a current or potential drinking water resource)
(Surface water body IS located within 150 meters of release site)
(ug/l)

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Taste & Odors, etc.) Table G-1	Drinking Water Toxicity Table D-3a	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (chronic) Table D-4a
LEAD	5.6E+00	Aquatic Habitat Goal	5.0E+04	1.5E+01		5.6E+00
MERCURY	2.5E-02	Aquatic Habitat Goal	3.0E+01	2.0E+00	(Use soil gas)	2.5E-02
METHOXYCHLOR	3.0E-02	Aquatic Habitat Goal	5.0E+01	4.0E+01		3.0E-02
METHYL ETHYL KETONE	7.1E+03	Drinking Water Toxicity	8.4E+03	7.1E+03	1.9E+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	Gross Contamination	5.0E+00	1.2E+01	2.6E+04	1.8E+04
METHYLENE CHLORIDE	4.8E+00	Drinking Water Toxicity	9.1E+03	4.8E+00	3.9E+03	2.2E+03
METHYLNAPHTHALENE, 1-	2.1E+00	Aquatic Habitat Goal	1.0E+01	4.7E+00	2.5E+04	2.1E+00
METHYLNAPHTHALENE, 2-	2.1E+00	Aquatic Habitat Goal	1.0E+01	2.4E+01	2.5E+04	2.1E+00
MOLYBDENUM	1.8E+02	Drinking Water Toxicity	5.0E+04	1.8E+02		2.4E+02
NAPHTHALENE	1.7E+01	Drinking Water Toxicity	2.1E+01	1.7E+01	2.8E+04	2.4E+01
NICKEL	5.0E+00	Aquatic Habitat Goal	5.0E+04	1.8E+03		5.0E+00
NITROBENZENE	1.2E-01	Drinking Water Toxicity	5.0E+04	1.2E-01	(Use soil gas)	6.0E+01
NITROGLYCERIN	3.7E+00	Drinking Water Toxicity	5.0E+04	3.7E+00		1.4E+02
NITROTOLUENE, 2-	6.2E-02	Drinking Water Toxicity	5.0E+04	6.2E-02	(Use soil gas)	1.0E+03
NITROTOLUENE, 3-	1.2E+02	Drinking Water Toxicity	5.0E+04	1.2E+02	(Use soil gas)	3.8E+02
NITROTOLUENE, 4-	4.2E+00	Drinking Water Toxicity	5.0E+04	4.2E+00		1.6E+03
PENTACHLOROPHENOL	1.0E+00	Drinking Water Toxicity	3.0E+01	1.0E+00		7.9E+00
PENTAERYTHRITOLTETRANITRATE (PETN)	1.7E+01	Drinking Water Toxicity	2.2E+04	1.7E+01		8.5E+04
PERCHLORATE	2.6E+01	Drinking Water Toxicity	5.0E+04	2.6E+01		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	Gross Contamination	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
PROPICONAZOLE	2.6E+01	Aquatic Habitat Goal	5.0E+04	4.7E+02		2.6E+01
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	1.0E+00	Aquatic Habitat Goal	1.0E+02	1.8E+02		1.0E+00
SIMAZINE	2.0E+00	Aquatic Habitat Goal	3.1E+03	4.0E+00		2.0E+00
STYRENE	1.0E+01	Gross Contamination	1.0E+01	1.0E+02	3.1E+05	3.2E+01
TERBACIL	4.7E+02	Drinking Water Toxicity	5.0E+04	4.7E+02		2.3E+03
tert-BUTYL ALCOHOL	4.5E+00	Drinking Water Toxicity	5.0E+04	4.5E+00	(Use soil gas)	1.8E+04
TETRACHLOROETHANE, 1,1,1,2-	5.2E-01	Drinking Water Toxicity	5.0E+04	5.2E-01	(Use soil gas)	3.1E+02
TETRACHLOROETHANE, 1,1,2,2-	6.7E-02	Drinking Water Toxicity	5.0E+02	6.7E-02	2.0E+02	4.2E+02
TETRACHLOROETHYLENE	5.0E+00	Drinking Water Toxicity	1.7E+02	5.0E+00	1.8E+02	1.2E+02
TETRACHLOROPHENOL, 2,3,4,6-	1.2E+00	Aquatic Habitat Goal	1.2E+04	1.1E+03		1.2E+00
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	3.3E+02	Aquatic Habitat Goal	5.0E+04	1.8E+03		3.3E+02
THALLIUM	2.0E+00	Drinking Water Toxicity	5.0E+04	2.0E+00		2.0E+01
TOLUENE	4.0E+01	Gross Contamination	4.0E+01	1.0E+03	5.3E+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	Gross Contamination	1.0E+02	1.0E+02	(Use soil gas)	5.0E+02
TPH (middle distillates)	1.0E+02	Gross Contamination	1.0E+02	1.9E+02	(Use soil gas)	6.4E+02
TPH (residual fuels)	1.0E+02	Gross Contamination	1.0E+02	4.4E+03		6.4E+02
TRICHLOROBENZENE, 1,2,4-	2.5E+01	Aquatic Habitat Goal	3.0E+03	7.0E+01	8.8E+02	2.5E+01
TRICHLOROETHANE, 1,1,1-	6.2E+01	Aquatic Habitat Goal	9.7E+02	2.0E+02	3.4E+05	6.2E+01
TRICHLOROETHANE, 1,1,2-	5.0E+00	Drinking Water Toxicity	5.0E+04	5.0E+00	1.0E+02	4.7E+03

TABLE D-1a. GROUNDWATER ACTION LEVELS
(Groundwater IS a current or potential drinking water resource)
(Surface water body IS located within 150 meters of release site)
(ug/l)

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Taste & Odors, etc.) Table G-1	Drinking Water Toxicity Table D-3a	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (chronic) Table D-4a
TRICHLOROETHYLENE	5.0E+00	Drinking Water Toxicity	3.1E+02	5.0E+00	6.1E+02	3.6E+02
TRICHLOROPHENOL, 2,4,5-	1.1E+01	Aquatic Habitat Goal	2.0E+02	3.7E+03		1.1E+01
TRICHLOROPHENOL, 2,4,6-	6.1E+00	Drinking Water Toxicity	1.0E+02	6.1E+00		4.9E+02
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	3.7E+02	Drinking Water Toxicity	5.0E+04	3.7E+02		6.9E+02
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	3.0E+01	Aquatic Habitat Goal	5.0E+04	5.0E+01		3.0E+01
TRICHLOROPROPANE, 1,2,3-	6.0E-01	Drinking Water Toxicity	5.0E+04	6.0E-01	(Use soil gas)	1.4E+01
TRICHLOROPROPENE, 1,2,3-	6.2E-01	Aquatic Habitat Goal	5.0E+04	6.2E-01	(Use soil gas)	6.2E-01
TRIFLURALIN	8.7E+00	Drinking Water Toxicity	9.2E+01	8.7E+00		2.0E+01
TRINITROBENZENE, 1,3,5-	3.0E+01	Aquatic Habitat Goal	5.0E+04	1.1E+03		3.0E+01
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	1.5E+02	Aquatic Habitat Goal	3.7E+04	1.5E+02		1.5E+02
TRINITROTOLUENE, 2,4,6- (TNT)	2.2E+00	Drinking Water Toxicity	5.0E+04	2.2E+00		1.3E+02
VANADIUM	1.9E+01	Aquatic Habitat Goal	5.0E+04	1.8E+02		1.9E+01
VINYL CHLORIDE	2.0E+00	Drinking Water Toxicity	3.4E+03	2.0E+00	6.2E+01	7.8E+02
XYLENES	2.0E+01	Gross Contamination	2.0E+01	1.0E+04	1.5E+05	1.0E+02
ZINC	2.2E+01	Aquatic Habitat Goal	5.0E+03	1.1E+04		2.2E+01

Notes:

1. Lowest of action levels for gross contamination, drinking water toxicity, vapor intrusion and aquatic habitat impacts. Used to develop soil leaching action levels for protection of groundwater quality.

TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.
Gross Contamination: Odor threshold, 1/2 solubility or 50000 ug/L maximum, whichever is lower. Intended to limit general groundwater resource degradation.
Drinking Water Toxicity: Based on primary maximum concentration levels (MCLs), or equivalent. Considered protective of human health.
Vapor Intrusion: Addresses potential emission of volatile chemicals from groundwater into buildings and subsequent impact on indoor air. Assumes moderately permeable, sandy soil or fill material immediately beneath building slab and unrestricted ("residential") land use (refer to Chapter 5).
Aquatic Habitat Impacts: Addresses potential discharge of groundwater to estuarine aquatic habitat and subsequent impact on aquatic life; dilution of groundwater upon discharge to surface water not considered, in order to take into account potential impacts to benthic organisms (see Chapter 5).
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 reporting limits and background concentrations replace final screening level as appropriate.

TABLE D-1b. GROUNDWATER ACTION LEVELS
(Groundwater IS a current or potential drinking water resource)
(Surface water body IS NOT located within 150m of release site)
(ug/l)

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Taste & Odors, etc.) Table G-1	Drinking Water Toxicity Table D-3a	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (acute) Table D-4a
ACENAPHTHENE	2.0E+01	Gross Contamination	2.0E+01	3.7E+02	3.9E+03	3.2E+02
ACENAPHTHYLENE	2.4E+02	Drinking Water Toxicity	2.0E+03	2.4E+02	(Use soil gas)	3.0E+02
ACETONE	1.5E+03	Aquatic Habitat Goal	2.0E+04	2.2E+04	5.6E+08	1.5E+03
ALDRIN	4.0E-03	Drinking Water Toxicity	8.5E+00	4.0E-03		1.3E+00
AMETRYN	1.5E+02	Aquatic Habitat Goal	5.0E+04	3.3E+02		1.5E+02
AMINO,2- DINITROTOLUENE,4,6-	7.3E+01	Drinking Water Toxicity	5.0E+04	7.3E+01		1.5E+02
AMINO,4- DINITROTOLUENE,2,6-	7.3E+01	Drinking Water Toxicity	5.0E+04	7.3E+01		1.5E+02
ANTHRACENE	2.2E+01	Gross Contamination	2.2E+01	1.8E+03	4.3E+01	3.0E+02
ANTIMONY	6.0E+00	Drinking Water Toxicity	5.0E+04	6.0E+00		1.5E+03
ARSENIC	1.0E+01	Drinking Water Toxicity	5.0E+04	1.0E+01		6.9E+01
ATRAZINE	3.0E+00	Drinking Water Toxicity	2.0E+01	3.0E+00		3.5E+02
BARIUM	1.0E+03	Aquatic Habitat Goal	5.0E+04	2.0E+03		1.0E+03
BENZENE	5.0E+00	Drinking Water Toxicity	1.7E+02	5.0E+00	1.9E+03	1.7E+03
BENZO(a)ANTHRACENE	9.2E-02	Drinking Water Toxicity	4.7E+00	9.2E-02		3.0E+02
BENZO(a)PYRENE	2.0E-01	Drinking Water Toxicity	8.1E-01	2.0E-01		3.0E+02
BENZO(b)FLUORANTHENE	9.2E-02	Drinking Water Toxicity	7.5E-01	9.2E-02		3.0E+02
BENZO(g,h,i)PERYLENE	1.3E-01	Gross Contamination	1.3E-01	1.5E+03		3.0E+02
BENZO(k)FLUORANTHENE	4.0E-01	Gross Contamination	4.0E-01	9.2E-01		3.0E+02
BERYLLIUM	4.0E+00	Drinking Water Toxicity	5.0E+04	4.0E+00		4.3E+01
BIPHENYL, 1,1-	5.0E-01	Gross Contamination	5.0E-01	8.3E-01	(Use soil gas)	1.4E+01
BIS(2-CHLOROETHYL)ETHER	1.2E-02	Drinking Water Toxicity	3.6E+02	1.2E-02	1.3E+02	2.4E+05
BIS(2-CHLOROISOPROPYL)ETHER	3.2E-01	Drinking Water Toxicity	3.2E+02	3.2E-01	(Use soil gas)	2.4E+05
BIS(2-ETHYLHEXYL)PHTHALATE	6.0E+00	Drinking Water Toxicity	1.4E+02	6.0E+00		3.2E+01
BORON	7.3E+03	Aquatic Habitat Goal	5.0E+04	7.3E+03		7.3E+03
BROMODICHLOROMETHANE	1.2E-01	Drinking Water Toxicity	5.0E+04	1.2E-01	9.8E+01	1.1E+04
BROMOFORM	8.0E+01	Drinking Water Toxicity	5.1E+02	8.0E+01		1.1E+04
BROMOMETHANE	8.7E+00	Drinking Water Toxicity	5.0E+04	8.7E+00	4.6E+02	1.1E+04
CADMIUM	3.0E+00	Aquatic Habitat Goal	5.0E+04	5.0E+00		3.0E+00
CARBON TETRACHLORIDE	5.0E+00	Drinking Water Toxicity	5.2E+02	5.0E+00	9.8E+01	1.2E+04
CHLORDANE (TECHNICAL)	9.0E-02	Aquatic Habitat Goal	2.5E+00	2.0E+00		9.0E-02
CHLOROANILINE, p-	3.4E-01	Drinking Water Toxicity	5.0E+04	3.4E-01		5.0E+00
CHLOROBENZENE	5.0E+01	Gross Contamination	5.0E+01	1.0E+02	1.2E+04	1.6E+02
CHLOROETHANE	1.6E+01	Gross Contamination	1.6E+01	2.1E+04	5.5E+05	2.1E+04
CHLOROFORM	7.0E+01	Drinking Water Toxicity	2.4E+03	7.0E+01	9.4E+01	9.6E+03
CHLOROMETHANE	1.8E+00	Drinking Water Toxicity	5.0E+04	1.8E+00	3.7E+02	1.1E+04
CHLOROPHENOL, 2-	1.8E-01	Gross Contamination	1.8E-01	3.0E+01	7.3E+04	1.4E+03
CHROMIUM (Total)	1.0E+02	Drinking Water Toxicity	5.0E+04	1.0E+02		5.7E+02
CHROMIUM III	5.7E+02	Aquatic Habitat Goal	5.0E+04	5.5E+04		5.7E+02
CHROMIUM VI	1.3E+01	Drinking Water Toxicity	5.0E+04	1.3E+01		1.6E+01
CHRYSENE	1.0E+00	Gross Contamination	1.0E+00	9.2E+00		3.0E+02
COBALT	3.0E+00	Aquatic Habitat Goal	5.0E+04	1.1E+01		3.0E+00
COPPER	2.9E+00	Aquatic Habitat Goal	1.0E+03	1.3E+03		2.9E+00
CYANIDE (Free)	1.0E+00	Aquatic Habitat Goal	1.7E+02	2.0E+02	(Use soil gas)	1.0E+00
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	6.1E-01	Drinking Water Toxicity	3.0E+04	6.1E-01		1.4E+03
DALAPON	2.0E+02	Drinking Water Toxicity	5.0E+04	2.0E+02		3.0E+03
DIBENZO(a,h)ANTHTRACENE	9.2E-03	Drinking Water Toxicity	5.2E-01	9.2E-03		3.0E+02
DIBROMO,1,2- CHLOROPROPANE,3-	4.0E-02	Aquatic Habitat Goal	1.0E+01	4.0E-02	(Use soil gas)	4.0E-02

TABLE D-1b. GROUNDWATER ACTION LEVELS
(Groundwater IS a current or potential drinking water resource)
(Surface water body IS NOT located within 150m of release site)
(ug/l)

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Taste & Odors, etc.) Table G-1	Drinking Water Toxicity Table D-3a	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (acute) Table D-4a
DIBROMOCHLOROMETHANE	1.6E-01	Drinking Water Toxicity	5.0E+04	1.6E-01	3.4E+02	1.1E+04
DIBROMOETHANE, 1,2-	4.0E-02	Drinking Water Toxicity	5.0E+04	4.0E-02	1.6E+01	1.4E+03
DICHLOROBENZENE, 1,2-	1.0E+01	Gross Contamination	1.0E+01	6.0E+02	8.0E+04	3.7E+02
DICHLOROBENZENE, 1,3-	5.0E+00	Gross Contamination	5.0E+00	1.8E+02	(Use soil gas)	3.7E+02
DICHLOROBENZENE, 1,4-	5.0E+00	Gross Contamination	5.0E+00	7.5E+01	3.8E+02	3.7E+02
DICHLOROBENZIDINE, 3,3-	1.5E-01	Drinking Water Toxicity	1.6E+03	1.5E-01		2.5E+02
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.8E-01	Drinking Water Toxicity	4.5E+01	2.8E-01		6.0E-01
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.0E-01	Drinking Water Toxicity	2.0E+01	2.0E-01		1.1E+00
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.3E-02	Aquatic Habitat Goal	2.8E+00	2.0E-01		1.3E-02
DICHLOROETHANE, 1,1-	2.4E+00	Drinking Water Toxicity	5.0E+04	2.4E+00	9.4E+02	4.7E+01
DICHLOROETHANE, 1,2-	1.5E-01	Drinking Water Toxicity	7.0E+03	1.5E-01	1.6E+02	3.8E+04
DICHLOROETHYLENE, 1,1-	7.0E+00	Drinking Water Toxicity	1.5E+03	7.0E+00	6.4E+03	3.9E+03
DICHLOROETHYLENE, Cis 1,2-	7.0E+01	Drinking Water Toxicity	5.0E+04	7.0E+01	1.1E+03	1.2E+04
DICHLOROETHYLENE, Trans 1,2-	1.0E+02	Drinking Water Toxicity	2.6E+02	1.0E+02	5.0E+03	1.2E+04
DICHLOROPHENOL, 2,4-	3.0E-01	Gross Contamination	3.0E-01	1.1E+02		6.7E+02
DICHLOROPHENOXYACETIC ACID (2,4-D)	7.0E+01	Drinking Water Toxicity	5.0E+04	7.0E+01		2.0E+02
DICHLOROPROPANE, 1,2-	5.0E+00	Drinking Water Toxicity	1.0E+01	5.0E+00	2.6E+02	3.4E+03
DICHLOROPROPENE, 1,3-	4.3E-01	Drinking Water Toxicity	5.0E+04	4.3E-01	5.5E+02	2.6E+02
DIELDRIN	4.2E-03	Drinking Water Toxicity	4.1E+01	4.2E-03		7.1E-01
DIETHYLPHTHALATE	9.4E+02	Aquatic Habitat Goal	5.0E+04	2.9E+04		9.4E+02
DIMETHYLPHENOL, 2,4-	1.2E+02	Drinking Water Toxicity	4.0E+02	1.2E+02	1.5E+06	2.7E+02
DIMETHYLPHTHALATE	9.4E+02	Aquatic Habitat Goal	5.0E+04	3.7E+05		9.4E+02
DINITROBENZENE, 1,3-	3.7E+00	Drinking Water Toxicity	5.0E+04	3.7E+00		1.1E+02
DINITROPHENOL, 2,4-	7.3E+01	Drinking Water Toxicity	5.0E+04	7.3E+01		2.3E+02
DINITROTOLUENE, 2,4- (2,4-DNT)	2.2E-01	Drinking Water Toxicity	5.0E+04	2.2E-01		1.1E+02
DINITROTOLUENE, 2,6- (2,6-DNT)	3.7E+01	Drinking Water Toxicity	5.0E+04	3.7E+01		1.1E+02
DIOXANE, 1,4-	6.7E-01	Drinking Water Toxicity	5.0E+04	6.7E-01		3.4E+06
DIOXINS (TEQ)	3.0E-05	Drinking Water Toxicity	6.0E-02	3.0E-05		3.0E-03
DIURON	7.3E+01	Drinking Water Toxicity	2.1E+04	7.3E+01		2.0E+02
ENDOSULFAN	3.4E-02	Aquatic Habitat Goal	2.3E+02	2.2E+02		3.4E-02
ENDRIN	3.7E-02	Aquatic Habitat Goal	4.1E+01	2.0E+00		3.7E-02
ETHANOL	5.0E+04	Gross Contamination	5.0E+04			
ETHYLBENZENE	3.0E+01	Gross Contamination	3.0E+01	7.0E+02	6.6E+04	4.3E+02
FLUORANTHENE	1.3E+02	Gross Contamination	1.3E+02	1.5E+03		3.0E+02
FLUORENE	2.4E+02	Drinking Water Toxicity	9.5E+02	2.4E+02	1.9E+03	3.0E+02
GLYPHOSATE	6.0E+02	Aquatic Habitat Goal	5.0E+04	7.0E+02		6.0E+02
HEPTACHLOR	5.3E-02	Aquatic Habitat Goal	2.0E+01	4.0E-01		5.3E-02
HEPTACHLOR EPOXIDE	5.3E-02	Aquatic Habitat Goal	1.0E+02	2.0E-01		5.3E-02
HEXACHLOROBENZENE	1.0E+00	Drinking Water Toxicity	3.1E+00	1.0E+00		6.0E+00
HEXACHLOROBUTADIENE	8.6E-01	Drinking Water Toxicity	6.0E+00	8.6E-01		1.1E+01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	1.6E-01	Aquatic Habitat Goal	4.0E+03	2.0E-01		1.6E-01
HEXACHLOROETHANE	4.8E+00	Drinking Water Toxicity	1.0E+01	4.8E+00		3.1E+02
HEXAZINONE	1.2E+03	Drinking Water Toxicity	5.0E+04	1.2E+03		5.0E+04
INDENO(1,2,3-cd)PYRENE	9.2E-02	Drinking Water Toxicity	9.5E-02	9.2E-02		3.0E+02
ISOPHORONE	7.1E+01	Drinking Water Toxicity	5.0E+04	7.1E+01		4.3E+03
LEAD	1.5E+01	Drinking Water Toxicity	5.0E+04	1.5E+01		2.9E+01

TABLE D-1b. GROUNDWATER ACTION LEVELS
(Groundwater IS a current or potential drinking water resource)
(Surface water body IS NOT located within 150m of release site)
(ug/l)

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Taste & Odors, etc.) Table G-1	Drinking Water Toxicity Table D-3a	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (acute) Table D-4a
MERCURY	2.0E+00	Drinking Water Toxicity	3.0E+01	2.0E+00	(Use soil gas)	2.1E+00
METHOXYCHLOR	3.0E-02	Aquatic Habitat Goal	5.0E+01	4.0E+01		3.0E-02
METHYL ETHYL KETONE	7.1E+03	Drinking Water Toxicity	8.4E+03	7.1E+03	1.9E+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	Gross Contamination	5.0E+00	1.2E+01	2.6E+04	5.3E+04
METHYLENE CHLORIDE	4.8E+00	Drinking Water Toxicity	9.1E+03	4.8E+00	3.9E+03	1.1E+04
METHYLNAPHTHALENE, 1-	4.7E+00	Drinking Water Toxicity	1.0E+01	4.7E+00	2.5E+04	3.0E+02
METHYLNAPHTHALENE, 2-	1.0E+01	Gross Contamination	1.0E+01	2.4E+01	2.5E+04	3.0E+02
MOLYBDENUM	1.8E+02	Drinking Water Toxicity	5.0E+04	1.8E+02		2.4E+02
NAPHTHALENE	1.7E+01	Drinking Water Toxicity	2.1E+01	1.7E+01	2.8E+04	7.7E+02
NICKEL	5.0E+00	Aquatic Habitat Goal	5.0E+04	1.8E+03		5.0E+00
NITROBENZENE	1.2E-01	Drinking Water Toxicity	5.0E+04	1.2E-01	(Use soil gas)	2.0E+03
NITROGLYCERIN	3.7E+00	Drinking Water Toxicity	5.0E+04	3.7E+00		1.4E+02
NITROTOLUENE, 2-	6.2E-02	Drinking Water Toxicity	5.0E+04	6.2E-02	(Use soil gas)	7.5E+03
NITROTOLUENE, 3-	1.2E+02	Drinking Water Toxicity	5.0E+04	1.2E+02	(Use soil gas)	3.8E+03
NITROTOLUENE, 4-	4.2E+00	Drinking Water Toxicity	5.0E+04	4.2E+00		3.3E+03
PENTACHLOROPHENOL	1.0E+00	Drinking Water Toxicity	3.0E+01	1.0E+00		1.3E+01
PENTAERYTHRITOLTETRANITRATE (PETN)	1.7E+01	Drinking Water Toxicity	2.2E+04	1.7E+01		4.3E+04
PERCHLORATE	2.6E+01	Drinking Water Toxicity	5.0E+04	2.6E+01		6.0E+02
PHENANTHRENE	2.4E+02	Drinking Water Toxicity	4.1E+02	2.4E+02	(Use soil gas)	3.0E+02
PHENOL	5.0E+00	Gross Contamination	5.0E+00	1.1E+04		3.4E+03
POLYCHLORINATED BIPHENYLS (PCBs)	5.0E-01	Drinking Water Toxicity	1.6E+01	5.0E-01		2.0E+00
PROPICONAZOLE	2.6E+02	Aquatic Habitat Goal	5.0E+04	4.7E+02		2.6E+02
PYRENE	6.8E+01	Gross Contamination	6.8E+01	1.8E+02	1.4E+02	3.0E+02
SELENIUM	2.0E+01	Aquatic Habitat Goal	5.0E+04	5.0E+01		2.0E+01
SILVER	1.0E+00	Aquatic Habitat Goal	1.0E+02	1.8E+02		1.0E+00
SIMAZINE	4.0E+00	Drinking Water Toxicity	3.1E+03	4.0E+00		1.0E+01
STYRENE	1.0E+01	Gross Contamination	1.0E+01	1.0E+02	3.1E+05	3.2E+01
TERBACIL	4.7E+02	Drinking Water Toxicity	5.0E+04	4.7E+02		2.3E+04
tert-BUTYL ALCOHOL	4.5E+00	Drinking Water Toxicity	5.0E+04	4.5E+00	(Use soil gas)	1.8E+05
TETRACHLOROETHANE, 1,1,1,2-	5.2E-01	Drinking Water Toxicity	5.0E+04	5.2E-01	(Use soil gas)	3.1E+03
TETRACHLOROETHANE, 1,1,2,2-	6.7E-02	Drinking Water Toxicity	5.0E+02	6.7E-02	2.0E+02	3.0E+03
TETRACHLOROETHYLENE	5.0E+00	Drinking Water Toxicity	1.7E+02	5.0E+00	1.8E+02	1.8E+03
TETRACHLOROPHENOL, 2,3,4,6-	1.0E+01	Aquatic Habitat Goal	1.2E+04	1.1E+03		1.0E+01
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	1.8E+03	Drinking Water Toxicity	5.0E+04	1.8E+03		1.9E+03
THALLIUM	2.0E+00	Drinking Water Toxicity	5.0E+04	2.0E+00		4.7E+02
TOLUENE	4.0E+01	Gross Contamination	4.0E+01	1.0E+03	5.3E+05	5.8E+03
TOXAPHENE	2.1E-01	Aquatic Habitat Goal	1.4E+02	3.0E+00		2.1E-01
TPH (gasolines)	1.0E+02	Gross Contamination	1.0E+02	1.0E+02	(Use soil gas)	5.0E+03
TPH (middle distillates)	1.0E+02	Gross Contamination	1.0E+02	1.9E+02	(Use soil gas)	2.5E+03
TPH (residual fuels)	1.0E+02	Gross Contamination	1.0E+02	4.4E+03		2.5E+03
TRICHLOROBENZENE, 1,2,4-	7.0E+01	Drinking Water Toxicity	3.0E+03	7.0E+01	8.8E+02	1.6E+02
TRICHLOROETHANE, 1,1,1-	2.0E+02	Drinking Water Toxicity	9.7E+02	2.0E+02	3.4E+05	6.0E+03
TRICHLOROETHANE, 1,1,2-	5.0E+00	Drinking Water Toxicity	5.0E+04	5.0E+00	1.0E+02	6.0E+03
TRICHLOROETHYLENE	5.0E+00	Drinking Water Toxicity	3.1E+02	5.0E+00	6.1E+02	7.0E+02

TABLE D-1b. GROUNDWATER ACTION LEVELS
(Groundwater IS a current or potential drinking water resource)
(Surface water body IS NOT located within 150m of release site)
(ug/l)

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Taste & Odors, etc.) Table G-1	Drinking Water Toxicity Table D-3a	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (acute) Table D-4a
TRICHLOROPHENOL, 2,4,5-	1.0E+02	Aquatic Habitat Goal	2.0E+02	3.7E+03		1.0E+02
TRICHLOROPHENOL, 2,4,6-	6.1E+00	Drinking Water Toxicity	1.0E+02	6.1E+00		4.9E+02
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	3.7E+02	Drinking Water Toxicity	5.0E+04	3.7E+02		6.9E+02
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	3.0E+01	Aquatic Habitat Goal	5.0E+04	5.0E+01		3.0E+01
TRICHLOROPROPANE, 1,2,3-	6.0E-01	Drinking Water Toxicity	5.0E+04	6.0E-01	(Use soil gas)	1.4E+02
TRICHLOROPROPENE, 1,2,3-	6.2E-01	Aquatic Habitat Goal	5.0E+04	6.2E-01	(Use soil gas)	6.2E-01
TRIFLURALIN	8.7E+00	Drinking Water Toxicity	9.2E+01	8.7E+00		2.0E+01
TRINITROBENZENE, 1,3,5-	1.4E+02	Aquatic Habitat Goal	5.0E+04	1.1E+03		1.4E+02
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	1.5E+02	Aquatic Habitat Goal	3.7E+04	1.5E+02		1.5E+02
TRINITROTOLUENE, 2,4,6- (TNT)	2.2E+00	Drinking Water Toxicity	5.0E+04	2.2E+00		5.7E+02
VANADIUM	1.9E+01	Aquatic Habitat Goal	5.0E+04	1.8E+02		1.9E+01
VINYL CHLORIDE	2.0E+00	Drinking Water Toxicity	3.4E+03	2.0E+00	6.2E+01	7.8E+02
XYLENES	2.0E+01	Gross Contamination	2.0E+01	1.0E+04	1.5E+05	1.0E+03
ZINC	2.2E+01	Aquatic Habitat Goal	5.0E+03	1.1E+04		2.2E+01

Notes:

1. Lowest of action levels for gross contamination, drinking water toxicity, vapor intrusion and aquatic habitat impacts. Used to develop soil leaching action levels for protection of groundwater quality.

TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.
Gross Contamination: Odor threshold, 1/2 solubility or 50000 ug/L maximum, whichever is lower. Intended to limit general groundwater resource degradation.
Drinking Water Toxicity: Based on primary maximum concentration levels (MCLs), or equivalent. Considered protective of human health.
Vapor Intrusion: Addresses potential emission of volatile chemicals from groundwater into buildings and subsequent impact on indoor air. Assumes moderately permeable, sandy soil or fill material immediately beneath building slab and unrestricted ("residential") land use (refer to Chapter 5).
Aquatic Habitat Impacts: Addresses potential discharge of groundwater to estuarine aquatic habitat and subsequent impact on aquatic life; dilution of groundwater upon discharge to surface water not considered, in order to take into account potential impacts to benthic organisms (see Chapter 5).
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 reporting limits and background concentrations replace final screening level as appropriate.

TABLE D-1c. GROUNDWATER ACTION LEVELS
(Groundwater IS NOT a current or potential drinking water resource)
(Surface water body IS located within 150m of release site)
(ug/l)

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Odors, etc.) Table G-2	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (chronic) Table D-4a
ACENAPHTHENE	2.3E+01	Aquatic Habitat Goal	2.0E+02	3.9E+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	5.6E+08	1.5E+03
ALDRIN	1.3E-01	Aquatic Habitat Goal	8.5E+00		1.3E-01
AMETRYN	1.5E+01	Aquatic Habitat Goal	5.0E+04		1.5E+01
AMINO,2- DINITROTOLUENE,4,6-	1.5E+01	Aquatic Habitat Goal	5.0E+04		1.5E+01
AMINO,4- DINITROTOLUENE,2,6-	1.5E+01	Aquatic Habitat Goal	5.0E+04		1.5E+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
ATRAZINE	1.2E+01	Aquatic Habitat Goal	1.7E+04		1.2E+01
BARIUM	2.0E+02	Aquatic Habitat Goal	5.0E+04		2.0E+02
BENZENE	4.6E+01	Aquatic Habitat Goal	2.0E+04	1.9E+03	4.6E+01
BENZO(a)ANTHRACENE	2.7E-02	Aquatic Habitat Goal	4.7E+00		2.7E-02
BENZO(a)PYRENE	1.4E-02	Aquatic Habitat Goal	8.1E-01		1.4E-02
BENZO(b)FLUORANTHENE	7.5E-01	Gross Contamination	7.5E-01		9.1E+00
BENZO(g,h,i)PERYLENE	1.0E-01	Aquatic Habitat Goal	1.3E-01		1.0E-01
BENZO(k)FLUORANTHENE	4.0E-01	Gross Contamination	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	Gross Contamination	5.0E+00	(Use soil gas)	1.4E+01
BIS(2-CHLOROETHYL)ETHER	6.1E+01	Aquatic Habitat Goal	3.6E+03	1.3E+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	1.4E+02		3.2E+01
BORON	7.3E+03	Aquatic Habitat Goal	5.0E+04		7.3E+03
BROMODICHLOROMETHANE	9.8E+01	Vapor Intrusion	5.0E+04	9.8E+01	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	3.0E+00	Aquatic Habitat Goal	5.0E+04		3.0E+00
CARBON TETRACHLORIDE	9.8E+00	Aquatic Habitat Goal	5.2E+03	9.8E+01	9.8E+00
CHLORDANE (TECHNICAL)	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	1.2E+04	2.5E+01
CHLOROETHANE	1.6E+02	Gross Contamination	1.6E+02	5.5E+05	2.1E+04
CHLOROFORM	9.4E+01	Vapor Intrusion	2.4E+04	9.4E+01	6.2E+02
CHLOROMETHANE	3.7E+02	Vapor Intrusion	5.0E+04	3.7E+02	3.2E+03
CHLOROPHENOL, 2-	1.8E+00	Gross Contamination	1.8E+00	7.3E+04	1.4E+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	1.0E+00		3.5E-01
COBALT	3.0E+00	Aquatic Habitat Goal	5.0E+04		3.0E+00
COPPER	2.9E+00	Aquatic Habitat Goal	5.0E+04		2.9E+00
CYANIDE (Free)	1.0E+00	Aquatic Habitat Goal	1.7E+03	(Use soil gas)	1.0E+00
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	1.9E+02	Aquatic Habitat Goal	3.0E+04		1.9E+02
DALAPON	3.0E+02	Aquatic Habitat Goal	5.0E+04		3.0E+02
DIBENZO(a,h)ANTHTRACENE	5.2E-01	Gross Contamination	5.2E-01		7.5E+00

TABLE D-1c. GROUNDWATER ACTION LEVELS
(Groundwater IS NOT a current or potential drinking water resource)
(Surface water body IS located within 150m of release site)
(ug/l)

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Odors, etc.) Table G-2	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (chronic) Table D-4a
DIBROMO,1,2- CHLOROPROPANE,3-	4.0E-02	Aquatic Habitat Goal	1.0E+02	(Use soil gas)	4.0E-02
DIBROMOCHLOROMETHANE	3.4E+02	Vapor Intrusion	5.0E+04	3.4E+02	3.2E+03
DIBROMOETHANE, 1,2-	1.6E+01	Vapor Intrusion	5.0E+04	1.6E+01	1.4E+03
DICHLOROBENZENE, 1,2-	1.4E+01	Aquatic Habitat Goal	1.0E+02	8.0E+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	3.8E+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	4.5E+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	2.8E+00		1.0E-03
DICHLOROETHANE, 1,1-	4.7E+01	Aquatic Habitat Goal	5.0E+04	9.4E+02	4.7E+01
DICHLOROETHANE, 1,2-	1.6E+02	Vapor Intrusion	5.0E+04	1.6E+02	1.0E+04
DICHLOROETHYLENE, 1,1-	2.5E+01	Aquatic Habitat Goal	1.5E+04	6.4E+03	2.5E+01
DICHLOROETHYLENE, Cis 1,2-	5.9E+02	Aquatic Habitat Goal	5.0E+04	1.1E+03	5.9E+02
DICHLOROETHYLENE, Trans 1,2-	5.9E+02	Aquatic Habitat Goal	2.6E+03	5.0E+03	5.9E+02
DICHLOROPHENOL, 2,4-	3.0E+00	Gross Contamination	3.0E+00		1.8E+02
DICHLOROPHENOXYACETIC ACID (2,4-D)	4.0E+01	Aquatic Habitat Goal	5.0E+04		4.0E+01
DICHLOROPROPANE, 1,2-	1.0E+02	Gross Contamination	1.0E+02	2.6E+02	1.5E+03
DICHLOROPROPENE, 1,3-	1.2E+02	Aquatic Habitat Goal	5.0E+04	5.5E+02	1.2E+02
DIELDRIN	1.9E-03	Aquatic Habitat Goal	1.3E+02		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	1.5E+06	1.1E+02
DIMETHYLPHTHALATE	1.5E+00	Aquatic Habitat Goal	5.0E+04		1.5E+00
DINITROBENZENE, 1,3-	3.0E+01	Aquatic Habitat Goal	5.0E+04		3.0E+01
DINITROPHENOL, 2,4-	7.5E+01	Aquatic Habitat Goal	5.0E+04		7.5E+01
DINITROTOLUENE, 2,4- (2,4-DNT)	4.4E+01	Aquatic Habitat Goal	5.0E+04		4.4E+01
DINITROTOLUENE, 2,6- (2,6-DNT)	4.4E+01	Aquatic Habitat Goal	5.0E+04		4.4E+01
DIOXANE, 1,4-	5.0E+04	Gross Contamination	5.0E+04		3.4E+05
DIOXINS (TEQ)	5.0E-06	Aquatic Habitat Goal	6.0E-02		5.0E-06
DIURON	6.0E+01	Aquatic Habitat Goal	2.1E+04		6.0E+01
ENDOSULFAN	8.7E-03	Aquatic Habitat Goal	2.3E+02		8.7E-03
ENDRIN	2.3E-03	Aquatic Habitat Goal	1.3E+02		2.3E-03
ETHANOL	5.0E+04	Gross Contamination	5.0E+04		
ETHYLBENZENE	2.9E+02	Aquatic Habitat Goal	3.0E+02	6.6E+04	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
GLYPHOSATE	6.5E+01	Aquatic Habitat Goal	5.0E+04		6.5E+01
HEPTACHLOR	3.6E-03	Aquatic Habitat Goal	9.0E+01		3.6E-03
HEPTACHLOR EPOXIDE	3.6E-03	Aquatic Habitat Goal	1.0E+02		3.6E-03
HEXACHLOROBENZENE	3.1E+00	Gross Contamination	3.1E+00		3.7E+00
HEXACHLOROBUTADIENE	4.7E+00	Aquatic Habitat Goal	6.0E+01		4.7E+00
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	8.0E-02	Aquatic Habitat Goal	4.0E+03		8.0E-02
HEXACHLOROETHANE	1.2E+01	Aquatic Habitat Goal	1.0E+02		1.2E+01
HEXAZINONE	5.0E+03	Aquatic Habitat Goal	5.0E+04		5.0E+03
INDENO(1,2,3-cd)PYRENE	9.5E-02	Gross Contamination	9.5E-02		4.3E+00
ISOPHORONE	1.3E+02	Aquatic Habitat Goal	5.0E+04		1.3E+02

TABLE D-1c. GROUNDWATER ACTION LEVELS
(Groundwater IS NOT a current or potential drinking water resource)
(Surface water body IS located within 150m of release site)
(ug/l)

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Odors, etc.) Table G-2	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (chronic) Table D-4a
LEAD	5.6E+00	Aquatic Habitat Goal	5.0E+04		5.6E+00
MERCURY	2.5E-02	Aquatic Habitat Goal	3.0E+01	(Use soil gas)	2.5E-02
METHOXYCHLOR	3.0E-02	Aquatic Habitat Goal	5.0E+01		3.0E-02
METHYL ETHYL KETONE	1.4E+04	Aquatic Habitat Goal	5.0E+04	1.9E+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	Gross Contamination	1.8E+03	2.6E+04	1.8E+04
METHYLENE CHLORIDE	2.2E+03	Aquatic Habitat Goal	5.0E+04	3.9E+03	2.2E+03
METHYLNAPHTHALENE, 1-	2.1E+00	Aquatic Habitat Goal	1.0E+02	2.5E+04	2.1E+00
METHYLNAPHTHALENE, 2-	2.1E+00	Aquatic Habitat Goal	1.0E+02	2.5E+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	2.8E+04	2.4E+01
NICKEL	5.0E+00	Aquatic Habitat Goal	5.0E+04		5.0E+00
NITROBENZENE	6.0E+01	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	6.0E+01
NITROGLYCERIN	1.4E+02	Aquatic Habitat Goal	5.0E+04		1.4E+02
NITROTOLUENE, 2-	1.0E+03	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	1.0E+03
NITROTOLUENE, 3-	3.8E+02	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	3.8E+02
NITROTOLUENE, 4-	1.6E+03	Aquatic Habitat Goal	5.0E+04		1.6E+03
PENTACHLOROPHENOL	7.9E+00	Aquatic Habitat Goal	5.9E+03		7.9E+00
PENTAERYTHRITOLTETRANITRATE (PETN)	2.2E+04	Gross Contamination	2.2E+04		8.5E+04
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
PROPICONAZOLE	2.6E+01	Aquatic Habitat Goal	5.0E+04		2.6E+01
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	1.0E+00	Aquatic Habitat Goal	5.0E+04		1.0E+00
SIMAZINE	2.0E+00	Aquatic Habitat Goal	3.1E+03		2.0E+00
STYRENE	3.2E+01	Aquatic Habitat Goal	1.1E+02	3.1E+05	3.2E+01
TERBACIL	2.3E+03	Aquatic Habitat Goal	5.0E+04		2.3E+03
tert-BUTYL ALCOHOL	1.8E+04	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	1.8E+04
TETRACHLOROETHANE, 1,1,1,2-	3.1E+02	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	3.1E+02
TETRACHLOROETHANE, 1,1,2,2-	2.0E+02	Vapor Intrusion	5.0E+03	2.0E+02	4.2E+02
TETRACHLOROETHYLENE	1.2E+02	Aquatic Habitat Goal	3.0E+03	1.8E+02	1.2E+02
TETRACHLOROPHENOL, 2,3,4,6-	1.2E+00	Aquatic Habitat Goal	1.2E+04		1.2E+00
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	3.3E+02	Aquatic Habitat Goal	5.0E+04		3.3E+02
THALLIUM	2.0E+01	Aquatic Habitat Goal	5.0E+04		2.0E+01
TOLUENE	1.3E+02	Aquatic Habitat Goal	4.0E+02	5.3E+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	2.5E+04	8.8E+02	2.5E+01
TRICHLOROETHANE, 1,1,1-	6.2E+01	Aquatic Habitat Goal	5.0E+04	3.4E+05	6.2E+01
TRICHLOROETHANE, 1,1,2-	1.0E+02	Vapor Intrusion	5.0E+04	1.0E+02	4.7E+03

TABLE D-1c. GROUNDWATER ACTION LEVELS
(Groundwater IS NOT a current or potential drinking water resource)
(Surface water body IS located within 150m of release site)
(ug/l)

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Odors, etc.) Table G-2	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (chronic) Table D-4a
TRICHLOROETHYLENE	3.6E+02	Aquatic Habitat Goal	5.0E+04	6.1E+02	3.6E+02
TRICHLOROPHENOL, 2,4,5-	1.1E+01	Aquatic Habitat Goal	2.0E+03		1.1E+01
TRICHLOROPHENOL, 2,4,6-	4.9E+02	Aquatic Habitat Goal	1.0E+03		4.9E+02
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	6.9E+02	Aquatic Habitat Goal	5.0E+04		6.9E+02
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	3.0E+01	Aquatic Habitat Goal	5.0E+04		3.0E+01
TRICHLOROPROPANE, 1,2,3-	1.4E+01	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	1.4E+01
TRICHLOROPROPENE, 1,2,3-	6.2E-01	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	6.2E-01
TRIFLURALIN	2.0E+01	Aquatic Habitat Goal	9.2E+01		2.0E+01
TRINITROBENZENE, 1,3,5-	3.0E+01	Aquatic Habitat Goal	5.0E+04		3.0E+01
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	1.5E+02	Aquatic Habitat Goal	3.7E+04		1.5E+02
TRINITROTOLUENE, 2,4,6- (TNT)	1.3E+02	Aquatic Habitat Goal	5.0E+04		1.3E+02
VANADIUM	1.9E+01	Aquatic Habitat Goal	5.0E+04		1.9E+01
VINYL CHLORIDE	6.2E+01	Vapor Intrusion	3.4E+04	6.2E+01	7.8E+02
XYLENES	1.0E+02	Aquatic Habitat Goal	5.3E+03	1.5E+05	1.0E+02
ZINC	2.2E+01	Aquatic Habitat Goal	5.0E+04		2.2E+01

Notes:

1. Lowest of action levels for gross contamination, vapor intrusion and aquatic habitat impacts. Used to develop soil leaching action levels for protection of groundwater quality.

TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.
Gross Contamination: Odor threshold, 1/2 solubility or 50000 ug/L maximum, whichever is lower. Intended to limit general groundwater resource degradation.
Vapor Intrusion: Addresses potential emission of volatile chemicals from groundwater into buildings and subsequent impact on indoor air. Assumes moderately permeable, sandy soil or fill material immediately beneath building slab and unrestricted ("residential") land use (refer to Chapter 5).
Aquatic Habitat Impacts: Addresses potential discharge of groundwater to estuarine aquatic habitat and subsequent impact on aquatic life; dilution of groundwater upon discharge to surface water not considered, in order to take into account potential impacts to benthic organisms (see Chapter 5).
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 reporting limits and background concentrations replace final screening level as appropriate.

TABLE D-1d. GROUNDWATER ACTION LEVELS
(Groundwater IS NOT a current or potential drinking water resource)
(Surface water body IS NOT located within 150m of release site)
(ug/l)

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Odors, etc.) Table G-2	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (acute) Table D-4a
ACENAPHTHENE	2.0E+02	Gross Contamination	2.0E+02	3.9E+03	3.2E+02
ACENAPHTHYLENE	3.0E+02	Aquatic Habitat Goal	2.0E+03	(Use soil gas)	3.0E+02
ACETONE	1.5E+03	Aquatic Habitat Goal	5.0E+04	5.6E+08	1.5E+03
ALDRIN	1.3E+00	Aquatic Habitat Goal	8.5E+00		1.3E+00
AMETRYN	1.5E+02	Aquatic Habitat Goal	5.0E+04		1.5E+02
AMINO,2- DINITROTOLUENE,4,6-	1.5E+02	Aquatic Habitat Goal	5.0E+04		1.5E+02
AMINO,4- DINITROTOLUENE,2,6-	1.5E+02	Aquatic Habitat Goal	5.0E+04		1.5E+02
ANTHRACENE	2.2E+01	Gross Contamination	2.2E+01	4.3E+01	3.0E+02
ANTIMONY	1.5E+03	Aquatic Habitat Goal	5.0E+04		1.5E+03
ARSENIC	6.9E+01	Aquatic Habitat Goal	5.0E+04		6.9E+01
ATRAZINE	3.5E+02	Aquatic Habitat Goal	1.7E+04		3.5E+02
BARIUM	1.0E+03	Aquatic Habitat Goal	5.0E+04		1.0E+03
BENZENE	1.7E+03	Aquatic Habitat Goal	2.0E+04	1.9E+03	1.7E+03
BENZO(a)ANTHRACENE	4.7E+00	Gross Contamination	4.7E+00		3.0E+02
BENZO(a)PYRENE	8.1E-01	Gross Contamination	8.1E-01		3.0E+02
BENZO(b)FLUORANTHENE	7.5E-01	Gross Contamination	7.5E-01		3.0E+02
BENZO(g,h,i)PERYLENE	1.3E-01	Gross Contamination	1.3E-01		3.0E+02
BENZO(k)FLUORANTHENE	4.0E-01	Gross Contamination	4.0E-01		3.0E+02
BERYLLIUM	4.3E+01	Aquatic Habitat Goal	5.0E+04		4.3E+01
BIPHENYL, 1,1-	5.0E+00	Gross Contamination	5.0E+00	(Use soil gas)	1.4E+01
BIS(2-CHLOROETHYL)ETHER	1.3E+02	Vapor Intrusion	3.6E+03	1.3E+02	2.4E+05
BIS(2-CHLOROISOPROPYL)ETHER	3.2E+03	Gross Contamination	3.2E+03	(Use soil gas)	2.4E+05
BIS(2-ETHYLHEXYL)PHTHALATE	3.2E+01	Aquatic Habitat Goal	1.4E+02		3.2E+01
BORON	7.3E+03	Aquatic Habitat Goal	5.0E+04		7.3E+03
BROMODICHLOROMETHANE	9.8E+01	Vapor Intrusion	5.0E+04	9.8E+01	1.1E+04
BROMOFORM	5.1E+03	Gross Contamination	5.1E+03		1.1E+04
BROMOMETHANE	4.6E+02	Vapor Intrusion	5.0E+04	4.6E+02	1.1E+04
CADMIUM	3.0E+00	Aquatic Habitat Goal	5.0E+04		3.0E+00
CARBON TETRACHLORIDE	9.8E+01	Vapor Intrusion	5.2E+03	9.8E+01	1.2E+04
CHLORDANE (TECHNICAL)	9.0E-02	Aquatic Habitat Goal	2.5E+01		9.0E-02
CHLOROANILINE, p-	5.0E+00	Aquatic Habitat Goal	5.0E+04		5.0E+00
CHLOROBENZENE	1.6E+02	Aquatic Habitat Goal	5.0E+02	1.2E+04	1.6E+02
CHLOROETHANE	1.6E+02	Gross Contamination	1.6E+02	5.5E+05	2.1E+04
CHLOROFORM	9.4E+01	Vapor Intrusion	2.4E+04	9.4E+01	9.6E+03
CHLOROMETHANE	3.7E+02	Vapor Intrusion	5.0E+04	3.7E+02	1.1E+04
CHLOROPHENOL, 2-	1.8E+00	Gross Contamination	1.8E+00	7.3E+04	1.4E+03
CHROMIUM (Total)	5.7E+02	Aquatic Habitat Goal	5.0E+04		5.7E+02
CHROMIUM III	5.7E+02	Aquatic Habitat Goal	5.0E+04		5.7E+02
CHROMIUM VI	1.6E+01	Aquatic Habitat Goal	5.0E+04		1.6E+01
CHRYSENE	1.0E+00	Gross Contamination	1.0E+00		3.0E+02
COBALT	3.0E+00	Aquatic Habitat Goal	5.0E+04		3.0E+00
COPPER	2.9E+00	Aquatic Habitat Goal	5.0E+04		2.9E+00
CYANIDE (Free)	1.0E+00	Aquatic Habitat Goal	1.7E+03	(Use soil gas)	1.0E+00
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	1.4E+03	Aquatic Habitat Goal	3.0E+04		1.4E+03
DALAPON	3.0E+03	Aquatic Habitat Goal	5.0E+04		3.0E+03
DIBENZO(a,h)ANTHTRACENE	5.2E-01	Gross Contamination	5.2E-01		3.0E+02

TABLE D-1d. GROUNDWATER ACTION LEVELS
(Groundwater IS NOT a current or potential drinking water resource)
(Surface water body IS NOT located within 150m of release site)
(ug/l)

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Odors, etc.) Table G-2	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (acute) Table D-4a
DIBROMO,1,2- CHLOROPROPANE,3-	4.0E-02	Aquatic Habitat Goal	1.0E+02	(Use soil gas)	4.0E-02
DIBROMOCHLOROMETHANE	3.4E+02	Vapor Intrusion	5.0E+04	3.4E+02	1.1E+04
DIBROMOETHANE, 1,2-	1.6E+01	Vapor Intrusion	5.0E+04	1.6E+01	1.4E+03
DICHLOROBENZENE, 1,2-	1.0E+02	Gross Contamination	1.0E+02	8.0E+04	3.7E+02
DICHLOROBENZENE, 1,3-	3.7E+02	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	3.7E+02
DICHLOROBENZENE, 1,4-	1.1E+02	Gross Contamination	1.1E+02	3.8E+02	3.7E+02
DICHLOROBENZIDINE, 3,3-	2.5E+02	Aquatic Habitat Goal	1.6E+03		2.5E+02
DICHLORODIPHENYLDICHLOROETHANE (DDD)	6.0E-01	Aquatic Habitat Goal	4.5E+01		6.0E-01
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.1E+00	Aquatic Habitat Goal	2.0E+01		1.1E+00
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.3E-02	Aquatic Habitat Goal	2.8E+00		1.3E-02
DICHLOROETHANE, 1,1-	4.7E+01	Aquatic Habitat Goal	5.0E+04	9.4E+02	4.7E+01
DICHLOROETHANE, 1,2-	1.6E+02	Vapor Intrusion	5.0E+04	1.6E+02	3.8E+04
DICHLOROETHYLENE, 1,1-	3.9E+03	Aquatic Habitat Goal	1.5E+04	6.4E+03	3.9E+03
DICHLOROETHYLENE, Cis 1,2-	1.1E+03	Vapor Intrusion	5.0E+04	1.1E+03	1.2E+04
DICHLOROETHYLENE, Trans 1,2-	2.6E+03	Gross Contamination	2.6E+03	5.0E+03	1.2E+04
DICHLOROPHENOL, 2,4-	3.0E+00	Gross Contamination	3.0E+00		6.7E+02
DICHLOROPHENOXYACETIC ACID (2,4-D)	2.0E+02	Aquatic Habitat Goal	5.0E+04		2.0E+02
DICHLOROPROPANE, 1,2-	1.0E+02	Gross Contamination	1.0E+02	2.6E+02	3.4E+03
DICHLOROPROPENE, 1,3-	2.6E+02	Aquatic Habitat Goal	5.0E+04	5.5E+02	2.6E+02
DIELDRIN	7.1E-01	Aquatic Habitat Goal	1.3E+02		7.1E-01
DIETHYLPHTHALATE	9.4E+02	Aquatic Habitat Goal	5.0E+04		9.4E+02
DIMETHYLPHENOL, 2,4-	2.7E+02	Aquatic Habitat Goal	4.0E+03	1.5E+06	2.7E+02
DIMETHYLPHTHALATE	9.4E+02	Aquatic Habitat Goal	5.0E+04		9.4E+02
DINITROBENZENE, 1,3-	1.1E+02	Aquatic Habitat Goal	5.0E+04		1.1E+02
DINITROPHENOL, 2,4-	2.3E+02	Aquatic Habitat Goal	5.0E+04		2.3E+02
DINITROTOLUENE, 2,4- (2,4-DNT)	1.1E+02	Aquatic Habitat Goal	5.0E+04		1.1E+02
DINITROTOLUENE, 2,6- (2,6-DNT)	1.1E+02	Aquatic Habitat Goal	5.0E+04		1.1E+02
DIOXANE, 1,4-	5.0E+04	Gross Contamination	5.0E+04		3.4E+06
DIOXINS (TEQ)	3.0E-03	Aquatic Habitat Goal	6.0E-02		3.0E-03
DIURON	2.0E+02	Aquatic Habitat Goal	2.1E+04		2.0E+02
ENDOSULFAN	3.4E-02	Aquatic Habitat Goal	2.3E+02		3.4E-02
ENDRIN	3.7E-02	Aquatic Habitat Goal	1.3E+02		3.7E-02
ETHANOL	5.0E+04	Gross Contamination	5.0E+04		
ETHYLBENZENE	3.0E+02	Gross Contamination	3.0E+02	6.6E+04	4.3E+02
FLUORANTHENE	1.3E+02	Gross Contamination	1.3E+02		3.0E+02
FLUORENE	3.0E+02	Aquatic Habitat Goal	9.5E+02	1.9E+03	3.0E+02
GLYPHOSATE	6.0E+02	Aquatic Habitat Goal	5.0E+04		6.0E+02
HEPTACHLOR	5.3E-02	Aquatic Habitat Goal	9.0E+01		5.3E-02
HEPTACHLOR EPOXIDE	5.3E-02	Aquatic Habitat Goal	1.0E+02		5.3E-02
HEXACHLOROBENZENE	3.1E+00	Gross Contamination	3.1E+00		6.0E+00
HEXACHLOROBUTADIENE	1.1E+01	Aquatic Habitat Goal	6.0E+01		1.1E+01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	1.6E-01	Aquatic Habitat Goal	4.0E+03		1.6E-01
HEXACHLOROETHANE	1.0E+02	Gross Contamination	1.0E+02		3.1E+02
HEXAZINONE	5.0E+04	Aquatic Habitat Goal	5.0E+04		5.0E+04
INDENO(1,2,3-cd)PYRENE	9.5E-02	Gross Contamination	9.5E-02		3.0E+02
ISOPHORONE	4.3E+03	Aquatic Habitat Goal	5.0E+04		4.3E+03

TABLE D-1d. GROUNDWATER ACTION LEVELS
(Groundwater IS NOT a current or potential drinking water resource)
(Surface water body IS NOT located within 150m of release site)
(ug/l)

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Odors, etc.) Table G-2	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (acute) Table D-4a
LEAD	2.9E+01	Aquatic Habitat Goal	5.0E+04		2.9E+01
MERCURY	2.1E+00	Aquatic Habitat Goal	3.0E+01	(Use soil gas)	2.1E+00
METHOXYCHLOR	3.0E-02	Aquatic Habitat Goal	5.0E+01		3.0E-02
METHYL ETHYL KETONE	1.4E+04	Aquatic Habitat Goal	5.0E+04	1.9E+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	Gross Contamination	1.8E+03	2.6E+04	5.3E+04
METHYLENE CHLORIDE	3.9E+03	Vapor Intrusion	5.0E+04	3.9E+03	1.1E+04
METHYLNAPHTHALENE, 1-	1.0E+02	Gross Contamination	1.0E+02	2.5E+04	3.0E+02
METHYLNAPHTHALENE, 2-	1.0E+02	Gross Contamination	1.0E+02	2.5E+04	3.0E+02
MOLYBDENUM	2.4E+02	Aquatic Habitat Goal	5.0E+04		2.4E+02
NAPHTHALENE	2.1E+02	Gross Contamination	2.1E+02	2.8E+04	7.7E+02
NICKEL	5.0E+00	Aquatic Habitat Goal	5.0E+04		5.0E+00
NITROBENZENE	2.0E+03	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	2.0E+03
NITROGLYCERIN	1.4E+02	Aquatic Habitat Goal	5.0E+04		1.4E+02
NITROTOLUENE, 2-	7.5E+03	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	7.5E+03
NITROTOLUENE, 3-	3.8E+03	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	3.8E+03
NITROTOLUENE, 4-	3.3E+03	Aquatic Habitat Goal	5.0E+04		3.3E+03
PENTACHLOROPHENOL	1.3E+01	Aquatic Habitat Goal	5.9E+03		1.3E+01
PENTAERYTHRITOLTETRANITRATE (PETN)	2.2E+04	Gross Contamination	2.2E+04		4.3E+04
PERCHLORATE	6.0E+02	Aquatic Habitat Goal	5.0E+04		6.0E+02
PHENANTHRENE	3.0E+02	Aquatic Habitat Goal	4.1E+02	(Use soil gas)	3.0E+02
PHENOL	3.4E+03	Aquatic Habitat Goal	5.0E+04		3.4E+03
POLYCHLORINATED BIPHENYLS (PCBs)	2.0E+00	Aquatic Habitat Goal	1.6E+01		2.0E+00
PROPICONAZOLE	2.6E+02	Aquatic Habitat Goal	5.0E+04		2.6E+02
PYRENE	6.8E+01	Gross Contamination	6.8E+01	1.4E+02	3.0E+02
SELENIUM	2.0E+01	Aquatic Habitat Goal	5.0E+04		2.0E+01
SILVER	1.0E+00	Aquatic Habitat Goal	5.0E+04		1.0E+00
SIMAZINE	1.0E+01	Aquatic Habitat Goal	3.1E+03		1.0E+01
STYRENE	3.2E+01	Aquatic Habitat Goal	1.1E+02	3.1E+05	3.2E+01
TERBACIL	2.3E+04	Aquatic Habitat Goal	5.0E+04		2.3E+04
tert-BUTYL ALCOHOL	5.0E+04	Gross Contamination	5.0E+04	(Use soil gas)	1.8E+05
TETRACHLOROETHANE, 1,1,1,2-	3.1E+03	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	3.1E+03
TETRACHLOROETHANE, 1,1,2,2-	2.0E+02	Vapor Intrusion	5.0E+03	2.0E+02	3.0E+03
TETRACHLOROETHYLENE	1.8E+02	Vapor Intrusion	3.0E+03	1.8E+02	1.8E+03
TETRACHLOROPHENOL, 2,3,4,6-	1.0E+01	Aquatic Habitat Goal	1.2E+04		1.0E+01
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	1.9E+03	Aquatic Habitat Goal	5.0E+04		1.9E+03
THALLIUM	4.7E+02	Aquatic Habitat Goal	5.0E+04		4.7E+02
TOLUENE	4.0E+02	Gross Contamination	4.0E+02	5.3E+05	5.8E+03
TOXAPHENE	2.1E-01	Aquatic Habitat Goal	1.4E+02		2.1E-01
TPH (gasolines)	5.0E+03	Aquatic Habitat Goal	5.0E+03	(Use soil gas)	5.0E+03
TPH (middle distillates)	2.5E+03	Aquatic Habitat Goal	2.5E+03	(Use soil gas)	2.5E+03
TPH (residual fuels)	2.5E+03	Aquatic Habitat Goal	2.5E+03		2.5E+03
TRICHLOROBENZENE, 1,2,4-	1.6E+02	Aquatic Habitat Goal	2.5E+04	8.8E+02	1.6E+02
TRICHLOROETHANE, 1,1,1-	6.0E+03	Aquatic Habitat Goal	5.0E+04	3.4E+05	6.0E+03
TRICHLOROETHANE, 1,1,2-	1.0E+02	Vapor Intrusion	5.0E+04	1.0E+02	6.0E+03

TABLE D-1d. GROUNDWATER ACTION LEVELS
(Groundwater IS NOT a current or potential drinking water resource)
(Surface water body IS NOT located within 150m of release site)
(ug/l)

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Odors, etc.) Table G-2	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (acute) Table D-4a
TRICHLOROETHYLENE	6.1E+02	Vapor Intrusion	5.0E+04	6.1E+02	7.0E+02
TRICHLOROPHENOL, 2,4,5-	1.0E+02	Aquatic Habitat Goal	2.0E+03		1.0E+02
TRICHLOROPHENOL, 2,4,6-	4.9E+02	Aquatic Habitat Goal	1.0E+03		4.9E+02
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	6.9E+02	Aquatic Habitat Goal	5.0E+04		6.9E+02
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	3.0E+01	Aquatic Habitat Goal	5.0E+04		3.0E+01
TRICHLOROPROPANE, 1,2,3-	1.4E+02	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	1.4E+02
TRICHLOROPROPENE, 1,2,3-	6.2E-01	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	6.2E-01
TRIFLURALIN	2.0E+01	Aquatic Habitat Goal	9.2E+01		2.0E+01
TRINITROBENZENE, 1,3,5-	1.4E+02	Aquatic Habitat Goal	5.0E+04		1.4E+02
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	1.5E+02	Aquatic Habitat Goal	3.7E+04		1.5E+02
TRINITROTOLUENE, 2,4,6- (TNT)	5.7E+02	Aquatic Habitat Goal	5.0E+04		5.7E+02
VANADIUM	1.9E+01	Aquatic Habitat Goal	5.0E+04		1.9E+01
VINYL CHLORIDE	6.2E+01	Vapor Intrusion	3.4E+04	6.2E+01	7.8E+02
XYLENES	1.0E+03	Aquatic Habitat Goal	5.3E+03	1.5E+05	1.0E+03
ZINC	2.2E+01	Aquatic Habitat Goal	5.0E+04		2.2E+01

Notes:

1. Lowest of action levels for gross contamination, vapor intrusion and aquatic habitat impacts. Used to develop soil leaching action levels for protection of groundwater quality.

TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.
Gross Contamination: Odor threshold, 1/2 solubility or 50000 ug/L maximum, whichever is lower. Intended to limit general groundwater resource degradation.
Vapor Intrusion: Addresses potential emission of volatile chemicals from groundwater into buildings and subsequent impact on indoor air. Assumes moderately permeable, sandy soil or fill material immediately beneath building slab and unrestricted ("residential") land use (refer to Chapter 5).
Aquatic Habitat Impacts: Addresses potential discharge of groundwater to estuarine aquatic habitat and subsequent impact on aquatic life; dilution of groundwater upon discharge to surface water not considered, in order to take into account potential impacts to benthic organisms (see Chapter 5).
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 reporting limits and background concentrations replace final screening level as appropriate.

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

CHEMICAL PARAMETER	[1]Final Surface Water Action Level	Basis	Gross Contamination (Taste & Odors, etc.) Table G-3	Drinking Water (Toxicity) Table D-3a	Fresh Water Aquatic Habitat Goal (Chronic Toxicity) Table D-4a	Bioaccumulation and Human Consumption Table D-4f
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	2.2E+04	1.5E+03	
ALDRIN	2.6E-05	Bioaccumulation/Human Consumption	8.5E+00	4.0E-03	3.0E-01	2.6E-05
AMETRYN	1.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	3.3E+02	1.5E+01	
AMINO,2- DINITROTOLUENE,4,6-	1.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	7.3E+01	1.5E+01	
AMINO,4- DINITROTOLUENE,2,6-	1.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	7.3E+01	1.5E+01	
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	1.5E+04
ARSENIC	1.4E-01	Bioaccumulation/Human Consumption	5.0E+04	1.0E+01	1.9E+02	1.4E-01
ATRAZINE	3.0E+00	Drinking Water Toxicity	2.0E+01	3.0E+00	1.2E+01	
BARIUM	2.0E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	2.0E+03	2.0E+02	
BENZENE	5.0E+00	Drinking Water Toxicity	1.7E+02	5.0E+00	4.6E+01	1.3E+01
BENZO(a)ANTHRACENE	1.8E-02	Bioaccumulation/Human Consumption	4.7E+00	9.2E-02	2.7E-02	1.8E-02
BENZO(a)PYRENE	1.4E-02	Aquatic Habitat Chronic Toxicity	8.1E-01	2.0E-01	1.4E-02	1.8E-02
BENZO(b)FLUORANTHENE	1.8E-02	Bioaccumulation/Human Consumption	7.5E-01	9.2E-02	9.1E+00	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	3.8E-02	Bioaccumulation/Human Consumption	5.0E+04	4.0E+00	2.7E+00	3.8E-02
BIPHENYL, 1,1-	5.0E-01	Ceiling Value	5.0E-01	8.3E-01	1.4E+01	
BIS(2-CHLOROETHYL)ETHER	1.2E-02	Drinking Water Toxicity	3.6E+02	1.2E-02	6.1E+01	4.4E-01
BIS(2-CHLOROISOPROPYL)ETHER	3.2E-01	Drinking Water Toxicity	3.2E+02	3.2E-01	6.1E+01	1.4E+03
BIS(2-ETHYLHEXYL)PHTHALATE	2.2E+00	Bioaccumulation/Human Consumption	1.4E+02	6.0E+00	3.2E+01	2.2E+00
BORON	7.3E+03	Drinking Water Toxicity	5.0E+04	7.3E+03	7.3E+03	
BROMODICHLOROMETHANE	1.2E-01	Drinking Water Toxicity	5.0E+04	1.2E-01	3.2E+03	
BROMOFORM	8.0E+01	Drinking Water Toxicity	5.1E+02	8.0E+01	3.2E+03	1.4E+02
BROMOMETHANE	8.7E+00	Drinking Water Toxicity	5.0E+04	8.7E+00	1.6E+02	1.5E+03
CADMIUM	3.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	5.0E+00	3.0E+00	
CARBON TETRACHLORIDE	2.3E+00	Bioaccumulation/Human Consumption	5.2E+02	5.0E+00	9.8E+00	2.3E+00
CHLORDANE (TECHNICAL)	1.6E-05	Bioaccumulation/Human Consumption	2.5E+00	2.0E+00	4.3E-03	1.6E-05
CHLOROANILINE, p-	3.4E-01	Drinking Water Toxicity	5.0E+04	3.4E-01	5.0E+00	
CHLOROBENZENE	2.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+01	1.0E+02	2.5E+01	2.1E+04
CHLOROETHANE	1.6E+01	Ceiling Value	1.6E+01	2.1E+04	2.1E+04	
CHLOROFORM	5.1E+00	Bioaccumulation/Human Consumption	2.4E+03	7.0E+01	6.2E+02	5.1E+00
CHLOROMETHANE	1.8E+00	Drinking Water Toxicity	5.0E+04	1.8E+00	3.2E+03	
CHLOROPHENOL, 2-	1.8E-01	Ceiling Value	1.8E-01	3.0E+01	1.4E+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	1.3E+01	1.1E+01	
CHRYSENE	1.8E-02	Bioaccumulation/Human Consumption	1.0E+00	9.2E+00	3.5E-01	1.8E-02
COBALT	3.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	1.1E+01	3.0E+00	
COPPER	6.0E+00	Aquatic Habitat Chronic Toxicity	1.0E+03	1.3E+03	6.0E+00	
CYANIDE (Free)	5.2E+00	Aquatic Habitat Chronic Toxicity	1.7E+02	2.0E+02	5.2E+00	2.2E+05
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX	6.1E-01	Drinking Water Toxicity	3.0E+04	6.1E-01	1.9E+02	

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

CHEMICAL PARAMETER	[1]Final Surface Water Action Level	Basis	Gross Contamination (Taste & Odors, etc.) Table G-3	Drinking Water (Toxicity) Table D-3a	Fresh Water Aquatic Habitat Goal (Chronic Toxicity) Table D-4a	Bioaccumulation and Human Consumption Table D-4f
DALAPON	2.0E+02	Drinking Water Toxicity	5.0E+04	2.0E+02	3.0E+02	
DIBENZO(a,h)ANTHTRACENE	9.2E-03	Drinking Water Toxicity	5.2E-01	9.2E-03	7.5E+00	1.8E-02
DIBROMO,1,2- CHLOROPROPANE,3-	4.0E-02	Drinking Water Toxicity	1.0E+01	4.0E-02	4.0E-02	
DIBROMOCHLOROMETHANE	1.6E-01	Drinking Water Toxicity	5.0E+04	1.6E-01	3.2E+03	1.3E+01
DIBROMOETHANE, 1,2-	4.0E-02	Drinking Water Toxicity	5.0E+04	4.0E-02	1.4E+03	
DICHLOROBENZENE, 1,2-	1.0E+01	Ceiling Value	1.0E+01	6.0E+02	1.4E+01	8.5E+02
DICHLOROBENZENE, 1,3-	7.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.8E+02	7.1E+01	8.5E+02
DICHLOROBENZENE, 1,4-	5.0E+00	Ceiling Value	5.0E+00	7.5E+01	1.5E+01	8.5E+02
DICHLOROBENZIDINE, 3,3-	7.0E-03	Bioaccumulation/Human Consumption	1.6E+03	1.5E-01	2.5E+02	7.0E-03
DICHLORODIPHENYLDICHLOROETHANE (DDD)	3.1E-04	Bioaccumulation/Human Consumption	4.5E+01	2.8E-01	1.0E-03	3.1E-04
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.2E-04	Bioaccumulation/Human Consumption	2.0E+01	2.0E-01	1.0E-03	2.2E-04
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	8.0E-06	Bioaccumulation/Human Consumption	2.8E+00	2.0E-01	1.0E-03	8.0E-06
DICHLOROETHANE, 1,1-	2.4E+00	Drinking Water Toxicity	5.0E+04	2.4E+00	4.7E+01	
DICHLOROETHANE, 1,2-	1.5E-01	Drinking Water Toxicity	7.0E+03	1.5E-01	1.0E+04	7.9E+01
DICHLOROETHYLENE, 1,1-	6.0E-01	Bioaccumulation/Human Consumption	1.5E+03	7.0E+00	2.5E+01	6.0E-01
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
DICHLOROPHENOXYACETIC ACID (2,4-D)	7.0E+01	Drinking Water Toxicity	5.0E+04	7.0E+01	2.2E+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-	4.3E-01	Drinking Water Toxicity	5.0E+04	4.3E-01	1.2E+02	4.6E+00
DIELDRIN	2.5E-05	Bioaccumulation/Human Consumption	4.1E+01	4.2E-03	1.9E-03	2.5E-05
DIETHYLPHTHALATE	1.5E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	2.9E+04	1.5E+00	4.4E+04
DIMETHYLPHENOL, 2,4-	1.2E+02	Drinking Water Toxicity	4.0E+02	1.2E+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
DINITROBENZENE, 1,3-	3.7E+00	Drinking Water Toxicity	5.0E+04	3.7E+00	3.0E+01	
DINITROPHENOL, 2,4-	7.3E+01	Drinking Water Toxicity	5.0E+04	7.3E+01	7.5E+01	5.3E+03
DINITROTOLUENE, 2,4- (2,4-DNT)	2.2E-01	Drinking Water Toxicity	5.0E+04	2.2E-01	4.4E+01	3.0E+00
DINITROTOLUENE, 2,6- (2,6-DNT)	3.7E+01	Drinking Water Toxicity	5.0E+04	3.7E+01	4.4E+01	
DIOXANE, 1,4-	6.7E-01	Drinking Water Toxicity	5.0E+04	6.7E-01	3.4E+05	
DIOXINS (TEQ)	5.0E-09	Bioaccumulation/Human Consumption	6.0E-02	3.0E-05	5.0E-06	5.0E-09
DIURON	6.0E+01	Aquatic Habitat Chronic Toxicity	2.1E+04	7.3E+01	6.0E+01	
ENDOSULFAN	5.6E-02	Aquatic Habitat Chronic Toxicity	2.3E+02	2.2E+02	5.6E-02	5.2E+01
ENDRIN	2.3E-03	Aquatic Habitat Chronic Toxicity	4.1E+01	2.0E+00	2.3E-03	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	1.1E+03
FLUORANTHENE	8.1E+00	Aquatic Habitat Chronic Toxicity	1.3E+02	1.5E+03	8.1E+00	1.8E+01
FLUORENE	3.9E+00	Aquatic Habitat Chronic Toxicity	9.5E+02	2.4E+02	3.9E+00	5.3E+03
GLYPHOSATE	6.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	7.0E+02	6.5E+01	
HEPTACHLOR	9.0E-05	Bioaccumulation/Human Consumption	2.0E+01	4.0E-01	3.8E-03	9.0E-05
HEPTACHLOR EPOXIDE	3.9E-05	Bioaccumulation/Human Consumption	1.0E+02	2.0E-01	3.8E-03	3.9E-05
HEXACHLOROBENZENE	2.4E-04	Bioaccumulation/Human Consumption	3.1E+00	1.0E+00	3.7E+00	2.4E-04
HEXACHLOROBUTADIENE	8.6E-01	Drinking Water Toxicity	6.0E+00	8.6E-01	4.7E+00	1.6E+01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	2.0E-02	Bioaccumulation/Human Consumption	4.0E+03	2.0E-01	8.0E-02	2.0E-02

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

CHEMICAL PARAMETER	[1]Final Surface Water Action Level	Basis	Gross Contamination (Taste & Odors, etc.) Table G-3	Drinking Water (Toxicity) Table D-3a	Fresh Water Aquatic Habitat Goal (Chronic Toxicity) Table D-4a	Bioaccumulation and Human Consumption Table D-4f
HEXACHLOROETHANE	2.9E+00	Bioaccumulation/Human Consumption	1.0E+01	4.8E+00	1.2E+01	2.9E+00
HEXAZINONE	1.2E+03	Drinking Water Toxicity	5.0E+04	1.2E+03	5.0E+03	
INDENO(1,2,3-cd)PYRENE	1.8E-02	Bioaccumulation/Human Consumption	9.5E-02	9.2E-02	4.3E+00	1.8E-02
ISOPHORONE	7.1E+01	Drinking Water Toxicity	5.0E+04	7.1E+01	1.2E+03	1.7E+05
LEAD	1.5E+01	Drinking Water Toxicity	5.0E+04	1.5E+01	2.9E+01	
MERCURY	4.7E-02	Bioaccumulation/Human Consumption	3.0E+01	2.0E+00	5.5E-01	4.7E-02
METHOXYCHLOR	3.0E-02	Aquatic Habitat Chronic Toxicity	5.0E+01	4.0E+01	3.0E-02	
METHYL ETHYL KETONE	7.1E+03	Drinking Water Toxicity	8.4E+03	7.1E+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	1.2E+01	5.1E+04	
METHYLENE CHLORIDE	4.8E+00	Drinking Water Toxicity	9.1E+03	4.8E+00	2.2E+03	5.9E+02
METHYLNAPHTHALENE, 1-	2.1E+00	Aquatic Habitat Chronic Toxicity	1.0E+01	4.7E+00	2.1E+00	
METHYLNAPHTHALENE, 2-	2.1E+00	Aquatic Habitat Chronic Toxicity	1.0E+01	2.4E+01	2.1E+00	
MOLYBDENUM	1.8E+02	Drinking Water Toxicity	5.0E+04	1.8E+02	2.4E+02	
NAPHTHALENE	1.7E+01	Drinking Water Toxicity	2.1E+01	1.7E+01	2.4E+01	
NICKEL	5.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	1.8E+03	5.0E+00	3.3E+01
NITROBENZENE	1.2E-01	Drinking Water Toxicity	5.0E+04	1.2E-01	2.2E+02	
NITROGLYCERIN	3.7E+00	Drinking Water Toxicity	5.0E+04	3.7E+00	1.4E+02	
NITROTOLUENE, 2-	6.2E-02	Drinking Water Toxicity	5.0E+04	6.2E-02	1.0E+03	
NITROTOLUENE, 3-	1.2E+02	Drinking Water Toxicity	5.0E+04	1.2E+02	3.8E+02	
NITROTOLUENE, 4-	4.2E+00	Drinking Water Toxicity	5.0E+04	4.2E+00	1.6E+03	
PENTACHLOROPHENOL	1.0E+00	Drinking Water Toxicity	3.0E+01	1.0E+00	1.3E+01	3.0E+00
PENTAERYTHRITOLTETRANITRATE (PETN)	1.7E+01	Drinking Water Toxicity	2.2E+04	1.7E+01	8.5E+04	
PERCHLORATE	2.6E+01	Drinking Water Toxicity	5.0E+04	2.6E+01	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)	7.9E-05	Bioaccumulation/Human Consumption	1.6E+01	5.0E-01	1.4E-02	7.9E-05
PROPICONAZOLE	4.2E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	4.7E+02	4.2E+01	
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	1.0E+00	Aquatic Habitat Chronic Toxicity	1.0E+02	1.8E+02	1.0E+00	
SIMAZINE	4.0E+00	Drinking Water Toxicity	3.1E+03	4.0E+00	1.7E+01	
STYRENE	1.0E+01	Ceiling Value	1.0E+01	1.0E+02	3.2E+01	
TERBACIL	4.7E+02	Drinking Water Toxicity	5.0E+04	4.7E+02	2.3E+03	
tert-BUTYL ALCOHOL	4.5E+00	Drinking Water Toxicity	5.0E+04	4.5E+00	1.8E+04	
TETRACHLOROETHANE, 1,1,1,2-	5.2E-01	Drinking Water Toxicity	5.0E+04	5.2E-01	3.1E+02	
TETRACHLOROETHANE, 1,1,2,2-	6.7E-02	Drinking Water Toxicity	5.0E+02	6.7E-02	4.2E+02	3.5E+00
TETRACHLOROETHYLENE	2.9E+00	Bioaccumulation/Human Consumption	1.7E+02	5.0E+00	1.2E+02	2.9E+00
TETRACHLOROPHENOL, 2,3,4,6-	1.2E+00	Aquatic Habitat Chronic Toxicity	1.2E+04	1.1E+03	1.2E+00	
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	3.3E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	1.8E+03	3.3E+02	
THALLIUM	2.0E+00	Drinking Water Toxicity	5.0E+04	2.0E+00	2.0E+01	1.6E+01
TOLUENE	4.0E+01	Ceiling Value	4.0E+01	1.0E+03	1.3E+02	1.4E+05
TOXAPHENE	2.0E-04	Aquatic Habitat Chronic Toxicity	1.4E+02	3.0E+00	2.0E-04	2.4E-04

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

CHEMICAL PARAMETER	[1]Final Surface Water Action Level	Basis	Gross Contamination (Taste & Odors, etc.) Table G-3	Drinking Water (Toxicity) Table D-3a	Fresh Water Aquatic Habitat Goal (Chronic Toxicity) Table D-4a	Bioaccumulation and Human Consumption Table D-4f
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	1.9E+02	6.4E+02	
TPH (residual fuels)	1.0E+02	Ceiling Value	1.0E+02	4.4E+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	3.4E+05
TRICHLOROETHANE, 1,1,2-	5.0E+00	Drinking Water Toxicity	5.0E+04	5.0E+00	4.7E+03	1.4E+01
TRICHLOROETHYLENE	5.0E+00	Drinking Water Toxicity	3.1E+02	5.0E+00	3.6E+02	2.6E+01
TRICHLOROPHENOL, 2,4,5-	6.3E+01	Aquatic Habitat Chronic Toxicity	2.0E+02	3.7E+03	6.3E+01	3.6E+03
TRICHLOROPHENOL, 2,4,6-	1.2E+00	Bioaccumulation/Human Consumption	1.0E+02	6.1E+00	4.9E+02	1.2E+00
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	3.7E+02	Drinking Water Toxicity	5.0E+04	3.7E+02	6.9E+02	-
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	3.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	5.0E+01	3.0E+01	
TRICHLOROPROPANE, 1,2,3-	6.0E-01	Drinking Water Toxicity	5.0E+04	6.0E-01	1.4E+01	
TRICHLOROPROPENE, 1,2,3-	6.2E-01	Drinking Water Toxicity	5.0E+04	6.2E-01	6.2E-01	
TRIFLURALIN	8.7E+00	Drinking Water Toxicity	9.2E+01	8.7E+00	2.0E+01	
TRINITROBENZENE, 1,3,5-	3.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.1E+03	3.0E+01	
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	1.5E+02	Drinking Water Toxicity	3.7E+04	1.5E+02	1.5E+02	
TRINITROTOLUENE, 2,4,6- (TNT)	2.2E+00	Drinking Water Toxicity	5.0E+04	2.2E+00	1.3E+02	
VANADIUM	1.9E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.8E+02	1.9E+01	
VINYL CHLORIDE	2.0E+00	Drinking Water Toxicity	3.4E+03	2.0E+00	7.8E+02	1.7E+02
XYLENES	2.0E+01	Ceiling Value	2.0E+01	1.0E+04	1.0E+02	
ZINC	2.2E+01	Aquatic Habitat Chronic Toxicity	5.0E+03	1.1E+04	2.2E+01	

Notes:

1. Lowest of gross contamination, drinking water toxicity, aquatic habitat and bioaccumulation action levels.

TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.
Gross Contamination: 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 reporting limits and background concentrations replace final screening level as appropriate.

TABLE D-2b. SURFACE WATER ACTION LEVELS
Marine Habitats
(ug/l)

CHEMICAL PARAMETER	[1]Final Surface Water Action Level	Basis	Gross Contamination (Odors, etc.) Table G-4	Marine Aquatic Habitat Goal (Chronic Toxicity) Table D-4a	Bioaccumulation and Human Consumption Table D-4F
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	2.6E-05	Bioaccumulation/Human Consumption	8.5E+00	1.3E-01	2.6E-05
AMETRYN	1.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.5E+01	
AMINO,2- DINITROTOLUENE,4,6-	1.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.5E+01	
AMINO,4- DINITROTOLUENE,2,6-	1.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.5E+01	
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	1.5E+04
ARSENIC	1.4E-01	Bioaccumulation/Human Consumption	5.0E+04	3.6E+01	1.4E-01
ATRAZINE	2.6E+01	Aquatic Habitat Chronic Toxicity	1.7E+04	2.6E+01	
BARIUM	2.0E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	2.0E+02	
BENZENE	1.3E+01	Bioaccumulation/Human Consumption	2.0E+03	3.5E+02	1.3E+01
BENZO(a)ANTHRACENE	1.8E-02	Bioaccumulation/Human Consumption	4.7E+00	2.7E-02	1.8E-02
BENZO(a)PYRENE	1.4E-02	Aquatic Habitat Chronic Toxicity	8.1E-01	1.4E-02	1.8E-02
BENZO(b)FLUORANTHENE	1.8E-02	Bioaccumulation/Human Consumption	7.5E-01	9.1E+00	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	3.8E-02	Bioaccumulation/Human Consumption	5.0E+04	2.7E+00	3.8E-02
BIPHENYL, 1,1-	5.0E-01	Ceiling Level	5.0E-01	1.4E+01	
BIS(2-CHLOROETHYL)ETHER	4.4E-01	Bioaccumulation/Human Consumption	3.6E+02	6.1E+01	4.4E-01
BIS(2-CHLOROISOPROPYL)ETHER	6.1E+01	Aquatic Habitat Chronic Toxicity	3.2E+02	6.1E+01	1.4E+03
BIS(2-ETHYLHEXYL)PHTHALATE	2.2E+00	Bioaccumulation/Human Consumption	1.4E+02	3.2E+01	2.2E+00
BORON	7.3E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	7.3E+03	
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	9.3E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	9.3E+00	
CARBON TETRACHLORIDE	2.3E+00	Bioaccumulation/Human Consumption	5.2E+02	3.2E+03	2.3E+00
CHLORDANE (TECHNICAL)	1.6E-05	Bioaccumulation/Human Consumption	2.5E+00	4.0E-03	1.6E-05
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	1.6E+01	Ceiling Level	1.6E+01	2.1E+04	
CHLOROFORM	5.1E+00	Bioaccumulation/Human Consumption	2.4E+03	3.2E+03	5.1E+00
CHLOROMETHANE	3.2E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	3.2E+03	
CHLOROPHENOL, 2-	1.8E-01	Ceiling Level	1.8E-01	1.4E+02	1.5E+02
CHROMIUM (Total)	1.0E+04	Aquatic Habitat Chronic Toxicity	5.0E+04	1.0E+04	
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	
CHRYSENE	1.8E-02	Bioaccumulation/Human Consumption	1.0E+00	3.5E-01	1.8E-02
COBALT	3.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	3.0E+00	
COPPER	2.9E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	2.9E+00	
CYANIDE (Free)	1.0E+00	Aquatic Habitat Chronic Toxicity	1.7E+02	1.0E+00	2.2E+05
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX	1.9E+02	Aquatic Habitat Chronic Toxicity	3.0E+04	1.9E+02	

TABLE D-2b. SURFACE WATER ACTION LEVELS
Marine Habitats
(ug/l)

CHEMICAL PARAMETER	[1]Final Surface Water Action Level	Basis	Gross Contamination (Odors, etc.) Table G-4	Marine Aquatic Habitat Goal (Chronic Toxicity) Table D-4a	Bioaccumulation and Human Consumption Table D-4F
DALAPON	3.0E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	3.0E+02	
DIBENZO(a,h)ANTHTRACENE	1.8E-02	Bioaccumulation/Human Consumption	5.2E-01	7.5E+00	1.8E-02
DIBROMO,1,2- CHLOROPROPANE,3-	4.0E-02	Aquatic Habitat Chronic Toxicity	1.0E+01	4.0E-02	
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	8.5E+02
DICHLOROBENZENE, 1,3-	6.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	6.5E+01	8.5E+02
DICHLOROBENZENE, 1,4-	1.1E+01	Ceiling Level	1.1E+01	6.5E+01	8.5E+02
DICHLOROBENZIDINE, 3,3-	7.0E-03	Bioaccumulation/Human Consumption	1.6E+03	2.5E+02	7.0E-03
DICHLORODIPHENYLDICHLOROETHANE (DDD)	3.1E-04	Bioaccumulation/Human Consumption	4.5E+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)	8.0E-06	Bioaccumulation/Human Consumption	2.8E+00	1.0E-03	8.0E-06
DICHLOROETHANE, 1,1-	4.7E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	4.7E+01	
DICHLOROETHANE, 1,2-	7.9E+01	Bioaccumulation/Human Consumption	2.0E+04	1.0E+04	7.9E+01
DICHLOROETHYLENE, 1,1-	6.0E-01	Bioaccumulation/Human Consumption	1.5E+03	2.5E+01	6.0E-01
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
DICHLOROPHENOXYACETIC ACID (2,4-D)	4.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	4.0E+01	
DICHLOROPROPANE, 1,2-	1.0E+01	Ceiling Level	1.0E+01	1.5E+03	1.5E+01
DICHLOROPROPENE, 1,3-	4.6E+00	Bioaccumulation/Human Consumption	5.0E+04	1.2E+02	4.6E+00
DIELDRIN	2.5E-05	Bioaccumulation/Human Consumption	4.1E+01	1.9E-03	2.5E-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
DINITROBENZENE, 1,3-	3.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	3.0E+01	
DINITROPHENOL, 2,4-	7.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	7.5E+01	5.3E+03
DINITROTOLUENE, 2,4- (2,4-DNT)	3.0E+00	Bioaccumulation/Human Consumption	5.0E+04	6.7E+01	3.0E+00
DINITROTOLUENE, 2,6- (2,6-DNT)	6.7E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	6.7E+01	
DIOXANE, 1,4-	5.0E+04	Ceiling Level	5.0E+04	5.0E+05	
DIOXINS (TEQ)	5.0E-09	Bioaccumulation/Human Consumption	6.0E-02	5.0E-06	5.0E-09
DIURON	6.0E+01	Aquatic Habitat Chronic Toxicity	2.1E+04	6.0E+01	
ENDOSULFAN	8.7E-03	Aquatic Habitat Chronic Toxicity	2.3E+02	8.7E-03	5.2E+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	1.1E+03
FLUORANTHENE	8.0E+00	Aquatic Habitat Chronic Toxicity	1.3E+02	8.0E+00	1.8E+01
FLUORENE	3.9E+00	Aquatic Habitat Chronic Toxicity	9.5E+02	3.9E+00	5.3E+03
GLYPHOSATE	6.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	6.5E+01	
HEPTACHLOR	9.0E-05	Bioaccumulation/Human Consumption	2.0E+01	3.6E-03	9.0E-05
HEPTACHLOR EPOXIDE	3.9E-05	Bioaccumulation/Human Consumption	1.0E+02	3.6E-03	3.9E-05
HEXACHLOROBENZENE	2.4E-04	Bioaccumulation/Human Consumption	3.1E+00	6.5E+01	2.4E-04
HEXACHLOROBUTADIENE	4.7E+00	Aquatic Habitat Chronic Toxicity	6.0E+00	4.7E+00	1.6E+01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	2.0E-02	Bioaccumulation/Human Consumption	4.0E+03	8.0E-02	2.0E-02

TABLE D-2b. SURFACE WATER ACTION LEVELS
Marine Habitats
(ug/l)

CHEMICAL PARAMETER	[1]Final Surface Water Action Level	Basis	Gross Contamination (Odors, etc.) Table G-4	Marine Aquatic Habitat Goal (Chronic Toxicity) Table D-4a	Bioaccumulation and Human Consumption Table D-4F
HEXACHLOROETHANE	2.9E+00	Bioaccumulation/Human Consumption	1.0E+01	1.2E+01	2.9E+00
HEXAZINONE	5.0E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	5.0E+03	
INDENO(1,2,3-cd)PYRENE	1.8E-02	Bioaccumulation/Human Consumption	9.5E-02	4.3E+00	1.8E-02
ISOPHORONE	1.3E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	1.3E+02	1.7E+05
LEAD	5.6E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	5.6E+00	
MERCURY	2.5E-02	Aquatic Habitat Chronic Toxicity	3.0E+01	2.5E-02	4.7E-02
METHOXYCHLOR	3.0E-02	Aquatic Habitat Chronic Toxicity	5.0E+01	3.0E-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	1.8E+04	
METHYLENE CHLORIDE	5.9E+02	Bioaccumulation/Human Consumption	9.1E+03	3.2E+03	5.9E+02
METHYLNAPHTHALENE, 1-	2.1E+00	Aquatic Habitat Chronic Toxicity	1.0E+01	2.1E+00	
METHYLNAPHTHALENE, 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	8.3E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	8.3E+00	3.3E+01
NITROBENZENE	6.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	6.0E+01	
NITROGLYCERIN	1.4E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	1.4E+02	
NITROTOLUENE, 2-	1.0E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	1.0E+03	
NITROTOLUENE, 3-	3.8E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	3.8E+02	
NITROTOLUENE, 4-	1.6E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	1.6E+03	
PENTACHLOROPHENOL	3.0E+00	Bioaccumulation/Human Consumption	5.9E+02	7.9E+00	3.0E+00
PENTAERYTHRITOLTETRANITRATE (PETN)	2.2E+04	Ceiling Level	2.2E+04	8.5E+04	
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)	7.9E-05	Bioaccumulation/Human Consumption	1.6E+01	3.0E-02	7.9E-05
PROPICONAZOLE	2.6E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	2.6E+01	
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	1.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	1.0E+00	
SIMAZINE	2.0E+00	Aquatic Habitat Chronic Toxicity	3.1E+03	2.0E+00	
STYRENE	1.1E+01	Ceiling Level	1.1E+01	3.2E+01	
TERBACIL	2.3E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	2.3E+03	
tert-BUTYL ALCOHOL	1.8E+04	Aquatic Habitat Chronic Toxicity	5.0E+04	1.8E+04	
TETRACHLOROETHANE, 1,1,1,2-	3.1E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	3.1E+02	
TETRACHLOROETHANE, 1,1,2,2-	3.5E+00	Bioaccumulation/Human Consumption	5.0E+02	4.2E+02	3.5E+00
TETRACHLOROETHYLENE	2.9E+00	Bioaccumulation/Human Consumption	3.0E+02	1.5E+02	2.9E+00
TETRACHLOROPHENOL, 2,3,4,6-	4.0E+00	Aquatic Habitat Chronic Toxicity	1.2E+04	4.0E+00	
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	3.3E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	3.3E+02	
THALLIUM	1.6E+01	Bioaccumulation/Human Consumption	5.0E+04	2.0E+01	1.6E+01
TOLUENE	4.0E+01	Ceiling Level	4.0E+01	2.5E+03	1.4E+05
TOXAPHENE	2.0E-04	Aquatic Habitat Chronic Toxicity	1.4E+02	2.0E-04	2.4E-04

TABLE D-2b. SURFACE WATER ACTION LEVELS
Marine Habitats
(ug/l)

CHEMICAL PARAMETER	[1]Final Surface Water Action Level	Basis	Gross Contamination (Odors, etc.) Table G-4	Marine Aquatic Habitat Goal (Chronic Toxicity) Table D-4a	Bioaccumulation and Human Consumption Table D-4F
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	3.4E+05
TRICHLOROETHANE, 1,1,2-	1.4E+01	Bioaccumulation/Human Consumption	5.0E+04	4.7E+03	1.4E+01
TRICHLOROETHYLENE	2.6E+01	Bioaccumulation/Human Consumption	1.0E+04	3.6E+02	2.6E+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-	1.2E+00	Bioaccumulation/Human Consumption	1.0E+02	4.9E+02	1.2E+00
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	6.9E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	6.9E+02	
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	3.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	3.0E+01	
TRICHLOROPROPANE, 1,2,3-	1.4E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.4E+01	
TRICHLOROPROPENE, 1,2,3-	6.2E-01	Aquatic Habitat Chronic Toxicity	5.0E+04	6.2E-01	
TRIFLURALIN	2.0E+01	Aquatic Habitat Chronic Toxicity	9.2E+01	2.0E+01	
TRINITROBENZENE, 1,3,5-	3.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	3.0E+01	
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	1.5E+02	Aquatic Habitat Chronic Toxicity	3.7E+04	1.5E+02	
TRINITROTOLUENE, 2,4,6- (TNT)	2.0E+01	Ceiling Level	2.0E+01	1.3E+02	
VANADIUM	1.9E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.9E+01	
VINYL CHLORIDE	1.7E+02	Bioaccumulation/Human Consumption	3.4E+03	7.8E+02	1.7E+02
XYLENES	1.0E+02	Aquatic Habitat Chronic Toxicity	5.3E+02	1.0E+02	
ZINC	8.6E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	8.6E+01	

Notes:

1. Lowest of gross contamination, aquatic habitat and bioaccumulation action levels.

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 reporting limits and background concentrations replace final screening level as appropriate.

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

CHEMICAL PARAMETER	[1]Final Surface Water Action Level	Basis	Gross Contamination (Odors, etc.) Table G-4	Estuary Aquatic Habitat Goal (Chronic Toxicity) Table D-4a	Bioaccumulation and Human Consumption Table D-4f
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	2.6E-05	Bioaccumulation/Human Consumption	8.5E+00	1.3E-01	2.6E-05
AMETRYN	1.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.5E+01	
AMINO,2- DINITROTOLUENE,4,6-	1.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.5E+01	
AMINO,4- DINITROTOLUENE,2,6-	1.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.5E+01	
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	1.5E+04
ARSENIC	1.4E-01	Bioaccumulation/Human Consumption	5.0E+04	3.6E+01	1.4E-01
ATRAZINE	1.2E+01	Aquatic Habitat Chronic Toxicity	1.7E+04	1.2E+01	
BARIUM	2.0E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	2.0E+02	
BENZENE	1.3E+01	Bioaccumulation/Human Consumption	2.0E+03	4.6E+01	1.3E+01
BENZO(a)ANTHRACENE	1.8E-02	Bioaccumulation/Human Consumption	4.7E+00	2.7E-02	1.8E-02
BENZO(a)PYRENE	1.4E-02	Aquatic Habitat Chronic Toxicity	8.1E-01	1.4E-02	1.8E-02
BENZO(b)FLUORANTHENE	1.8E-02	Bioaccumulation/Human Consumption	7.5E-01	9.1E+00	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	3.8E-02	Bioaccumulation/Human Consumption	5.0E+04	2.7E+00	3.8E-02
BIPHENYL, 1,1-	5.0E-01	Ceiling Level	5.0E-01	1.4E+01	
BIS(2-CHLOROETHYL)ETHER	4.4E-01	Bioaccumulation/Human Consumption	3.6E+02	6.1E+01	4.4E-01
BIS(2-CHLOROISOPROPYL)ETHER	6.1E+01	Aquatic Habitat Chronic Toxicity	3.2E+02	6.1E+01	1.4E+03
BIS(2-ETHYLHEXYL)PHTHALATE	2.2E+00	Bioaccumulation/Human Consumption	1.4E+02	3.2E+01	2.2E+00
BORON	7.3E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	7.3E+03	
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	3.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	3.0E+00	
CARBON TETRACHLORIDE	2.3E+00	Bioaccumulation/Human Consumption	5.2E+02	9.8E+00	2.3E+00
CHLORDANE (TECHNICAL)	1.6E-05	Bioaccumulation/Human Consumption	2.5E+00	4.0E-03	1.6E-05
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	1.6E+01	Ceiling Level	1.6E+01	2.1E+04	
CHLOROFORM	5.1E+00	Bioaccumulation/Human Consumption	2.4E+03	6.2E+02	5.1E+00
CHLOROMETHANE	3.2E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	3.2E+03	
CHLOROPHENOL, 2-	1.8E-01	Ceiling Level	1.8E-01	1.4E+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	1.0E+00	3.5E-01	1.8E-02
COBALT	3.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	3.0E+00	
COPPER	2.9E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	2.9E+00	
CYANIDE (Free)	1.0E+00	Aquatic Habitat Chronic Toxicity	1.7E+02	1.0E+00	2.2E+05
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	1.9E+02	Aquatic Habitat Chronic Toxicity	3.0E+04	1.9E+02	

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

CHEMICAL PARAMETER	[1]Final Surface Water Action Level	Basis	Gross Contamination (Odors, etc.) Table G-4	Estuary Aquatic Habitat Goal (Chronic Toxicity) Table D-4a	Bioaccumulation and Human Consumption Table D-4f
DALAPON	3.0E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	3.0E+02	
DIBENZO(a,h)ANTHTRACENE	1.8E-02	Bioaccumulation/Human Consumption	5.2E-01	7.5E+00	1.8E-02
DIBROMO,1,2- CHLOROPROPANE,3-	4.0E-02	Aquatic Habitat Chronic Toxicity	1.0E+01	4.0E-02	
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	8.5E+02
DICHLOROBENZENE, 1,3-	6.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	6.5E+01	8.5E+02
DICHLOROBENZENE, 1,4-	1.1E+01	Ceiling Level	1.1E+01	1.5E+01	8.5E+02
DICHLOROBENZIDINE, 3,3-	7.0E-03	Bioaccumulation/Human Consumption	1.6E+03	2.5E+02	7.0E-03
DICHLORODIPHENYLDICHLOROETHANE (DDD)	3.1E-04	Bioaccumulation/Human Consumption	4.5E+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)	8.0E-06	Bioaccumulation/Human Consumption	2.8E+00	1.0E-03	8.0E-06
DICHLOROETHANE, 1,1-	4.7E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	4.7E+01	
DICHLOROETHANE, 1,2-	7.9E+01	Bioaccumulation/Human Consumption	2.0E+04	1.0E+04	7.9E+01
DICHLOROETHYLENE, 1,1-	6.0E-01	Bioaccumulation/Human Consumption	1.5E+03	2.5E+01	6.0E-01
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
DICHLOROPHENOXYACETIC ACID (2,4-D)	4.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	4.0E+01	
DICHLOROPROPANE, 1,2-	1.0E+01	Ceiling Level	1.0E+01	1.5E+03	1.5E+01
DICHLOROPROPENE, 1,3-	4.6E+00	Bioaccumulation/Human Consumption	5.0E+04	1.2E+02	4.6E+00
DIELDRIN	2.5E-05	Bioaccumulation/Human Consumption	4.1E+01	1.9E-03	2.5E-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
DINITROBENZENE, 1,3-	3.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	3.0E+01	
DINITROPHENOL, 2,4-	7.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	7.5E+01	5.3E+03
DINITROTOLUENE, 2,4- (2,4-DNT)	3.0E+00	Bioaccumulation/Human Consumption	5.0E+04	4.4E+01	3.0E+00
DINITROTOLUENE, 2,6- (2,6-DNT)	4.4E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	4.4E+01	
DIOXANE, 1,4-	5.0E+04	Ceiling Level	5.0E+04	3.4E+05	
DIOXINS (TEQ)	5.0E-09	Bioaccumulation/Human Consumption	6.0E-02	5.0E-06	5.0E-09
DIURON	6.0E+01	Aquatic Habitat Chronic Toxicity	2.1E+04	6.0E+01	
ENDOSULFAN	8.7E-03	Aquatic Habitat Chronic Toxicity	2.3E+02	8.7E-03	5.2E+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	1.1E+03
FLUORANTHENE	8.0E+00	Aquatic Habitat Chronic Toxicity	1.3E+02	8.0E+00	1.8E+01
FLUORENE	3.9E+00	Aquatic Habitat Chronic Toxicity	9.5E+02	3.9E+00	5.3E+03
GLYPHOSATE	6.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	6.5E+01	
HEPTACHLOR	9.0E-05	Bioaccumulation/Human Consumption	2.0E+01	3.6E-03	9.0E-05
HEPTACHLOR EPOXIDE	3.9E-05	Bioaccumulation/Human Consumption	1.0E+02	3.6E-03	3.9E-05
HEXACHLOROBENZENE	2.4E-04	Bioaccumulation/Human Consumption	3.1E+00	3.7E+00	2.4E-04
HEXACHLOROBUTADIENE	4.7E+00	Aquatic Habitat Chronic Toxicity	6.0E+00	4.7E+00	1.6E+01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	2.0E-02	Bioaccumulation/Human Consumption	4.0E+03	8.0E-02	2.0E-02

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

CHEMICAL PARAMETER	[1]Final Surface Water Action Level	Basis	Gross Contamination (Odors, etc.) Table G-4	Estuary Aquatic Habitat Goal (Chronic Toxicity) Table D-4a	Bioaccumulation and Human Consumption Table D-4f
HEXACHLOROETHANE	2.9E+00	Bioaccumulation/Human Consumption	1.0E+01	1.2E+01	2.9E+00
HEXAZINONE	5.0E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	5.0E+03	
INDENO(1,2,3-cd)PYRENE	1.8E-02	Bioaccumulation/Human Consumption	9.5E-02	4.3E+00	1.8E-02
ISOPHORONE	1.3E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	1.3E+02	1.7E+05
LEAD	5.6E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	5.6E+00	
MERCURY	2.5E-02	Aquatic Habitat Chronic Toxicity	3.0E+01	2.5E-02	4.7E-02
METHOXYCHLOR	3.0E-02	Aquatic Habitat Chronic Toxicity	5.0E+01	3.0E-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	1.8E+04	
METHYLENE CHLORIDE	5.9E+02	Bioaccumulation/Human Consumption	9.1E+03	2.2E+03	5.9E+02
METHYLNAPHTHALENE, 1-	2.1E+00	Aquatic Habitat Chronic Toxicity	1.0E+01	2.1E+00	
METHYLNAPHTHALENE, 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	5.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	5.0E+00	3.3E+01
NITROBENZENE	6.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	6.0E+01	
NITROGLYCERIN	1.4E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	1.4E+02	
NITROTOLUENE, 2-	1.0E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	1.0E+03	
NITROTOLUENE, 3-	3.8E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	3.8E+02	
NITROTOLUENE, 4-	1.6E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	1.6E+03	
PENTACHLOROPHENOL	3.0E+00	Bioaccumulation/Human Consumption	5.9E+02	7.9E+00	3.0E+00
PENTAERYTHRITOLTETRANITRATE (PETN)	2.2E+04	Ceiling Level	2.2E+04	8.5E+04	
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)	7.9E-05	Bioaccumulation/Human Consumption	1.6E+01	1.4E-02	7.9E-05
PROPICONAZOLE	2.6E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	2.6E+01	
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	1.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	1.0E+00	
SIMAZINE	2.0E+00	Aquatic Habitat Chronic Toxicity	3.1E+03	2.0E+00	
STYRENE	1.1E+01	Ceiling Level	1.1E+01	3.2E+01	
TERBACIL	2.3E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	2.3E+03	
tert-BUTYL ALCOHOL	1.8E+04	Aquatic Habitat Chronic Toxicity	5.0E+04	1.8E+04	
TETRACHLOROETHANE, 1,1,1,2-	3.1E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	3.1E+02	
TETRACHLOROETHANE, 1,1,2,2-	3.5E+00	Bioaccumulation/Human Consumption	5.0E+02	4.2E+02	3.5E+00
TETRACHLOROETHYLENE	2.9E+00	Bioaccumulation/Human Consumption	3.0E+02	1.2E+02	2.9E+00
TETRACHLOROPHENOL, 2,3,4,6-	1.2E+00	Aquatic Habitat Chronic Toxicity	1.2E+04	1.2E+00	
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	3.3E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	3.3E+02	
THALLIUM	1.6E+01	Bioaccumulation/Human Consumption	5.0E+04	2.0E+01	1.6E+01
TOLUENE	4.0E+01	Ceiling Level	4.0E+01	1.3E+02	1.4E+05
TOXAPHENE	2.0E-04	Aquatic Habitat Chronic Toxicity	1.4E+02	2.0E-04	2.4E-04

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

CHEMICAL PARAMETER	[1]Final Surface Water Action Level	Basis	Gross Contamination (Odors, etc.) Table G-4	Estuary Aquatic Habitat Goal (Chronic Toxicity) Table D-4a	Bioaccumulation and Human Consumption Table D-4f
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	
TRICHLOROETHANE, 1,1,1-	6.2E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	6.2E+01	3.4E+05
TRICHLOROETHANE, 1,1,2-	1.4E+01	Bioaccumulation/Human Consumption	5.0E+04	4.7E+03	1.4E+01
TRICHLOROETHYLENE	2.6E+01	Bioaccumulation/Human Consumption	1.0E+04	3.6E+02	2.6E+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-	1.2E+00	Bioaccumulation/Human Consumption	1.0E+02	4.9E+02	1.2E+00
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	6.9E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	6.9E+02	
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	3.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	3.0E+01	
TRICHLOROPROPANE, 1,2,3-	1.4E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.4E+01	
TRICHLOROPROPENE, 1,2,3-	6.2E-01	Aquatic Habitat Chronic Toxicity	5.0E+04	6.2E-01	
TRIFLURALIN	2.0E+01	Aquatic Habitat Chronic Toxicity	9.2E+01	2.0E+01	
TRINITROBENZENE, 1,3,5-	3.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	3.0E+01	
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	1.5E+02	Aquatic Habitat Chronic Toxicity	3.7E+04	1.5E+02	
TRINITROTOLUENE, 2,4,6- (TNT)	2.0E+01	Ceiling Level	2.0E+01	1.3E+02	
VANADIUM	1.9E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.9E+01	
VINYL CHLORIDE	1.7E+02	Bioaccumulation/Human Consumption	3.4E+03	7.8E+02	1.7E+02
XYLENES	1.0E+02	Aquatic Habitat Chronic Toxicity	5.3E+02	1.0E+02	
ZINC	2.2E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	2.2E+01	

Notes:

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

1. Lowest of gross contamination, aquatic habitat and bioaccumulation action levels.

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 reporting limits and background concentrations replace final screening level as appropriate.

TABLE D-3a. FINAL DRINKING WATER ACTION LEVELS FOR HUMAN TOXICITY.
(ug/L)

CHEMICAL PARAMETER	Final Action Level	Basis	HDOH Primary MCL	Other Criteria	Reference	Risk-Based Action Level (Table D-3b)	Basis
ACENAPHTHENE	3.7E+02	noncarcinogenic effects				3.7E+02	noncarcinogenic effects
ACENAPHTHYLENE	2.4E+02	noncarcinogenic effects				2.4E+02	noncarcinogenic effects
ACETONE	2.2E+04	noncarcinogenic effects				2.2E+04	noncarcinogenic effects
ALDRIN	4.0E-03	carcinogenic effects				4.0E-03	carcinogenic effects
AMETRYN	3.3E+02	noncarcinogenic effects				3.3E+02	noncarcinogenic effects
AMINO,2- DINITROTOLUENE,4,6-	7.3E+01	noncarcinogenic effects				7.3E+01	noncarcinogenic effects
AMINO,4- DINITROTOLUENE,2,6-	7.3E+01	noncarcinogenic effects				7.3E+01	noncarcinogenic effects
ANTHRACENE	1.8E+03	noncarcinogenic effects				1.8E+03	noncarcinogenic effects
ANTIMONY	6.0E+00	HDOH Primary MCL	6.0E+00			1.5E+01	noncarcinogenic effects
ARSENIC	1.0E+01	HDOH Primary MCL	1.0E+01			4.5E-02	carcinogenic effects
ATRAZINE	3.0E+00	HDOH Primary MCL	3.0E+00			2.9E-01	carcinogenic effects
BARIUM	2.0E+03	HDOH Primary MCL	2.0E+03			7.3E+03	noncarcinogenic effects
BENZENE	5.0E+00	HDOH Primary MCL	5.0E+00			4.1E-01	carcinogenic effects
BENZO(a)ANTHRACENE	9.2E-02	carcinogenic effects				9.2E-02	carcinogenic effects
BENZO(a)PYRENE	2.0E-01	HDOH 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	HDOH Primary MCL	4.0E+00			7.3E+01	noncarcinogenic effects
BIPHENYL, 1,1-	8.3E-01	noncarcinogenic effects				8.3E-01	noncarcinogenic effects
BIS(2-CHLOROETHYL)ETHER	1.2E-02	carcinogenic effects				1.2E-02	carcinogenic effects
BIS(2-CHLOROISOPROPYL)ETHER	3.2E-01	carcinogenic effects				3.2E-01	carcinogenic effects
BIS(2-ETHYLHEXYL)PHTHALATE	6.0E+00	HDOH Primary MCL	6.0E+00			4.8E+00	carcinogenic effects
BORON	7.3E+03	noncarcinogenic effects				7.3E+03	noncarcinogenic effects
BROMODICHLOROMETHANE	1.2E-01	carcinogenic effects				1.2E-01	carcinogenic effects
BROMOFORM	8.0E+01	HDOH Primary MCL	8.0E+01		Total Trihalomethanes	8.5E+00	carcinogenic effects
BROMOMETHANE	8.7E+00	noncarcinogenic effects				8.7E+00	noncarcinogenic effects
CADMIUM	5.0E+00	HDOH Primary MCL	5.0E+00			3.7E+01	noncarcinogenic effects
CARBON TETRACHLORIDE	5.0E+00	HDOH Primary MCL	5.0E+00			4.4E-01	carcinogenic effects
CHLORDANE (TECHNICAL)	2.0E+00	HDOH Primary MCL	2.0E+00			1.9E-01	carcinogenic effects
CHLOROANILINE, p-	3.4E-01	carcinogenic effects				3.4E-01	carcinogenic effects
CHLOROBENZENE	1.0E+02	HDOH Primary MCL	1.0E+02			9.1E+01	noncarcinogenic effects
CHLOROETHANE	2.1E+04	noncarcinogenic effects				2.1E+04	noncarcinogenic effects
CHLOROFORM	7.0E+01	HDOH public health goal		7.0E+01	HDOH public health goal	1.9E-01	carcinogenic effects
CHLOROMETHANE	1.8E+00	carcinogenic effects				1.8E+00	carcinogenic effects
CHLOROPHENOL, 2-	3.0E+01	noncarcinogenic effects				3.0E+01	noncarcinogenic effects
CHROMIUM (Total)	1.0E+02	HDOH Primary MCL	1.0E+02				
CHROMIUM III	5.5E+04	noncarcinogenic effects				5.5E+04	noncarcinogenic effects
CHROMIUM VI	1.3E+01	carcinogenic effects				1.3E+01	carcinogenic effects
CHRYSENE	9.2E+00	carcinogenic effects				9.2E+00	carcinogenic effects
COBALT	1.1E+01	noncarcinogenic effects				1.1E+01	noncarcinogenic effects
COPPER	1.3E+03	HDOH Primary MCL	1.3E+03			1.5E+03	noncarcinogenic effects
CYANIDE (Free)	2.0E+02	HDOH Primary MCL	2.0E+02			7.3E+02	noncarcinogenic effects
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	6.1E-01	carcinogenic effects				6.1E-01	carcinogenic effects

TABLE D-3a. FINAL DRINKING WATER ACTION LEVELS FOR HUMAN TOXICITY.
(ug/L)

CHEMICAL PARAMETER	Final Action Level	Basis	HDOH Primary MCL	Other Criteria	Reference	Risk-Based Action Level (Table D-3b)	Basis
DALAPON	2.0E+02	HDOH Primary MCL	2.0E+02			1.1E+03	noncarcinogenic effects
DIBENZO(a,h)ANTHTRACENE	9.2E-03	carcinogenic effects				9.2E-03	carcinogenic effects
DIBROMO,1,2- CHLOROPROPANE,3-	4.0E-02	HDOH Primary MCL	4.0E-02			8.0E-04	carcinogenic effects
DIBROMOCHLOROMETHANE	1.6E-01	carcinogenic effects				1.6E-01	carcinogenic effects
DIBROMOETHANE, 1,2-	4.0E-02	HDOH Primary MCL	4.0E-02			6.5E-03	carcinogenic effects
DICHLOROBENZENE, 1,2-	6.0E+02	HDOH 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	HDOH Primary MCL	7.5E+01			4.3E-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)	2.0E-01	carcinogenic effects				2.0E-01	carcinogenic effects
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	2.0E-01	carcinogenic effects				2.0E-01	carcinogenic effects
DICHLOROETHANE, 1,1-	2.4E+00	carcinogenic effects				2.4E+00	carcinogenic effects
DICHLOROETHANE, 1,2-	1.5E-01	carcinogenic effects				1.5E-01	carcinogenic effects
DICHLOROETHYLENE, 1,1-	7.0E+00	HDOH Primary MCL	7.0E+00			3.4E+02	noncarcinogenic effects
DICHLOROETHYLENE, Cis 1,2-	7.0E+01	HDOH Primary MCL	7.0E+01			1.2E+01	noncarcinogenic effects
DICHLOROETHYLENE, Trans 1,2-	1.0E+02	HDOH Primary MCL	1.0E+02			1.1E+02	noncarcinogenic effects
DICHLOROPHENOL, 2,4-	1.1E+02	noncarcinogenic effects				1.1E+02	noncarcinogenic effects
DICHLOROPHENOXYACETIC ACID (2,4-D)	7.0E+01	HDOH Primary MCL	7.0E+01			3.7E+02	noncarcinogenic effects
DICHLOROPROPANE, 1,2-	5.0E+00	HDOH Primary MCL	5.0E+00			3.9E-01	carcinogenic effects
DICHLOROPROPENE, 1,3-	4.3E-01	carcinogenic effects				4.3E-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-	1.2E+02	noncarcinogenic effects				1.2E+02	noncarcinogenic effects
DIMETHYLPHTHALATE	3.7E+05	noncarcinogenic effects				3.7E+05	noncarcinogenic effects
DINITROBENZENE, 1,3-	3.7E+00	noncarcinogenic effects				3.7E+00	noncarcinogenic effects
DINITROPHENOL, 2,4-	7.3E+01	noncarcinogenic effects				7.3E+01	noncarcinogenic effects
DINITROTOLUENE, 2,4- (2,4-DNT)	2.2E-01	carcinogenic effects				2.2E-01	carcinogenic effects
DINITROTOLUENE, 2,6- (2,6-DNT)	3.7E+01	noncarcinogenic effects				3.7E+01	noncarcinogenic effects
DIOXANE, 1,4-	6.7E-01	carcinogenic effects				6.7E-01	carcinogenic effects
DIOXINS (TEQ)	3.0E-05	HDOH Primary MCL	3.0E-05			1.2E-04	noncarcinogenic effects
DIURON	7.3E+01	noncarcinogenic effects				7.3E+01	noncarcinogenic effects
ENDOSULFAN	2.2E+02	noncarcinogenic effects				2.2E+02	noncarcinogenic effects
ENDRIN	2.0E+00	HDOH Primary MCL	2.0E+00			1.1E+01	noncarcinogenic effects
ETHANOL							
ETHYLBENZENE	7.0E+02	HDOH Primary MCL	7.0E+02			1.5E+00	carcinogenic effects
FLUORANTHENE	1.5E+03	noncarcinogenic effects				1.5E+03	noncarcinogenic effects
FLUORENE	2.4E+02	noncarcinogenic effects				2.4E+02	noncarcinogenic effects
GLYPHOSATE	7.0E+02	HDOH Primary MCL	7.0E+02			3.7E+03	noncarcinogenic effects
HEPTACHLOR	4.0E-01	HDOH Primary MCL	4.0E-01			1.5E-02	carcinogenic effects
HEPTACHLOR EPOXIDE	2.0E-01	HDOH Primary MCL	2.0E-01			7.4E-03	carcinogenic effects
HEXACHLOROBENZENE	1.0E+00	HDOH 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	HDOH Primary MCL	2.0E-01			6.1E-02	carcinogenic effects

TABLE D-3a. FINAL DRINKING WATER ACTION LEVELS FOR HUMAN TOXICITY.
(ug/L)

CHEMICAL PARAMETER	Final Action Level	Basis	HDOH Primary MCL	Other Criteria	Reference	Risk-Based Action Level (Table D-3b)	Basis
HEXACHLOROETHANE	4.8E+00	carcinogenic effects				4.8E+00	carcinogenic effects
HEXAZINONE	1.2E+03	noncarcinogenic effects				1.2E+03	noncarcinogenic effects
INDENO(1,2,3-cd)PYRENE	9.2E-02	carcinogenic effects				9.2E-02	carcinogenic effects
ISOPHORONE	7.1E+01	carcinogenic effects				7.1E+01	carcinogenic effects
LEAD	1.5E+01	HDOH Primary MCL	1.5E+01				
MERCURY	2.0E+00	HDOH Primary MCL	2.0E+00			6.2E-02	noncarcinogenic effects
METHOXYCHLOR	4.0E+01	HDOH Primary MCL	4.0E+01			1.8E+02	noncarcinogenic effects
METHYL ETHYL KETONE	7.1E+03	noncarcinogenic effects				7.1E+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	1.2E+01	carcinogenic effects				1.2E+01	carcinogenic effects
METHYLENE CHLORIDE	4.8E+00	carcinogenic effects				4.8E+00	carcinogenic effects
METHYLNAPHTHALENE, 1-	4.7E+00	carcinogenic effects				4.7E+00	carcinogenic effects
METHYLNAPHTHALENE, 2-	2.4E+01	noncarcinogenic effects				2.4E+01	noncarcinogenic effects
MOLYBDENUM	1.8E+02	noncarcinogenic effects				1.8E+02	noncarcinogenic effects
NAPHTHALENE	1.7E+01	CDPH notification level		1.7E+01	CDPH notification level	1.4E-01	carcinogenic effects
NICKEL	1.8E+03	noncarcinogenic effects				1.8E+03	noncarcinogenic effects
NITROBENZENE	1.2E-01	carcinogenic effects				1.2E-01	carcinogenic effects
NITROGLYCERIN	3.7E+00	noncarcinogenic effects				3.7E+00	noncarcinogenic effects
NITROTOLUENE, 2-	6.2E-02	carcinogenic effects				6.2E-02	carcinogenic effects
NITROTOLUENE, 3-	1.2E+02	noncarcinogenic effects				1.2E+02	noncarcinogenic effects
NITROTOLUENE, 4-	4.2E+00	carcinogenic effects				4.2E+00	carcinogenic effects
PENTACHLOROPHENOL	1.0E+00	HDOH Primary MCL	1.0E+00			1.7E-01	carcinogenic effects
PENTAERYTHRITOLTETRANITRATE (PETN)	1.7E+01	carcinogenic effects				1.7E+01	carcinogenic effects
PERCHLORATE	2.6E+01	noncarcinogenic effects				2.6E+01	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	HDOH Primary MCL	5.0E-01			3.4E-02	carcinogenic effects
PROPICONAZOLE	4.7E+02	noncarcinogenic effects				4.7E+02	noncarcinogenic effects
PYRENE	1.8E+02	noncarcinogenic effects				1.8E+02	noncarcinogenic effects
SELENIUM	5.0E+01	HDOH Primary MCL	5.0E+01			1.8E+02	noncarcinogenic effects
SILVER	1.8E+02	noncarcinogenic effects				1.8E+02	noncarcinogenic effects
SIMAZINE	4.0E+00	HDOH Primary MCL	4.0E+00			5.6E-01	carcinogenic effects
STYRENE	1.0E+02	HDOH Primary MCL	1.0E+02			1.6E+03	noncarcinogenic effects
TERBACIL	4.7E+02	noncarcinogenic effects				4.7E+02	noncarcinogenic effects
tert-BUTYL ALCOHOL	4.5E+00	carcinogenic effects				4.5E+00	carcinogenic effects
TETRACHLOROETHANE, 1,1,1,2-	5.2E-01	carcinogenic effects				5.2E-01	carcinogenic effects
TETRACHLOROETHANE, 1,1,2,2-	6.7E-02	carcinogenic effects				6.7E-02	carcinogenic effects
TETRACHLOROETHYLENE	5.0E+00	HDOH Primary MCL	5.0E+00			1.1E-01	carcinogenic effects
TETRACHLOROPHENOL, 2,3,4,6-	1.1E+03	noncarcinogenic effects				1.1E+03	noncarcinogenic effects
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	1.8E+03	noncarcinogenic effects				1.8E+03	noncarcinogenic effects
THALLIUM	2.0E+00	HDOH Primary MCL	2.0E+00			3.7E-01	noncarcinogenic effects
TOLUENE	1.0E+03	HDOH Primary MCL	1.0E+03			2.3E+03	noncarcinogenic effects
TOXAPHENE	3.0E+00	HDOH Primary MCL	3.0E+00			6.1E-02	carcinogenic effects

TABLE D-3a. FINAL DRINKING WATER ACTION LEVELS FOR HUMAN TOXICITY.
(ug/L)

CHEMICAL PARAMETER	Final Action Level	Basis	HDOH Primary MCL	Other Criteria	Reference	Risk-Based Action Level (Table D-3b)	Basis
TPH (gasolines)	1.0E+02	noncarcinogenic effects				1.0E+02	noncarcinogenic effects
TPH (middle distillates)	1.9E+02	noncarcinogenic effects				1.9E+02	noncarcinogenic effects
TPH (residual fuels)	4.4E+03	noncarcinogenic effects				4.4E+03	noncarcinogenic effects
TRICHLOROBENZENE, 1,2,4-	7.0E+01	HDOH Primary MCL	7.0E+01			4.7E-01	carcinogenic effects
TRICHLOROETHANE, 1,1,1-	2.0E+02	HDOH Primary MCL	2.0E+02			9.1E+03	noncarcinogenic effects
TRICHLOROETHANE, 1,1,2-	5.0E+00	HDOH Primary MCL	5.0E+00			2.4E-01	carcinogenic effects
TRICHLOROETHYLENE	5.0E+00	HDOH Primary MCL	5.0E+00			2.0E+00	carcinogenic effects
TRICHLOROPHENOL, 2,4,5-	3.7E+03	noncarcinogenic effects				3.7E+03	noncarcinogenic effects
TRICHLOROPHENOL, 2,4,6-	6.1E+00	carcinogenic effects				6.1E+00	carcinogenic effects
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	3.7E+02	noncarcinogenic effects				3.7E+02	noncarcinogenic effects
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	5.0E+01	HDOH Primary MCL	5.0E+01			2.9E+02	noncarcinogenic effects
TRICHLOROPROPANE, 1,2,3-	6.0E-01	HDOH Primary MCL	6.0E-01			4.5E-04	carcinogenic effects
TRICHLOROPROPENE, 1,2,3-	6.2E-01	noncarcinogenic effects				6.2E-01	noncarcinogenic effects
TRIFLURALIN	8.7E+00	carcinogenic effects				8.7E+00	carcinogenic effects
TRINITROBENZENE, 1,3,5-	1.1E+03	noncarcinogenic effects				1.1E+03	noncarcinogenic effects
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	1.5E+02	noncarcinogenic effects				1.5E+02	noncarcinogenic effects
TRINITROTOLUENE, 2,4,6- (TNT)	2.2E+00	carcinogenic effects				2.2E+00	carcinogenic effects
VANADIUM	1.8E+02	noncarcinogenic effects				1.8E+02	noncarcinogenic effects
VINYL CHLORIDE	2.0E+00	HDOH Primary MCL	2.0E+00			1.6E-02	carcinogenic effects
XYLENES	1.0E+04	HDOH 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):

Hawai'I Department of Health Primary Maximum Concentration Level. (HDOH 2009).

CDPH: California Department of Public Health, Drinking Water Notification Level (December 2007), http://ww2.cdph.ca.gov/certlic/drinkingwater/Pages/NotificationLevels.aspx

Notes:

Used for development of groundwater and soil screening levels.

Final health-based screening level for drinking water: HDOH Primary MCLs or, in order of preference and availability, USEPA Primary MCL and risk-based Tapwater Goal (Table D-3b)

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

TABLE D-3b. RISK-BASED ACTION LEVELS FOR TAPWATER
(ug/l)

CHEMICAL PARAMETER	Lowest Tapwater Goal (ug/L	Basis	Carcinogenic Effects	Mutagenic Effects	Noncancer Effects
ACENAPHTHENE	3.7E+02	noncarcinogenic effects			3.7E+02
ACENAPHTHYLENE	2.4E+02	noncarcinogenic effects			2.4E+02
ACETONE	2.2E+04	noncarcinogenic effects			2.2E+04
ALDRIN	4.0E-03	carcinogenic effects	4.0E-03		1.1E+00
AMETRYN	3.3E+02	noncarcinogenic effects			3.3E+02
AMINO,2- DINITROTOLUENE,4,6-	7.3E+01	noncarcinogenic effects			7.3E+01
AMINO,4- DINITROTOLUENE,2,6-	7.3E+01	noncarcinogenic effects			7.3E+01
ANTHRACENE	1.8E+03	noncarcinogenic effects			1.8E+03
ANTIMONY	1.5E+01	noncarcinogenic effects			1.5E+01
ARSENIC	4.5E-02	carcinogenic effects	4.5E-02		1.1E+01
ATRAZINE	2.9E-01	carcinogenic effects	2.9E-01		1.3E+03
BARIUM	7.3E+03	noncarcinogenic effects			7.3E+03
BENZENE	4.1E-01	carcinogenic effects	4.1E-01		4.4E+01
BENZO(a)ANTHRACENE	9.2E-02	carcinogenic effects	9.2E-02	2.9E-02	
BENZO(a)PYRENE	9.2E-03	carcinogenic effects	9.2E-03	2.9E-03	
BENZO(b)FLUORANTHENE	9.2E-02	carcinogenic effects	9.2E-02	2.9E-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	2.9E-01	
BERYLLIUM	7.3E+01	noncarcinogenic effects			7.3E+01
BIPHENYL, 1,1-	8.3E-01	noncarcinogenic effects	1.7E+00		8.3E-01
BIS(2-CHLOROETHYL)ETHER	1.2E-02	carcinogenic effects	1.2E-02		
BIS(2-CHLOROISOPROPYL)ETHER	3.2E-01	carcinogenic effects	3.2E-01		2.4E+02
BIS(2-ETHYLHEXYL)PHTHALATE	4.8E+00	carcinogenic effects	4.8E+00		7.3E+02
BORON	7.3E+03	noncarcinogenic effects			7.3E+03
BROMODICHLOROMETHANE	1.2E-01	carcinogenic effects	1.2E-01		1.2E+02
BROMOFORM	8.5E+00	carcinogenic effects	8.5E+00		7.3E+02
BROMOMETHANE	8.7E+00	noncarcinogenic effects			8.7E+00
CADMIUM	3.7E+01	noncarcinogenic effects			3.7E+01
CARBON TETRACHLORIDE	4.4E-01	carcinogenic effects	4.4E-01		8.6E+01
CHLORDANE (TECHNICAL)	1.9E-01	carcinogenic effects	1.9E-01		1.8E+01
CHLOROANILINE, p-	3.4E-01	carcinogenic effects	3.4E-01		1.5E+02
CHLOROBENZENE	9.1E+01	noncarcinogenic effects			9.1E+01
CHLOROETHANE	2.1E+04	noncarcinogenic effects			2.1E+04
CHLOROFORM	1.9E-01	carcinogenic effects	1.9E-01		1.3E+02
CHLOROMETHANE	1.8E+00	carcinogenic effects	1.8E+00		1.9E+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	1.3E+01	carcinogenic effects	1.3E+01	4.3E+00	1.1E+02
CHRYSENE	9.2E+00	carcinogenic effects	9.2E+00	2.9E+00	
COBALT	1.1E+01	noncarcinogenic effects			1.1E+01
COPPER	1.5E+03	noncarcinogenic effects			1.5E+03
CYANIDE (Free)	7.3E+02	noncarcinogenic effects			7.3E+02
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	6.1E-01	carcinogenic effects	6.1E-01		1.1E+02
DALAPON	1.1E+03	noncarcinogenic effects			1.1E+03
DIBENZO(a,h)ANTHTRACENE	9.2E-03	carcinogenic effects	9.2E-03	2.9E-03	
DIBROMO,1,2- CHLOROPROPANE,3-	8.0E-04	carcinogenic effects	8.0E-04	3.2E-04	3.9E-01
DIBROMOCHLOROMETHANE	1.6E-01	carcinogenic effects	1.6E-01		1.2E+02
DIBROMOETHANE, 1,2-	6.5E-03	carcinogenic effects	6.5E-03		1.8E+01
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-	4.3E-01	carcinogenic effects	4.3E-01		1.0E+03
DICHLOROBENZIDINE, 3,3-	1.5E-01	carcinogenic effects	1.5E-01		
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.8E-01	carcinogenic effects	2.8E-01		
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.0E-01	carcinogenic effects	2.0E-01		
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	2.0E-01	carcinogenic effects	2.0E-01		1.8E+01
DICHLOROETHANE, 1,1-	2.4E+00	carcinogenic effects	2.4E+00		1.2E+03
DICHLOROETHANE, 1,2-	1.5E-01	carcinogenic effects	1.5E-01		1.4E+01
DICHLOROETHYLENE, 1,1-	3.4E+02	noncarcinogenic effects			3.4E+02
DICHLOROETHYLENE, Cis 1,2-	1.2E+01	noncarcinogenic effects			1.2E+01
DICHLOROETHYLENE, Trans 1,2-	1.1E+02	noncarcinogenic effects			1.1E+02
DICHLOROPHENOL, 2,4-	1.1E+02	noncarcinogenic effects			1.1E+02
DICHLOROPHENOXYACETIC ACID (2,4-D)	3.7E+02	noncarcinogenic effects			3.7E+02
DICHLOROPROPANE, 1,2-	3.9E-01	carcinogenic effects	3.9E-01		8.3E+00
DICHLOROPROPENE, 1,3-	4.3E-01	carcinogenic effects	4.3E-01		4.0E+01
DIELDRIN	4.2E-03	carcinogenic effects	4.2E-03		1.8E+00
DIETHYLPHTHALATE	2.9E+04	noncarcinogenic effects			2.9E+04
DIMETHYLPHENOL, 2,4-	1.2E+02	noncarcinogenic effects			1.2E+02
DIMETHYLPHTHALATE	3.7E+05	noncarcinogenic effects			3.7E+05

TABLE D-3b. RISK-BASED ACTION LEVELS FOR TAPWATER
(ug/l)

CHEMICAL PARAMETER	Lowest Tapwater Goal (ug/L	Basis	Carcinogenic Effects	Mutagenic Effects	Noncancer Effects
DINITROBENZENE, 1,3-	3.7E+00	noncarcinogenic effects			3.7E+00
DINITROPHENOL, 2,4-	7.3E+01	noncarcinogenic effects			7.3E+01
DINITROTOLUENE, 2,4- (2,4-DNT)	2.2E-01	carcinogenic effects	2.2E-01		7.3E+01
DINITROTOLUENE, 2,6- (2,6-DNT)	3.7E+01	noncarcinogenic effects			3.7E+01
DIOXANE, 1,4-	6.7E-01	carcinogenic effects	6.7E-01		1.1E+03
DIOXINS (TEQ)	1.2E-04	noncarcinogenic effects			1.2E-04
DIURON	7.3E+01	noncarcinogenic effects			7.3E+01
ENDOSULFAN	2.2E+02	noncarcinogenic effects			2.2E+02
ENDRIN	1.1E+01	noncarcinogenic effects			1.1E+01
ETHANOL					
ETHYLBENZENE	1.5E+00	carcinogenic effects	1.5E+00		1.3E+03
FLUORANTHENE	1.5E+03	noncarcinogenic effects			1.5E+03
FLUORENE	2.4E+02	noncarcinogenic effects			2.4E+02
GLYPHOSATE	3.7E+03	noncarcinogenic effects			3.7E+03
HEPTACHLOR	1.5E-02	carcinogenic effects	1.5E-02		1.8E+01
HEPTACHLOR EPOXIDE	7.4E-03	carcinogenic effects	7.4E-03		4.7E-01
HEXACHLOROBENZENE	4.2E-02	carcinogenic effects	4.2E-02		2.9E+01
HEXACHLOROBUTADIENE	8.6E-01	carcinogenic effects	8.6E-01		3.7E+01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	6.1E-02	carcinogenic effects	6.1E-02		1.1E+01
HEXACHLOROETHANE	4.8E+00	carcinogenic effects	4.8E+00		3.7E+01
HEXAZINONE	1.2E+03	noncarcinogenic effects			1.2E+03
INDENO(1,2,3-cd)PYRENE	9.2E-02	carcinogenic effects	9.2E-02	2.9E-02	
ISOPHORONE	7.1E+01	carcinogenic effects	7.1E+01		7.3E+03
LEAD					
MERCURY	6.2E-02	noncarcinogenic effects			6.2E-02
METHOXYCHLOR	1.8E+02	noncarcinogenic effects			1.8E+02
METHYL ETHYL KETONE	7.1E+03	noncarcinogenic effects			7.1E+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	1.2E+01	carcinogenic effects	1.2E+01		6.3E+03
METHYLENE CHLORIDE	4.8E+00	carcinogenic effects	4.8E+00		1.1E+03
METHYLNAPHTHALENE, 1-	4.7E+00	carcinogenic effects	4.7E+00		4.3E+02
METHYLNAPHTHALENE, 2-	2.4E+01	noncarcinogenic effects			2.4E+01
MOLYBDENUM	1.8E+02	noncarcinogenic effects			1.8E+02
NAPHTHALENE	1.4E-01	carcinogenic effects	1.4E-01		6.2E+00
NICKEL	1.8E+03	noncarcinogenic effects			1.8E+03
NITROBENZENE	1.2E-01	carcinogenic effects	1.2E-01		9.3E+00
NITROGLYCERIN	3.7E+00	noncarcinogenic effects	4.0E+00		3.7E+00
NITROTOLUENE, 2-	6.2E-02	carcinogenic effects	6.2E-02		5.5E+00
NITROTOLUENE, 3-	1.2E+02	noncarcinogenic effects			1.2E+02
NITROTOLUENE, 4-	4.2E+00	carcinogenic effects	4.2E+00		1.5E+02
PENTACHLOROPHENOL	1.7E-01	carcinogenic effects	1.7E-01		1.8E+02
PENTAERYTHRITOLTETRANITRATE (PETN)	1.7E+01	carcinogenic effects	1.7E+01		7.3E+01
PERCHLORATE	2.6E+01	noncarcinogenic effects			2.6E+01
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	3.4E-02		7.3E-01
PROPICONAZOLE	4.7E+02	noncarcinogenic effects			4.7E+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
SIMAZINE	5.6E-01	carcinogenic effects	5.6E-01		1.8E+02
STYRENE	1.6E+03	noncarcinogenic effects			1.6E+03
TERBACIL	4.7E+02	noncarcinogenic effects			4.7E+02
tert-BUTYL ALCOHOL	4.5E+00	carcinogenic effects	4.5E+00		
TETRACHLOROETHANE, 1,1,1,2-	5.2E-01	carcinogenic effects	5.2E-01		1.8E+02
TETRACHLOROETHANE, 1,1,2,2-	6.7E-02	carcinogenic effects	6.7E-02		7.3E+02
TETRACHLOROETHYLENE	1.1E-01	carcinogenic effects	1.1E-01		2.2E+02
TETRACHLOROPHENOL, 2,3,4,6-	1.1E+03	noncarcinogenic effects			1.1E+03
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	1.8E+03	noncarcinogenic effects			1.8E+03
THALLIUM	3.7E-01	noncarcinogenic effects			3.7E-01
TOLUENE	2.3E+03	noncarcinogenic effects			2.3E+03
TOXAPHENE	6.1E-02	carcinogenic effects	6.1E-02		
TPH (gasolines)	1.0E+02	noncarcinogenic effects			1.0E+02
TPH (middle distillates)	1.9E+02	noncarcinogenic effects			1.9E+02
TPH (residual fuels)	4.4E+03	noncarcinogenic effects			4.4E+03
TRICHLOROBENZENE, 1,2,4-	4.7E-01	carcinogenic effects	4.7E-01		4.1E+00
TRICHLOROETHANE, 1,1,1-	9.1E+03	noncarcinogenic effects			9.1E+03
TRICHLOROETHANE, 1,1,2-	2.4E-01	carcinogenic effects	2.4E-01		4.2E-01

TABLE D-3b. RISK-BASED ACTION LEVELS FOR TAPWATER
(ug/l)

CHEMICAL PARAMETER	Lowest Tapwater Goal (ug/L	Basis	Carcinogenic Effects	Mutagenic Effects	Noncancer Effects
TRICHLOROETHYLENE	2.0E+00	carcinogenic effects	2.0E+00		9.7E+00
TRICHLOROPHENOL, 2,4,5-	3.7E+03	noncarcinogenic effects			3.7E+03
TRICHLOROPHENOL, 2,4,6-	6.1E+00	carcinogenic effects	6.1E+00		3.7E+01
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	3.7E+02	noncarcinogenic effects			3.7E+02
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	2.9E+02	noncarcinogenic effects			2.9E+02
TRICHLOROPROPANE, 1,2,3-	4.5E-04	carcinogenic effects	4.5E-04	1.7E-04	6.2E-01
TRICHLOROPROPENE, 1,2,3-	6.2E-01	noncarcinogenic effects			6.2E-01
TRIFLURALIN	8.7E+00	carcinogenic effects	8.7E+00		2.7E+02
TRINITROBENZENE, 1,3,5-	1.1E+03	noncarcinogenic effects			1.1E+03
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	1.5E+02	noncarcinogenic effects			1.5E+02
TRINITROTOLUENE, 2,4,6- (TNT)	2.2E+00	carcinogenic effects	2.2E+00		1.8E+01
VANADIUM	1.8E+02	noncarcinogenic effects			1.8E+02
VINYL CHLORIDE	1.6E-02	carcinogenic effects	1.6E-02	2.8E-02	7.2E+01
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 Regional Screening Levels guidance (USEPA 2011a).

Notes:
Addresses use of water for drinking water and inhalation of volatile chemicals during showering.
Target risk = 10^{-6}. Target HQ = 1.0. See Appendix 2 for equations.
TPH (gasolines) action level rounded from 95 ug/L to 100 ug/L.

TABLE D-4a. SUMMARY OF AQUATIC HABITAT GOALS

	Estuarine		Freshwater		Marine	
CONTAMINANT	Chronic Aquatic Toxicity (ug/L)	Acute Aquatic Toxicity (ug/L)	Chronic Aquatic Toxicity (ug/L)	Acute Aquatic Toxicity (ug/L)	Chronic Aquatic Toxicity (ug/L)	Acute Aquatic Toxicity (ug/L)
ACENAPHTHENE	2.3E+01	3.2E+02	2.3E+01	5.7E+02	4.0E+01	3.2E+02
ACENAPHTHYLENE	3.0E+01	3.0E+02	3.0E+01	3.0E+02	3.0E+01	3.0E+02
ACETONE	1.5E+03	1.5E+03	1.5E+03	1.5E+03	1.5E+03	1.5E+03
ALDRIN	1.3E-01	1.3E+00	3.0E-01	3.0E+00	1.3E-01	1.3E+00
AMETRYN	1.5E+01	1.5E+02	1.5E+01	1.5E+02	1.5E+01	1.5E+02
AMINO,2- DINITROTOLUENE,4,6-	1.5E+01	1.5E+02	1.5E+01	1.5E+02	1.5E+01	1.5E+02
AMINO,4- DINITROTOLUENE,2,6-	1.5E+01	1.5E+02	1.5E+01	1.5E+02	1.5E+01	1.5E+02
ANTHRACENE	7.3E-01	3.0E+02	7.3E-01	3.0E+02	7.3E-01	3.0E+02
ANTIMONY	3.0E+01	1.5E+03	3.0E+01	3.0E+03	5.0E+02	1.5E+03
ARSENIC	3.6E+01	6.9E+01	1.9E+02	3.6E+02	3.6E+01	6.9E+01
ATRAZINE	1.2E+01	3.5E+02	1.2E+01	3.5E+02	2.6E+01	7.6E+02
BARIUM	2.0E+02	1.0E+03	2.0E+02	1.0E+03	2.0E+02	1.0E+03
BENZENE	4.6E+01	1.7E+03	4.6E+01	1.8E+03	3.5E+02	1.7E+03
BENZO(a)ANTHRACENE	2.7E-02	3.0E+02	2.7E-02	3.0E+02	2.7E-02	3.0E+02
BENZO(a)PYRENE	1.4E-02	3.0E+02	1.4E-02	3.0E+02	1.4E-02	3.0E+02
BENZO(b)FLUORANTHENE	9.1E+00	3.0E+02	9.1E+00	3.0E+02	9.1E+00	3.0E+02
BENZO(g,h,i)PERYLENE	1.0E-01	3.0E+02	1.0E-01	3.0E+02	1.0E-01	3.0E+02
BENZO(k)FLUORANTHENE	3.7E+00	3.0E+02	3.7E+00	3.0E+02	3.7E+00	3.0E+02
BERYLLIUM	2.7E+00	4.3E+01	2.7E+00	4.3E+01	2.7E+00	4.3E+01
BIPHENYL, 1,1-	1.4E+01	1.4E+01	1.4E+01	1.4E+01	1.4E+01	1.4E+01
BIS(2-CHLOROETHYL)ETHER	6.1E+01	2.4E+05	6.1E+01	2.4E+05	6.1E+01	2.4E+05
BIS(2-CHLOROISOPROPYL)ETHER	6.1E+01	2.4E+05	6.1E+01	2.4E+05	6.1E+01	2.4E+05
BIS(2-ETHYLHEXYL)PHTHALATE	3.2E+01	3.2E+01	3.2E+01	3.2E+01	3.2E+01	3.2E+01
BORON	7.3E+03	7.3E+03	7.3E+03	7.3E+03	7.3E+03	7.3E+03
BROMODICHLOROMETHANE	3.2E+03	1.1E+04	3.2E+03	1.1E+04	3.2E+03	1.2E+04
BROMOFORM	3.2E+03	1.1E+04	3.2E+03	1.1E+04	3.2E+03	1.2E+04
BROMOMETHANE	1.6E+02	1.1E+04	1.6E+02	1.1E+04	3.2E+03	1.2E+04
CADMIUM	3.0E+00	3.0E+00	3.0E+00	3.0E+00	9.3E+00	4.3E+01
CARBON TETRACHLORIDE	9.8E+00	1.2E+04	9.8E+00	1.2E+04	3.2E+03	1.6E+04
CHLORDANE (TECHNICAL)	4.0E-03	9.0E-02	4.3E-03	2.4E+00	4.0E-03	9.0E-02
CHLOROANILINE, p-	5.0E+00	5.0E+00	5.0E+00	5.0E+00	5.0E+00	5.0E+00
CHLOROBENZENE	2.5E+01	1.6E+02	2.5E+01	2.5E+02	6.5E+01	1.6E+02
CHLOROETHANE	2.1E+04	2.1E+04	2.1E+04	2.1E+04	2.1E+04	2.1E+04
CHLOROFORM	6.2E+02	9.6E+03	6.2E+02	9.6E+03	3.2E+03	1.2E+04
CHLOROMETHANE	3.2E+03	1.1E+04	3.2E+03	1.1E+04	3.2E+03	1.2E+04
CHLOROPHENOL, 2-	1.4E+02	1.4E+03	1.4E+02	1.4E+03	1.4E+02	1.4E+03
CHROMIUM (Total)	7.4E+01	5.7E+02	7.4E+01	5.7E+02	1.0E+04	1.0E+04
CHROMIUM III	7.4E+01	5.7E+02	7.4E+01	5.7E+02	7.4E+01	1.0E+04
CHROMIUM VI	1.1E+01	1.6E+01	1.1E+01	1.6E+01	5.0E+01	1.1E+03
CHRYSENE	3.5E-01	3.0E+02	3.5E-01	3.0E+02	3.5E-01	3.0E+02
COBALT	3.0E+00	3.0E+00	3.0E+00	3.0E+00	3.0E+00	3.0E+00
COPPER	2.9E+00	2.9E+00	6.0E+00	6.0E+00	2.9E+00	2.9E+00

TABLE D-4a. SUMMARY OF AQUATIC HABITAT GOALS

	Estuarine		Freshwater		Marine	
CONTAMINANT	Chronic Aquatic Toxicity (ug/L)	Acute Aquatic Toxicity (ug/L)	Chronic Aquatic Toxicity (ug/L)	Acute Aquatic Toxicity (ug/L)	Chronic Aquatic Toxicity (ug/L)	Acute Aquatic Toxicity (ug/L)
CYANIDE (Free)	1.0E+00	1.0E+00	5.2E+00	2.2E+01	1.0E+00	1.0E+00
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	1.9E+02	1.4E+03	1.9E+02	1.4E+03	1.9E+02	1.4E+03
DALAPON	3.0E+02	3.0E+03	3.0E+02	3.0E+03	3.0E+02	3.0E+03
DIBENZO(a,h)ANTHTRACENE	7.5E+00	3.0E+02	7.5E+00	3.0E+02	7.5E+00	3.0E+02
DIBROMO-3-CHLOROPROPANE, 1,2-	4.0E-02	4.0E-02	4.0E-02	4.0E-02	4.0E-02	4.0E-02
DIBROMOCHLOROMETHANE	3.2E+03	1.1E+04	3.2E+03	1.1E+04	3.2E+03	1.2E+04
DIBROMOETHANE, 1,2-	1.4E+03	1.4E+03	1.4E+03	1.4E+03	1.4E+03	1.4E+03
DICHLOROBENZENE, 1,2-	1.4E+01	3.7E+02	1.4E+01	3.7E+02	6.5E+01	6.6E+02
DICHLOROBENZENE, 1,3-	6.5E+01	3.7E+02	7.1E+01	3.7E+02	6.5E+01	6.6E+02
DICHLOROBENZENE, 1,4-	1.5E+01	3.7E+02	1.5E+01	3.7E+02	6.5E+01	6.6E+02
DICHLOROBENZIDINE, 3,3-	2.5E+02	2.5E+02	2.5E+02	2.5E+02	2.5E+02	2.5E+02
DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.0E-03	6.0E-01	1.0E-03	6.0E-01	1.0E-03	3.6E+00
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.0E-03	1.1E+00	1.0E-03	1.1E+00	1.0E-03	1.4E+01
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.0E-03	1.3E-02	1.0E-03	1.1E+00	1.0E-03	1.3E-02
DICHLOROETHANE, 1,1-	4.7E+01	4.7E+01	4.7E+01	4.7E+01	4.7E+01	4.7E+01
DICHLOROETHANE, 1,2-	1.0E+04	3.8E+04	1.0E+04	3.9E+04	1.0E+04	3.8E+04
DICHLOROETHYLENE, 1,1-	2.5E+01	3.9E+03	2.5E+01	3.9E+03	2.5E+01	7.5E+04
DICHLOROETHYLENE, Cis 1,2-	5.9E+02	1.2E+04	5.9E+02	1.2E+04	5.9E+02	2.2E+05
DICHLOROETHYLENE, Trans 1,2-	5.9E+02	1.2E+04	5.9E+02	1.2E+04	5.9E+02	2.2E+05
DICHLOROPHENOL, 2,4-	1.8E+02	6.7E+02	1.8E+02	6.7E+02	1.8E+02	6.7E+02
DICHLOROPHENOXYACETIC ACID (2,4-D)	4.0E+01	2.0E+02	2.2E+02	2.9E+03	4.0E+01	2.0E+02
DICHLOROPROPANE, 1,2-	1.5E+03	3.4E+03	2.9E+03	7.7E+03	1.5E+03	3.4E+03
DICHLOROPROPENE, 1,3-	1.2E+02	2.6E+02	1.2E+02	2.0E+03	1.2E+02	2.6E+02
DIELDRIN	1.9E-03	7.1E-01	1.9E-03	2.5E+00	1.9E-03	7.1E-01
DIETHYLPHTHALATE	1.5E+00	9.4E+02	1.5E+00	9.4E+02	1.7E+00	2.9E+03
DIMETHYLPHENOL, 2,4-	1.1E+02	2.7E+02	5.3E+02	7.0E+02	1.1E+02	2.7E+02
DIMETHYLPHTHALATE	1.5E+00	9.4E+02	1.5E+00	9.4E+02	1.7E+00	2.9E+03
DINITROBENZENE, 1,3-	3.0E+01	1.1E+02	3.0E+01	1.1E+02	3.0E+01	1.1E+02
DINITROPHENOL, 2,4-	7.5E+01	2.3E+02	7.5E+01	2.3E+02	7.5E+01	4.9E+03
DINITROTOLUENE, 2,4- (2,4-DNT)	4.4E+01	1.1E+02	4.4E+01	1.1E+02	6.7E+01	2.0E+02
DINITROTOLUENE, 2,6- (2,6-DNT)	4.4E+01	1.1E+02	4.4E+01	1.1E+02	6.7E+01	2.0E+02
DIOXANE, 1,4-	3.4E+05	3.4E+06	3.4E+05	3.4E+06	5.0E+05	5.0E+06
DIOXINS (TEQ)	5.0E-06	3.0E-03	5.0E-06	3.0E-03	5.0E-06	3.0E-03
DIURON	6.0E+01	2.0E+02	6.0E+01	2.0E+02	6.0E+01	5.5E+02
ENDOSULFAN	8.7E-03	3.4E-02	5.6E-02	2.2E-01	8.7E-03	3.4E-02
ENDRIN	2.3E-03	3.7E-02	2.3E-03	1.8E-01	2.3E-03	3.7E-02
ETHANOL						
ETHYLBENZENE	2.9E+02	4.3E+02	2.9E+02	1.1E+04	2.9E+02	4.3E+02
FLUORANTHENE	8.0E+00	3.0E+02	8.1E+00	3.0E+02	8.0E+00	3.0E+02
FLUORENE	3.9E+00	3.0E+02	3.9E+00	3.0E+02	3.9E+00	3.0E+02
GLYPHOSATE	6.5E+01	6.0E+02	6.5E+01	6.0E+02	6.5E+01	6.0E+02
HEPTACHLOR	3.6E-03	5.3E-02	3.8E-03	5.2E-01	3.6E-03	5.3E-02

TABLE D-4a. SUMMARY OF AQUATIC HABITAT GOALS

	Estuarine		Freshwater		Marine	
CONTAMINANT	Chronic Aquatic Toxicity (ug/L)	Acute Aquatic Toxicity (ug/L)	Chronic Aquatic Toxicity (ug/L)	Acute Aquatic Toxicity (ug/L)	Chronic Aquatic Toxicity (ug/L)	Acute Aquatic Toxicity (ug/L)
HEPTACHLOR EPOXIDE	3.6E-03	5.3E-02	3.8E-03	5.2E-01	3.6E-03	5.3E-02
HEXACHLOROBENZENE	3.7E+00	6.0E+00	3.7E+00	6.0E+00	6.5E+01	6.2E+00
HEXACHLOROBUTADIENE	4.7E+00	1.1E+01	4.7E+00	3.0E+01	4.7E+00	1.1E+01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	8.0E-02	1.6E-01	8.0E-02	2.0E+00	8.0E-02	1.6E-01
HEXACHLOROETHANE	1.2E+01	3.1E+02	1.2E+01	3.3E+02	1.2E+01	3.1E+02
HEXAZINONE	5.0E+03	5.0E+04	5.0E+03	5.0E+04	5.0E+03	5.0E+04
INDENO(1,2,3-cd)PYRENE	4.3E+00	3.0E+02	4.3E+00	3.0E+02	4.3E+00	3.0E+02
ISOPHORONE	1.3E+02	4.3E+03	1.2E+03	3.9E+04	1.3E+02	4.3E+03
LEAD	5.6E+00	2.9E+01	2.9E+01	2.9E+01	5.6E+00	1.4E+02
MERCURY	2.5E-02	2.1E+00	5.5E-01	2.4E+00	2.5E-02	2.1E+00
METHOXYCHLOR	3.0E-02	3.0E-02	3.0E-02	3.0E-02	3.0E-02	3.0E-02
METHYL ETHYL KETONE	1.4E+04	1.4E+04	1.4E+04	1.4E+04	1.4E+04	1.4E+04
METHYL ISOBUTYL KETONE	1.7E+02	1.7E+02	1.7E+02	1.7E+02	1.7E+02	1.7E+02
METHYL MERCURY	3.0E-03	3.0E-03	3.0E-03	3.0E-03	3.0E-03	3.0E-03
METHYL TERT BUTYL ETHER	1.8E+04	5.3E+04	5.1E+04	1.5E+05	1.8E+04	5.3E+04
METHYLENE CHLORIDE	2.2E+03	1.1E+04	2.2E+03	1.1E+04	3.2E+03	1.2E+04
METHYLNAPHTHALENE, 1-	2.1E+00	3.0E+02	2.1E+00	3.0E+02	2.1E+00	3.0E+02
METHYLNAPHTHALENE, 2-	2.1E+00	3.0E+02	2.1E+00	3.0E+02	2.1E+00	3.0E+02
MOLYBDENUM	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02
NAPHTHALENE	2.4E+01	7.7E+02	2.4E+01	7.7E+02	2.4E+01	7.8E+02
NICKEL	5.0E+00	5.0E+00	5.0E+00	5.0E+00	8.3E+00	7.5E+01
NITROBENZENE	6.0E+01	2.0E+03	2.2E+02	9.0E+03	6.0E+01	2.0E+03
NITROGLYCERIN	1.4E+02	1.4E+02	1.4E+02	1.4E+02	1.4E+02	1.4E+02
NITROTOLUENE, 2-	1.0E+03	7.5E+03	1.0E+03	7.5E+03	1.0E+03	7.5E+03
NITROTOLUENE, 3-	3.8E+02	3.8E+03	3.8E+02	3.8E+03	3.8E+02	3.8E+03
NITROTOLUENE, 4-	1.6E+03	3.3E+03	1.6E+03	1.7E+04	1.6E+03	3.3E+03
PENTACHLOROPHENOL	7.9E+00	1.3E+01	1.3E+01	2.0E+01	7.9E+00	1.3E+01
PENTAERYTHRITOLTETRANITRATE (PETN)	8.5E+04	4.3E+04	8.5E+04	4.3E+04	8.5E+04	4.3E+04
PERCHLORATE	6.0E+02	6.0E+02	6.0E+02	6.0E+02	6.0E+02	6.0E+02
PHENANTHRENE	4.6E+00	3.0E+02	6.3E+00	3.0E+02	4.6E+00	3.0E+02
PHENOL	1.3E+03	3.4E+03	1.3E+03	3.4E+03	1.3E+03	5.8E+03
POLYCHLORINATED BIPHENYLS (PCBs)	1.4E-02	2.0E+00	1.4E-02	2.0E+00	3.0E-02	1.0E+01
PROPICONAZOLE	2.6E+01	2.6E+02	4.2E+01	4.2E+02	2.6E+01	2.6E+02
PYRENE	2.0E+00	3.0E+02	2.0E+00	3.0E+02	2.0E+00	3.0E+02
SELENIUM	5.0E+00	2.0E+01	5.0E+00	2.0E+01	7.1E+01	3.0E+02
SILVER	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	2.3E+00
SIMAZINE	2.0E+00	1.0E+01	1.7E+01	3.1E+02	2.0E+00	1.0E+01
STYRENE	3.2E+01	3.2E+01	3.2E+01	3.2E+01	3.2E+01	3.2E+01
TERBACIL	2.3E+03	2.3E+04	2.3E+03	2.3E+04	2.3E+03	2.3E+04
tert-BUTYL ALCOHOL	1.8E+04	1.8E+05	1.8E+04	1.8E+05	1.8E+04	1.8E+05
TETRACHLOROETHANE, 1,1,1,2-	3.1E+02	3.1E+03	3.1E+02	3.1E+03	3.1E+02	3.1E+03
TETRACHLOROETHANE, 1,1,2,2-	4.2E+02	3.0E+03	4.2E+02	9.3E+03	4.2E+02	3.0E+03

TABLE D-4a. SUMMARY OF AQUATIC HABITAT GOALS

	Estuarine		Freshwater		Marine	
CONTAMINANT	**Chronic Aquatic Toxicity (ug/L)**	**Acute Aquatic Toxicity (ug/L)**	**Chronic Aquatic Toxicity (ug/L)**	**Acute Aquatic Toxicity (ug/L)**	**Chronic Aquatic Toxicity (ug/L)**	**Acute Aquatic Toxicity (ug/L)**
TETRACHLOROETHYLENE	1.2E+02	1.8E+03	1.2E+02	1.8E+03	1.5E+02	3.4E+03
TETRACHLOROPHENOL, 2,3,4,6-	1.2E+00	1.0E+01	1.2E+00	2.2E+01	4.0E+00	1.0E+01
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	3.3E+02	1.9E+03	3.3E+02	1.9E+03	3.3E+02	1.9E+03
THALLIUM	2.0E+01	4.7E+02	2.0E+01	4.7E+02	2.0E+01	7.1E+02
TOLUENE	1.3E+02	5.8E+03	1.3E+02	5.8E+03	2.5E+03	6.3E+03
TOXAPHENE	2.0E-04	2.1E-01	2.0E-04	7.3E-01	2.0E-04	2.1E-01
TPH (gasolines)	5.0E+02	5.0E+03	5.0E+02	5.0E+03	3.7E+03	5.0E+03
TPH (middle distillates)	6.4E+02	2.5E+03	6.4E+02	2.5E+03	6.4E+02	2.5E+03
TPH (residual fuels)	6.4E+02	2.5E+03	6.4E+02	2.5E+03	6.4E+02	2.5E+03
TRICHLOROBENZENE, 1,2,4-	2.5E+01	1.6E+02	2.5E+01	2.5E+02	6.5E+01	1.6E+02
TRICHLOROETHANE, 1,1,1-	6.2E+01	6.0E+03	6.2E+01	6.0E+03	6.2E+01	1.0E+04
TRICHLOROETHANE, 1,1,2-	4.7E+03	6.0E+03	4.7E+03	6.0E+03	4.7E+03	6.0E+03
TRICHLOROETHYLENE	3.6E+02	7.0E+02	3.6E+02	1.5E+04	3.6E+02	7.0E+02
TRICHLOROPHENOL, 2,4,5-	1.1E+01	1.0E+02	6.3E+01	1.0E+02	1.1E+01	2.4E+02
TRICHLOROPHENOL, 2,4,6-	4.9E+02	4.9E+02	4.9E+02	4.9E+02	4.9E+02	4.9E+02
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	6.9E+02	6.9E+02	6.9E+02	6.9E+02	6.9E+02	6.9E+02
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	3.0E+01	3.0E+01	3.0E+01	3.0E+01	3.0E+01	3.0E+01
TRICHLOROPROPANE, 1,2,3-	1.4E+01	1.4E+02	1.4E+01	1.4E+02	1.4E+01	1.4E+02
TRICHLOROPROPENE, 1,2,3-	6.2E-01	6.2E-01	6.2E-01	6.2E-01	6.2E-01	6.2E-01
TRIFLURALIN	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01
TRINITROBENZENE, 1,3,5-	3.0E+01	1.4E+02	3.0E+01	1.4E+02	3.0E+01	1.4E+02
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	1.5E+02	1.5E+02	1.5E+02	1.5E+02	1.5E+02	1.5E+02
TRINITROTOLUENE, 2,4,6- (TNT)	1.3E+02	5.7E+02	1.3E+02	5.7E+02	1.3E+02	5.7E+02
VANADIUM	1.9E+01	1.9E+01	1.9E+01	1.9E+01	1.9E+01	1.9E+01
VINYL CHLORIDE	7.8E+02	7.8E+02	7.8E+02	7.8E+02	7.8E+02	7.8E+02
XYLENES	1.0E+02	1.0E+03	1.0E+02	1.0E+03	1.0E+02	1.0E+03
ZINC	2.2E+01	2.2E+01	2.2E+01	2.2E+01	8.6E+01	9.5E+01

Notes:

Reference: Appendix 1, Table D-4b (chronic) and D-4c (acute).

Aquatic goals for estuarine environments based on lowest of lowest of freshwater and marine goals.

TABLE D-4b. SUMMARY OF SELECTED CHRONIC AQUATIC HABITAT GOALS

	[1]Aquatic Habitat Goals					
CHEMICAL PARAMETER	[1]Estuarine Aquatic Habitat Goal (ug/L)	Basis	Lowest Freshwater Aquatic Habitat Goal (ug/L)	Basis	Lowest Marine Aquatic Habitat Goal (ug/L)	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% USEPA SW CMC	3.0E-01	10% USEPA FW CMC	1.3E-01	10% USEPA SW CMC
AMETRYN	1.5E+01	5% FW Acute LC50	1.5E+01	5% FW Acute LC50	1.5E+01	5% FW Acute LC50
AMINO,2- DINITROTOLUENE,4,6-	1.5E+01	5% FW Acute LC50	1.5E+01	5% FW Acute LC50	1.5E+01	5% FW Acute LC50
AMINO,4- DINITROTOLUENE,2,6-	1.5E+01	5% FW Acute LC50	1.5E+01	5% FW Acute LC50	1.5E+01	5% FW Acute LC50
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	USEPA FW CCC	3.0E+01	USEPA FW CCC	5.0E+02	USEPA SW CCC
ARSENIC	3.6E+01	Hawai'i Chronic SW WQS	1.9E+02	Hawai'i Chronic FW WQS	3.6E+01	Hawai'i Chronic SW WQS
ATRAZINE	1.2E+01	USEPA FW CCC	1.2E+01	USEPA FW CCC	2.6E+01	USEPA SW CCC
BARIUM	2.0E+02	BC SW Chronic	2.0E+02	BC SW Chronic	2.0E+02	BC SW Chronic
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	9.1E+00	USEPA Reg. V FW Chronic	9.1E+00	USEPA Reg. V FW Chronic	9.1E+00	USEPA Reg. V FW Chronic
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	7.3E+03	=Drinking Water (Table D-3a)	7.3E+03	=Drinking Water (Table D-3a)	7.3E+03	=Drinking Water (Table D-3a)
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	3.0E+00	Hawai'i Chronic FW WQS	3.0E+00	Hawai'i Chronic FW WQS	9.3E+00	Hawai'i Chronic SW WQS
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 (TECHNICAL)	4.0E-03	Hawai'i Chronic SW WQS	4.3E-03	Hawai'i Chronic FW WQS	4.0E-03	Hawai'i Chronic SW WQS
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	2.1E+04	=Drinking Water (Table D-3a)	2.1E+04	=Drinking Water (Table D-3a)	2.1E+04	=Drinking Water (Table D-3a)
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-	1.4E+02	10% HI DOH FW Acute	1.4E+02	10% HI DOH FW Acute	1.4E+02	10% HI DOH FW Acute
CHROMIUM (Total)	7.4E+01	=Cr III	7.4E+01	=Cr III	1.0E+04	=Cr III
CHROMIUM III	7.4E+01	USEPA FW CCC	7.4E+01	USEPA FW CCC	7.4E+01	USEPA FW CCC
CHROMIUM VI	1.1E+01	Hawai'i Chronic FW WQS	1.1E+01	Hawai'i Chronic FW WQS	5.0E+01	Hawai'i Chronic SW WQS
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

TABLE D-4b. SUMMARY OF SELECTED CHRONIC AQUATIC HABITAT GOALS

	[1]Aquatic Habitat Goals					
CHEMICAL PARAMETER	[1]Estuarine Aquatic Habitat Goal (ug/L)	Basis	Lowest Freshwater Aquatic Habitat Goal (ug/L)	Basis	Lowest Marine Aquatic Habitat Goal (ug/L)	Basis
COPPER	2.9E+00	Hawai'i Chronic SW WQS	6.0E+00	Hawai'i Chronic FW WQS	2.9E+00	Hawai'i Chronic SW WQS
CYANIDE (Free)	1.0E+00	Hawai'i Chronic SW WQS	5.2E+00	Hawai'i Chronic FW WQS	1.0E+00	Hawai'i Chronic SW WQS
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	1.9E+02	ORNL FW SCV	1.9E+02	ORNL FW SCV	1.9E+02	ORNL FW SCV
DALAPON	3.0E+02	5% FW Acute LC50	3.0E+02	5% FW Acute LC50	3.0E+02	5% FW Acute LC50
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
DIBROMO,1,2- CHLOROPROPANE,3-	4.0E-02	=Drinking Water (Table D-3a)	4.0E-02	=Drinking Water (Table D-3a)	4.0E-02	=Drinking Water (Table D-3a)
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	Hawai'i Chronic FW WQS	1.0E-03	Hawai'i Chronic FW WQS	1.0E-03	Hawai'i Chronic SW WQS
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
DICHLOROPHENOXYACETIC ACID (2,4-D)	4.0E+01	UK SW WQS	2.2E+02	MDEQ FW FCV	4.0E+01	UK SW WQS
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	Hawai'i Chronic FW WQS	1.9E-03	Hawai'i Chronic FW WQS	1.9E-03	Hawai'i Chronic SW WQS
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	USEPA SW CCC	5.3E+02	USEPA FW CCC	1.1E+02	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
DINITROBENZENE, 1,3-	3.0E+01	ORNL FW SCV	3.0E+01	ORNL FW SCV	3.0E+01	ORNL FW SCV
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- (2,4-DNT)	4.4E+01	USEPA Reg. V FW Chronic	4.4E+01	USEPA Reg. V FW Chronic	6.7E+01	USEPA Region IV
DINITROTOLUENE, 2,6- (2,6-DNT)	4.4E+01	=2,4 DNT	4.4E+01	=2,4 DNT	6.7E+01	=2,4 DNT
DIOXANE, 1,4-	3.4E+05	5% Acute FW LC 50	3.4E+05	5% Acute FW LC 50	5.0E+05	5% Acute SW LC 50
DIOXINS (TEQ)	5.0E-06	50% USEPA FW Chronic LOEL	5.0E-06	50% USEPA FW Chronic LOEL	5.0E-06	50% USEPA FW Chronic LOEL
DIURON	6.0E+01	50% FW EC50	6.0E+01	50% FW EC50	6.0E+01	50% FW EC50
ENDOSULFAN	8.7E-03	Hawai'i Chronic SW WQS	5.6E-02	Hawai'i Chronic FW WQS	8.7E-03	Hawai'i Chronic SW WQS
ENDRIN	2.3E-03	Hawai'i Chronic FW WQS	2.3E-03	Hawai'i Chronic FW WQS	2.3E-03	Hawai'i Chronic SW WQS
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

TABLE D-4b. SUMMARY OF SELECTED CHRONIC AQUATIC HABITAT GOALS

	[1]Aquatic Habitat Goals					
CHEMICAL PARAMETER	[1]Estuarine Aquatic Habitat Goal (ug/L)	Basis	Lowest Freshwater Aquatic Habitat Goal (ug/L)	Basis	Lowest Marine Aquatic Habitat Goal (ug/L)	Basis
GLYPHOSATE	6.5E+01	CCME EQG	6.5E+01	CCME EQG	6.5E+01	CCME EQG
HEPTACHLOR	3.6E-03	Hawai'i Chronic SW WQS	3.8E-03	Hawai'i Chronic FW WQS	3.6E-03	Hawai'i Chronic SW WQS
HEPTACHLOR EPOXIDE	3.6E-03	USEPA SW CCC	3.8E-03	USEPA FW CCC	3.6E-03	USEPA SW CCC
HEXACHLOROBENZENE	3.7E+00	USEPA FW CCC	3.7E+00	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	Hawai'i Chronic FW WQS	8.0E-02	Hawai'i Chronic FW WQS	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
HEXAZINONE	5.0E+03	5% FW Acute LC50	5.0E+03	5% FW Acute LC50	5.0E+03	5% FW Acute LC50
INDENO(1,2,3-cd)PYRENE	4.3E+00	USEPA Reg. V FW Chronic	4.3E+00	USEPA Reg. V FW Chronic	4.3E+00	USEPA Reg. V FW Chronic
ISOPHORONE	1.3E+02	USEPA Reg. IV SW Chronic	1.2E+03	USEPA Reg. IV FW Chronic	1.3E+02	USEPA Reg. IV SW Chronic
LEAD	5.6E+00	Hawai'i Chronic SW WQS	2.9E+01	Hawai'i Chronic FW WQS	5.6E+00	Hawai'i Chronic SW WQS
MERCURY	2.5E-02	Hawai'i Chronic SW WQS	5.5E-01	Hawai'i Chronic FW WQS	2.5E-02	Hawai'i Chronic SW WQS
METHOXYCHLOR	3.0E-02	Hawai'i Chronic FW WQS	3.0E-02	Hawai'i Chronic FW WQS	3.0E-02	Hawai'i Chronic SW WQS
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	1.8E+04	USEPA SW CCC	5.1E+04	USEPA FW CCC	1.8E+04	USEPA SW CCC
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, 1-	2.1E+00	USDOE FW Chronic PRG	2.1E+00	USDOE FW Chronic PRG	2.1E+00	USDOE FW Chronic PRG
METHYLNAPHTHALENE, 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	5.0E+00	Hawai'i Chronic FW WQS	5.0E+00	Hawai'i Chronic FW WQS	8.3E+00	Hawai'i Chronic SW WQS
NITROBENZENE	6.0E+01	USEPA Reg. IV FW Chronic	2.2E+02	MDEQ FW FCV	6.0E+01	USEPA Reg. IV FW Chronic
NITROGLYCERIN	1.4E+02	USEPA Reg. VI FW Chronic	1.4E+02	USEPA Reg. VI FW Chronic	1.4E+02	USEPA Reg. VI FW Chronic
NITROTOLUENE, 2-	1.0E+03	=3 NT	1.0E+03	=3 NT	1.0E+03	=3 NT
NITROTOLUENE, 3-	3.8E+02	5% FW Acute LC50	3.8E+02	5% FW Acute LC50	3.8E+02	5% FW Acute LC50
NITROTOLUENE, 4-	1.6E+03	50% FW EC50	1.6E+03	50% FW EC50	1.6E+03	50% FW EC50
PENTACHLOROPHENOL	7.9E+00	USEPA SW CCC	1.3E+01	Hawai'i Chronic FW WQS	7.9E+00	USEPA SW CCC
PENTAERYTHRITOLTETRANITRATE (PETN)	8.5E+04	USEPA Reg. VI FW Chronic	8.5E+04	USEPA Reg. VI FW Chronic	8.5E+04	USEPA Reg. VI FW Chronic
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	USEPA SW CCC	6.3E+00	USEPA FW CCC	4.6E+00	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	Hawai'i Chronic FW WQS	1.4E-02	Hawai'i Chronic FW WQS	3.0E-02	Hawai'i Chronic SW WQS
PROPICONAZOLE	2.6E+01	5% SW LC50	4.2E+01	5% FW Acute LC50	2.6E+01	5% SW LC50
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	Hawai'i Chronic FW WQS	5.0E+00	Hawai'i Chronic FW WQS	7.1E+01	Hawai'i Chronic SW WQS
SILVER	1.0E+00	Hawai'i Chronic FW WQS	1.0E+00	Hawai'i Chronic FW WQS	1.0E+00	HI DOH FW Chronic
SIMAZINE	2.0E+00	UK SW WQS	1.7E+01	MDEQ FW FCV	2.0E+00	UK SW WQS
STYRENE	3.2E+01	USEPA Reg. VI FW Chronic	3.2E+01	USEPA Reg. VI FW Chronic	3.2E+01	USEPA Reg. VI FW Chronic
TERBACIL	2.3E+03	5% FW Acute LC50	2.3E+03	5% FW Acute LC50	2.3E+03	5% FW Acute LC50

TABLE D-4b. SUMMARY OF SELECTED CHRONIC AQUATIC HABITAT GOALS

	[1]Aquatic Habitat Goals					
CHEMICAL PARAMETER	[1]Estuarine Aquatic Habitat Goal (ug/L)	Basis	Lowest Freshwater Aquatic Habitat Goal (ug/L)	Basis	Lowest Marine Aquatic Habitat Goal (ug/L)	Basis
tert-BUTYL ALCOHOL	1.8E+04	10% Acute FW LC0	1.8E+04	10% Acute FW LC0	1.8E+04	10% Acute FW LC0
TETRACHLOROETHANE, 1,1,1,2-	3.1E+02	10% HI DOH FW Acute	3.1E+02	10% HI DOH FW Acute	3.1E+02	10% HI DOH FW Acute
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	1.5E+02	Hawai'i Chronic SW WQS
TETRACHLOROPHENOL, 2,3,4,6-	1.2E+00	MDEQ FW FCV	1.2E+00	MDEQ FW FCV	4.0E+00	CA Daily SW Max
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	3.3E+02	ORNL FW SCV	3.3E+02	ORNL FW SCV	3.3E+02	ORNL FW SCV
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	Hawai'i Chronic FW WQS	2.0E-04	Hawai'i Chronic FW WQS	2.0E-04	Hawai'i Chronic SW WQS
TPH (gasolines)	5.0E+02	CA FW Chronic	5.0E+02	CA FW Chronic	3.7E+03	CA SW Chronic
TPH (middle distillates)	6.4E+02	CA FW Chronic	6.4E+02	CA FW Chronic	6.4E+02	CA FW Chronic
TPH (residual fuels)	6.4E+02	CA FW Chronic	6.4E+02	CA FW Chronic	6.4E+02	CA FW Chronic
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	USEPA SW CCC	6.3E+01	USEPA FW CCC	1.1E+01	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
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	6.9E+02	USEPA Reg. V FW Chronic	6.9E+02	USEPA Reg. V FW Chronic	6.9E+02	USEPA Reg. V FW Chronic
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	3.0E+01	USEPA Reg. V FW Chronic	3.0E+01	USEPA Reg. V FW Chronic	3.0E+01	USEPA Reg. V FW Chronic
TRICHLOROPROPANE, 1,2,3-	1.4E+01	50% FW EC50	1.4E+01	50% FW EC50	1.4E+01	50% FW EC50
TRICHLOROPROPENE, 1,2,3-	6.2E-01	=Drinking Water (Table D-3a)	6.2E-01	=Drinking Water (Table D-3a)	6.2E-01	=Drinking Water (Table D-3a)
TRIFLURALIN	2.0E+01	CCME FW EQG	2.0E+01	CCME FW EQG	2.0E+01	CCME FW EQG
TRINITROBENZENE, 1,3,5-	3.0E+01	ORNL FW SCV	3.0E+01	ORNL FW SCV	3.0E+01	ORNL FW SCV
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	1.5E+02	=Drinking Water (Table D-3a)	1.5E+02	=Drinking Water (Table D-3a)	1.5E+02	=Drinking Water (Table D-3a)
TRINITROTOLUENE, 2,4,6- (TNT)	1.3E+02	ORNL FW SCV	1.3E+02	ORNL FW SCV	1.3E+02	ORNL FW SCV
VANADIUM	1.9E+01	USEPA Ecotox FW Chronic	1.9E+01	USEPA Ecotox FW Chronic	1.9E+01	USEPA Ecotox FW Chronic

TABLE D-4b. SUMMARY OF SELECTED CHRONIC AQUATIC HABITAT GOALS

	[1]Aquatic Habitat Goals					
CHEMICAL PARAMETER	**[1]Estuarine Aquatic Habitat Goal (ug/L)**	**Basis**	**Lowest Freshwater Aquatic Habitat Goal (ug/L)**	**Basis**	**Lowest Marine Aquatic Habitat Goal (ug/L)**	**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	2.2E+01	Hawai'i Chronic FW WQS	2.2E+01	Hawai'i Chronic FW WQS	8.6E+01	Hawai'i Chronic SW WQS

Notes:

1. Refer to Table D-4d and D-4e for summary of aquatic habitat goal sources. Lowest Estuary Goal = Lowest of Freshwater vs Marine chronic goals. Used for selection of groundwater action levels.

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

USEPA Ecotox FW chronic aquatic toxicity screening level of 240 ug/L for ethylbenzene used in preference of older, HDOH chronic surface water standard of 140 ug/L for purposes of screening groundwater and pending update of HDOH standard.

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).

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

AWQC: Aquatic Water Quality Criteria

BC: British Columbia Water Quality Guidelines (NOAA 2008).

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 D-4c. SUMMARY OF SELECTED ACUTE AQUATIC HABITAT GOALS

	[1]Aquatic Habitat Goals					
CONTAMINANT	[1]Estuarine Acute Aquatic Habitat Goal (ug/L)	Basis	Freshwater Acute Aquatic Habitat Goal (ug/L)	Basis	Saltwater Acute Aquatic Habitat Goal (ug/L)	Basis
ACENAPHTHENE	3.2E+02	Hawai'i Acute SW WQS	5.7E+02	Hawai'i Acute FW WQS	3.2E+02	Hawai'i Acute SW WQS
ACENAPHTHYLENE	3.0E+02	CCME PAHs Acute goal	3.0E+02	CCME PAHs Acute goal	3.0E+02	CCME PAHs Acute goal
ACETONE	1.5E+03	FW Chronic goal	1.5E+03	FW Chronic goal	1.5E+03	SW Chronic goal
ALDRIN	1.3E+00	Hawai'i Acute SW WQS	3.0E+00	Hawai'i Acute FW WQS	1.3E+00	Hawai'i Acute SW WQS
AMETRYN	1.5E+02	50% FW LC50	1.5E+02	50% FW LC50	1.5E+02	50% FW LC50
AMINO,2- DINITROTOLUENE,4,6-	1.5E+02	50% FW LC50	1.5E+02	50% FW LC50	1.5E+02	50% FW LC50
AMINO,4- DINITROTOLUENE,2,6-	1.5E+02	50% FW LC50	1.5E+02	50% FW LC50	1.5E+02	50% FW LC50
ANTHRACENE	3.0E+02	CCME PAHs Acute goal	3.0E+02	CCME PAHs Acute goal	3.0E+02	CCME PAHs Acute goal
ANTIMONY	1.5E+03	USEPA SW CMC	3.0E+03	Hawai'i Acute FW WQS	1.5E+03	USEPA SW CMC
ARSENIC	6.9E+01	Hawai'i Acute SW WQS	3.6E+02	Hawai'i Acute FW WQS	6.9E+01	Hawai'i Acute SW WQS
ATRAZINE	3.5E+02	USEPA FW CMC	3.5E+02	USEPA FW CMC	7.6E+02	USEPA SW CMC
BARIUM	1.0E+03	BC SW Acute	1.0E+03	BC SW Acute	1.0E+03	BC SW Acute
BENZENE	1.7E+03	Hawai'i Acute SW WQS	1.8E+03	Hawai'i Acute FW WQS	1.7E+03	Hawai'i Acute SW WQS
BENZO(a)ANTHRACENE	3.0E+02	CCME PAHs Acute goal	3.0E+02	CCME PAHs Acute goal	3.0E+02	CCME PAHs Acute goal
BENZO(a)PYRENE	3.0E+02	CCME PAHs Acute goal	3.0E+02	CCME PAHs Acute goal	3.0E+02	CCME PAHs Acute goal
BENZO(b)FLUORANTHENE	3.0E+02	CCME PAHs Acute goal	3.0E+02	CCME PAHs Acute goal	3.0E+02	CCME PAHs Acute goal
BENZO(g,h,i)PERYLENE	3.0E+02	CCME PAHs Acute goal	3.0E+02	CCME PAHs Acute goal	3.0E+02	CCME PAHs Acute goal
BENZO(k)FLUORANTHENE	3.0E+02	CCME PAHs Acute goal	3.0E+02	CCME PAHs Acute goal	3.0E+02	CCME PAHs Acute goal
BERYLLIUM	4.3E+01	Hawai'i Acute FW WQS	4.3E+01	Hawai'i Acute FW WQS	4.3E+01	Hawai'i Acute FW WQS
BIPHENYL, 1,1-	1.4E+01	FW Chronic goal	1.4E+01	FW Chronic goal	1.4E+01	SW Chronic goal
BIS(2-CHLOROETHYL)ETHER	2.4E+05	USEPA FW Acute LOEL	2.4E+05	USEPA FW Acute LOEL	2.4E+05	USEPA FW Acute LOEL
BIS(2-CHLOROISOPROPYL)ETHER	2.4E+05	USEPA FW Acute LOEL	2.4E+05	USEPA FW Acute LOEL	2.4E+05	USEPA FW Acute LOEL
BIS(2-ETHYLHEXYL)PHTHALATE	3.2E+01	FW Chronic goal	3.2E+01	FW Chronic goal	3.2E+01	SW Chronic goal
BORON	7.3E+03	=Drinking Water (Table D-3a)	7.3E+03	=Drinking Water (Table D-3a)	7.3E+03	=Drinking Water (Table D-3a)
BROMODICHLOROMETHANE	1.1E+04	USEPA FW Acute LOEL	1.1E+04	USEPA FW Acute LOEL	1.2E+04	USEPA SW Acute LOEL
BROMOFORM	1.1E+04	USEPA FW Acute LOEL	1.1E+04	USEPA FW Acute LOEL	1.2E+04	USEPA SW Acute LOEL
BROMOMETHANE	1.1E+04	USEPA FW Acute LOEL	1.1E+04	USEPA FW Acute LOEL	1.2E+04	USEPA SW Acute LOEL
CADMIUM	3.0E+00	Hawai'i Acute FW WQS	3.0E+00	Hawai'i Acute FW WQS	4.3E+01	Hawai'i Acute SW WQS
CARBON TETRACHLORIDE	1.2E+04	Hawai'i Acute FW WQS	1.2E+04	Hawai'i Acute FW WQS	1.6E+04	Hawai'i Acute SW WQS
CHLORDANE (TECHNICAL)	9.0E-02	Hawai'i Acute SW WQS	2.4E+00	Hawai'i Acute FW WQS	9.0E-02	Hawai'i Acute SW WQS
CHLOROANILINE, p-	5.0E+00	FW Chronic goal	5.0E+00	FW Chronic goal	5.0E+00	SW Chronic goal
CHLOROBENZENE	1.6E+02	USEPA SW Acute LOEL	2.5E+02	USEPA FW Acute LOEL	1.6E+02	USEPA SW Acute LOEL
CHLOROETHANE	2.1E+04	=Drinking Water (Table D-3a)	2.1E+04	=Drinking Water (Table D-3a)	2.1E+04	=Drinking Water (Table D-3a)
CHLOROFORM	9.6E+03	Hawai'i Acute FW WQS	9.6E+03	Hawai'i Acute FW WQS	1.2E+04	USEPA SW Acute LOEL
CHLOROMETHANE	1.1E+04	USEPA FW Acute LOEL	1.1E+04	USEPA FW Acute LOEL	1.2E+04	USEPA SW Acute LOEL
CHLOROPHENOL, 2-	1.4E+03	Hawai'i Acute FW WQS	1.4E+03	Hawai'i Acute FW WQS	1.4E+03	Hawai'i Acute FW WQS
CHROMIUM (Total)	5.7E+02	=CrIII	5.7E+02	=CrIII	1.0E+04	=CrIII
CHROMIUM III	5.7E+02	USEPA FW CMC	5.7E+02	USEPA FW CMC	1.0E+04	USEPA SW Acute LOEL
CHROMIUM VI	1.6E+01	Hawai'i Acute FW WQS	1.6E+01	Hawai'i Acute FW WQS	1.1E+03	Hawai'i Acute SW WQS
CHRYSENE	3.0E+02	CCME PAHs Acute goal	3.0E+02	CCME PAHs Acute goal	3.0E+02	CCME PAHs Acute goal
COBALT	3.0E+00	FW Chronic goal	3.0E+00	FW Chronic goal	3.0E+00	SW Chronic goal
COPPER	2.9E+00	Hawai'i Acute SW WQS	6.0E+00	Hawai'i Acute FW WQS	2.9E+00	Hawai'i Acute SW WQS
CYANIDE (Free)	1.0E+00	Hawai'i Acute SW WQS	2.2E+01	Hawai'i Acute FW WQS	1.0E+00	Hawai'i Acute SW WQS
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	1.4E+03	ORNL FW SAV	1.4E+03	ORNL FW SAV	1.4E+03	ORNL FW SAV
DALAPON	3.0E+03	50% FW LC50	3.0E+03	50% FW LC50	3.0E+03	50% FW LC50
DIBENZO(a,h)ANTHTRACENE	3.0E+02	USEPA SW Acute LOEL	3.0E+02	USEPA SW Acute LOEL	3.0E+02	USEPA SW Acute LOEL
DIBROMO-3-CHLOROPROPANE, 1,2-	4.0E-02	=Drinking Water (Table D-3a)	4.0E-02	=Drinking Water (Table D-3a)	4.0E-02	=Drinking Water (Table D-3a)
DIBROMOCHLOROMETHANE	1.1E+04	USEPA FW Acute LOEL	1.1E+04	USEPA FW Acute LOEL	1.2E+04	USEPA SW Acute LOEL

TABLE D-4c. SUMMARY OF SELECTED ACUTE AQUATIC HABITAT GOALS

	[1]Aquatic Habitat Goals					
CONTAMINANT	[1]Estuarine Acute Aquatic Habitat Goal (ug/L)	Basis	Freshwater Acute Aquatic Habitat Goal (ug/L)	Basis	Saltwater Acute Aquatic Habitat Goal (ug/L)	Basis
DIBROMOETHANE, 1,2-	1.4E+03	FW Chronic goal	1.4E+03	FW Chronic goal	1.4E+03	SW Chronic goal
DICHLOROBENZENE, 1,2-	3.7E+02	Hawai'i Acute FW WQS	3.7E+02	Hawai'i Acute FW WQS	6.6E+02	Hawai'i Acute SW WQS
DICHLOROBENZENE, 1,3-	3.7E+02	Hawai'i Acute FW WQS	3.7E+02	Hawai'i Acute FW WQS	6.6E+02	Hawai'i Acute SW WQS
DICHLOROBENZENE, 1,4-	3.7E+02	Hawai'i Acute FW WQS	3.7E+02	Hawai'i Acute FW WQS	6.6E+02	Hawai'i Acute SW WQS
DICHLOROBENZIDINE, 3,3-	2.5E+02	FW Chronic goal	2.5E+02	FW Chronic goal	2.5E+02	SW Chronic goal
DICHLORODIPHENYLDICHLOROETHANE (DDD)	6.0E-01	USEPA FW Acute LOEL	6.0E-01	USEPA FW Acute LOEL	3.6E+00	USEPA SW Acute LOEL
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.1E+00	USEPA FW Acute LOEL	1.1E+00	USEPA FW Acute LOEL	1.4E+01	USEPA SW Acute LOEL
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.3E-02	Hawai'i Acute SW WQS	1.1E+00	Hawai'i Acute FW WQS	1.3E-02	Hawai'i Acute SW WQS
DICHLOROETHANE, 1,1-	4.7E+01	FW Chronic goal	4.7E+01	FW Chronic goal	4.7E+01	SW Chronic goal
DICHLOROETHANE, 1,2-	3.8E+04	Hawai'i Acute SW WQS	3.9E+04	Hawai'i Acute FW WQS	3.8E+04	Hawai'i Acute SW WQS
DICHLOROETHYLENE, 1,1-	3.9E+03	Hawai'i Acute FW WQS	3.9E+03	Hawai'i Acute FW WQS	7.5E+04	Hawai'i Acute SW WQS
DICHLOROETHYLENE, Cis 1,2-	1.2E+04	USEPA FW Acute LOEL	1.2E+04	USEPA FW Acute LOEL	2.2E+05	USEPA SW Acute LOEL
DICHLOROETHYLENE, Trans 1,2-	1.2E+04	USEPA FW Acute LOEL	1.2E+04	USEPA FW Acute LOEL	2.2E+05	USEPA SW Acute LOEL
DICHLOROPHENOL, 2,4-	6.7E+02	Hawai'i Acute FW WQS	6.7E+02	Hawai'i Acute FW WQS	6.7E+02	Hawai'i Acute FW WQS
DICHLOROPHENOXYACETIC ACID (2,4-D)	2.0E+02	UK SW WQS	2.9E+03	MDEQ FW FAV	2.0E+02	UK SW WQS
DICHLOROPROPANE, 1,2-	3.4E+03	Hawai'i Acute SW WQS	7.7E+03	Hawai'i Acute FW WQS	3.4E+03	Hawai'i Acute SW WQS
DICHLOROPROPENE, 1,3-	2.6E+02	Hawai'i Acute SW WQS	2.0E+03	Hawai'i Acute FW WQS	2.6E+02	Hawai'i Acute SW WQS
DIELDRIN	7.1E-01	Hawai'i Acute SW WQS	2.5E+00	Hawai'i Acute FW WQS	7.1E-01	Hawai'i Acute SW WQS
DIETHYLPHTHALATE	9.4E+02	USEPA FW Acute LOEL	9.4E+02	USEPA FW Acute LOEL	2.9E+03	USEPA SW Acute LOEL
DIMETHYLPHENOL, 2,4-	2.7E+02	USEPA SW CMC	7.0E+02	Hawai'i Acute FW WQS	2.7E+02	USEPA SW CMC
DIMETHYLPHTHALATE	9.4E+02	USEPA FW Acute LOEL	9.4E+02	USEPA FW Acute LOEL	2.9E+03	USEPA SW Acute LOEL
DINITROBENZENE, 1,3-	1.1E+02	ORNL FW SAV	1.1E+02	ORNL FW SAV	1.1E+02	ORNL FW SAV
DINITROPHENOL, 2,4-	2.3E+02	USEPA FW Acute LOEL	2.3E+02	USEPA FW Acute LOEL	4.9E+03	USEPA SW Acute LOEL
DINITROTOLUENE, 2,4- (2,4-DNT)	1.1E+02	Hawai'i Acute FW WQS	1.1E+02	Hawai'i Acute FW WQS	2.0E+02	Hawai'i Acute SW WQS
DINITROTOLUENE, 2,6- (2,6-DNT)	1.1E+02	Hawai'i Acute FW WQS	1.1E+02	Hawai'i Acute FW WQS	2.0E+02	Hawai'i Acute SW WQS
DIOXANE, 1,4-	3.4E+06	50% FW LC50	3.4E+06	50% FW LC50	5.0E+06	50% SW LC50
DIOXINS (TEQ)	3.0E-03	Hawai'i Acute FW WQS	3.0E-03	Hawai'i Acute FW WQS	3.0E-03	Hawai'i Acute FW WQS
DIURON	2.0E+02	50% FW LC50	2.0E+02	50% FW LC50	5.5E+02	50% SW LC50
ENDOSULFAN	3.4E-02	Hawai'i Acute SW WQS	2.2E-01	Hawai'i Acute FW WQS	3.4E-02	Hawai'i Acute SW WQS
ENDRIN	3.7E-02	Hawai'i Acute SW WQS	1.8E-01	Hawai'i Acute FW WQS	3.7E-02	Hawai'i Acute SW WQS
ETHANOL						
ETHYLBENZENE	4.3E+02	USEPA SW Acute LOEL	1.1E+04	Hawai'i Acute FW WQS	4.3E+02	USEPA SW Acute LOEL
FLUORANTHENE	3.0E+02	USEPA SW Acute LOEL	3.0E+02	USEPA SW Acute LOEL	3.0E+02	USEPA SW Acute LOEL
FLUORENE	3.0E+02	USEPA SW Acute LOEL	3.0E+02	USEPA SW Acute LOEL	3.0E+02	USEPA SW Acute LOEL
GLYPHOSATE	6.0E+02	50% FW LC50	6.0E+02	50% FW LC50	6.0E+02	50% FW LC50
HEPTACHLOR	5.3E-02	Hawai'i Acute SW WQS	5.2E-01	Hawai'i Acute FW WQS	5.3E-02	Hawai'i Acute SW WQS
HEPTACHLOR EPOXIDE	5.3E-02	USEPA SW CMC	5.2E-01	USEPA FW CMC	5.3E-02	USEPA SW CMC
HEXACHLOROBENZENE	6.0E+00	USEPA FW CMC	6.0E+00	USEPA FW CMC	6.2E+00	solubility
HEXACHLOROBUTADIENE	1.1E+01	Hawai'i Acute SW WQS	3.0E+01	Hawai'i Acute FW WQS	1.1E+01	Hawai'i Acute SW WQS
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	1.6E-01	Hawai'i Acute SW WQS	2.0E+00	Hawai'i Acute FW WQS	1.6E-01	Hawai'i Acute SW WQS
HEXACHLOROETHANE	3.1E+02	Hawai'i Acute SW WQS	3.3E+02	Hawai'i Acute FW WQS	3.1E+02	Hawai'i Acute SW WQS
HEXAZINONE	5.0E+04	50% FW LC50	5.0E+04	50% FW LC50	5.0E+04	50% FW LC50
INDENO(1,2,3-cd)PYRENE	3.0E+02	USEPA SW Acute LOEL	3.0E+02	USEPA SW Acute LOEL	3.0E+02	USEPA SW Acute LOEL
ISOPHORONE	4.3E+03	Hawai'i Acute SW WQS	3.9E+04	Hawai'i Acute FW WQS	4.3E+03	Hawai'i Acute SW WQS
LEAD	2.9E+01	Hawai'i Acute FW WQS	2.9E+01	Hawai'i Acute FW WQS	1.4E+02	Hawai'i Acute SW WQS
MERCURY	2.1E+00	Hawai'i Acute SW WQS	2.4E+00	Hawai'i Acute FW WQS	2.1E+00	Hawai'i Acute SW WQS
METHOXYCHLOR	3.0E-02	USEPA FW CMC	3.0E-02	USEPA FW CMC	3.0E-02	USEPA SW CMC
METHYL ETHYL KETONE	1.4E+04	FW Chronic goal	1.4E+04	FW Chronic goal	1.4E+04	SW Chronic goal

TABLE D-4c. SUMMARY OF SELECTED ACUTE AQUATIC HABITAT GOALS

CONTAMINANT	[1]Aquatic Habitat Goals					
	[1]Estuarine Acute Aquatic Habitat Goal (ug/L)	Basis	Freshwater Acute Aquatic Habitat Goal (ug/L)	Basis	Saltwater Acute Aquatic Habitat Goal (ug/L)	Basis
METHYL ISOBUTYL KETONE	1.7E+02	FW Chronic goal	1.7E+02	FW Chronic goal	1.7E+02	SW Chronic goal
METHYL MERCURY	3.0E-03	FW Chronic goal	3.0E-03	FW Chronic goal	3.0E-03	SW Chronic goal
METHYL TERT BUTYL ETHER	5.3E+04	USEPA SW CMC	1.5E+05	USEPA FW CMC	5.3E+04	USEPA SW CMC
METHYLENE CHLORIDE	1.1E+04	USEPA FW Acute LOEL	1.1E+04	USEPA FW Acute LOEL	1.2E+04	USEPA SW Acute LOEL
METHYLNAPHTHALENE, 1-	3.0E+02	USEPA SW Acute LOEL	3.0E+02	USEPA SW Acute LOEL	3.0E+02	USEPA SW Acute LOEL
METHYLNAPHTHALENE, 2-	3.0E+02	USEPA SW Acute LOEL	3.0E+02	USEPA SW Acute LOEL	3.0E+02	USEPA SW Acute LOEL
MOLYBDENUM	2.4E+02	FW Chronic goal	2.4E+02	FW Chronic goal	2.4E+02	SW Chronic goal
NAPHTHALENE	7.7E+02	Hawai'i Acute FW WQS	7.7E+02	Hawai'i Acute FW WQS	7.8E+02	Hawai'i Acute SW WQS
NICKEL	5.0E+00	Hawai'i Acute FW WQS	5.0E+00	Hawai'i Acute FW WQS	7.5E+01	Hawai'i Acute SW WQS
NITROBENZENE	2.0E+03	Hawai'i Acute SW WQS	9.0E+03	Hawai'i Acute FW WQS	2.0E+03	Hawai'i Acute SW WQS
NITROGLYCERIN	1.4E+02	FW Chronic goal	1.4E+02	FW Chronic goal	1.4E+02	SW Chronic goal
NITROTOLUENE, 2-	7.5E+03	=3 NT	7.5E+03	=3 NT	7.5E+03	=3 NT
NITROTOLUENE, 3-	3.8E+03	50% FW LC50	3.8E+03	50% FW LC50	3.8E+03	50% FW LC50
NITROTOLUENE, 4-	3.3E+03	50% SW LC50	1.7E+04	50% FW LC50	3.3E+03	50% SW LC50
PENTACHLOROPHENOL	1.3E+01	Hawai'i Acute SW WQS	2.0E+01	Hawai'i Acute FW WQS	1.3E+01	Hawai'i Acute SW WQS
PENTAERYTHRITOLTETRANITRATE (PETN)	4.3E+04	solubility	4.3E+04	solubility	4.3E+04	solubility
PERCHLORATE	6.0E+02	FW Chronic goal	6.0E+02	FW Chronic goal	6.0E+02	SW Chronic goal
PHENANTHRENE	3.0E+02	USEPA SW Acute LOEL	3.0E+02	USEPA SW Acute LOEL	3.0E+02	USEPA SW Acute LOEL
PHENOL	3.4E+03	Hawai'i Acute FW WQS	3.4E+03	Hawai'i Acute FW WQS	5.8E+03	USEPA SW Acute LOEL
POLYCHLORINATED BIPHENYLS (PCBs)	2.0E+00	Hawai'i Acute FW WQS	2.0E+00	Hawai'i Acute FW WQS	1.0E+01	Hawai'i Acute SW WQS
PROPICONAZOLE	2.6E+02	50% SW LC50	4.2E+02	50% FW LC50	2.6E+02	50% SW LC50
PYRENE	3.0E+02	USEPA SW Acute LOEL	3.0E+02	USEPA SW Acute LOEL	3.0E+02	USEPA SW Acute LOEL
SELENIUM	2.0E+01	Hawai'i Acute FW WQS	2.0E+01	Hawai'i Acute FW WQS	3.0E+02	Hawai'i Acute SW WQS
SILVER	1.0E+00	Hawai'i Acute FW WQS	1.0E+00	Hawai'i Acute FW WQS	2.3E+00	Hawai'i Acute SW WQS
SIMAZINE	1.0E+01	UK SW WQS	3.1E+02	MDEQ FW FAV	1.0E+01	UK SW WQS
STYRENE	3.2E+01	FW Chronic goal	3.2E+01	FW Chronic goal	3.2E+01	SW Chronic goal
TERBACIL	2.3E+04	50% FW LC50	2.3E+04	50% FW LC50	2.3E+04	50% FW LC50
tert-BUTYL ALCOHOL	1.8E+05	FW LC0	1.8E+05	FW LC0	1.8E+05	FW LC0
TETRACHLOROETHANE, 1,1,1,2-	3.1E+03	Hawai'i Acute FW WQS	3.1E+03	Hawai'i Acute FW WQS	3.1E+03	Hawai'i Acute FW WQS
TETRACHLOROETHANE, 1,1,2,2-	3.0E+03	Hawai'i Acute SW WQS	9.3E+03	USEPA FW Acute LOEL	3.0E+03	Hawai'i Acute SW WQS
TETRACHLOROETHYLENE	1.8E+03	Hawai'i Acute FW WQS	1.8E+03	Hawai'i Acute FW WQS	3.4E+03	Hawai'i Acute SW WQS
TETRACHLOROPHENOL, 2,3,4,6-	1.0E+01	CA Instant. SW Max	2.2E+01	MDEQ FW FAV	1.0E+01	CA Instant. SW Max
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	1.9E+03	ORNL FW SAV	1.9E+03	ORNL FW SAV	1.9E+03	ORNL FW SAV
THALLIUM	4.7E+02	Hawai'i Acute FW WQS	4.7E+02	Hawai'i Acute FW WQS	7.1E+02	Hawai'i Acute SW WQS
TOLUENE	5.8E+03	Hawai'i Acute FW WQS	5.8E+03	Hawai'i Acute FW WQS	6.3E+03	USEPA SW Acute LOEL
TOXAPHENE	2.1E-01	Hawai'i Acute SW WQS	7.3E-01	Hawai'i Acute FW WQS	2.1E-01	Hawai'i Acute SW WQS
TPH (gasolines)	5.0E+03	Ceiling Level	5.0E+03	Ceiling Level	5.0E+03	Ceiling Level
TPH (middle distillates)	2.5E+03	Ceiling Level	2.5E+03	Ceiling Level	2.5E+03	Ceiling Level
TPH (residual fuels)	2.5E+03	Ceiling Level	2.5E+03	Ceiling Level	2.5E+03	Ceiling Level
TRICHLOROBENZENE, 1,2,4-	1.6E+02	USEPA SW Acute LOEL	2.5E+02	USEPA FW Acute LOEL	1.6E+02	USEPA SW Acute LOEL
TRICHLOROETHANE, 1,1,1-	6.0E+03	Hawai'i Acute FW WQS	6.0E+03	Hawai'i Acute FW WQS	1.0E+04	Hawai'i Acute SW WQS
TRICHLOROETHANE, 1,1,2-	6.0E+03	Hawai'i Acute FW WQS	6.0E+03	Hawai'i Acute FW WQS	6.0E+03	Hawai'i Acute FW WQS
TRICHLOROETHYLENE	7.0E+02	Hawai'i Acute SW WQS	1.5E+04	Hawai'i Acute FW WQS	7.0E+02	Hawai'i Acute SW WQS
TRICHLOROPHENOL, 2,4,5-	1.0E+02	USEPA FW CMC	1.0E+02	USEPA FW CMC	2.4E+02	USEPA SW CMC
TRICHLOROPHENOL, 2,4,6-	4.9E+02	FW Chronic goal	4.9E+02	FW Chronic goal	4.9E+02	SW Chronic goal
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	6.9E+02	FW Chronic goal	6.9E+02	FW Chronic goal	6.9E+02	SW Chronic goal
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	3.0E+01	FW Chronic goal	3.0E+01	FW Chronic goal	3.0E+01	SW Chronic goal
TRICHLOROPROPANE, 1,2,3-	1.4E+02	5xFW EC50	1.4E+02	5xFW EC50	1.4E+02	5xFW EC50

TABLE D-4c. SUMMARY OF SELECTED ACUTE AQUATIC HABITAT GOALS

CONTAMINANT	[1]Aquatic Habitat Goals					
	[1]Estuarine Acute Aquatic Habitat Goal (ug/L)	Basis	Freshwater Acute Aquatic Habitat Goal (ug/L)	Basis	Saltwater Acute Aquatic Habitat Goal (ug/L)	Basis
TRICHLOROPROPENE, 1,2,3-	6.2E-01	=Drinking Water (Table D-3a)	6.2E-01	=Drinking Water (Table D-3a)	6.2E-01	=Drinking Water (Table D-3a)
TRIFLURALIN	2.0E+01	FW Chronic goal	2.0E+01	FW Chronic goal	2.0E+01	SW Chronic goal
TRINITROBENZENE, 1,3,5-	1.4E+02	ORNL FW SAV	1.4E+02	ORNL FW SAV	1.4E+02	ORNL FW SAV
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	1.5E+02	=Drinking Water (Table D-3a)	1.5E+02	=Drinking Water (Table D-3a)	1.5E+02	=Drinking Water (Table D-3a)
TRINITROTOLUENE, 2,4,6- (TNT)	5.7E+02	ORNL FW SAV	5.7E+02	ORNL FW SAV	5.7E+02	ORNL FW SAV
VANADIUM	1.9E+01	FW Chronic goal	1.9E+01	FW Chronic goal	1.9E+01	SW Chronic goal
VINYL CHLORIDE	7.8E+02	FW Chronic goal	7.8E+02	FW Chronic goal	7.8E+02	SW Chronic goal
XYLENES	1.0E+03	50% SW LC50	1.0E+03	50% SW LC50	1.0E+03	50% SW LC50
ZINC	2.2E+01	Hawai'i Acute FW WQS	2.2E+01	Hawai'i Acute FW WQS	9.5E+01	Hawai'i Acute SW WQS

Notes:

1. Estuarine Goal = Lowest of Freshwater vs Saltwater chronic goals.
See text for prioritization and selection of surface water quality goals.
Chronic surface water goal referred to if no acute goal available (see Table D-4b (chronic)). Drinking water action level referred to if aquatic habitat goals not available.
AWQC: Aquatic Water Quality Criteria
BC: British Columbia Water Quality Guidelines (NOAA 2008).
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 D-4d. SUMMARY OF HAWAI'I CHRONIC AND ACUTE SURFACE WATER (AQUATIC HABITAT) STANDARDS

	Freshwater (ug/L)		Saltwater (ug/L)	
CONTAMINANT	**Chronic**	**Acute**	**Chronic**	**Acute**
ACENAPHTHENE		5.7E+02		3.2E+02
ACENAPHTHYLENE				
ACETONE				
ALDRIN		3.0E+00		1.3E+00
AMETRYN				
AMINO,2- DINITROTOLUENE,4,6-				
AMINO,4- DINITROTOLUENE,2,6-				
ANTHRACENE				
ANTIMONY		3.0E+03		
ARSENIC	1.9E+02	3.6E+02	3.6E+01	6.9E+01
ATRAZINE				
BARIUM				
BENZENE		1.8E+03		1.7E+03
BENZO(a)ANTHRACENE				
BENZO(a)PYRENE				
BENZO(b)FLUORANTHENE				
BENZO(g,h,i)PERYLENE				
BENZO(k)FLUORANTHENE				
BERYLLIUM		4.3E+01		
BIPHENYL, 1,1-				
BIS(2-CHLOROETHYL)ETHER				
BIS(2-CHLOROISOPROPYL)ETHER				
BIS(2-ETHYLHEXYL)PHTHALATE				
BORON				
BROMODICHLOROMETHANE				
BROMOFORM				
BROMOMETHANE				
CADMIUM	3.0E+00	3.0E+00	9.3E+00	4.3E+01
CARBON TETRACHLORIDE		1.2E+04		1.6E+04
CHLORDANE (TECHNICAL)	4.3E-03	2.4E+00	4.0E-03	9.0E-02
CHLOROANILINE, p-				
CHLOROBENZENE				
CHLOROETHANE				
CHLOROFORM		9.6E+03		
CHLOROMETHANE				
CHLOROPHENOL, 2-		1.4E+03		
CHROMIUM (Total)				
CHROMIUM III				
CHROMIUM VI	1.1E+01	1.6E+01	5.0E+01	1.1E+03
CHRYSENE				
COBALT				
COPPER	6.0E+00	6.0E+00	2.9E+00	2.9E+00
CYANIDE (Free)	5.2E+00	2.2E+01	1.0E+00	1.0E+00
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)				
DALAPON				
DIBENZO(a,h)ANTHTRACENE				
DIBROMO-3-CHLOROPROPANE, 1,2-				
DIBROMOCHLOROMETHANE				
DIBROMOETHANE, 1,2-				
DICHLOROBENZENE, 1,2-		3.7E+02		6.6E+02
DICHLOROBENZENE, 1,3-		3.7E+02		6.6E+02
DICHLOROBENZENE, 1,4-		3.7E+02		6.6E+02
DICHLOROBENZIDINE, 3,3-				

TABLE D-4d. SUMMARY OF HAWAI'I CHRONIC AND ACUTE SURFACE WATER (AQUATIC HABITAT) STANDARDS

	Freshwater (ug/L)		Saltwater (ug/L)	
CONTAMINANT	Chronic	Acute	Chronic	Acute
DICHLORODIPHENYLDICHLOROETHANE (DDD)				
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)				
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.0E-03	1.1E+00	1.0E-03	1.3E-02
DICHLOROETHANE, 1,1-				
DICHLOROETHANE, 1,2-		3.9E+04		3.8E+04
DICHLOROETHYLENE, 1,1-		3.9E+03		7.5E+04
DICHLOROETHYLENE, Cis 1,2-				
DICHLOROETHYLENE, Trans 1,2-				
DICHLOROPHENOL, 2,4-		6.7E+02		
DICHLOROPHENOXYACETIC ACID (2,4-D)				
DICHLOROPROPANE, 1,2-		7.7E+03		3.4E+03
DICHLOROPROPENE, 1,3-		2.0E+03		2.6E+02
DIELDRIN	1.9E-03	2.5E+00	1.9E-03	7.1E-01
DIETHYLPHTHALATE				
DIMETHYLPHENOL, 2,4-		7.0E+02		
DIMETHYLPHTHALATE				
DINITROBENZENE, 1,3-				
DINITROPHENOL, 2,4-				
DINITROTOLUENE, 2,4- (2,4-DNT)		1.1E+02		2.0E+02
DINITROTOLUENE, 2,6- (2,6-DNT)		1.1E+02		2.0E+02
DIOXANE, 1,4-				
DIOXINS (TEQ)		3.0E-03		
DIURON				
ENDOSULFAN	5.6E-02	2.2E-01	8.7E-03	3.4E-02
ENDRIN	2.3E-03	1.8E-01	2.3E-03	3.7E-02
ETHANOL				
ETHYLBENZENE		1.1E+04		
FLUORANTHENE		1.3E+03		
FLUORENE				
GLYPHOSATE				
HEPTACHLOR	3.8E-03	5.2E-01	3.6E-03	5.3E-02
HEPTACHLOR EPOXIDE				
HEXACHLOROBENZENE				
HEXACHLOROBUTADIENE		3.0E+01		1.1E+01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	8.0E-02	2.0E+00		1.6E-01
HEXACHLOROETHANE		3.3E+02		3.1E+02
HEXAZINONE				
INDENO(1,2,3-cd)PYRENE				
ISOPHORONE		3.9E+04		4.3E+03
LEAD	2.9E+01	2.9E+01	5.6E+00	1.4E+02
MERCURY	5.5E-01	2.4E+00	2.5E-02	2.1E+00
METHOXYCHLOR	3.0E-02		3.0E-02	
METHYL ETHYL KETONE				
METHYL ISOBUTYL KETONE				
METHYL MERCURY				
METHYL TERT BUTYL ETHER				
METHYLENE CHLORIDE				
METHYLNAPHTHALENE, 1-				
METHYLNAPHTHALENE, 2-				
MOLYBDENUM				
NAPHTHALENE		7.7E+02		7.8E+02
NICKEL	5.0E+00	5.0E+00	8.3E+00	7.5E+01
NITROBENZENE		9.0E+03		2.0E+03
NITROGLYCERIN				
NITROTOLUENE, 2-				
NITROTOLUENE, 3-				
NITROTOLUENE, 4-				

TABLE D-4d. SUMMARY OF HAWAI'I CHRONIC AND ACUTE SURFACE WATER (AQUATIC HABITAT) STANDARDS

	Freshwater (ug/L)		Saltwater (ug/L)	
CONTAMINANT	**Chronic**	**Acute**	**Chronic**	**Acute**
PENTACHLOROPHENOL	1.3E+01	2.0E+01		1.3E+01
PENTAERYTHRITOLTETRANITRATE (PETN)				
PERCHLORATE				
PHENANTHRENE				
PHENOL		3.4E+03		
POLYCHLORINATED BIPHENYLS (PCBs)	1.4E-02	2.0E+00	3.0E-02	1.0E+01
PROPICONAZOLE				
PYRENE				
SELENIUM	5.0E+00	2.0E+01	7.1E+01	3.0E+02
SILVER	1.0E+00	1.0E+00		2.3E+00
SIMAZINE				
STYRENE				
TERBACIL				
tert-BUTYL ALCOHOL				
TETRACHLOROETHANE, 1,1,1,2-		3.1E+03		
TETRACHLOROETHANE, 1,1,2,2-				3.0E+03
TETRACHLOROETHYLENE		1.8E+03	1.45E+02	3.4E+03
TETRACHLOROPHENOL, 2,3,4,6-				
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)				
THALLIUM		4.7E+02		7.1E+02
TOLUENE		5.8E+03		2.1E+03
TOXAPHENE	2.0E-04	7.3E-01	2.0E-04	2.1E-01
TPH (gasolines)				
TPH (middle distillates)				
TPH (residual fuels)				
TRICHLOROBENZENE, 1,2,4-				
TRICHLOROETHANE, 1,1,1-		6.0E+03		1.0E+04
TRICHLOROETHANE, 1,1,2-		6.0E+03		
TRICHLOROETHYLENE		1.5E+04		7.0E+02
TRICHLOROPHENOL, 2,4,5-				
TRICHLOROPHENOL, 2,4,6-				
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)				
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)				
TRICHLOROPROPANE, 1,2,3-				
TRICHLOROPROPENE, 1,2,3-				
TRIFLURALIN				
TRINITROBENZENE, 1,3,5-				
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)				
TRINITROTOLUENE, 2,4,6- (TNT)				
VANADIUM				
VINYL CHLORIDE				
XYLENES				
ZINC	2.2E+01	2.2E+01	8.6E+01	9.5E+01

Primary Reference:

1. Hawai'I Administrative Rules, Title 11, Chapter 54, Section 11-54-04: Basic Water Quality Criteria, August 2009.

2009 HDOH acute freshwater standard for dinitrotoluene and saltwater standards for antimony, ethylbenzene, phenol and toluene replaced with updated USEPA goals (USEPA 2006) for use in development of groundwater action levels. Consult Clean Water Branch for applcation of updated goals to surface water.

TABLE D-4e. SUMMARY OF USEPA AND OTHER PUBLISHED AQUATIC HABITAT GOALS
(ug/l)

	Freshwater									Marine								
CONTAMINANT	CCC	USEPA Chronic LOEL	CMC	USEPA Acute LOEL	Ecotox Chronic Threshold (AWQC, FCV Or Tier II)	Other Acute	Basis	Other Chronic	Basis	CCC	USEPA Chronic LOEL	CMC	USEPA Acute LOEL	Ecotox Chronic Threshold (AWQC, FCV Or Tier II)	Other Acute	Basis	Other Chronic	Basis
ACENAPHTHENE		5.2E+02		1.7E+03	2.3E+01						7.1E+02		9.7E+02	4.0E+01				
ACENAPHTHYLENE															3.0E+02	CCME 2002		
ACETONE								1.5E+03	USDOE FW Chronic PRG									
ALDRIN			3.0E+00									1.3E+00						
AMETRYN						1.5E+02	50% FW LC50	1.5E+01	5% FW Acute LC50									
AMINO,2- DINITROTOLUENE,4,6-						1.5E+02	50% FW LC50	1.5E+01	5% FW Acute LC50									
AMINO,4- DINITROTOLUENE,2,6-						1.5E+02	50% FW LC50	1.5E+01	5% FW Acute LC50									
ANTHRACENE								7.3E-01	USDOE FW Chronic PRG						3.0E+02	CCME 2002		
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				
ATRAZINE	1.2E+01		3.5E+02							2.6E+01		7.6E+02						
BARIUM															1.0E+03	BC SW Acute	2.0E+02	BC SW Chronic
BENZENE				5.3E+03	4.6E+01						7.0E+02		5.1E+03					
BENZO(a)ANTHRACENE								2.7E-02	USDOE FW Chronic PRG						3.0E+02	CCME 2002		
BENZO(a)PYRENE					1.4E-02										3.0E+02	CCME 2002		
BENZO(b)FLUORANTHENE								9.1E+00	USEPA Reg. IV FW Chronic						3.0E+02	CCME 2002		
BENZO(g,h,i)PERYLENE								1.0E-01	50% MOEE FW Chronic LOEL						3.0E+02	CCME 2002		
BENZO(k)FLUORANTHENE								3.7E+00	50% MOEE FW Chronic LOEL						3.0E+02	CCME 2002		
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																		
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 (TECHNICAL)	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	=Cr III								1.0E+04	=Cr III
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						3.0E+02	CCME 2002		
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				
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)						1.4E+03	ORNL FW SAV	1.9E+02	ORNL FW SCV									
DALAPON						3.0E+03	50% FW LC50	3.0E+02	5% FW Acute LC50									
DIBENZO(a,h)ANTHTRACENE								7.5E+00	50% MOEE FW Chronic LOEL						3.0E+02	CCME 2002		
DIBROMO-3-CHLOROPROPANE, 1,2-																		
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+00				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					
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														
DICHLOROPHENOXYACETIC ACID (2,4-D)						2.9E+03	MDEQ FW FAV	2.2E+02	MDEQ FW FCV						2.0E+02	UK SW WQS	4.0E+01	UK SW WQS
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						

TABLE D-4e. SUMMARY OF USEPA AND OTHER PUBLISHED AQUATIC HABITAT GOALS
(ug/l)

	Freshwater									Marine								
CONTAMINANT	CCC	USEPA Chronic LOEL	CMC	USEPA Acute LOEL	Ecotox Chronic Threshold (AWQC, FCV Or Tier II)	Other Acute	Basis	Other Chronic	Basis	CCC	USEPA Chronic LOEL	CMC	USEPA Acute LOEL	Ecotox Chronic Threshold (AWQC, FCV Or Tier II)	Other Acute	Basis	Other Chronic	Basis
DIMETHYLPHTHALATE		3.0E+00		9.4E+02							3.4E+00		2.94E+03					
DINITROBENZENE, 1,3-						1.1E+02	ORNL FW SAV	3.0E+01	ORNL FW SCV									
DINITROPHENOL, 2,4-		1.5E+02		2.3E+02									4.85E+03					
DINITROTOLUENE, 2,4- (2,4-DNT)								4.4E+01	USEPA Reg. V FW Chronic								6.7E+01	USEPA Region IV
DINITROTOLUENE, 2,6- (2,6-DNT)								4.4E+01	=2,4 DNT								6.7E+01	=2,4 DNT
DIOXANE, 1,4-						3.4E+06	50% FW LC50	3.4E+05	5% Acute FW LC 50						5.0E+06	50% SW LC50	5.0E+05	5% Acute SW LC 50
DIOXINS (TEQ)		1.0E-05		1.0E-02														
DIURON						2.0E+02	50% FW LC50	6.0E+01	50% FW EC50						5.5E+02	50% SW LC50		
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				3.0E+02	CCME 2002		
FLUORENE					3.9E+00										3.0E+02	CCME 2002		
GLYPHOSATE						6.0E+02	50% FW LC50	6.5E+01	CCME EQG									
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					
HEXAZINONE						5.0E+04	50% FW LC50	5.0E+03	5% FW Acute LC50									
INDENO(1,2,3-cd)PYRENE								4.3E+00	USEPA Reg. IV FW Chronic						3.0E+02	CCME 2002		
ISOPHORONE						1.2E+04	SW Acute	1.2E+03	USEPA Reg. IV FW Chronic				1.3E+04		1.3E+03	SW Acute	1.3E+02	Chronic
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	5.1E+04		1.5E+05							1.8E+04		5.3E+04					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, 1-								2.1E+00	USDOE FW Chronic PRG				3.0E+02					
METHYLNAPHTHALENE, 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				
NITROBENZENE						2.1E+03	MDEQ FW FAV	2.2E+02	MDEQ FW FCV								6.0E+01	Chronic
NITROGLYCERIN								1.4E+02	USEPA Reg. VI FW Chronic									
NITROTOLUENE, 2-						7.5E+03	=3 NT	1.0E+03	=3 NT									
NITROTOLUENE, 3-						3.8E+03	50% FW LC50	3.8E+02	5% FW Acute LC50									
NITROTOLUENE, 4-						1.7E+04	50% FW LC50	1.6E+03	50% FW EC50						3.3E+03	50% SW LC50		
PENTACHLOROPHENOL	1.5E+01		1.9E+01		1.3E+01					7.9E+00		1.3E+01		7.9E+00				
PENTAERYTHRITOLTETRANITRATE (PETN)								8.5E+04	USEPA Reg. VI FW Chronic									
PERCHLORATE					6.0E+02													
PHENANTHRENE	6.3E+00		3.0E+01		6.3E+00					4.6E+00				8.3E+00	3.0E+02	CCME 2002		
PHENOL		2.56E+03		1.02E+04									5.8E+03					
POLYCHLORINATED BIPHENYLS (PCBs)	1.4E-02				1.9E-01					3.0E-02								
PROPICONAZOLE						4.2E+02	50% FW LC50	4.2E+01	5% FW Acute LC50						2.6E+02	50% SW LC50	2.6E+01	5% SW LC50
PYRENE								2.0E+00	50% MOEE FW Chronic LOEL						3.0E+02	CCME 2002		
SELENIUM	5.0E+00				5.0E+00					7.1E+01		2.9E+02		7.1E+01				
SILVER			3.2E+00									1.9E+00						
SIMAZINE						3.1E+02	MDEQ FW FAV	1.7E+01	MDEQ FW FCV						1.0E+01	UK SW WQS	2.0E+00	UK SW WQS
STYRENE								3.2E+01	USEPA Reg. IV FW Chronic									
TERBACIL						2.3E+04	50% FW LC50	2.3E+03	5% FW Acute LC50									
tert-BUTYL ALCOHOL						1.8E+05	FW LC0	1.8E+04	10% Acute FW LC0									
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					
TETRACHLOROPHENOL, 2,3,4,6-						2.2E+01	MDEQ FW FAV	1.2E+00	MDEQ FW FCV						1.0E+01	Max	4.0E+00	CA Daily SW Max
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)						1.9E+03	ORNL FW SAV	3.3E+02	ORNL FW SCV									
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+03	Ceiling Level	5.0E+02	CA FW Chronic						5.0E+03	Ceiling Level	3.7E+03	CA SW Chronic
TPH (middle distillates)						2.5E+03	Ceiling Level	6.4E+02	CA FW Chronic						2.5E+03	Ceiling Level		
TPH (residual fuels)						2.5E+03	Ceiling Level	6.4E+02	CA FW Chronic						2.5E+03	Ceiling Level		
TRICHLOROBENZENE, 1,2,4-		5.0E+01		2.5E+02	1.1E+02						1.29E+02		1.6E+02					

TABLE D-4e. SUMMARY OF USEPA AND OTHER PUBLISHED AQUATIC HABITAT GOALS
(ug/l)

	Freshwater									Marine								
CONTAMINANT	CCC	USEPA Chronic LOEL	CMC	USEPA Acute LOEL	Ecotox Chronic Threshold (AWQC, FCV Or Tier II)	Other Acute	Basis	Other Chronic	Basis	CCC	USEPA Chronic LOEL	CMC	USEPA Acute LOEL	Ecotox Chronic Threshold (AWQC, FCV Or Tier II)	Other Acute	Basis	Other Chronic	Basis
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																
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)								6.9E+02	USEPA Reg. V FW Chronic									
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)								3.0E+01	USEPA Reg. V FW Chronic									
TRICHLOROPROPANE, 1,2,3-						1.4E+02	5xFW EC50	1.4E+01	50% FW EC50									
TRICHLOROPROPENE, 1,2,3-																		
TRIFLURALIN								2.0E+01	CCME FW EQG									
TRINITROBENZENE, 1,3,5-						1.4E+02	ORNL FW SAV	3.0E+01	ORNL FW SCV									
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)																		
TRINITROTOLUENE, 2,4,6- (TNT)						5.7E+02	ORNL FW SAV	1.3E+02	ORNL FW SCV									
VANADIUM					1.9E+01													
VINYL CHLORIDE								7.8E+02	USDOE FW Chronic PRG									
XYLENES															1.0E+03	50% SW LC50	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 USEPA (2006, 1996b), MOEE (1996), USDOE (1997, 2008). USEPA standards and goals presented in *A Compilation of Water Quality Goals* , CalEPA RWQCB Central Valley Region (RWQCBCV 2007).
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 action levels.
See text for prioritization and selection of surface water quality action 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 action level. LC 50 divided by factor of twenty.
2-amino-4,6-dinitrotoluene aquatic toxicity data not available; assumed equal to 4-amino-2,6-dinitrotoluene. (Note that goals are coincidentally equal to ametryn, directly above.)
Barium marine aquatic toxicity screening noted (NOAA 2008, from British Columbia Water Quality guidance); published freshwater aquatic habitat screening levels not considered due to low confidence and natural background concentrations of barium in groundwater in Hawai'i.
MTBE aquatic goals from USEPA *Ambient Water Quality Criteria Update for MTBE* (March 2006), http://www.epa.gov/waterscience/criteria/mtbe-fs.html
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.
Trinitrobenzene Tier II Secondary Acute and Chronic Values as reported on UDOE RAIS database (USDOE 2008)
Xylenes: Acute saltwater action 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
BC: British Columbia Water Quality Guidelines (in NOAA 2008).
CCC: Criterion for Continuous Concentration
CCME: Canadian Council of Ministers of the Environment (CCME 2002)
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)
ORNL: Oak Ridge National Laboratories
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 D-4f. SURFACE WATER QUALITY STANDARDS FOR BIOACCUMULATION AND HUMAN CONSUMPTION OF AQUATIC ORGANISMS
(ug/l)

CONTAMINANT	Selected Criteria	Basis	[1]HI DOH WQS	[2]USEPA NWQC
ACENAPHTHENE	9.9E+02	USEPA Aquatic Organism Consumption		9.9E+02
ACENAPHTHYLENE				
ACETONE				
ALDRIN	2.6E-05	HI DOH Fish Consumption	2.6E-05	5.0E-05
AMETRYN				
AMINO,2- DINITROTOLUENE,4,6-				
AMINO,4- DINITROTOLUENE,2,6-				
ANTHRACENE	4.0E+04	USEPA Aquatic Organism Consumption		4.0E+04
ANTIMONY	1.5E+04	HI DOH Fish Consumption	1.5E+04	6.4E+02
ARSENIC	1.4E-01	USEPA Aquatic Organism Consumption		1.4E-01
ATRAZINE				
BARIUM				
BENZENE	1.3E+01	HI DOH Fish Consumption	1.3E+01	5.1E+01
BENZO(a)ANTHRACENE	1.8E-02	USEPA Aquatic Organism Consumption		1.8E-02
BENZO(a)PYRENE	1.8E-02	USEPA Aquatic Organism Consumption		1.8E-02
BENZO(b)FLUORANTHENE	1.8E-02	USEPA Aquatic Organism Consumption		1.8E-02
BENZO(g,h,i)PERYLENE				
BENZO(k)FLUORANTHENE	1.8E-02	USEPA Aquatic Organism Consumption		1.8E-02
BERYLLIUM	3.8E-02	HI DOH Fish Consumption	3.8E-02	
BIPHENYL, 1,1-				
BIS(2-CHLOROETHYL)ETHER	4.4E-01	HI DOH Fish Consumption	4.4E-01	5.3E-01
BIS(2-CHLOROISOPROPYL)ETHER	1.4E+03	HI DOH Fish Consumption	1.4E+03	6.5E+04
BIS(2-ETHYLHEXYL)PHTHALATE	2.2E+00	USEPA Aquatic Organism Consumption		2.2E+00
BORON				
BROMODICHLOROMETHANE				
BROMOFORM	1.4E+02	USEPA Aquatic Organism Consumption		1.4E+02
BROMOMETHANE	1.5E+03	USEPA Aquatic Organism Consumption		1.5E+03
CADMIUM				
CARBON TETRACHLORIDE	2.3E+00	HI DOH Fish Consumption	2.3E+00	1.6E+00
CHLORDANE (TECHNICAL)	1.6E-05	HI DOH Fish Consumption	1.6E-05	8.1E-04
CHLOROANILINE, p-				
CHLOROBENZENE	2.1E+04	USEPA Aquatic Organism Consumption		2.1E+04
CHLOROETHANE				
CHLOROFORM	5.1E+00	HI DOH Fish Consumption	5.1E+00	4.7E+02
CHLOROMETHANE				
CHLOROPHENOL, 2-	1.5E+02	USEPA Aquatic Organism Consumption		1.5E+02
CHROMIUM (Total)				
CHROMIUM III				
CHROMIUM VI				
CHRYSENE	1.8E-02	USEPA Aquatic Organism Consumption		1.8E-02
COBALT				
COPPER				
CYANIDE (Free)	2.2E+05	USEPA Aquatic Organism Consumption		2.2E+05

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

CONTAMINANT	Selected Criteria	Basis	[1]HI DOH WQS	[2]USEPA NWQC
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)				
DALAPON				
DIBENZO(a,h)ANTHTRACENE	1.8E-02	USEPA Aquatic Organism Consumption		1.8E-02
DIBROMO-3-CHLOROPROPANE, 1,2-				
DIBROMOCHLOROMETHANE	1.3E+01	USEPA Aquatic Organism Consumption		1.3E+01
DIBROMOETHANE, 1,2-				
DICHLOROBENZENE, 1,2-	8.5E+02	HI DOH Fish Consumption	8.5E+02	1.7E+04
DICHLOROBENZENE, 1,3-	8.5E+02	HI DOH Fish Consumption	8.5E+02	9.6E+02
DICHLOROBENZENE, 1,4-	8.5E+02	HI DOH Fish Consumption	8.5E+02	2.6E+03
DICHLOROBENZIDINE, 3,3-	7.0E-03	HI DOH Fish Consumption	7.0E-03	2.8E-02
DICHLORODIPHENYLDICHLOROETHANE (DDD)	3.1E-04	USEPA Aquatic Organism Consumption		3.1E-04
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.2E-04	USEPA Aquatic Organism Consumption		2.2E-04
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	8.0E-06	HI DOH Fish Consumption	8.0E-06	2.2E-04
DICHLOROETHANE, 1,1-				
DICHLOROETHANE, 1,2-	7.9E+01	HI DOH Fish Consumption	7.9E+01	3.7E+01
DICHLOROETHYLENE, 1,1-	6.0E-01	HI DOH Fish Consumption	6.0E-01	3.2E+00
DICHLOROETHYLENE, Cis 1,2-				
DICHLOROETHYLENE, Trans 1,2-	140000	USEPA Aquatic Organism Consumption		140000
DICHLOROPHENOL, 2,4-	2.9E+02	USEPA Aquatic Organism Consumption		2.9E+02
DICHLOROPHENOXYACETIC ACID (2,4-D)				
DICHLOROPROPANE, 1,2-	1.5E+01	USEPA Aquatic Organism Consumption		1.5E+01
DICHLOROPROPENE, 1,3-	4.6E+00	HI DOH Fish Consumption	4.6E+00	1.7E+03
DIELDRIN	2.5E-05	HI DOH Fish Consumption	2.5E-05	5.4E-05
DIETHYLPHTHALATE	4.4E+04	USEPA Aquatic Organism Consumption		4.4E+04
DIMETHYLPHENOL, 2,4-	8.5E+02	USEPA Aquatic Organism Consumption		8.5E+02
DIMETHYLPHTHALATE	1.1E+06	USEPA Aquatic Organism Consumption		1.1E+06
DINITROBENZENE, 1,3-				
DINITROPHENOL, 2,4-	5.3E+03	USEPA Aquatic Organism Consumption		5.3E+03
DINITROTOLUENE, 2,4- (2,4-DNT)	3.0E+00	HI DOH Fish Consumption	3.0E+00	3.4E+00
DINITROTOLUENE, 2,6- (2,6-DNT)				
DIOXANE, 1,4-				
DIOXINS (TEQ)	5.0E-09	HI DOH Fish Consumption	5.0E-09	5.1E-09
DIURON				
ENDOSULFAN	5.2E+01	HI DOH Fish Consumption	5.2E+01	8.9E+01
ENDRIN	8.1E-01	USEPA Aquatic Organism Consumption		8.1E-01
ETHANOL				
ETHYLBENZENE	1.1E+03	HI DOH Fish Consumption	1.1E+03	2.9E+04
FLUORANTHENE	1.8E+01	HI DOH Fish Consumption	1.8E+01	1.4E+02
FLUORENE	5.3E+03	USEPA Aquatic Organism Consumption		5.3E+03
GLYPHOSATE				
HEPTACHLOR	9.0E-05	HI DOH Fish Consumption	9.0E-05	7.9E-05
HEPTACHLOR EPOXIDE	3.9E-05	USEPA Aquatic Organism Consumption		3.9E-05
HEXACHLOROBENZENE	2.4E-04	HI DOH Fish Consumption	2.4E-04	2.9E-04

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

CONTAMINANT	Selected Criteria	Basis	[1]HI DOH WQS	[2]USEPA NWQC
HEXACHLOROBUTADIENE	1.6E+01	HI DOH Fish Consumption	1.6E+01	1.8E+01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	2.0E-02	HI DOH Fish Consumption	2.0E-02	6.3E-02
HEXACHLOROETHANE	2.9E+00	HI DOH Fish Consumption	2.9E+00	3.3E+00
HEXAZINONE				
INDENO(1,2,3-cd)PYRENE	1.8E-02	USEPA Aquatic Organism Consumption		1.8E-02
ISOPHORONE	1.7E+05	HI DOH Fish Consumption	1.70E+05	
LEAD				
MERCURY	4.7E-02	HI DOH Fish Consumption	4.7E-02	3.0E-01
METHOXYCHLOR				
METHYL ETHYL KETONE				
METHYL ISOBUTYL KETONE				
METHYL MERCURY				
METHYL TERT BUTYL ETHER				
METHYLENE CHLORIDE	5.9E+02	USEPA Aquatic Organism Consumption		5.9E+02
METHYLNAPHTHALENE, 1-				
METHYLNAPHTHALENE, 2-				
MOLYBDENUM				
NAPHTHALENE				
NICKEL	3.3E+01	HI DOH Fish Consumption	3.3E+01	4.6E+03
NITROBENZENE				
NITROGLYCERIN				
NITROTOLUENE, 2-				
NITROTOLUENE, 3-				
NITROTOLUENE, 4-				
PENTACHLOROPHENOL	3.0E+00	USEPA Aquatic Organism Consumption		3.0E+00
PENTAERYTHRITOLTETRANITRATE (PETN)				
PERCHLORATE				
PHENANTHRENE				
PHENOL	1.7E+06	USEPA Aquatic Organism Consumption		1.7E+06
POLYCHLORINATED BIPHENYLS (PCBs)	7.9E-05	HI DOH Fish Consumption	7.9E-05	6.4E-05
PROPICONAZOLE				
PYRENE	4.0E+03	USEPA Aquatic Organism Consumption		4.0E+03
SELENIUM				
SILVER				
SIMAZINE				
STYRENE				
TERBACIL				
tert-BUTYL ALCOHOL				
TETRACHLOROETHANE, 1,1,1,2-				
TETRACHLOROETHANE, 1,1,2,2-	3.5E+00	HI DOH Fish Consumption	3.5E+00	4.0E+00
TETRACHLOROETHYLENE	2.9E+00	HI DOH Fish Consumption	2.90E+00	3.3E+00
TETRACHLOROPHENOL, 2,3,4,6-				
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)				

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

CONTAMINANT	Selected Criteria	Basis	[1]HI DOH WQS	[2]USEPA NWQC
THALLIUM	1.6E+01	HI DOH Fish Consumption	1.6E+01	6.3E+00
TOLUENE	1.4E+05	HI DOH Fish Consumption	1.4E+05	2.0E+05
TOXAPHENE	2.4E-04	HI DOH Fish Consumption	2.4E-04	2.8E-04
TPH (gasolines)				
TPH (middle distillates)				
TPH (residual fuels)				
TRICHLOROBENZENE, 1,2,4-				
TRICHLOROETHANE, 1,1,1-	3.4E+05	HI DOH Fish Consumption	3.4E+05	
TRICHLOROETHANE, 1,1,2-	1.4E+01	HI DOH Fish Consumption	1.4E+01	1.6E+01
TRICHLOROETHYLENE	2.6E+01	HI DOH Fish Consumption	2.6E+01	3.0E+01
TRICHLOROPHENOL, 2,4,5-	3.6E+03	USEPA Aquatic Organism Consumption		3.6E+03
TRICHLOROPHENOL, 2,4,6-	1.2E+00	HI DOH Fish Consumption	1.2E+00	
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)				
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)				
TRICHLOROPROPANE, 1,2,3-				
TRICHLOROPROPENE, 1,2,3-				
TRIFLURALIN				
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)				
TRINITROTOLUENE, 1,3,5-				
TRINITROTOLUENE, 2,4,6- (TNT)				
VANADIUM				
VINYL CHLORIDE	1.7E+02	HI DOH Fish Consumption	1.70E+02	5.30E+02
XYLENES				
ZINC				

References:

1. Hawai'I Administrative Rules, Title 11, Chapter 54, Section 11-54-04: Basic Water Quality Criteria, August 2009.
2. USEPA National Recommended Water Quality Criteria (USEPA 2006).

Notes:

Hawai'I Surface Water Quality Standards for fish consumption considered if available.
Addresses potential accumulation of chemical in aquatic organisms and subsequent consumption by humans.

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

CHEMICAL PARAMETER	Agricultural Water Quality Goals
ACENAPHTHENE	-
ACENAPHTHYLENE	-
ACETONE	-
ALDRIN	-
AMETRYN	-
AMINO,2- DINITROTOLUENE,4,6-	-
AMINO,4- DINITROTOLUENE,2,6-	-
ANTHRACENE	-
ANTIMONY	-
ARSENIC	1.0E+02
ATRAZINE	-
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 (TECHNICAL)	-
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)	-
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	-
DALAPON	-
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-	-

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

CHEMICAL PARAMETER	Agricultural Water Quality Goals
DICHLORODIPHENYLDICHLOROETHANE (DDD)	-
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	-
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	-
DICHLOROETHANE, 1,1-	-
DICHLOROETHANE, 1,2-	-
DICHLOROETHYLENE, 1,1-	-
DICHLOROETHYLENE, Cis 1,2-	-
DICHLOROETHYLENE, Trans 1,2-	-
DICHLOROPHENOL, 2,4-	-
DICHLOROPHENOXYACETIC ACID (2,4-D)	-
DICHLOROPROPANE, 1,2-	-
DICHLOROPROPENE, 1,3-	-
DIELDRIN	-
DIETHYLPHTHALATE	-
DIMETHYLPHENOL, 2,4-	-
DIMETHYLPHTHALATE	-
DINITROBENZENE, 1,3-	-
DINITROPHENOL, 2,4-	-
DINITROTOLUENE, 2,4- (2,4-DNT)	-
DINITROTOLUENE, 2,6- (2,6-DNT)	-
DIOXANE, 1,4-	-
DIOXINS (TEQ)	-
DIURON	-
ENDOSULFAN	-
ENDRIN	-
ETHANOL	-
ETHYLBENZENE	-
FLUORANTHENE	-
FLUORENE	-
GLYPHOSATE	-
HEPTACHLOR	-
HEPTACHLOR EPOXIDE	-
HEXACHLOROBENZENE	-
HEXACHLOROBUTADIENE	-
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	-
HEXACHLOROETHANE	-
HEXAZINONE	-
INDENO(1,2,3-cd)PYRENE	-
ISOPHORONE	-
LEAD	-
MERCURY	-
METHOXYCHLOR	-
METHYL ETHYL KETONE	-
METHYL ISOBUTYL KETONE	-
METHYL MERCURY	-
METHYL TERT BUTYL ETHER	-
METHYLENE CHLORIDE	-
METHYLNAPHTHALENE, 1-	-
METHYLNAPHTHALENE, 2-	-
MOLYBDENUM	1.0E+01
NAPHTHALENE	-
NICKEL	2.0E+02
NITROBENZENE	-

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

CHEMICAL PARAMETER	Agricultural Water Quality Goals
NITROGLYCERIN	-
NITROTOLUENE, 2-	-
NITROTOLUENE, 3-	-
NITROTOLUENE, 4-	-
PENTACHLOROPHENOL	-
PENTAERYTHRITOLTETRANITRATE (PETN)	-
PERCHLORATE	-
PHENANTHRENE	-
PHENOL	-
POLYCHLORINATED BIPHENYLS (PCBs)	-
PROPICONAZOLE	-
PYRENE	-
SELENIUM	2.0E+01
SILVER	-
SIMAZINE	-
STYRENE	-
TERBACIL	-
tert-BUTYL ALCOHOL	-
TETRACHLOROETHANE, 1,1,1,2-	-
TETRACHLOROETHANE, 1,1,2,2-	-
TETRACHLOROETHYLENE	-
TETRACHLOROPHENOL, 2,3,4,6-	-
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	-
THALLIUM	-
TOLUENE	-
TOXAPHENE	-
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-	-
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	-
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	-
TRICHLOROPROPANE, 1,2,3-	-
TRICHLOROPROPENE, 1,2,3-	-
TRIFLURALIN	-
TRINITROBENZENE, 1,3,5-	-
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	-
TRINITROTOLUENE, 2,4,6- (TNT)	-
VANADIUM	1.0E+02
VINYL CHLORIDE	-
XYLENES	-
ZINC	2.0E+03

References:
A Compiliation of Water Quality Goals (RWQCBCV 2007).

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

TABLE E. SOIL ACTION LEVELS FOR LEACHING CONCERNS

					Target Groundwater Concentrations				Soil Leaching Action Levels			
					Drinking Water IS Threatened		Drinking Water NOT Threatened		Drinking Water IS Threatened		Drinking Water NOT Threatened	
CONTAMINANT	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 (Surface Water Within 150m; Table D-1a) (ug/L)	Target Groundwater Concentration (Surface Water NOT Within 150m; Table D-1b) (ug/L)	Target Groundwater Concentration (Surface Water Within 150m; Table D-1c) (ug/L)	Target Groundwater Concentration (Surface Water NOT Within 150m; Table D-1d) (ug/L)	Soil Leaching Action Level (Surface Water Within 150m) (mg/kg)	Soil Leaching Action Level (Surface Water NOT Within 150m) (mg/kg)	Soil Leaching Action Level (Surface Water Within 150m) (mg/kg)	Soil Leaching Action Level (Surface Water NOT Within 150m) (mg/kg)
#ACENAPHTHENE	5.03E+03	1.80E-04	8.36E+02	1.2E+02	2.0E+01	2.0E+01	2.3E+01	2.0E+02	1.2E+02	1.2E+02	1.2E+02	1.7E+02
ACENAPHTHYLENE	2.50E+03	1.45E-03	4.24E+02	5.9E+01	3.0E+01	2.4E+02	3.0E+01	3.0E+02	1.3E+01	1.0E+02	1.3E+01	1.3E+02
ACETONE	2.60E+00	3.90E-05	6.74E-01	1.2E+05	1.5E+03	1.5E+03	1.5E+03	1.5E+03	1.0E+00	1.0E+00	1.0E+00	1.0E+00
#ALDRIN	8.20E+04	4.39E-05	1.36E+04	8.4E+00	4.0E-03	4.0E-03	1.3E-01	1.3E+00	8.4E+00	8.4E+00	8.4E+00	1.8E+01
AMETRYN	4.28E+02	2.39E-09	7.10E+01	5.6E+02	1.5E+01	1.5E+02	1.5E+01	1.5E+02	1.1E+00	1.1E+01	1.1E+00	1.1E+01
AMINO,2- DINITROTOLUENE,4,6-	2.83E+02	1.61E-10	4.70E+01	2.2E+03	1.5E+01	7.3E+01	1.5E+01	1.5E+02	7.0E-01	3.4E+00	7.0E-01	7.0E+00
AMINO,4- DINITROTOLUENE,2,6-	2.83E+02	1.61E-10	4.70E+01	2.2E+03	1.5E+01	7.3E+01	1.5E+01	1.5E+02	7.0E-01	3.4E+00	7.0E-01	7.0E+00
#ANTHRACENE	1.64E+04	5.61E-05	2.72E+03	4.3E+00	7.3E-01	2.2E+01	7.3E-01	2.2E+01	4.3E+00	5.9E+01	4.3E+00	5.9E+01
ANTIMONY					6.0E+00	6.0E+00	3.0E+01	1.5E+03	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
ARSENIC					1.0E+01	1.0E+01	3.6E+01	6.9E+01	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
ATRAZINE	2.25E+02	2.34E-09	3.74E+01	5.0E+01	3.0E+00	3.0E+00	1.2E+01	3.5E+02	1.1E-01	1.1E-01	4.5E-01	1.3E+01
BARIUM					2.0E+02	1.0E+03	2.0E+02	1.0E+03	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
BENZENE	1.46E+02	5.61E-03	5.91E+01	1.8E+03	5.0E+00	5.0E+00	4.6E+01	1.7E+03	3.0E-01	3.0E-01	2.7E+00	1.0E+02
#BENZO(a)ANTHRACENE	1.77E+05	1.20E-05	2.94E+04	1.0E+01	2.7E-02	9.2E-02	2.7E-02	4.7E+00	1.0E+01	1.0E+01	1.0E+01	1.4E+02
#BENZO(a)PYRENE	5.87E+05	4.63E-07	9.75E+04	5.7E+00	1.4E-02	2.0E-01	1.4E-02	8.1E-01	5.7E+00	2.0E+01	5.7E+00	7.9E+01
#BENZO(b)FLUORANTHENE	5.99E+05	6.59E-07	9.95E+04	5.4E+00	9.2E-02	9.2E-02	7.5E-01	7.5E-01	9.2E+00	9.2E+00	7.5E+01	7.5E+01
#BENZO(g,h,i)PERYLENE	1.60E+06	1.44E-07	2.66E+05	2.5E+00	1.0E-01	1.3E-01	1.0E-01	1.3E-01	2.7E+01	3.5E+01	2.7E+01	3.5E+01
#BENZO(k)FLUORANTHENE	5.87E+05	5.85E-07	9.75E+04	2.8E+00	4.0E-01	4.0E-01	4.0E-01	4.0E-01	3.9E+01	3.9E+01	3.9E+01	3.9E+01
BERYLLIUM					2.7E+00	4.0E+00	2.7E+00	4.3E+01	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
#BIPHENYL, 1,1-	5.13E+03	3.17E-04	8.53E+02	2.1E+02	5.0E-01	5.0E-01	5.0E+00	5.0E+00	2.1E+02	2.1E+02	2.1E+02	2.1E+02
BIS(2-CHLOROETHYL)ETHER	3.20E+01	1.71E-05	5.42E+00	5.0E+03	1.2E-02	1.2E-02	6.1E+01	1.3E+02	6.4E-05	6.4E-05	3.3E-01	7.2E-01
BIS(2-CHLOROISOPROPYL)ETHER	6.10E+01	1.13E-04	1.08E+01	7.9E+02	3.2E-01	3.2E-01	6.1E+01	3.2E+03	3.5E-03	3.5E-03	6.6E-01	3.5E+01
BIS(2-ETHYLHEXYL)PHTHALATE	1.20E+05	2.68E-07	1.99E+04	1.9E+02	6.0E+00	6.0E+00	3.2E+01	3.2E+01	1.9E+02	1.9E+02	6.4E+02	6.4E+02
BORON					7.3E+03	7.3E+03	7.3E+03	7.3E+03	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
BROMODICHLOROMETHANE	3.18E+01	2.12E-03	1.84E+01	9.3E+02	1.2E-01	1.2E-01	9.8E+01	9.8E+01	2.2E-03	2.2E-03	1.8E+00	1.8E+00
BROMOFORM	3.18E+01	5.37E-04	8.61E+00	9.1E+02	8.0E+01	8.0E+01	3.2E+03	5.1E+03	6.9E-01	6.9E-01	2.8E+01	4.4E+01
BROMOMETHANE	1.32E+01	6.34E-03	4.16E+01	3.5E+03	8.7E+00	8.7E+00	1.6E+02	4.6E+02	3.6E-01	3.6E-01	6.6E+00	1.9E+01
CADMIUM					3.0E+00	3.0E+00	3.0E+00	3.0E+00	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
CARBON TETRACHLORIDE	4.39E+01	2.68E-02	1.74E+02	4.5E+02	5.0E+00	5.0E+00	9.8E+00	9.8E+01	8.7E-01	8.7E-01	1.7E+00	1.7E+01
#CHLORDANE (TECHNICAL)	8.67E+04	4.88E-05	1.44E+04	2.9E+01	4.0E-03	9.0E-02	4.0E-03	9.0E-02	2.9E+01	2.9E+01	2.9E+01	2.9E+01
CHLOROANILINE, p-	1.13E+02	1.15E-06	1.87E+01	3.0E+03	3.4E-01	3.4E-01	5.0E+00	5.0E+00	6.3E-03	6.3E-03	9.4E-02	9.4E-02
CHLOROBENZENE	2.34E+02	3.17E-03	5.85E+01	7.6E+02	2.5E+01	5.0E+01	2.5E+01	1.6E+02	1.5E+00	2.9E+00	1.5E+00	9.4E+00
CHLOROETHANE	2.18E+01	1.10E-02	7.17E+01	2.1E+03	1.6E+01	1.6E+01	1.6E+02	1.6E+02	1.1E+00	1.1E+00	1.1E+01	1.1E+01
CHLOROFORM	3.18E+01	3.66E-03	2.80E+01	2.5E+03	7.0E+01	7.0E+01	9.4E+01	9.4E+01	2.0E+00	2.0E+00	2.6E+00	2.6E+00
CHLOROMETHANE	1.32E+01	8.78E-03	5.67E+01	1.3E+03	1.8E+00	1.8E+00	3.7E+02	3.7E+02	1.0E-01	1.0E-01	2.1E+01	2.1E+01
CHLOROPHENOL, 2-	3.06E+02	1.12E-05	5.09E+01	5.5E+04	1.8E-01	1.8E-01	1.8E+00	1.8E+00	9.2E-03	9.2E-03	9.2E-02	9.2E-02
CHROMIUM (Total)					7.4E+01	1.0E+02	7.4E+01	5.7E+02	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
CHROMIUM III					7.4E+01	5.7E+02	7.4E+01	5.7E+02	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
CHROMIUM VI					1.1E+01	1.3E+01	1.1E+01	1.6E+01	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
#CHRYSENE	1.81E+05	5.12E-06	3.00E+04	2.2E+00	3.5E-01	1.0E+00	3.5E-01	1.0E+00	1.0E+01	3.0E+01	1.0E+01	3.0E+01
COBALT					3.0E+00	3.0E+00	3.0E+00	3.0E+00	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
COPPER					2.9E+00	2.9E+00	2.9E+00	2.9E+00	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
CYANIDE (Free)					1.0E+00	1.0E+00	1.0E+00	1.0E+00	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	8.91E+01	6.34E-08	1.48E+01	3.8E+01	6.1E-01	6.1E-01	1.9E+02	1.4E+03	9.0E-03	9.0E-03	2.8E+00	2.1E+01
DALAPON	3.20E+00	9.02E-08	5.32E-01	6.0E+04	2.0E+02	2.0E+02	3.0E+02	3.0E+03	1.1E-01	1.1E-01	1.6E-01	1.6E+00
#DIBENZO(a,h)ANTHTRACENE	1.91E+06	1.22E-07	3.17E+05	1.2E+01	9.2E-03	9.2E-03	5.2E-01	5.2E-01	1.2E+01	1.2E+01	1.6E+02	1.6E+02
DIBROMO,1,2- CHLOROPROPANE,3-	1.31E+02	1.46E-04	2.26E+01	1.1E+03	4.0E-02	4.0E-02	4.0E-02	4.0E-02	9.0E-04	9.0E-04	9.0E-04	9.0E-04
DIBROMOCHLOROMETHANE	3.18E+01	7.80E-04	1.01E+01	8.0E+02	1.6E-01	1.6E-01	3.4E+02	3.4E+02	1.6E-03	1.6E-03	3.4E+00	3.4E+00
DIBROMOETHANE, 1,2-	3.18E+01	6.59E-04	9.37E+00	1.2E+03	4.0E-02	4.0E-02	1.6E+01	1.6E+01	3.7E-04	3.7E-04	1.5E-01	1.5E-01
DICHLOROBENZENE, 1,2-	3.83E+02	1.90E-03	7.54E+01	1.9E+02	1.0E+01	1.0E+01	1.4E+01	1.0E+02	7.5E-01	7.5E-01	1.1E+00	7.5E+00
DICHLOROBENZENE, 1,3-	6.17E+02	1.90E-03	1.14E+02	6.0E+02	5.0E+00	5.0E+00	6.5E+01	3.7E+02	5.7E-01	5.7E-01	7.4E+00	4.2E+01
DICHLOROBENZENE, 1,4-	3.75E+02	2.41E-03	7.72E+01	1.9E+02	5.0E+00	5.0E+00	1.5E+01	1.1E+02	3.9E-01	3.9E-01	1.2E+00	8.5E+00
DICHLOROBENZIDINE, 3,3-	3.19E+03	5.12E-11	5.30E+02	6.0E+01	1.5E-01	1.5E-01	2.5E+02	2.5E+02	7.9E-02	7.9E-02	1.3E+02	1.3E+02
#DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.18E+05	6.59E-06	1.95E+04	6.3E+01	1.0E-03	2.8E-01	1.0E-03	6.0E-01	6.3E+01	6.3E+01	6.3E+01	6.3E+01
#DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.18E+05	4.15E-05	1.95E+04	2.8E+01	1.0E-03	2.0E-01	1.0E-03	1.1E+00	2.8E+01	2.8E+01	2.8E+01	2.8E+01
#DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.69E+05	8.29E-06	2.80E+04	5.6E+00	1.0E-03	1.3E-02	1.0E-03	1.3E-02	5.6E+00	5.6E+00	5.6E+00	5.6E+00

TABLE E. SOIL ACTION LEVELS FOR LEACHING CONCERNS

					Target Groundwater Concentrations				Soil Leaching Action Levels			
					Drinking Water IS Threatened		Drinking Water NOT Threatened		Drinking Water IS Threatened		Drinking Water NOT Threatened	
CONTAMINANT	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 (Surface Water Within 150m; Table D-1a) (ug/L)	Target Groundwater Concentration (Surface Water NOT Within 150m; Table D-1b) (ug/L)	Target Groundwater Concentration (Surface Water Within 150m; Table D-1c) (ug/L)	Target Groundwater Concentration (Surface Water NOT Within 150m; Table D-1d) (ug/L)	Soil Leaching Action Level (Surface Water Within 150m) (mg/kg)	Soil Leaching Action Level (Surface Water NOT Within 150m) (mg/kg)	Soil Leaching Action Level (Surface Water Within 150m) (mg/kg)	Soil Leaching Action Level (Surface Water NOT Within 150m) (mg/kg)
DICHLOROETHANE, 1,1-	3.18E+01	5.61E-03	4.01E+01	1.7E+03	2.4E+00	2.4E+00	4.7E+01	4.7E+01	9.7E-02	9.7E-02	1.9E+00	1.9E+00
DICHLOROETHANE, 1,2-	3.96E+01	1.17E-03	1.38E+01	1.8E+03	1.5E-01	1.5E-01	1.6E+02	1.6E+02	2.1E-03	2.1E-03	2.2E+00	2.2E+00
DICHLOROETHYLENE, 1,1-	3.18E+01	2.68E-02	1.72E+02	1.2E+03	7.0E+00	7.0E+00	2.5E+01	3.9E+03	1.2E+00	1.2E+00	4.3E+00	6.7E+02
DICHLOROETHYLENE, Cis 1,2-	3.96E+01	4.15E-03	3.23E+01	1.3E+03	7.0E+01	7.0E+01	5.9E+02	1.1E+03	2.3E+00	2.3E+00	1.9E+01	3.5E+01
DICHLOROETHYLENE, Trans 1,2-	3.96E+01	9.27E-03	6.41E+01	1.4E+03	1.0E+02	1.0E+02	5.9E+02	2.6E+03	6.4E+00	6.4E+00	3.8E+01	1.7E+02
DICHLOROPHENOL, 2,4-	4.92E+02	2.20E-06	8.17E+01	1.4E+04	3.0E-01	3.0E-01	3.0E+00	3.0E+00	2.5E-02	2.5E-02	2.5E-01	2.5E-01
DICHLOROPHENOXYACETIC ACID (2,4-D)	2.96E+01	3.41E-08	4.91E+00	1.9E+02	4.0E+01	7.0E+01	4.0E+01	2.0E+02	2.0E-01	3.4E-01	2.0E-01	9.8E-01
DICHLOROPROPANE, 1,2-	6.07E+01	2.93E-03	2.82E+01	1.4E+03	5.0E+00	5.0E+00	1.0E+02	1.0E+02	1.4E-01	1.4E-01	2.8E+00	2.8E+00
DICHLOROPROPENE, 1,3-	7.22E+01	3.66E-03	3.47E+01	1.6E+03	4.3E-01	4.3E-01	1.2E+02	2.6E+02	1.5E-02	1.5E-02	4.2E+00	9.0E+00
#DIELDRIN	2.01E+04	1.00E-05	3.34E+03	3.0E+01	1.9E-03	4.2E-03	1.9E-03	7.1E-01	3.0E+01	3.0E+01	3.0E+01	3.0E+01
DIETHYLPHTHALATE	1.05E+02	6.10E-07	1.74E+01	7.9E+02	1.5E+00	9.4E+02	1.5E+00	9.4E+02	2.6E-02	1.6E+01	2.6E-02	1.6E+01
DIMETHYLPHENOL, 2,4-	4.92E+02	9.51E-07	8.17E+01	2.4E+04	1.1E+02	1.2E+02	1.1E+02	2.7E+02	9.0E+00	9.9E+00	9.0E+00	2.2E+01
DIMETHYLPHTHALATE	1.40E+02	1.05E-07	2.32E+01	4.7E+03	1.5E+00	9.4E+02	1.5E+00	9.4E+02	3.5E-02	2.2E+01	3.5E-02	2.2E+01
DINITROBENZENE, 1,3-	3.52E+02	4.88E-08	5.84E+01	1.2E+03	3.7E+00	3.7E+00	3.0E+01	1.1E+02	2.1E-01	2.1E-01	1.8E+00	6.4E+00
DINITROPHENOL, 2,4-	4.61E+02	8.54E-08	7.65E+01	8.0E+03	7.3E+01	7.3E+01	7.5E+01	2.3E+02	5.6E+00	5.6E+00	5.7E+00	1.8E+01
DINITROTOLUENE, 2,4- (2,4-DNT)	5.87E+02	5.37E-08	9.74E+01	9.8E+02	2.2E-01	2.2E-01	4.4E+01	1.1E+02	2.1E-02	2.1E-02	4.3E+00	1.1E+01
DINITROTOLUENE, 2,6- (2,6-DNT)	5.87E+02	7.56E-07	9.74E+01	1.3E+03	3.7E+01	3.7E+01	4.4E+01	1.1E+02	3.6E+00	3.6E+00	4.3E+00	1.1E+01
DIOXANE, 1,4-	2.60E+00	4.88E-06	4.62E-01	1.2E+05	6.7E-01	6.7E-01	5.0E+04	5.0E+04	3.1E-04	3.1E-04	2.3E+01	2.3E+01
#DIOXINS (TEQ)	2.49E+05	2.20E-06	4.14E+04	1.8E-01	5.0E-06	3.0E-05	5.0E-06	3.0E-03	1.8E-01	1.8E-01	1.8E-01	1.8E-01
DIURON	1.09E+02	5.12E-10	1.81E+01	3.2E+01	6.0E+01	7.3E+01	6.0E+01	2.0E+02	1.1E+00	1.3E+00	1.1E+00	3.6E+00
#ENDOSULFAN	6.76E+03	6.59E-05	1.12E+03	1.8E+01	8.7E-03	3.4E-02	8.7E-03	3.4E-02	1.8E+01	1.8E+01	1.8E+01	1.8E+01
#ENDRIN	2.01E+04	6.34E-06	3.33E+03	3.0E+01	2.3E-03	3.7E-02	2.3E-03	3.7E-02	3.0E+01	3.0E+01	3.0E+01	3.0E+01
ETHANOL	3.09E-01	6.29E-06	9.03E-02	1.0E+05	5.0E+04	5.0E+04	5.0E+04	5.0E+04	4.5E+00	4.5E+00	4.5E+00	4.5E+00
ETHYLBENZENE	4.46E+02	7.80E-03	1.22E+02	4.8E+02	3.0E+01	3.0E+01	2.9E+02	3.0E+02	3.7E+00	3.7E+00	3.6E+01	3.7E+01
#FLUORANTHENE	5.55E+04	8.78E-06	9.20E+03	8.7E+01	8.0E+00	1.3E+02	8.0E+00	1.3E+02	8.7E+01	1.2E+03	8.7E+01	1.2E+03
#FLUORENE	9.16E+03	9.51E-05	1.52E+03	1.0E+02	3.9E+00	2.4E+02	3.9E+00	3.0E+02	1.0E+02	3.7E+02	1.0E+02	4.6E+02
GLYPHOSATE	1.00E+00	4.15E-19	1.66E-01	1.3E+03	6.5E+01	6.0E+02	6.5E+01	6.0E+02	1.1E-02	1.0E-01	1.1E-02	1.0E-01
#HEPTACHLOR	4.13E+04	2.93E-04	6.85E+03	4.5E+01	3.6E-03	5.3E-02	3.6E-03	5.3E-02	4.5E+01	4.5E+01	4.5E+01	4.5E+01
#HEPTACHLOR EPOXIDE	1.01E+04	2.10E-05	1.68E+03	1.2E+01	3.6E-03	5.3E-02	3.6E-03	5.3E-02	1.2E+01	1.2E+01	1.2E+01	1.2E+01
#HEXACHLOROBENZENE	6.20E+03	1.71E-03	1.04E+03	2.3E-01	1.0E+00	1.0E+00	3.1E+00	3.1E+00	1.0E+00	1.0E+00	3.2E+00	3.2E+00
HEXACHLOROBUTADIENE	8.45E+02	1.02E-02	2.04E+02	1.7E+01	8.6E-01	8.6E-01	4.7E+00	1.1E+01	1.8E-01	1.8E-01	9.5E-01	2.2E+00
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	2.81E+03	5.12E-06	4.66E+02	1.4E+02	8.0E-02	1.6E-01	8.0E-02	1.6E-01	3.7E-02	7.5E-02	3.7E-02	7.5E-02
HEXACHLOROETHANE	1.97E+02	3.90E-03	5.69E+01	6.6E+01	4.8E+00	4.8E+00	1.2E+01	1.0E+02	2.7E-01	2.7E-01	6.8E-01	5.7E+00
HEXAZINONE	1.29E+02	2.24E-12	2.14E+01	2.9E+04	1.2E+03	1.2E+03	5.0E+03	5.0E+04	2.6E+01	2.6E+01	1.1E+02	1.1E+03
#INDENO(1,2,3-cd)PYRENE	1.95E+06	3.41E-07	3.24E+05	2.2E+00	9.2E-02	9.2E-02	9.5E-02	9.5E-02	3.0E+01	3.0E+01	3.1E+01	3.1E+01
ISOPHORONE	6.52E+01	6.59E-06	1.09E+01	5.9E+03	7.1E+01	7.1E+01	1.3E+02	4.3E+03	7.7E-01	7.7E-01	1.4E+00	4.7E+01
LEAD					5.6E+00	1.5E+01	5.6E+00	2.9E+01	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
MERCURY					2.5E-02	2.0E+00	2.5E-02	2.1E+00	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
#METHOXYCHLOR	2.69E+04	2.02E-07	4.46E+03	1.6E+01	3.0E-02	3.0E-02	3.0E-02	3.0E-02	1.6E+01	1.6E+01	1.6E+01	1.6E+01
METHYL ETHYL KETONE	4.51E+00	5.61E-05	1.10E+00	2.8E+04	7.1E+03	7.1E+03	1.4E+04	1.4E+04	7.7E+00	7.7E+00	1.5E+01	1.5E+01
METHYL ISOBUTYL KETONE	1.26E+01	1.37E-04	2.94E+00	3.4E+03	1.7E+02	1.7E+02	1.7E+02	1.7E+02	5.0E-01	5.0E-01	5.0E-01	5.0E-01
METHYL MERCURY					3.0E-03	3.0E-03	3.0E-03	3.0E-03	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
METHYL TERT BUTYL ETHER	1.16E+01	5.85E-04	5.56E+00	8.9E+03	5.0E+00	5.0E+00	1.8E+03	1.8E+03	2.8E-02	2.8E-02	1.0E+01	1.0E+01
METHYLENE CHLORIDE	2.17E+01	3.17E-03	2.33E+01	3.3E+03	4.8E+00	4.8E+00	2.2E+03	3.9E+03	1.1E-01	1.1E-01	5.1E+01	9.2E+01
METHYLNAPHTHALENE, 1-	2.26E+03	5.12E-04	3.78E+02	3.4E+02	2.1E+00	4.7E+00	2.1E+00	1.0E+02	7.9E-01	1.8E+00	7.9E-01	3.8E+01
METHYLNAPHTHALENE, 2-	2.48E+03	5.12E-04	4.15E+02	3.7E+02	2.1E+00	1.0E+01	2.1E+00	1.0E+02	8.7E-01	4.1E+00	8.7E-01	4.1E+01
MOLYBDENUM					1.8E+02	1.8E+02	2.4E+02	2.4E+02	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
NAPHTHALENE	1.54E+03	4.39E-04	2.59E+02	2.9E+02	1.7E+01	1.7E+01	2.4E+01	2.1E+02	4.4E+00	4.4E+00	6.2E+00	5.4E+01
NICKEL					5.0E+00	5.0E+00	5.0E+00	5.0E+00	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
NITROBENZENE	2.26E+02	2.39E-05	3.77E+01	3.0E+03	1.2E-01	1.2E-01	6.0E+01	2.0E+03	4.6E-03	4.6E-03	2.3E+00	7.5E+01
NITROGLYCERIN	1.16E+02	9.76E-08	1.93E+01	1.1E+03	3.7E+00	3.7E+00	1.4E+02	1.4E+02	7.0E-02	7.0E-02	2.7E+00	2.7E+00
NITROTOLUENE, 2-	3.71E+02	1.24E-05	6.17E+01	1.5E+03	6.2E-02	6.2E-02	1.0E+03	7.5E+03	3.8E-03	3.8E-03	6.2E+01	4.6E+02
NITROTOLUENE, 3-	3.63E+02	2.39E-05	6.04E+01	9.5E+02	1.2E+02	1.2E+02	3.8E+02	3.8E+03	7.3E+00	7.3E+00	2.3E+01	2.3E+02
NITROTOLUENE, 4-	3.63E+02	5.61E-06	6.03E+01	1.0E+03	4.2E+00	4.2E+00	1.6E+03	3.3E+03	2.5E-01	2.5E-01	9.6E+01	2.0E+02
PENTACHLOROPHENOL	4.96E+03	2.44E-08	8.23E+02	4.2E+02	1.0E+00	1.0E+00	7.9E+00	1.3E+01	8.2E-01	8.2E-01	6.5E+00	1.1E+01
PENTAERYTHRITOLTETRANITRATE (PETN)	1.51E+02	1.20E-11	2.51E+01	4.3E+01	1.7E+01	1.7E+01	2.2E+04	2.2E+04	4.2E-01	4.2E-01	5.4E+02	5.4E+02

TABLE E. SOIL ACTION LEVELS FOR LEACHING CONCERNS

					Target Groundwater Concentrations				Soil Leaching Action Levels			
					Drinking Water IS Threatened		Drinking Water NOT Threatened		Drinking Water IS Threatened		Drinking Water NOT Threatened	
CONTAMINANT	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 (Surface Water Within 150m; Table D-1a) (ug/L)	Target Groundwater Concentration (Surface Water NOT Within 150m; Table D-1b) (ug/L)	Target Groundwater Concentration (Surface Water Within 150m; Table D-1c) (ug/L)	Target Groundwater Concentration (Surface Water NOT Within 150m; Table D-1d) (ug/L)	Soil Leaching Action Level (Surface Water Within 150m) (mg/kg)	Soil Leaching Action Level (Surface Water NOT Within 150m) (mg/kg)	Soil Leaching Action Level (Surface Water Within 150m) (mg/kg)	Soil Leaching Action Level (Surface Water NOT Within 150m) (mg/kg)
PERCHLORATE					2.6E+01	2.6E+01	6.0E+02	6.0E+02	7.0E-03	7.0E-03	1.2E+00	1.2E+00
#PHENANTHRENE	1.40E+04	3.93E-05	2.32E+03	6.9E+01	4.6E+00	2.4E+02	4.6E+00	3.0E+02	6.9E+01	5.7E+02	6.9E+01	7.0E+02
PHENOL	1.87E+02	3.41E-07	3.10E+01	1.0E+05	5.0E+00	5.0E+00	1.3E+03	3.4E+03	1.6E-01	1.6E-01	4.0E+01	1.1E+02
#POLYCHLORINATED BIPHENYLS (PCBs)	3.30E+04	2.93E-04	5.48E+03	6.3E+00	1.4E-02	5.0E-01	1.4E-02	2.0E+00	6.3E+00	6.3E+00	6.3E+00	1.1E+01
PROPICONAZOLE	1.56E+03	4.15E-09	2.58E+02	1.0E+03	2.6E+01	2.6E+02	2.6E+01	2.6E+02	6.6E+00	6.6E+01	6.6E+00	6.6E+01
#PYRENE	5.43E+04	1.20E-05	9.02E+03	4.4E+01	2.0E+00	6.8E+01	2.0E+00	6.8E+01	4.4E+01	6.1E+02	4.4E+01	6.1E+02
SELENIUM					5.0E+00	2.0E+01	5.0E+00	2.0E+01	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
SILVER					1.0E+00	1.0E+00	1.0E+00	1.0E+00	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
SIMAZINE	1.47E+02	9.51E-10	2.44E+01	6.1E+00	2.0E+00	4.0E+00	2.0E+00	1.0E+01	4.9E-02	9.8E-02	4.9E-02	2.4E-01
STYRENE	4.46E+02	2.68E-03	9.07E+01	8.7E+02	1.0E+01	1.0E+01	3.2E+01	3.2E+01	9.1E-01	9.1E-01	2.9E+00	2.9E+00
TERBACIL	5.01E+01	1.20E-10	8.32E+00	2.8E+02	4.7E+02	4.7E+02	2.3E+03	2.3E+04	3.9E+00	3.9E+00	1.9E+01	1.9E+02
tert-BUTYL ALCOHOL	3.70E+01	1.17E-05	6.21E+00	3.2E+05	4.5E+00	4.5E+00	1.8E+04	5.0E+04	2.8E-02	2.8E-02	1.1E+02	3.1E+02
TETRACHLOROETHANE, 1,1,1,2-	8.60E+01	2.41E-03	2.93E+01	6.8E+02	5.2E-01	5.2E-01	3.1E+02	3.1E+03	1.5E-02	1.5E-02	9.1E+00	9.1E+01
TETRACHLOROETHANE, 1,1,2,2-	9.49E+01	3.66E-04	1.80E+01	1.9E+03	6.7E-02	6.7E-02	2.0E+02	2.0E+02	1.2E-03	1.2E-03	3.7E+00	3.7E+00
TETRACHLOROETHYLENE	9.49E+01	1.76E-02	1.25E+02	1.7E+02	5.0E+00	5.0E+00	1.2E+02	1.8E+02	6.2E-01	6.2E-01	1.5E+01	2.2E+01
TETRACHLOROPHENOL, 2,3,4,6-	2.97E+03	8.78E-06	4.93E+02	4.1E+02	1.2E+00	1.0E+01	1.2E+00	1.0E+01	5.9E-01	4.9E+00	5.9E-01	4.9E+00
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	5.32E+02	8.54E-10	8.83E+01	3.1E+04	3.3E+02	1.8E+03	3.3E+02	1.9E+03	2.9E+01	1.6E+02	2.9E+01	1.7E+02
THALLIUM					2.0E+00	2.0E+00	2.0E+01	4.7E+02	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
TOLUENE	2.34E+02	6.59E-03	7.97E+01	8.2E+02	4.0E+01	4.0E+01	1.3E+02	4.0E+02	3.2E+00	3.2E+00	1.0E+01	3.2E+01
#TOXAPHENE	7.72E+04	6.10E-06	1.28E+04	2.5E+02	2.0E-04	2.1E-01	2.0E-04	2.1E-01	2.5E+02	2.5E+02	2.5E+02	2.5E+02
TPH (gasolines)	5.00E+03	7.80E-01	5.67E+03	5.4E+03	1.0E+02	1.0E+02	5.0E+02	5.0E+03	1.0E+02	1.0E+02	4.0E+02	2.0E+03
TPH (middle distillates)	5.00E+03	1.00E+00	7.04E+03	1.9E+02	1.0E+02	1.0E+02	6.4E+02	2.5E+03	1.0E+02	1.0E+02	5.0E+02	5.0E+03
TPH (residual fuels)					1.0E+02	1.0E+02	6.4E+02	2.5E+03	1.0E+03	1.0E+03	1.0E+03	5.0E+03
TRICHLOROBENZENE, 1,2,4-	1.36E+03	1.41E-03	2.34E+02	4.0E+02	2.5E+01	7.0E+01	2.5E+01	1.6E+02	5.8E+00	1.6E+01	5.8E+00	3.7E+01
TRICHLOROETHANE, 1,1,1-	4.34E+01	1.71E-02	1.13E+02	6.4E+02	6.2E+01	2.0E+02	6.2E+01	6.0E+03	7.0E+00	2.3E+01	7.0E+00	6.8E+02
TRICHLOROETHANE, 1,1,2-	6.07E+01	8.29E-04	1.52E+01	5.2E+02	5.0E+00	5.0E+00	1.0E+02	1.0E+02	7.6E-02	7.6E-02	1.6E+00	1.6E+00
TRICHLOROETHYLENE	6.07E+01	9.76E-03	7.06E+01	6.9E+02	5.0E+00	5.0E+00	3.6E+02	6.1E+02	3.5E-01	3.5E-01	2.5E+01	4.3E+01
TRICHLOROPHENOL, 2,4,5-	1.78E+03	1.61E-06	2.95E+02	1.3E+04	1.1E+01	1.0E+02	1.1E+01	1.0E+02	3.2E+00	2.9E+01	3.2E+00	2.9E+01
TRICHLOROPHENOL, 2,4,6-	1.78E+03	2.68E-06	2.95E+02	8.6E+03	6.1E+00	6.1E+00	4.9E+02	4.9E+02	1.8E+00	1.8E+00	1.4E+02	1.4E+02
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	1.07E+02	4.63E-08	1.78E+01	2.1E+02	3.7E+02	3.7E+02	6.9E+02	6.9E+02	6.5E+00	6.5E+00	1.2E+01	1.2E+01
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	1.75E+02	9.02E-09	2.91E+01	2.3E+02	3.0E+01	3.0E+01	3.0E+01	3.0E+01	8.7E-01	8.7E-01	8.7E-01	8.7E-01
TRICHLOROPROPANE, 1,2,3-	9.49E+01	3.41E-04	1.79E+01	1.2E+03	6.0E-01	6.0E-01	1.4E+01	1.4E+02	1.1E-02	1.1E-02	2.5E-01	2.5E+00
TRICHLOROPROPENE, 1,2,3-	1.16E+02	2.80E-02	1.93E+02	2.7E+03	6.2E-01	6.2E-01	6.2E-01	6.2E-01	1.2E-01	1.2E-01	1.2E-01	1.2E-01
#TRIFLURALIN	1.64E+04	1.02E-04	2.72E+03	1.8E+01	8.7E+00	8.7E+00	2.0E+01	2.0E+01	2.4E+01	2.4E+01	5.4E+01	5.4E+01
TRINITROBENZENE, 1,3,5-	1.68E+03	3.17E-09	2.79E+02	2.8E+03	3.0E+01	1.4E+02	3.0E+01	1.4E+02	8.4E+00	3.9E+01	8.4E+00	3.9E+01
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.61E+03	2.68E-09	7.64E+02	2.1E+03	1.5E+02	1.5E+02	1.5E+02	1.5E+02	1.1E+02	1.1E+02	1.1E+02	1.1E+02
TRINITROTOLUENE, 2,4,6- (TNT)	2.81E+03	4.63E-07	4.67E+02	2.2E+03	2.2E+00	2.2E+00	1.3E+02	5.7E+02	1.0E+00	1.0E+00	6.1E+01	2.7E+02
VANADIUM					1.9E+01	1.9E+01	1.9E+01	1.9E+01	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)

TABLE E. SOIL ACTION LEVELS FOR LEACHING CONCERNS

					Target Groundwater Concentrations				Soil Leaching Action Levels			
					Drinking Water IS Threatened		Drinking Water NOT Threatened		Drinking Water IS Threatened		Drinking Water NOT Threatened	
CONTAMINANT	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 (Surface Water Within 150m; Table D-1a) (ug/L)	Target Groundwater Concentration (Surface Water NOT Within 150m; Table D-1b) (ug/L)	Target Groundwater Concentration (Surface Water Within 150m; Table D-1c) (ug/L)	Target Groundwater Concentration (Surface Water NOT Within 150m; Table D-1d) (ug/L)	Soil Leaching Action Level (Surface Water Within 150m) (mg/kg)	Soil Leaching Action Level (Surface Water NOT Within 150m) (mg/kg)	Soil Leaching Action Level (Surface Water Within 150m) (mg/kg)	Soil Leaching Action Level (Surface Water NOT Within 150m) (mg/kg)
VINYL CHLORIDE	2.17E+01	2.68E-02	1.70E+02	3.9E+03	2.0E+00	2.0E+00	6.2E+01	6.2E+01	3.4E-01	3.4E-01	1.1E+01	1.1E+01
XYLENES	3.75E+02	7.07E-03	1.06E+02	3.9E+02	2.0E+01	2.0E+01	1.0E+02	1.0E+03	2.1E+00	2.1E+00	1.1E+01	1.1E+02
ZINC					2.2E+01	2.2E+01	2.2E+01	2.2E+01	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)

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 5,000 cm3/g, theoretical soil saturation level ("sat") used in place of leaching model action level if higher (see text).
Soil saturation levels calculated using equation presented in USEPA Regional action levels guidance (USEPA 2011, see Appendix 2).

Physio-Chemical constants for chemicals from USEPA RSLs guidance (USEPA 2011) or Ontario MOEE (MOEE 1996) when not available unless otherwise noted (see also Table H).

TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories. TPH action levels presented in 1996 HIDOH RBCA document applied to NDW, >150m from surface water groundwater category. May be applicable to other areas on a site-by-site basis if groundwater monitoring indicates that leaching of residual contamination from soil is not significant hazard.

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 action levels for leaching of TPH in general from soil (MADEP 1997, refer to Table H). Soil leaching level rounded to nearest hundred.

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

Action levels for TPH categories rounded to nearest 100 mg/kg.

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

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

TABLE F-1. CRITERIA FOR ASSIGNMENT OF SOIL GROSS CONTAMINATION ACTION LEVELS

Soil Category	Criteria	Gross Contamination Action Level (mg/kg)
Surface Soils		
Unrestricted Land Use (includes Residential, Schools, Parkland, etc.)	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 Land Use Only	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		
Unrestricted Land Use (includes Residential, Schools, Parkland, etc.)	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 Land Use Only	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 F-2. GROSS CONTAMINATION ACTION LEVELS FOR [1]EXPOSED OR POTENTIALLY EXPOSED SOIL (mg/kg)

CONTAMINANT	[2]Final Unrestricted Land Use Action Level	Final Industrial/ Commercial Land Use Action Level	[2]Raw Unrestricted Action Level	Raw Industrial/ Commercial Action 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	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	5.0E+02	1.0E+03	NA	2.9E-02	-	-	-
ACETONE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	1.2E+05	2.70E+02	3.09E+04	1.30E+01	2.08E+01
ALDRIN	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.3E-05	2.63E+02	1.70E-02	1.35E-03
AMETRYN	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	2.74E-06	-	-	-
AMINO,2- DINITROTOLUENE,4,6-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.07E-04	-	-	-
AMINO,4- DINITROTOLUENE,2,6-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.07E-04	-	-	-
ANTHRACENE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.7E-05	-	-	-
ANTIMONY	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-
ARSENIC	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-
ATRAZINE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	2.89E-07	-	-	-
BARIUM	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-
BENZENE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	1.8E+03	9.50E+01	4.89E+03	1.50E+00	6.33E+01
BENZO(a)ANTHRACENE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	2.2E-08	-	-	-
BENZO(a)PYRENE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	5.6E-09	-	-	-
BENZO(b)FLUORANTHENE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	5.0E-07	-	-	-
BENZO(g,h,i)PERYLENE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.1E-10	-	-	-
BENZO(k)FLUORANTHENE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	9.6E-11	-	-	-
BERYLLIUM	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-
BIPHENYL, 1,1-	5.0E+02	1.0E+03	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	5.0E+02	1.0E+03	5.0E+03	7.1E-01	2.87E+02	4.9E-02	1.45E+01
BIS(2-CHLOROISOPROPYL)ETHER	5.0E+02	7.9E+02	5.0E+02	1.0E+03	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	5.0E+02	1.0E+03	NA	6.2E-08	-	-	-
BORON	1.0E+02	5.0E+02	1.0E+02	5.0E+02	NA	-	-	-	-
BROMODICHLOROMETHANE	9.3E+02	9.3E+02	1.0E+03	2.5E+03	9.3E+02	5.00E+01	1.10E+07	1.68E+03	2.98E-02
BROMOFORM	5.0E+02	1.0E+03	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	5.0E+02	1.0E+03	3.5E+03	1.42E+03	8.00E+04	2.00E+01	7.10E+01
CADMIUM	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-
CARBON TETRACHLORIDE	4.5E+02	4.5E+02	5.0E+02	1.0E+03	4.5E+02	1.13E+02	6.30E+04	1.00E+01	1.13E+01
CHLORDANE (TECHNICAL)	1.0E+03	2.5E+03	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	1.0E+03	2.5E+03	NA	1.0E-05	-	-	-
CHLOROBENZENE	5.0E+02	7.6E+02	5.0E+02	1.0E+03	7.6E+02	1.18E+01	1.00E+03	2.20E-01	5.36E+01
CHLOROETHANE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	2.1E+03	1.01E+03	3.80E+05	1.40E+02	7.20E+00
CHLOROFORM	5.0E+02	1.0E+03	5.0E+02	1.0E+03	2.5E+03	1.60E+02	4.22E+05	8.50E+01	1.88E+00
CHLOROMETHANE	1.0E+02	5.0E+02	1.0E+02	5.0E+02	1.3E+03	4.30E+03	-	-	-
CHLOROPHENOL, 2-	1.0E+02	5.0E+02	1.0E+02	5.0E+02	5.5E+04	1.42E+00	1.90E+01	3.60E-03	3.94E+02
CHROMIUM (Total)	-	-	-	-	-	-	-	-	-
CHROMIUM III	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-
CHROMIUM VI	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-
CHRYSENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	6.3E-07	-	-	-
COBALT	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-
COPPER	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-
CYANIDE (Free)	1.0E+02	5.0E+02	1.0E+02	5.0E+02	NA	6.20E+02	6.52E+02	5.80E-01	1.07E+03
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	4.10E-09	-	-	-
DALAPON	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	6.70E-01	-	-	-
DIBENZO(a,h)ANTHTRACENE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.0E-10	-	-	-
DIBROMO-3-CHLOROPROPANE, 1,2-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	1.1E+03	8.00E-01	-	-	-
DIBROMOCHLOROMETHANE	1.0E+02	5.0E+02	1.0E+02	5.0E+02	NA	7.60E+01	-	-	-
DIBROMOETHANE, 1,2-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.20E+01	2.00E+05	2.60E+01	4.62E-01

TABLE F-2. GROSS CONTAMINATION ACTION LEVELS FOR [1]EXPOSED OR POTENTIALLY EXPOSED SOIL (mg/kg)

CONTAMINANT	[2]Final Unrestricted Land Use Action Level	Final Industrial/ Commercial Land Use Action Level	[2]Raw Unrestricted Action Level	Raw Industrial/ Commercial Action 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
DICHLOROBENZENE, 1,2-	1.9E+02	1.9E+02	1.0E+03	2.5E+03	1.9E+02	1.50E+00	3.05E+05	5.00E+01	3.00E-02
DICHLOROBENZENE, 1,3-	1.0E+02	5.0E+02	1.0E+02	5.0E+02	6.0E+02	2.30E+00	-	-	-
DICHLOROBENZENE, 1,4-	5.0E+02	1.0E+03	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	5.0E+02	1.0E+03	NA	4.5E-09	-	-	-
DICHLORODIPHENYLDICHLOROETHANE (DDD)	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.0E-06	-	-	-
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	6.5E-06	-	-	-
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	5.5E-06	-	-	-
DICHLOROETHANE, 1,1-	5.0E+02	1.0E+03	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	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	5.0E+02	1.0E+03	1.2E+03	5.91E+02	2.00E+06	5.00E+02	1.18E+00
DICHLOROETHYLENE, Cis 1,2-	1.0E+02	5.0E+02	1.0E+02	5.0E+02	1.3E+03	2.15E+02	-	-	-
DICHLOROETHYLENE, Trans 1,2-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	1.4E+03	3.31E+02	6.73E+04	1.70E+01	1.95E+01
DICHLOROPHENOL, 2,4-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	6.7E-02	1.40E+03	2.10E-01	3.19E-01
DICHLOROPHENOXYACETIC ACID (2,4-D)	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	8.25E-05	-	-	-
DICHLOROPROPANE, 1,2-	1.0E+02	5.0E+02	1.0E+02	5.0E+02	1.4E+03	4.20E+01	1.19E+03	2.50E-01	1.68E+02
DICHLOROPROPENE, 1,3-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	1.6E+03	4.30E+01	4.16E+03	1.00E+00	4.30E+01
DIELDRIN	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.8E-08	-	-	-
DIETHYLPHTHALATE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	3.5E-04	-	-	-
DIMETHYLPHENOL, 2,4-	1.0E+02	5.0E+02	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	5.0E+02	1.0E+03	NA	1.7E-03	-	-	-
DINITROBENZENE, 1,3-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	9.00E-04	-	-	-
DINITROPHENOL, 2,4-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.5E-05	-	-	-
DINITROTOLUENE, 2,4- (2,4-DNT)	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.47E-04	-	-	-
DINITROTOLUENE, 2,6- (2,6-DNT)	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	5.67E-04	-	-	-
DIOXANE, 1,4-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	3.70E+01	6.12E+05	1.70E+02	2.18E-01
DIOXINS (TEQ)	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.50E-09	-	-	-
DIURON	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	6.90E-08	-	-	-
ENDOSULFAN	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.0E-05	-	-	-
ENDRIN	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	2.0E-07	-	-	-
ETHANOL	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	5.65E+01	1.92E+04	1.00E+01	5.65E+00
ETHYLBENZENE	4.8E+02	4.8E+02	5.0E+02	1.0E+03	4.8E+02	1.00E+01	2.00E+03	4.50E-01	2.22E+01
FLUORANTHENE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	5.0E-06	-	-	-
FLUORENE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	3.2E-04	-	-	-
GLYPHOSATE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	4.30E-10	-	-	-
HEPTACHLOR	1.0E+03	2.5E+03	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	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	5.0E+02	1.0E+03	NA	1.1E-05	-	-	-
HEXACHLOROBUTADIENE	5.0E+02	1.0E+03	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	5.0E+02	1.0E+03	NA	9.4E-06	-	-	-
HEXACHLOROETHANE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	2.1E-01	-	-	-
HEXAZINONE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	2.25E-07	-	-	-
INDENO(1,2,3-cd)PYRENE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.0E-06	-	-	-
ISOPHORONE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	4.38E-01	-	-	-
LEAD	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-
MERCURY	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	2.0E-03	-	-	-
METHOXYCHLOR	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.4E-06	-	-	-
METHYL ETHYL KETONE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	2.8E+04	1.00E+02	3.20E+04	1.10E+01	9.09E+00
METHYL ISOBUTYL KETONE	1.0E+02	5.0E+02	1.0E+02	5.0E+02	3.4E+03	1.00E+01	4.20E+02	1.00E-01	1.00E+02
METHYL MERCURY	1.0E+02	5.0E+02	1.0E+02	5.0E+02	NA	-	-	-	-

TABLE F-2. GROSS CONTAMINATION ACTION LEVELS FOR [1]EXPOSED OR POTENTIALLY EXPOSED SOIL (mg/kg)

CONTAMINANT	[2]Final Unrestricted Land Use Action Level	Final Industrial/ Commercial Land Use Action Level	[2]Raw Unrestricted Action Level	Raw Industrial/ Commercial Action 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
METHYL TERT BUTYL ETHER	1.0E+02	5.0E+02	1.0E+02	5.0E+02	8.9E+03	2.45E+02	5.30E+02	1.30E-01	1.88E+03
METHYLENE CHLORIDE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	3.3E+03	4.29E+02	5.60E+05	1.60E+02	2.68E+00
METHYLNAPHTHALENE, 1-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	6.8E-02	6.80E+01	1.15E-02	5.91E+00
METHYLNAPHTHALENE, 2-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	6.8E-02	6.80E+01	1.15E-02	5.91E+00
MOLYBDENUM	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-
NAPHTHALENE	5.0E+02	1.0E+03	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	1.0E+03	2.5E+03	NA	-	-	-	-
NITROBENZENE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	3.0E+03	2.45E-01	-	-	-
NITROGLYCERIN	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	4.00E-02	-	-	-
NITROTOLUENE, 2-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	2.09E-01	-	-	-
NITROTOLUENE, 3-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	2.04E-01	-	-	-
NITROTOLUENE, 4-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	4.90E-03	-	-	-
PENTACHLOROPHENOL	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.1E-04	-	-	-
PENTAERYTHRITOLTETRANITRATE (PETN)	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	8.38E-04	-	-	-
PERCHLORATE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-
PHENANTHRENE	5.0E+02	1.0E+03	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	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	5.0E+02	1.0E+03	NA	4.9E-04 to 6.7E-03	-	-	-
PROPICONAZOLE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.00E-06	-	-	-
PYRENE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	2.5E-06	-	-	-
SELENIUM	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-
SILVER	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-
SIMAZINE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	2.21E-08	-	-	-
STYRENE	5.0E+02	8.7E+02	5.0E+02	1.0E+03	8.7E+02	5.00E+00	1.36E+03	3.00E-01	1.67E+01
TERBACIL	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	2.76E-07	-	-	-
tert-BUTYL ALCOHOL	1.0E+02	5.0E+02	1.0E+02	5.0E+02	3.2E+05	4.20E+01	-	-	-
TETRACHLOROETHANE, 1,1,1,2-	1.0E+02	5.0E+02	1.0E+02	5.0E+02	6.8E+02	1.20E+01	-	-	-
TETRACHLOROETHANE, 1,1,2,2-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	1.9E+03	4.00E+00	1.05E+04	1.50E+00	2.67E+00
TETRACHLOROETHYLENE	1.7E+02	1.7E+02	5.0E+02	1.0E+03	1.7E+02	1.90E+01	3.17E+04	4.68E+00	4.06E+00
TETRACHLOROPHENOL, 2,3,4,6-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	6.66E-04	-	-	-
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	2.41E-08	-	-	-
THALLIUM	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-
TOLUENE	5.0E+02	8.2E+02	5.0E+02	1.0E+03	8.2E+02	2.80E+01	3.00E+04	8.00E+00	3.50E+00
TOXAPHENE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	4.00E-01	-	-	-
TPH (gasolines)	1.0E+02	5.0E+02	1.0E+02	5.0E+02	5.4E+03	3.00E+02	1.00E+03	2.00E-01	1.50E+03
TPH (middle distillates)	5.0E+02	5.0E+02	5.0E+02	1.0E+03	5.0E+02	5.00E+00	1.00E+03	1.41E-01	3.55E+01
TPH (residual fuels)	5.0E+02	2.5E+03	5.0E+02	2.5E+03	NA	-	-	-	-
TRICHLOROBENZENE, 1,2,4-	5.0E+02	1.0E+03	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	6.4E+02	5.0E+02	1.0E+03	6.4E+02	1.00E+02	6.51E+04	1.20E+01	8.33E+00
TRICHLOROETHANE, 1,1,2-	1.0E+02	5.0E+02	1.0E+02	5.0E+02	5.2E+02	2.25E+01	-	-	-
TRICHLOROETHYLENE	5.0E+02	6.9E+02	5.0E+02	2.5E+03	6.9E+02	7.70E+01	1.36E+06	2.49E+02	3.09E-01
TRICHLOROPHENOL, 2,4,5-	1.0E+02	5.0E+02	1.0E+02	5.0E+02	NA	-	-	-	-
TRICHLOROPHENOL, 2,4,6-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.2E-02	3.00E-01	3.60E-05	3.33E+02
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	3.75E-05	-	-	-
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	2.58E-06	-	-	-
TRICHLOROPROPANE, 1,2,3-	1.0E+02	5.0E+02	1.0E+02	5.0E+02	1.2E+03	3.69E+00	-	-	-
TRICHLOROPROPENE, 1,2,3-	1.0E+02	5.0E+02	1.0E+02	5.0E+02	2.7E+03	4.40E+00	-	-	-
TRIFLURALIN	1.0E+02	5.0E+02	1.0E+02	5.0E+02	NA	4.58E-05	-	-	-
TRINITROBENZENE, 1,3,5-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	6.40E-06	-	-	-

TABLE F-2. GROSS CONTAMINATION ACTION LEVELS FOR [1]EXPOSED OR POTENTIALLY EXPOSED SOIL (mg/kg)

CONTAMINANT	[2]Final Unrestricted Land Use Action Level	Final Industrial/ Commercial Land Use Action Level	[2]Raw Unrestricted Action Level	Raw Industrial/ Commercial Action 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
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.17E-07	-	-	-
TRINITROTOLUENE, 2,4,6- (TNT)	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	8.02E-06	-	-	-
VANADIUM	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-
VINYL CHLORIDE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	3.9E+03	2.58E+03	7.71E+05	2.94E+02	8.78E+00
XYLENES	3.9E+02	3.9E+02	5.0E+02	1.0E+03	3.9E+02	6.00E+00	4.41E+02	1.00E-01	6.00E+01
ZINC	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-

Notes:
1. Default 0-3m below ground surface for residential settings and 0-1m below ground surface for commercial/industrial settings.
2. Based on unrestricted current or future land use. Considered adequate for residential housing, schools, medical facilities, day-care centers and other sensitive uses.
3. Referred to as "ceiling levels" in original MADEP guidance (MADEP 1994).

Odor Index = VP/ORT in ppm-v
Physio-chemical constants Ontario MOEE (MOEE 1996) except as noted.
Physio-chemical constants for chloroethane 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 F-1 or saturation limit, if lower.
Saturation limits calculated using equation in USEPA RSL guidance (USEPA 2011) for chemicals that are liquid at ambient temperatures and pressures (refer to Appendix 2).
50% ORT of 0.13 ppm-v for MTBE from information in CaEPA Public Health Goal for MTBE (CalEPA 1999).
TPH VP values from NIOSH (2002); TPHd ORT value from ATSDR (2001a). TPHg ORT based on threshold of 0.2ppm (AHC 2004; worst-case gasoline with TAME) and assumed MW of 108 (refer to Table H); ORT in ug/m^3 = 200 ppbv x (104/24)= 900; rounded to 1,000 ug/m^3.

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).
5. Military range Database (ARAMS), U.S. Army Corps of Engineers, Engineer Research and Development Center, http://el.erdc.usace.army.mil/arams/databases.html (used for explosive-related contaminants).

TABLE F-3. GROSS CONTAMINATION ACTION LEVELS FOR [1]DEEP OR OTHERWISE ISOLATED SOILS (mg/kg)

CONTAMINANT	[2]Final Unrestricted Land Use Action Level	Final Industrial/ Commercial Land Use Action Level	[2]Raw Unrestricted Action Level	Raw Industrial/ Commercial Action 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	2.5E+03	5.0E+03	NA	4.50E-03	5.13E+02	8.00E-02	5.63E-02
ACENAPHTHYLENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.90E-02	-	-	-
ACETONE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	1.2E+05	2.70E+02	3.09E+04	1.30E+01	2.08E+01
ALDRIN	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	2.30E-05	2.63E+02	1.70E-02	1.35E-03
AMETRYN	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.74E-06	-	-	-
AMINO,2- DINITROTOLUENE,4,6-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.07E-04	-	-	-
AMINO,4- DINITROTOLUENE,2,6-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.07E-04	-	-	-
ANTHRACENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.70E-05	-	-	-
ANTIMONY	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
ARSENIC	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
ATRAZINE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.89E-07	-	-	-
BARIUM	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
BENZENE	1.0E+03	1.8E+03	1.0E+03	2.5E+03	1.8E+03	9.50E+01	4.89E+03	1.50E+00	6.33E+01
BENZO(a)ANTHRACENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.20E-08	-	-	-
BENZO(a)PYRENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	5.60E-09	-	-	-
BENZO(b)FLUORANTHENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	5.00E-07	-	-	-
BENZO(g,h,i)PERYLENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.10E-10	-	-	-
BENZO(k)FLUORANTHENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	9.60E-11	-	-	-
BERYLLIUM	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
BIPHENYL, 1,1-	1.0E+03	2.5E+03	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	1.0E+03	2.5E+03	5.0E+03	7.10E-01	2.87E+02	4.9E-02	1.45E+01
BIS(2-CHLOROISOPROPYL)ETHER	7.9E+02	7.9E+02	1.0E+03	2.5E+03	7.9E+02	8.50E-01	2.24E+03	3.20E-01	2.66E+00
BIS(2-ETHYLHEXYL)PHTHALATE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	6.20E-08	-	-	-
BORON	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	-	-	-	-
BROMODICHLOROMETHANE	9.3E+02	9.3E+02	2.5E+03	5.0E+03	9.3E+02	5.00E+01	1.10E+07	1.68E+03	2.98E-02
BROMOFORM	1.0E+03	2.5E+03	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	1.0E+03	2.5E+03	3.5E+03	1.42E+03	8.00E+04	2.00E+01	7.10E+01
CADMIUM	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
CARBON TETRACHLORIDE	4.5E+02	4.5E+02	1.0E+03	2.5E+03	4.5E+02	1.13E+02	6.30E+04	1.00E+01	1.13E+01
CHLORDANE (TECHNICAL)	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	1.00E-05	8.40E+00	4.92E-04	2.03E-02
CHLOROANILINE, p-	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	1.00E-05	-	-	-
CHLOROBENZENE	7.6E+02	7.6E+02	1.0E+03	2.5E+03	7.6E+02	1.18E+01	1.00E+03	2.20E-01	5.36E+01
CHLOROETHANE	1.0E+03	2.1E+03	1.0E+03	2.5E+03	2.1E+03	1.01E+03	3.80E+05	1.40E+02	7.20E+00
CHLOROFORM	1.0E+03	2.5E+03	1.0E+03	2.5E+03	2.5E+03	1.60E+02	4.22E+05	8.50E+01	1.88E+00
CHLOROMETHANE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	1.3E+03	4.30E+03	-	-	-
CHLOROPHENOL, 2-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	5.5E+04	1.42E+00	1.90E+01	3.60E-03	3.94E+02
CHROMIUM (Total)	-	-	-	-	-	-	-	-	-
CHROMIUM III	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
CHROMIUM VI	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
CHRYSENE	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	6.30E-07	-	-	-
COBALT	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
COPPER	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
CYANIDE (Free)	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	6.20E+02	6.52E+02	5.80E-01	1.07E+03
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	4.10E-09	-	-	-
DALAPON	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	6.70E-01	-	-	-
DIBENZO(a,h)ANTHTRACENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.00E-10	-	-	-
DIBROMO-3-CHLOROPROPANE, 1,2-	1.0E+03	1.1E+03	1.0E+03	2.5E+03	1.1E+03	8.00E-01	-	-	-
DIBROMOCHLOROMETHANE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	7.60E+01	-	-	-

TABLE F-3. GROSS CONTAMINATION ACTION LEVELS FOR [1]DEEP OR OTHERWISE ISOLATED SOILS (mg/kg)

CONTAMINANT	[2]Final Unrestricted Land Use Action Level	Final Industrial/ Commercial Land Use Action Level	[2]Raw Unrestricted Action Level	Raw Industrial/ Commercial Action 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
DIBROMOETHANE, 1,2-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.20E+01	2.00E+05	2.60E+01	4.62E-01
DICHLOROBENZENE, 1,2-	1.9E+02	1.9E+02	2.5E+03	5.0E+03	1.9E+02	1.50E+00	3.05E+05	5.00E+01	3.00E-02
DICHLOROBENZENE, 1,3-	5.0E+02	6.0E+02	5.0E+02	1.0E+03	6.0E+02	2.30E+00	-	-	-
DICHLOROBENZENE, 1,4-	1.0E+03	2.5E+03	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	1.0E+03	2.5E+03	NA	4.50E-09	-	-	-
DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.00E-06	-	-	-
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	6.50E-06	-	-	-
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	5.50E-06	-	-	-
DICHLOROETHANE, 1,1-	1.0E+03	1.7E+03	1.0E+03	2.5E+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	1.0E+03	2.5E+03	1.8E+03	7.90E+01	2.42E+03	5.90E-01	1.34E+02
DICHLOROETHYLENE, 1,1-	1.0E+03	1.2E+03	1.0E+03	2.5E+03	1.2E+03	5.91E+02	2.00E+06	5.00E+02	1.18E+00
DICHLOROETHYLENE, Cis 1,2-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	1.3E+03	2.15E+02	-	-	-
DICHLOROETHYLENE, Trans 1,2-	1.0E+03	1.4E+03	1.0E+03	2.5E+03	1.4E+03	3.31E+02	6.73E+04	1.70E+01	1.95E+01
DICHLOROPHENOL, 2,4-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	6.70E-02	1.40E+03	2.10E-01	3.19E-01
DICHLOROPHENOXYACETIC ACID (2,4-D)	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	8.25E-05	-	-	-
DICHLOROPROPANE, 1,2-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	1.4E+03	4.20E+01	1.19E+03	2.50E-01	1.68E+02
DICHLOROPROPENE, 1,3-	1.0E+03	1.6E+03	1.0E+03	2.5E+03	1.6E+03	4.30E+01	4.16E+03	1.00E+00	4.30E+01
DIELDRIN	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	1.80E-08	-	-	-
DIETHYLPHTHALATE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	3.50E-04	-	-	-
DIMETHYLPHENOL, 2,4-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	9.80E-02	1.00E+00	1.97E-04	4.97E+02
DIMETHYLPHTHALATE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.70E-03	-	-	-
DINITROBENZENE, 1,3-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	9.00E-04	-	-	-
DINITROPHENOL, 2,4-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.50E-05	-	-	-
DINITROTOLUENE, 2,4- (2,4-DNT)	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.47E-04	-	-	-
DINITROTOLUENE, 2,6- (2,6-DNT)	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	5.67E-04	-	-	-
DIOXANE, 1,4-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	3.70E+01	6.12E+05	1.70E+02	2.18E-01
DIOXINS (TEQ)	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	1.50E-09	-	-	-
DIURON	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	6.90E-08	-	-	-
ENDOSULFAN	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.00E-05	-	-	-
ENDRIN	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.00E-07	-	-	-
ETHANOL	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	5.65E+01	1.92E+04	1.00E+01	5.65E+00
ETHYLBENZENE	4.8E+02	4.8E+02	1.0E+03	2.5E+03	4.8E+02	1.00E+01	2.00E+03	4.50E-01	2.22E+01
FLUORANTHENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	5.00E-06	-	-	-
FLUORENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	3.20E-04	-	-	-
GLYPHOSATE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	4.30E-10	-	-	-
HEPTACHLOR	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	3.00E-04	3.00E+02	2.00E-02	1.50E-02
HEPTACHLOR EPOXIDE	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	2.60E-06	3.00E+02	1.90E-02	1.37E-04
HEXACHLOROBENZENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.10E-05	-	-	-
HEXACHLOROBUTADIENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.50E-01	1.20E+04	1.10E+00	1.36E-01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	9.40E-06	-	-	-
HEXACHLOROETHANE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.10E-01	-	-	-
HEXAZINONE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.25E-07	-	-	-
INDENO(1,2,3-cd)PYRENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.00E-06	-	-	-
ISOPHORONE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	4.38E-01	-	-	-
LEAD	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
MERCURY	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.00E-03	-	-	-
METHOXYCHLOR	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.40E-06	-	-	-
METHYL ETHYL KETONE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	2.8E+04	1.00E+02	3.20E+04	1.10E+01	9.09E+00

TABLE F-3. GROSS CONTAMINATION ACTION LEVELS FOR [1]DEEP OR OTHERWISE ISOLATED SOILS (mg/kg)

CONTAMINANT	[2]Final Unrestricted Land Use Action Level	Final Industrial/ Commercial Land Use Action Level	[2]Raw Unrestricted Action Level	Raw Industrial/ Commercial Action 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
METHYL ISOBUTYL KETONE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	3.4E+03	1.00E+01	4.20E+02	1.00E-01	1.00E+02
METHYL MERCURY	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	-	-	-	-
METHYL TERT BUTYL ETHER	5.0E+02	1.0E+03	5.0E+02	1.0E+03	8.9E+03	2.45E+02	5.30E+02	1.30E-01	1.88E+03
METHYLENE CHLORIDE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	3.3E+03	4.29E+02	5.60E+05	1.60E+02	2.68E+00
METHYLNAPHTHALENE, 1-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	6.80E-02	6.80E+01	1.15E-02	5.91E+00
METHYLNAPHTHALENE, 2-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	6.80E-02	6.80E+01	1.15E-02	5.91E+00
MOLYBDENUM	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
NAPHTHALENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	8.20E-02	4.40E+02	8.40E-02	9.76E-01
NICKEL	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
NITROBENZENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	3.0E+03	2.45E-01	-	-	-
NITROGLYCERIN	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	4.00E-02	-	-	-
NITROTOLUENE, 2-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.09E-01	-	-	-
NITROTOLUENE, 3-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.04E-01	-	-	-
NITROTOLUENE, 4-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	4.90E-03	-	-	-
PENTACHLOROPHENOL	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.10E-04	-	-	-
PENTAERYTHRITOLTETRANITRATE (PETN)	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	8.38E-04	-	-	-
PERCHLORATE	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
PHENANTHRENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	9.60E-04	5.50E+01	7.42E-03	1.29E-01
PHENOL	1.0E+03	2.5E+03	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	1.0E+03	2.5E+03	NA	6.70E-03	-	-	-
PROPICONAZOLE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.00E-06	-	-	-
PYRENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.50E-06	-	-	-
SELENIUM	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
SILVER	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
SIMAZINE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.21E-08	-	-	-
STYRENE	8.7E+02	8.7E+02	1.0E+03	2.5E+03	8.7E+02	5.00E+00	1.36E+03	3.00E-01	1.67E+01
TERBACIL	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.76E-07	-	-	-
tert-BUTYL ALCOHOL	5.0E+02	1.0E+03	5.0E+02	1.0E+03	3.2E+05	4.20E+01	-	-	-
TETRACHLOROETHANE, 1,1,1,2-	5.0E+02	6.8E+02	5.0E+02	1.0E+03	6.8E+02	1.20E+01	-	-	-
TETRACHLOROETHANE, 1,1,2,2-	1.0E+03	1.9E+03	1.0E+03	2.5E+03	1.9E+03	4.00E+00	1.05E+04	1.50E+00	2.67E+00
TETRACHLOROETHYLENE	1.7E+02	1.7E+02	1.0E+03	2.5E+03	1.7E+02	1.90E+01	3.17E+04	4.68E+00	4.06E+00
TETRACHLOROPHENOL, 2,3,4,6-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	6.66E-04	-	-	-
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.41E-08	-	-	-
THALLIUM	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
TOLUENE	8.2E+02	8.2E+02	1.0E+03	2.5E+03	8.2E+02	2.80E+01	3.00E+04	8.00E+00	3.50E+00
TOXAPHENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	4.00E-01	-	-	-
TPH (gasolines)	5.0E+03	5.0E+03	5.0E+03	5.0E+03	5.4E+03	3.00E+02	1.00E+03	2.00E-01	1.50E+03
TPH (middle distillates)	5.0E+03	5.0E+03	5.0E+03	5.0E+03	NA	5.00E+00	1.00E+03	1.41E-01	3.55E+01
TPH (residual fuels)	5.0E+03	5.0E+03	5.0E+03	5.0E+03	NA	-	-	-	-
TRICHLOROBENZENE, 1,2,4-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.90E-01	2.20E+04	2.96E+00	9.80E-02
TRICHLOROETHANE, 1,1,1-	6.4E+02	6.4E+02	1.0E+03	2.5E+03	6.4E+02	1.00E+02	6.51E+04	1.20E+01	8.33E+00
TRICHLOROETHANE, 1,1,2-	5.0E+02	5.2E+02	5.0E+02	1.0E+03	5.2E+02	2.25E+01	-	-	-
TRICHLOROETHYLENE	6.9E+02	6.9E+02	2.5E+03	5.0E+03	6.9E+02	7.70E+01	1.36E+06	2.49E+02	3.09E-01
TRICHLOROPHENOL, 2,4,5-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	-	-	-	-
TRICHLOROPHENOL, 2,4,6-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.20E-02	3.00E-01	3.60E-05	3.33E+02
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	3.75E-05	-	-	-
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.58E-06	-	-	-
TRICHLOROPROPANE, 1,2,3-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	1.2E+03	3.69E+00	-	-	-

TABLE F-3. GROSS CONTAMINATION ACTION LEVELS FOR [1]DEEP OR OTHERWISE ISOLATED SOILS (mg/kg)

CONTAMINANT	[2]Final Unrestricted Land Use Action Level	Final Industrial/ Commercial Land Use Action Level	[2]Raw Unrestricted Action Level	Raw Industrial/ Commercial Action 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
TRICHLOROPROPENE, 1,2,3-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	2.7E+03	4.40E+00	-	-	-
TRIFLURALIN	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	4.58E-05	-	-	-
TRINITROBENZENE, 1,3,5-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	6.40E-06	-	-	-
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.17E-07	-	-	-
TRINITROTOLUENE, 2,4,6- (TNT)	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	8.02E-06	-	-	-
VANADIUM	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
VINYL CHLORIDE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	3.9E+03	2.58E+03	7.71E+05	2.94E+02	8.78E+00
XYLENES	3.9E+02	3.9E+02	1.0E+03	2.5E+03	3.9E+02	6.00E+00	4.41E+02	1.00E-01	6.00E+01
ZINC	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-

Notes:
1. Default >3m below ground surface for residential settings and >1m below unpaved ground surface for commercial/industrial settings.
2. Based on unrestricted current or future land use. Considered adequate for residential housing, schools, medical facilities, day-care centers and other sensitive uses.
3. Referred to as "ceiling levels" in original MADEP guidance (MADEP 1994).

Odor Index = VP/ORT in ppm-v
Physio-chemical constants Ontario MOEE (MOEE 1996) except as noted.
Physio-chemical constants for chloroethane 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 F-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).
Ceiling Levels for TPH after guidance from Massachusetts Department of Environmental Protection (MADEP 1997a).
50% ORT of 0.13 ppm-v for MTBE from information in CaEPA Public Health Goal for MTBE (CalEPA 1999).
TPH VP values from NIOSH (2002); TPHd ORT value from ATSDR (2001a). TPHg ORT based on threshold of 0.2ppm (AHC 2004; worst-case gasoline with TAME) and assumed MW of 108 (refer to Table H); ORT in ug/m^3 = 200 ppbv x (104/24)= 900; rounded to 1,000 ug/m^3.
TPH(middle distillate fuels) gross contamination action level for isolated soils at commercial/industrial sites set at 5,000 mg/kg, based on profession judgement.

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 2000).

TABLE G-1. GROUNDWATER GROSS CONTAMINATION ACTION LEVELS
(groundwater IS a current or potential source of drinking water)
(ug/L)

CHEMICAL PARAMETER	Final Action Level	Basis	Solubility (1/2)	Taste And Odor Threshold	Basis	Upper Limit
ACENAPHTHENE	2.0E+01	Taste & Odors	2.0E+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
AMETRYN	5.0E+04	Upper Limit	1.0E+05	-	-	5.0E+04
AMINO,2- DINITROTOLUENE,4,6-	5.0E+04	Upper Limit	6.1E+05	-	-	5.0E+04
AMINO,4- DINITROTOLUENE,2,6-	5.0E+04	Upper Limit	6.1E+05	-	-	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
ATRAZINE	2.0E+01	Taste & Odors	1.7E+04	2.0E+01	Young et al	5.0E+04
BARIUM	5.0E+04	Upper Limit		-	-	5.0E+04
BENZENE	1.7E+02	Taste & Odors	9.0E+05	1.7E+02	Amoore & Hautala	5.0E+04
BENZO(a)ANTHRACENE	4.7E+00	Solubility	4.7E+00	-	-	5.0E+04
BENZO(a)PYRENE	8.1E-01	Solubility	8.1E-01	-	-	5.0E+04
BENZO(b)FLUORANTHENE	7.5E-01	Solubility	7.5E-01	-	-	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	3.5E+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	1.4E+02	Solubility	1.4E+02	-	-	5.0E+04
BORON	5.0E+04	Upper Limit		-	-	5.0E+04
BROMODICHLOROMETHANE	5.0E+04	Upper Limit	1.5E+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 (TECHNICAL)	2.5E+00	Taste & Odors	2.8E+01	2.5E+00	Ontario MOEE	5.0E+04
CHLOROANILINE, p-	5.0E+04	Upper Limit	2.0E+06	-	-	5.0E+04
CHLOROBENZENE	5.0E+01	Taste & Odors	2.5E+05	5.0E+01	Amoore & Hautala	5.0E+04
CHLOROETHANE	1.6E+01	Taste & Odors	3.4E+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	2.7E+06		-	5.0E+04
CHLOROPHENOL, 2-	1.8E-01	Taste & Odors	1.4E+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	8.5E+08	-	-	5.0E+04
CHRYSENE	1.0E+00	Solubility	1.0E+00	-	-	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		1.7E+02	Amoore & Hautala	5.0E+04
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	3.0E+04	Solubility	3.0E+04	-	-	5.0E+04

TABLE G-1. GROUNDWATER GROSS CONTAMINATION ACTION LEVELS
(groundwater IS a current or potential source of drinking water)
(ug/L)

CHEMICAL PARAMETER	Final Action Level	Basis	Solubility (1/2)	Taste And Odor Threshold	Basis	Upper Limit
DALAPON	5.0E+04	Upper Limit	2.5E+08	-	-	5.0E+04
DIBENZO(a,h)ANTHTRACENE	5.2E-01	Solubility	5.2E-01	-	-	5.0E+04
DIBROMO,1,2- CHLOROPROPANE,3-	1.0E+01	Taste & Odors	6.2E+05	1.0E+01	Amoore & Hautala	5.0E+04
DIBROMOCHLOROMETHANE	5.0E+04	Upper Limit	1.4E+06	-	-	5.0E+04
DIBROMOETHANE, 1,2-	5.0E+04	Upper Limit	2.0E+06	-	-	5.0E+04
DICHLOROBENZENE, 1,2-	1.0E+01	Taste & Odors	4.0E+04	1.0E+01	USEPA 2nd MCL	5.0E+04
DICHLOROBENZENE, 1,3-	5.0E+00	Taste & Odors	7.8E+04	5.0E+00	1,4 DCB	5.0E+04
DICHLOROBENZENE, 1,4-	5.0E+00	Taste & Odors	4.1E+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)	4.5E+01	Solubility	4.5E+01	-	-	5.0E+04
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.0E+01	Solubility	2.0E+01	-	-	5.0E+04
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	2.8E+00	Solubility	2.8E+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	2.6E+06	7.0E+03	Amoore & Hautala	5.0E+04
DICHLOROETHYLENE, 1,1-	1.5E+03	Taste & Odors	1.2E+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	1.8E+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
DICHLOROPHENOXYACETIC ACID (2,4-D)	5.0E+04	Upper Limit	3.4E+05	-	-	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	1.3E+02	4.1E+01	Ontario MOEE	5.0E+04
DIETHYLPHTHALATE	5.0E+04	Upper Limit	5.4E+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
DINITROBENZENE, 1,3-	5.0E+04	Upper Limit	2.7E+05	-	-	5.0E+04
DINITROPHENOL, 2,4-	5.0E+04	Upper Limit	1.4E+06	-	-	5.0E+04
DINITROTOLUENE, 2,4- (2,4-DNT)	5.0E+04	Upper Limit	1.4E+05	-	-	5.0E+04
DINITROTOLUENE, 2,6- (2,6-DNT)	5.0E+04	Upper Limit	1.8E+05	-	-	5.0E+04
DIOXANE, 1,4-	5.0E+04	Upper Limit	5.0E+08	2.3E+05	Amoore & Hautala	5.0E+04
DIOXINS (TEQ)	6.0E-02	Solubility	6.0E-02	-	-	5.0E+04
DIURON	2.1E+04	Solubility	2.1E+04	-	-	5.0E+04
ENDOSULFAN	2.3E+02	Solubility	2.3E+02	-	-	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
FLUORANTHENE	1.3E+02	Solubility	1.3E+02	-	-	5.0E+04
FLUORENE	9.5E+02	Solubility	9.5E+02	-	-	5.0E+04
GLYPHOSATE	5.0E+04	Upper Limit	6.0E+06	-	-	5.0E+04
HEPTACHLOR	2.0E+01	Taste & Odors	9.0E+01	2.0E+01	Ontario MOEE	5.0E+04
HEPTACHLOR EPOXIDE	1.0E+02	Solubility	1.0E+02	-	-	5.0E+04
HEXACHLOROBENZENE	3.1E+00	Solubility	3.1E+00	3.0E+03	Ontario MOEE	5.0E+04
HEXACHLOROBUTADIENE	6.0E+00	Taste & Odors	1.6E+03	6.0E+00	Ontario MOEE	5.0E+04
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	4.0E+03	Solubility	4.0E+03	1.2E+04	Ontario MOEE	5.0E+04

TABLE G-1. GROUNDWATER GROSS CONTAMINATION ACTION LEVELS
(groundwater IS a current or potential source of drinking water)
(ug/L)

CHEMICAL PARAMETER	Final Action Level	Basis	Solubility (1/2)	Taste And Odor Threshold	Basis	Upper Limit
HEXACHLOROETHANE	1.0E+01	Taste & Odors	2.5E+04	1.0E+01	Amoore & Hautala	5.0E+04
HEXAZINONE	5.0E+04	Upper Limit	1.7E+07	-	-	5.0E+04
INDENO(1,2,3-cd)PYRENE	9.5E-02	Solubility	9.5E-02	-	-	5.0E+04
ISOPHORONE	5.0E+04	Upper Limit	6.0E+06	-	-	5.0E+04
LEAD	5.0E+04	Upper Limit		-	-	5.0E+04
MERCURY	3.0E+01	Solubility	3.0E+01	-	-	5.0E+04
METHOXYCHLOR	5.0E+01	Solubility	5.0E+01	4.7E+03	Amoore & Hautala	5.0E+04
METHYL ETHYL KETONE	8.4E+03	Taste & Odors	1.1E+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	2.6E+07	5.0E+00	Cal DHS 2nd MCL	5.0E+04
METHYLENE CHLORIDE	9.1E+03	Taste & Odors	6.5E+06	9.1E+03	Ontario MOEE	5.0E+04
METHYLNAPHTHALENE, 1-	1.0E+01	Taste & Odors	1.3E+04	1.0E+01	Ontario MOEE	5.0E+04
METHYLNAPHTHALENE, 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
NITROBENZENE	5.0E+04	Upper Limit	1.0E+06	-	-	5.0E+04
NITROGLYCERIN	5.0E+04	Upper Limit	6.9E+05	-	-	5.0E+04
NITROTOLUENE, 2-	5.0E+04	Upper Limit	3.3E+05	-	-	5.0E+04
NITROTOLUENE, 3-	5.0E+04	Upper Limit	2.1E+05	-	-	5.0E+04
NITROTOLUENE, 4-	5.0E+04	Upper Limit	2.2E+05	-	-	5.0E+04
PENTACHLOROPHENOL	3.0E+01	Taste & Odors	7.0E+03	3.0E+01	Amoore & Hautala	5.0E+04
PENTAERYTHRITOLTETRANITRATE (PETN)	2.2E+04	Solubility	2.2E+04	-	-	5.0E+04
PERCHLORATE	5.0E+04	Upper Limit	1.2E+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	4.1E+07	5.0E+00	Cal DHS AL	5.0E+04
POLYCHLORINATED BIPHENYLS (PCBs)	1.6E+01	Solubility	1.6E+01	-	-	5.0E+04
PROPICONAZOLE	5.0E+04	Upper Limit	5.5E+04	-	-	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
SIMAZINE	3.1E+03	Solubility	3.1E+03	-	-	5.0E+04
STYRENE	1.0E+01	Taste & Odors	1.6E+05	1.0E+01	USEPA 2nd MCL	5.0E+04
TERBACIL	5.0E+04	Upper Limit	3.6E+05	-	-	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	5.4E+05	-	-	5.0E+04
TETRACHLOROETHANE, 1,1,2,2-	5.0E+02	Taste & Odors	1.4E+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
TETRACHLOROPHENOL, 2,3,4,6-	1.2E+04	Solubility	1.2E+04	-	-	5.0E+04
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	5.0E+04	Upper Limit	4.7E+06	-	-	5.0E+04
THALLIUM	5.0E+04	Upper Limit		-	-	5.0E+04
TOLUENE	4.0E+01	Taste & Odors	2.6E+05	4.0E+01	USEPA 2nd MCL	5.0E+04
TOXAPHENE	1.4E+02	Taste & Odors	2.8E+02	1.4E+02	USEPA 2nd MCL	5.0E+04

TABLE G-1. GROUNDWATER GROSS CONTAMINATION ACTION LEVELS
(groundwater IS a current or potential source of drinking water)
(ug/L)

CHEMICAL PARAMETER	Final Action Level	Basis	Solubility (1/2)	Taste And Odor Threshold	Basis	Upper Limit
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	2.5E+04	3.0E+03	USEPA (1995)	5.0E+04
TRICHLOROETHANE, 1,1,1-	9.7E+02	Taste & Odors	6.5E+05	9.7E+02	Amoore & Hautala	5.0E+04
TRICHLOROETHANE, 1,1,2-	5.0E+04	Upper Limit	5.5E+05	-	-	5.0E+04
TRICHLOROETHYLENE	3.1E+02	Taste & Odors	6.4E+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
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	5.0E+04	Upper Limit	1.4E+05	-	-	5.0E+04
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	5.0E+04	Upper Limit	1.0E+05	-	-	5.0E+04
TRICHLOROPROPANE, 1,2,3-	5.0E+04	Upper Limit	8.8E+05	-	-	5.0E+04
TRICHLOROPROPENE, 1,2,3-	5.0E+04	Upper Limit	1.4E+06	-	-	5.0E+04
TRIFLURALIN	9.2E+01	Solubility	9.2E+01	-	-	5.0E+04
TRINITROBENZENE, 1,3,5-	5.0E+04	Upper Limit	1.4E+05	-	-	5.0E+04
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	3.7E+04	Solubility	3.7E+04	-	-	5.0E+04
TRINITROTOLUENE, 2,4,6- (TNT)	5.0E+04	Upper Limit	6.5E+04	-	-	5.0E+04
VANADIUM	5.0E+04	Upper Limit		-	-	5.0E+04
VINYL CHLORIDE	3.4E+03	Taste & Odors	4.4E+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:

Amoore & Hautala (1983) and USEPA and California Dept of Health Services drinking water taste and odor threshold ("secondary MCLs") as presented in *A Compilation of Water Quality Goals* (RWQCBCV 2007).

Other references (see Appendix 1 text): Ontario Ministry of Energy and Environment (MOEE 1996); Young et al (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 RSL guidance (USEPA 2008a) or Ontario MOEE (MOEE 1996) if not available.

Notes:

Ceiling Level: lowest of 1/2 solubility, taste and odor threshold 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 G-2. GROUNDWATER GROSS CONTAMINATION ACTION LEVELS
(groundwater IS NOT a current or potential source of drinking water)
(ug/L)

CHEMICAL PARAMETER	Final Action Level	Basis	Solubility (1/2)	Nuisance Odor Threshold	Basis	Upper Limit
ACENAPHTHENE	2.0E+02	Nuisance Odors	2.0E+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
AMETRYN	5.0E+04	Upper Limit	1.0E+05	-	-	5.0E+04
AMINO,2- DINITROTOLUENE,4,6-	5.0E+04	Upper Limit	6.1E+05	-	-	5.0E+04
AMINO,4- DINITROTOLUENE,2,6-	5.0E+04	Upper Limit	6.1E+05	-	-	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
ATRAZINE	1.7E+04	Solubility	1.7E+04	-	-	5.0E+04
BARIUM	5.0E+04	Upper Limit		-	-	5.0E+04
BENZENE	2.0E+04	Nuisance Odors	9.0E+05	2.0E+04	Ontario MOEE	5.0E+04
BENZO(a)ANTHRACENE	4.7E+00	Solubility	4.7E+00	-	-	5.0E+04
BENZO(a)PYRENE	8.1E-01	Solubility	8.1E-01	-	-	5.0E+04
BENZO(b)FLUORANTHENE	7.5E-01	Solubility	7.5E-01	-	-	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	3.5E+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	1.4E+02	Solubility	1.4E+02	-	-	5.0E+04
BORON	5.0E+04	Upper Limit		-	-	5.0E+04
BROMODICHLOROMETHANE	5.0E+04	Upper Limit	1.5E+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 (TECHNICAL)	2.5E+01	Nuisance Odors	2.8E+01	2.5E+01	Ontario MOEE	5.0E+04
CHLOROANILINE, p-	5.0E+04	Upper Limit	2.0E+06	-	-	5.0E+04
CHLOROBENZENE	5.0E+02	Nuisance Odors	2.5E+05	5.0E+02	Ontario MOEE	5.0E+04
CHLOROETHANE	1.6E+02	Nuisance Odors	3.4E+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	2.7E+06	-	-	5.0E+04
CHLOROPHENOL, 2-	1.8E+00	Nuisance Odors	1.4E+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	8.5E+08	-	-	5.0E+04
CHRYSENE	1.0E+00	Solubility	1.0E+00	-	-	5.0E+04
COBALT	5.0E+04	Upper Limit		-	-	5.0E+04
COPPER	5.0E+04	Upper Limit		-	-	5.0E+04
CYANIDE (Free)	1.7E+03	Nuisance Odors		1.7E+03	Ontario MOEE	5.0E+04
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	3.0E+04	Solubility	3.0E+04	-	-	5.0E+04
DALAPON	5.0E+04	Upper Limit	2.5E+08	-	-	5.0E+04

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

CHEMICAL PARAMETER	Final Action Level	Basis	Solubility (1/2)	Nuisance Odor Threshold	Basis	Upper Limit
DIBENZO(a,h)ANTHTRACENE	5.2E-01	Solubility	5.2E-01	-	-	5.0E+04
DIBROMO,1,2- CHLOROPROPANE,3-	1.0E+02	Nuisance Odors	6.2E+05	1.0E+02	Amoore & Hautala	5.0E+04
DIBROMOCHLOROMETHANE	5.0E+04	Upper Limit	1.4E+06	-	-	5.0E+04
DIBROMOETHANE, 1,2-	5.0E+04	Upper Limit	2.0E+06	-	-	5.0E+04
DICHLOROBENZENE, 1,2-	1.0E+02	Nuisance Odors	4.0E+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	4.1E+04	1.1E+02	Ontario MOEE	5.0E+04
DICHLOROBENZIDINE, 3,3-	1.6E+03	Solubility	1.6E+03	-	-	5.0E+04
DICHLORODIPHENYLDICHLOROETHANE (DDD)	4.5E+01	Solubility	4.5E+01	-	-	5.0E+04
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.0E+01	Solubility	2.0E+01	-	-	5.0E+04
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	2.8E+00	Solubility	2.8E+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	2.6E+06	2.0E+05	Ontario MOEE	5.0E+04
DICHLOROETHYLENE, 1,1-	1.5E+04	Nuisance Odors	1.2E+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	1.8E+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
DICHLOROPHENOXYACETIC ACID (2,4-D)	5.0E+04	Upper Limit	3.4E+05	-	-	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	1.3E+02	Solubility	1.3E+02	4.1E+02	Ontario MOEE	5.0E+04
DIETHYLPHTHALATE	5.0E+04	Upper Limit	5.4E+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
DINITROBENZENE, 1,3-	5.0E+04	Upper Limit	2.7E+05	-	-	5.0E+04
DINITROPHENOL, 2,4-	5.0E+04	Upper Limit	1.4E+06	-	-	5.0E+04
DINITROTOLUENE, 2,4- (2,4-DNT)	5.0E+04	Upper Limit	1.4E+05	-	-	5.0E+04
DINITROTOLUENE, 2,6- (2,6-DNT)	5.0E+04	Upper Limit	1.8E+05	-	-	5.0E+04
DIOXANE, 1,4-	5.0E+04	Upper Limit	5.0E+08	-	-	5.0E+04
DIOXINS (TEQ)	6.0E-02	Solubility	6.0E-02	-	-	5.0E+04
DIURON	2.1E+04	Solubility	2.1E+04	-	-	5.0E+04
ENDOSULFAN	2.3E+02	Solubility	2.3E+02	-	-	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
GLYPHOSATE	5.0E+04	Upper Limit	6.0E+06	-	-	5.0E+04
HEPTACHLOR	9.0E+01	Solubility	9.0E+01	2.0E+02	Ontario MOEE	5.0E+04
HEPTACHLOR EPOXIDE	1.0E+02	Solubility	1.0E+02	-	-	5.0E+04
HEXACHLOROBENZENE	3.1E+00	Solubility	3.1E+00	3.0E+04	Ontario MOEE	5.0E+04
HEXACHLOROBUTADIENE	6.0E+01	Nuisance Odors	1.6E+03	6.0E+01	Ontario MOEE	5.0E+04
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	4.0E+03	Solubility	4.0E+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

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

CHEMICAL PARAMETER	Final Action Level	Basis	Solubility (1/2)	Nuisance Odor Threshold	Basis	Upper Limit
HEXAZINONE	5.0E+04	Upper Limit	1.7E+07	-	-	5.0E+04
INDENO(1,2,3-cd)PYRENE	9.5E-02	Solubility	9.5E-02	-	-	5.0E+04
ISOPHORONE	5.0E+04	Upper Limit	6.0E+06	-	-	5.0E+04
LEAD	5.0E+04	Upper Limit		-	-	5.0E+04
MERCURY	3.0E+01	Solubility	3.0E+01	-	-	5.0E+04
METHOXYCHLOR	5.0E+01	Solubility	5.0E+01	4.7E+04	Ontario MOEE	5.0E+04
METHYL ETHYL KETONE	5.0E+04	Upper Limit	1.1E+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	2.6E+07	1.8E+03	CalDHS	5.0E+04
METHYLENE CHLORIDE	5.0E+04	Upper Limit	6.5E+06	9.1E+04	Ontario MOEE	5.0E+04
METHYLNAPHTHALENE, 1-	1.0E+02	Nuisance Odors	1.3E+04	1.0E+02	Ontario MOEE	5.0E+04
METHYLNAPHTHALENE, 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
NITROBENZENE	5.0E+04	Upper Limit	1.0E+06	-	-	5.0E+04
NITROGLYCERIN	5.0E+04	Upper Limit	6.9E+05	-	-	5.0E+04
NITROTOLUENE, 2-	5.0E+04	Upper Limit	3.3E+05	-	-	5.0E+04
NITROTOLUENE, 3-	5.0E+04	Upper Limit	2.1E+05	-	-	5.0E+04
NITROTOLUENE, 4-	5.0E+04	Upper Limit	2.2E+05	-	-	5.0E+04
PENTACHLOROPHENOL	5.9E+03	Nuisance Odors	7.0E+03	5.9E+03	Ontario MOEE	5.0E+04
PENTAERYTHRITOLTETRANITRATE (PETN)	2.2E+04	Solubility	2.2E+04	-	-	5.0E+04
PERCHLORATE	5.0E+04	Upper Limit	1.2E+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	4.1E+07	7.9E+04	Ontario MOEE	5.0E+04
POLYCHLORINATED BIPHENYLS (PCBs)	1.6E+01	Solubility	1.6E+01	-	-	5.0E+04
PROPICONAZOLE	5.0E+04	Upper Limit	5.5E+04	-	-	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
SIMAZINE	3.1E+03	Solubility	3.1E+03	-	-	5.0E+04
STYRENE	1.1E+02	Nuisance Odors	1.6E+05	1.1E+02	Ontario MOEE	5.0E+04
TERBACIL	5.0E+04	Upper Limit	3.6E+05	-	-	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	5.4E+05	-	-	5.0E+04
TETRACHLOROETHANE, 1,1,2,2-	5.0E+03	Nuisance Odors	1.4E+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
TETRACHLOROPHENOL, 2,3,4,6-	1.2E+04	Solubility	1.2E+04	-	-	5.0E+04
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	5.0E+04	Upper Limit	4.7E+06	-	-	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	2.8E+02	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

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

CHEMICAL PARAMETER	Final Action Level	Basis	Solubility (1/2)	Nuisance Odor Threshold	Basis	Upper Limit
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-	2.5E+04	Solubility	2.5E+04	3.0E+04	USEPA (1995)	5.0E+04
TRICHLOROETHANE, 1,1,1-	5.0E+04	Upper Limit	6.5E+05	5.0E+05	Ontario MOEE	5.0E+04
TRICHLOROETHANE, 1,1,2-	5.0E+04	Upper Limit	5.5E+05	-	-	5.0E+04
TRICHLOROETHYLENE	5.0E+04	Upper Limit	6.4E+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
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	5.0E+04	Upper Limit	1.4E+05	-	-	5.0E+04
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	5.0E+04	Upper Limit	1.0E+05	-	-	5.0E+04
TRICHLOROPROPANE, 1,2,3-	5.0E+04	Upper Limit	8.8E+05	-	-	5.0E+04
TRICHLOROPROPENE, 1,2,3-	5.0E+04	Upper Limit	1.4E+06	-	-	5.0E+04
TRIFLURALIN	9.2E+01	Solubility	9.2E+01	-	-	5.0E+04
TRINITROBENZENE, 1,3,5-	5.0E+04	Upper Limit	1.4E+05	-	-	5.0E+04
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	3.7E+04	Solubility	3.7E+04	-	-	5.0E+04
TRINITROTOLUENE, 2,4,6- (TNT)	5.0E+04	Upper Limit	6.5E+04	-	-	5.0E+04
VANADIUM	5.0E+04	Upper Limit		-	-	5.0E+04
VINYL CHLORIDE	3.4E+04	Nuisance Odors	4.4E+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 threshold 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 2007).*
Upper limit of 50000 ug/L intended to limit general groundwater resource degradation (MOEE 1996).
1/2 solubility based on solubility constants in USEPA RSL guidance (USEPA 2008a) 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 threshold 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 G-3. SURFACE WATER GROSS CONTAMINATION ACTION LEVELS
(surface water IS a current or potential source of drinking water)
(ug/L)

CHEMICAL PARAMETER	Final Action Level	Basis	Solubility (1/2)	Taste And Odor Threshold	Basis	Upper Limit
ACENAPHTHENE	2.0E+01	Taste & Odors	2.0E+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
AMETRYN	5.0E+04	Upper Limit	1.0E+05	-	-	5.0E+04
AMINO,2- DINITROTOLUENE,4,6-	5.0E+04	Upper Limit	6.1E+05	-	-	5.0E+04
AMINO,4- DINITROTOLUENE,2,6-	5.0E+04	Upper Limit	6.1E+05	-	-	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
ATRAZINE	2.0E+01	Taste & Odors	1.7E+04	2.0E+01	Young et al	5.0E+04
BARIUM	5.0E+04	Upper Limit		-	-	5.0E+04
BENZENE	1.7E+02	Taste & Odors	9.0E+05	1.7E+02	Amoore & Hautala	5.0E+04
BENZO(a)ANTHRACENE	4.7E+00	Solubility	4.7E+00	-	-	5.0E+04
BENZO(a)PYRENE	8.1E-01	Solubility	8.1E-01	-	-	5.0E+04
BENZO(b)FLUORANTHENE	7.5E-01	Solubility	7.5E-01	-	-	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	3.5E+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	1.4E+02	Solubility	1.4E+02	-	-	5.0E+04
BORON	5.0E+04	Upper Limit		-	-	5.0E+04
BROMODICHLOROMETHANE	5.0E+04	Upper Limit	1.5E+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 (TECHNICAL)	2.5E+00	Taste & Odors	2.8E+01	2.5E+00	Ontario MOEE	5.0E+04
CHLOROANILINE, p-	5.0E+04	Upper Limit	2.0E+06	-	-	5.0E+04
CHLOROBENZENE	5.0E+01	Taste & Odors	2.5E+05	5.0E+01	Amoore & Hautala	5.0E+04
CHLOROETHANE	1.6E+01	Taste & Odors	3.4E+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	2.7E+06		-	5.0E+04
CHLOROPHENOL, 2-	1.8E-01	Taste & Odors	1.4E+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	8.5E+08	-	-	5.0E+04
CHRYSENE	1.0E+00	Solubility	1.0E+00	-	-	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		1.7E+02	Amoore & Hautala	5.0E+04
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	3.0E+04	Solubility	3.0E+04	-	-	5.0E+04

TABLE G-3. SURFACE WATER GROSS CONTAMINATION ACTION LEVELS
(surface water IS a current or potential source of drinking water)
(ug/L)

CHEMICAL PARAMETER	Final Action Level	Basis	Solubility (1/2)	Taste And Odor Threshold	Basis	Upper Limit
DALAPON	5.0E+04	Upper Limit	2.5E+08	-	-	5.0E+04
DIBENZO(a,h)ANTHTRACENE	5.2E-01	Solubility	5.2E-01	-	-	5.0E+04
DIBROMO,1,2- CHLOROPROPANE,3-	1.0E+01	Taste & Odors	6.2E+05	1.0E+01	Amoore & Hautala	5.0E+04
DIBROMOCHLOROMETHANE	5.0E+04	Upper Limit	1.4E+06	-	-	5.0E+04
DIBROMOETHANE, 1,2-	5.0E+04	Upper Limit	2.0E+06	-	-	5.0E+04
DICHLOROBENZENE, 1,2-	1.0E+01	Taste & Odors	4.0E+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	4.1E+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)	4.5E+01	Solubility	4.5E+01	-	-	5.0E+04
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.0E+01	Solubility	2.0E+01	-	-	5.0E+04
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	2.8E+00	Solubility	2.8E+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	2.6E+06	7.0E+03	Amoore & Hautala	5.0E+04
DICHLOROETHYLENE, 1,1-	1.5E+03	Taste & Odors	1.2E+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	1.8E+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
DICHLOROPHENOXYACETIC ACID (2,4-D)	5.0E+04	Upper Limit	3.4E+05	-	-	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	1.3E+02	4.1E+01	Ontario MOEE	5.0E+04
DIETHYLPHTHALATE	5.0E+04	Upper Limit	5.4E+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
DINITROBENZENE, 1,3-	5.0E+04	Upper Limit	2.7E+05	-	-	5.0E+04
DINITROPHENOL, 2,4-	5.0E+04	Upper Limit	1.4E+06	-	-	5.0E+04
DINITROTOLUENE, 2,4- (2,4-DNT)	5.0E+04	Upper Limit	1.4E+05	-	-	5.0E+04
DINITROTOLUENE, 2,6- (2,6-DNT)	5.0E+04	Upper Limit	1.8E+05	-	-	5.0E+04
DIOXANE, 1,4-	5.0E+04	Upper Limit	5.0E+08	2.3E+05	Amoore & Hautala	5.0E+04
DIOXINS (TEQ)	6.0E-02	Solubility	6.0E-02	-	-	5.0E+04
DIURON	2.1E+04	Solubility	2.1E+04	-	-	5.0E+04
ENDOSULFAN	2.3E+02	Solubility	2.3E+02	-	-	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
FLUORANTHENE	1.3E+02	Solubility	1.3E+02	-	-	5.0E+04
FLUORENE	9.5E+02	Solubility	9.5E+02	-	-	5.0E+04
GLYPHOSATE	5.0E+04	Upper Limit	6.0E+06	-	-	5.0E+04
HEPTACHLOR	2.0E+01	Taste & Odors	9.0E+01	2.0E+01	Ontario MOEE	5.0E+04
HEPTACHLOR EPOXIDE	1.0E+02	Solubility	1.0E+02	-	-	5.0E+04
HEXACHLOROBENZENE	3.1E+00	Solubility	3.1E+00	3.0E+03	Ontario MOEE	5.0E+04
HEXACHLOROBUTADIENE	6.0E+00	Taste & Odors	1.6E+03	6.0E+00	Ontario MOEE	5.0E+04
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	4.0E+03	Solubility	4.0E+03	1.2E+04	Ontario MOEE	5.0E+04

TABLE G-3. SURFACE WATER GROSS CONTAMINATION ACTION LEVELS
(surface water IS a current or potential source of drinking water)
(ug/L)

CHEMICAL PARAMETER	Final Action Level	Basis	Solubility (1/2)	Taste And Odor Threshold	Basis	Upper Limit
HEXACHLOROETHANE	1.0E+01	Taste & Odors	2.5E+04	1.0E+01	Amoore & Hautala	5.0E+04
HEXAZINONE	5.0E+04	Upper Limit	1.7E+07	-	-	5.0E+04
INDENO(1,2,3-cd)PYRENE	9.5E-02	Solubility	9.5E-02	-	-	5.0E+04
ISOPHORONE	5.0E+04	Upper Limit	6.0E+06	-	-	5.0E+04
LEAD	5.0E+04	Upper Limit		-	-	5.0E+04
MERCURY	3.0E+01	Solubility	3.0E+01	-	-	5.0E+04
METHOXYCHLOR	5.0E+01	Solubility	5.0E+01	4.7E+03	Amoore & Hautala	5.0E+04
METHYL ETHYL KETONE	8.4E+03	Taste & Odors	1.1E+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	2.6E+07	5.0E+00	Cal DHS 2nd MCL	5.0E+04
METHYLENE CHLORIDE	9.1E+03	Taste & Odors	6.5E+06	9.1E+03	Ontario MOEE	5.0E+04
METHYLNAPHTHALENE, 1-	1.0E+01	Taste & Odors	1.3E+04	1.0E+01	Ontario MOEE	5.0E+04
METHYLNAPHTHALENE, 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
NITROBENZENE	5.0E+04	Upper Limit	1.0E+06	-	-	5.0E+04
NITROGLYCERIN	5.0E+04	Upper Limit	6.9E+05	-	-	5.0E+04
NITROTOLUENE, 2-	5.0E+04	Upper Limit	3.3E+05	-	-	5.0E+04
NITROTOLUENE, 3-	5.0E+04	Upper Limit	2.1E+05	-	-	5.0E+04
NITROTOLUENE, 4-	5.0E+04	Upper Limit	2.2E+05	-	-	5.0E+04
PENTACHLOROPHENOL	3.0E+01	Taste & Odors	7.0E+03	3.0E+01	Amoore & Hautala	5.0E+04
PENTAERYTHRITOLTETRANITRATE (PETN)	2.2E+04	Solubility	2.2E+04	-	-	5.0E+04
PERCHLORATE	5.0E+04	Upper Limit	1.2E+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	4.1E+07	5.0E+00	Cal DHS AL	5.0E+04
POLYCHLORINATED BIPHENYLS (PCBs)	1.6E+01	Solubility	1.6E+01	-	-	5.0E+04
PROPICONAZOLE	5.0E+04	Upper Limit	5.5E+04	-	-	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
SIMAZINE	3.1E+03	Solubility	3.1E+03	-	-	5.0E+04
STYRENE	1.0E+01	Taste & Odors	1.6E+05	1.0E+01	USEPA 2nd MCL	5.0E+04
TERBACIL	5.0E+04	Upper Limit	3.6E+05	-	-	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	5.4E+05	-	-	5.0E+04
TETRACHLOROETHANE, 1,1,2,2-	5.0E+02	Taste & Odors	1.4E+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
TETRACHLOROPHENOL, 2,3,4,6-	1.2E+04	Solubility	1.2E+04	-	-	5.0E+04
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	5.0E+04	Upper Limit	4.7E+06	-	-	5.0E+04
THALLIUM	5.0E+04	Upper Limit		-	-	5.0E+04
TOLUENE	4.0E+01	Taste & Odors	2.6E+05	4.0E+01	USEPA 2nd MCL	5.0E+04
TOXAPHENE	1.4E+02	Taste & Odors	2.8E+02	1.4E+02	USEPA 2nd MCL	5.0E+04

TABLE G-3. SURFACE WATER GROSS CONTAMINATION ACTION LEVELS
(surface water IS a current or potential source of drinking water)
(ug/L)

CHEMICAL PARAMETER	Final Action Level	Basis	Solubility (1/2)	Taste And Odor Threshold	Basis	Upper Limit
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	2.5E+04	3.0E+03	USEPA (1995)	5.0E+04
TRICHLOROETHANE, 1,1,1-	9.7E+02	Taste & Odors	6.5E+05	9.7E+02	Amoore & Hautala	5.0E+04
TRICHLOROETHANE, 1,1,2-	5.0E+04	Upper Limit	5.5E+05	-	-	5.0E+04
TRICHLOROETHYLENE	3.1E+02	Taste & Odors	6.4E+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
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	5.0E+04	Upper Limit	1.4E+05	-	-	5.0E+04
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	5.0E+04	Upper Limit	1.0E+05	-	-	5.0E+04
TRICHLOROPROPANE, 1,2,3-	5.0E+04	Upper Limit	8.8E+05	-	-	5.0E+04
TRICHLOROPROPENE, 1,2,3-	5.0E+04	Upper Limit	1.4E+06	-	-	5.0E+04
TRIFLURALIN	9.2E+01	Solubility	9.2E+01	-	-	5.0E+04
TRINITROBENZENE, 1,3,5-	5.0E+04	Upper Limit	1.4E+05	-	-	5.0E+04
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	3.7E+04	Solubility	3.7E+04	-	-	5.0E+04
TRINITROTOLUENE, 2,4,6- (TNT)	5.0E+04	Upper Limit	6.5E+04	-	-	5.0E+04
VANADIUM	5.0E+04	Upper Limit		-	-	5.0E+04
VINYL CHLORIDE	3.4E+03	Taste & Odors	4.4E+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 threshold from summary in *A Compilation of Water Quality Goals* (RWQCBCV 2007) 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 RSL guidance (USEPA 2008a) or Ontario MOEE (MOEE 1996) if not available.
Notes:
Ceiling Level: lowest of 1/2 solubility, taste and odor threshold 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 G-4. SURFACE WATER GROSS CONTAMINATION ACTION LEVELS
(surface water IS NOT a current or potential source of drinking water)
(ug/L)

CHEMICAL PARAMETER	Final Action Level	Basis	Solubility (1/2)	Nuisance Odor Threshold	Basis	Upper Limit
ACENAPHTHENE	2.0E+01	Nuisance Odors	2.0E+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
AMETRYN	5.0E+04	Upper Limit	1.0E+05	-	-	5.0E+04
AMINO,2- DINITROTOLUENE,4,6-	5.0E+04	Upper Limit	6.1E+05	-	-	5.0E+04
AMINO,4- DINITROTOLUENE,2,6-	5.0E+04	Upper Limit	6.1E+05	-	-	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
ATRAZINE	1.7E+04	Solubility	1.7E+04	-	-	5.0E+04
BARIUM	5.0E+04	Upper Limit		-	-	5.0E+04
BENZENE	2.0E+03	Nuisance Odors	9.0E+05	2.0E+03	Ontario MOEE	5.0E+04
BENZO(a)ANTHRACENE	4.7E+00	Solubility	4.7E+00	-	-	5.0E+04
BENZO(a)PYRENE	8.1E-01	Solubility	8.1E-01	-	-	5.0E+04
BENZO(b)FLUORANTHENE	7.5E-01	Solubility	7.5E-01	-	-	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	3.5E+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	1.4E+02	Solubility	1.4E+02	-	-	5.0E+04
BORON	5.0E+04	Upper Limit		-	-	5.0E+04
BROMODICHLOROMETHANE	5.0E+04	Upper Limit	1.5E+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 (TECHNICAL)	2.5E+00	Nuisance Odors	2.8E+01	2.5E+00	Ontario MOEE	5.0E+04
CHLOROANILINE, p-	5.0E+04	Upper Limit	2.0E+06	-	-	5.0E+04
CHLOROBENZENE	5.0E+01	Nuisance Odors	2.5E+05	5.0E+01	Ontario MOEE	5.0E+04
CHLOROETHANE	1.6E+01	Nuisance Odors	3.4E+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	2.7E+06	-	-	5.0E+04
CHLOROPHENOL, 2-	1.8E-01	Nuisance Odors	1.4E+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	8.5E+08	-	-	5.0E+04
CHRYSENE	1.0E+00	Solubility	1.0E+00	-	-	5.0E+04
COBALT	5.0E+04	Upper Limit		-	-	5.0E+04
COPPER	5.0E+04	Upper Limit		-	-	5.0E+04
CYANIDE (Free)	1.7E+02	Nuisance Odors		1.7E+02	Ontario MOEE	5.0E+04
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	3.0E+04	Solubility	3.0E+04	-	-	5.0E+04

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

CHEMICAL PARAMETER	Final Action Level	Basis	Solubility (1/2)	Nuisance Odor Threshold	Basis	Upper Limit
DALAPON	5.0E+04	Upper Limit	2.5E+08	-	-	5.0E+04
DIBENZO(a,h)ANTHTRACENE	5.2E-01	Solubility	5.2E-01	-	-	5.0E+04
DIBROMO,1,2- CHLOROPROPANE,3-	1.0E+01	Nuisance Odors	6.2E+05	1.0E+01	Amoore & Hautala	5.0E+04
DIBROMOCHLOROMETHANE	5.0E+04	Upper Limit	1.4E+06	-	-	5.0E+04
DIBROMOETHANE, 1,2-	5.0E+04	Upper Limit	2.0E+06	-	-	5.0E+04
DICHLOROBENZENE, 1,2-	1.0E+01	Nuisance Odors	4.0E+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	4.1E+04	1.1E+01	Ontario MOEE	5.0E+04
DICHLOROBENZIDINE, 3,3-	1.6E+03	Solubility	1.6E+03	-	-	5.0E+04
DICHLORODIPHENYLDICHLOROETHANE (DDD)	4.5E+01	Solubility	4.5E+01	-	-	5.0E+04
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.0E+01	Solubility	2.0E+01	-	-	5.0E+04
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	2.8E+00	Solubility	2.8E+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	2.6E+06	2.0E+04	Ontario MOEE	5.0E+04
DICHLOROETHYLENE, 1,1-	1.5E+03	Nuisance Odors	1.2E+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	1.8E+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
DICHLOROPHENOXYACETIC ACID (2,4-D)	5.0E+04	Upper Limit	3.4E+05	-	-	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	1.3E+02	4.1E+01	Ontario MOEE	5.0E+04
DIETHYLPHTHALATE	5.0E+04	Upper Limit	5.4E+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
DINITROBENZENE, 1,3-	5.0E+04	Upper Limit	2.7E+05	-	-	5.0E+04
DINITROPHENOL, 2,4-	5.0E+04	Upper Limit	1.4E+06	-	-	5.0E+04
DINITROTOLUENE, 2,4- (2,4-DNT)	5.0E+04	Upper Limit	1.4E+05	-	-	5.0E+04
DINITROTOLUENE, 2,6- (2,6-DNT)	5.0E+04	Upper Limit	1.8E+05	-	-	5.0E+04
DIOXANE, 1,4-	5.0E+04	Upper Limit	5.0E+08	-	-	5.0E+04
DIOXINS (TEQ)	6.0E-02	Solubility	6.0E-02	-	-	5.0E+04
DIURON	2.1E+04	Solubility	2.1E+04	-	-	5.0E+04
ENDOSULFAN	2.3E+02	Solubility	2.3E+02	-	-	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
GLYPHOSATE	5.0E+04	Upper Limit	6.0E+06	-	-	5.0E+04
HEPTACHLOR	2.0E+01	Nuisance Odors	9.0E+01	2.0E+01	Ontario MOEE	5.0E+04
HEPTACHLOR EPOXIDE	1.0E+02	Solubility	1.0E+02	-	-	5.0E+04
HEXACHLOROBENZENE	3.1E+00	Solubility	3.1E+00	3.0E+03	Ontario MOEE	5.0E+04
HEXACHLOROBUTADIENE	6.0E+00	Nuisance Odors	1.6E+03	6.0E+00	Ontario MOEE	5.0E+04
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	4.0E+03	Solubility	4.0E+03	1.2E+04	Ontario MOEE	5.0E+04

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

CHEMICAL PARAMETER	Final Action Level	Basis	Solubility (1/2)	Nuisance Odor Threshold	Basis	Upper Limit
HEXACHLOROETHANE	1.0E+01	Nuisance Odors	2.5E+04	1.0E+01	Ontario MOEE	5.0E+04
HEXAZINONE	5.0E+04	Upper Limit	1.7E+07	-	-	5.0E+04
INDENO(1,2,3-cd)PYRENE	9.5E-02	Solubility	9.5E-02	-	-	5.0E+04
ISOPHORONE	5.0E+04	Upper Limit	6.0E+06	-	-	5.0E+04
LEAD	5.0E+04	Upper Limit		-	-	5.0E+04
MERCURY	3.0E+01	Solubility	3.0E+01	-	-	5.0E+04
METHOXYCHLOR	5.0E+01	Solubility	5.0E+01	4.7E+03	Ontario MOEE	5.0E+04
METHYL ETHYL KETONE	8.4E+03	Nuisance Odors	1.1E+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	2.6E+07	1.8E+02	CalDHS	5.0E+04
METHYLENE CHLORIDE	9.1E+03	Nuisance Odors	6.5E+06	9.1E+03	Ontario MOEE	5.0E+04
METHYLNAPHTHALENE, 1-	1.0E+01	Nuisance Odors	1.3E+04	1.0E+01	Ontario MOEE	5.0E+04
METHYLNAPHTHALENE, 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
NITROBENZENE	5.0E+04	Upper Limit	1.0E+06	-	-	5.0E+04
NITROGLYCERIN	5.0E+04	Upper Limit	6.9E+05	-	-	5.0E+04
NITROTOLUENE, 2-	5.0E+04	Upper Limit	3.3E+05	-	-	5.0E+04
NITROTOLUENE, 3-	5.0E+04	Upper Limit	2.1E+05	-	-	5.0E+04
NITROTOLUENE, 4-	5.0E+04	Upper Limit	2.2E+05	-	-	5.0E+04
PENTACHLOROPHENOL	5.9E+02	Nuisance Odors	7.0E+03	5.9E+02	Ontario MOEE	5.0E+04
PENTAERYTHRITOLTETRANITRATE (PETN)	2.2E+04	Solubility	2.2E+04	-	-	5.0E+04
PERCHLORATE	5.0E+04	Upper Limit	1.2E+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	4.1E+07	7.9E+03	Ontario MOEE	5.0E+04
POLYCHLORINATED BIPHENYLS (PCBs)	1.6E+01	Solubility	1.6E+01	-	-	5.0E+04
PROPICONAZOLE	5.0E+04	Upper Limit	5.5E+04	-	-	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
SIMAZINE	3.1E+03	Solubility	3.1E+03	-	-	5.0E+04
STYRENE	1.1E+01	Nuisance Odors	1.6E+05	1.1E+01	Ontario MOEE	5.0E+04
TERBACIL	5.0E+04	Upper Limit	3.6E+05	-	-	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	5.4E+05	-	-	5.0E+04
TETRACHLOROETHANE, 1,1,2,2-	5.0E+02	Nuisance Odors	1.4E+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
TETRACHLOROPHENOL, 2,3,4,6-	1.2E+04	Solubility	1.2E+04	-	-	5.0E+04
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	5.0E+04	Upper Limit	4.7E+06	-	-	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	2.8E+02	1.4E+02	USEPA 2nd MCL	5.0E+04

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

CHEMICAL PARAMETER	Final Action Level	Basis	Solubility (1/2)	Nuisance Odor Threshold	Basis	Upper Limit
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	2.5E+04	3.0E+03	USEPA (1995)	5.0E+04
TRICHLOROETHANE, 1,1,1-	5.0E+04	Nuisance Odors	6.5E+05	5.0E+04	Ontario MOEE	5.0E+04
TRICHLOROETHANE, 1,1,2-	5.0E+04	Upper Limit	5.5E+05	-	-	5.0E+04
TRICHLOROETHYLENE	1.0E+04	Nuisance Odors	6.4E+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
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	5.0E+04	Upper Limit	1.4E+05	-	-	5.0E+04
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	5.0E+04	Upper Limit	1.0E+05	-	-	5.0E+04
TRICHLOROPROPANE, 1,2,3-	5.0E+04	Upper Limit	8.8E+05	-	-	5.0E+04
TRICHLOROPROPENE, 1,2,3-	5.0E+04	Upper Limit	1.4E+06	-	-	5.0E+04
TRIFLURALIN	9.2E+01	Solubility	9.2E+01	-	-	5.0E+04
TRINITROBENZENE, 1,3,5-	5.0E+04	Upper Limit	1.4E+05	-	-	5.0E+04
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	3.7E+04	Solubility	3.7E+04	-	-	5.0E+04
TRINITROTOLUENE, 2,4,6- (TNT)	2.0E+01	Nuisance Odors	6.5E+04	2.0E+01	Ontario MOEE	5.0E+04
VANADIUM	5.0E+04	Upper Limit		-	-	5.0E+04
VINYL CHLORIDE	3.4E+03	Nuisance Odors	4.4E+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 threshold 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 2007).
Upper limit of 50000 ug/L intended to limit general groundwater resource degradation (MOEE 1996).
1/2 solubility based on solubility constants in USEPA RSL guidance (USEPA 2008a) 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 threshold 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 H. 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)	GI Absorption Factor GIABS (unitless)	Skin Absorption Factor ABS (unitless)	Cancer Slope Factor Oral CSFo (mg/kg-d)$^{-1}$	Cancer Unit Risk Factor (Inhalation) IUR (ug/m^3)$^{-1}$	Reference Dose Oral RfDo (mg/kg-d)	Reference Concentration (Inhalation) RfC (mg/m^3)
ACENAPHTHENE	V	S	154	5.03E+03	5.10E-02	8.30E-06	3.90E+00	1.80E-04	7.40E-03	1.0	0.13			6.0E-02	2.1E-01
ACENAPHTHYLENE	V	S	152	2.50E+03	6.08E-02	7.88E-06	3.93E+00	1.45E-03	5.95E-02	1.0	0.13			4.0E-02	1.4E-01
ACETONE	V	L	58	2.60E+00	1.10E-01	1.10E-05	1.00E+06	3.90E-05	1.60E-03	1.0				9.0E-01	3.1E+01
ALDRIN	NV	S	365	8.20E+04			1.70E-02	4.39E-05	1.80E-03	1.0	0.1	1.7E+01	4.9E-03	3.0E-05	
AMETRYN	NV	S	227	4.28E+02			2.09E+02	2.39E-09	9.80E-08	1.0	0.1			9.0E-03	
AMINO,2- DINITROTOLUENE,4,6-	NV	S	197	2.83E+02			1.22E+03	1.61E-10	6.60E-09	1.0	0.006			2.0E-03	
AMINO,4- DINITROTOLUENE,2,6-	NV	S	197	2.83E+02			1.22E+03	1.61E-10	6.60E-09	1.0	0.009			2.0E-03	
ANTHRACENE	V	S	178	1.64E+04	3.90E-02	7.90E-06	4.34E-02	5.61E-05	2.30E-03	1.0	0.13			3.0E-01	1.1E+00
ANTIMONY	NV	S	122							0.15	0.15			4.0E-04	
ARSENIC	NV	S	75							1.0	0.0004	1.5E+00	4.3E-03	3.0E-04	1.5E-05
ATRAZINE	NV	S	216	2.25E+02			3.47E+01	2.34E-09	9.60E-08	1.0	0.1	2.3E-01		3.5E-02	
BARIUM	NV	S	137							0.07				2.0E-01	5.0E-04
BENZENE	V	L	78	1.46E+02	9.00E-02	1.00E-05	1.79E+03	5.61E-03	2.30E-01	1.0		5.5E-02	7.8E-06	4.0E-03	3.0E-02
BENZO(a)ANTHRACENE	NV	S	228	1.77E+05			9.40E-03	1.20E-05	4.90E-04	1.0	0.13	7.3E-01	1.1E-04		
BENZO(a)PYRENE	NV	S	252	5.87E+05			1.62E-03	4.63E-07	1.90E-05	1.0	0.13	7.3E+00	1.1E-03		
BENZO(b)FLUORANTHENE	NV	S	252	5.99E+05			1.50E-03	6.59E-07	2.70E-05	1.0	0.13	7.3E-01	1.1E-04		
BENZO(g,h,i)PERYLENE	NV	S	276	1.60E+06			2.60E-04	1.44E-07	5.90E-06	1.0	0.13			4.0E-02	
BENZO(k)FLUORANTHENE	NV	S	252	5.87E+05			8.00E-04	5.85E-07	2.40E-05	1.0	0.13	7.3E-02	1.1E-04		
BERYLLIUM	NV	S	9							0.007			2.4E-03	2.0E-03	2.0E-05
BIPHENYL, 1,1-	V	S	154	5.13E+03	4.70E-02	7.60E-06	6.94E+00	3.17E-04	1.30E-02	1.0		8.0E-03	2.3E-06	5.0E-02	4.0E-04
BIS(2-CHLOROETHYL)ETHER	V	L	143	3.20E+01	5.70E-02	8.70E-06	1.72E+04	1.71E-05	7.00E-04	1.0		1.1E+00	3.3E-04		
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	1.0		7.0E-02	1.0E-05	4.00E-02	1.40E-01
BIS(2-ETHYLHEXYL)PHTHALATE	NV	S	391	1.20E+05			2.70E-01	2.68E-07	1.10E-05	1.0	0.1	1.4E-02	2.4E-06	2.0E-02	
BORON	NV	S	14							1.0				2.0E-01	2.0E-02
BROMODICHLOROMETHANE	V	L	164	3.18E+01	5.60E-02	1.10E-05	3.03E+03	2.12E-03	8.70E-02	1.0		6.2E-02	3.7E-05	2.0E-02	7.0E-02
BROMOFORM	NV	S	253	3.18E+01			3.10E+03	5.37E-04	2.20E-02	1.0	0.1	7.9E-03	1.1E-06	2.0E-02	
BROMOMETHANE	V	G	95	1.32E+01	1.00E-01	1.30E-05	1.52E+04	6.34E-03	2.60E-01	1.0				1.4E-03	5.0E-03
CADMIUM	NV	S	112							0.025	0.001		1.8E-03	1.0E-03	2.0E-05
CARBON TETRACHLORIDE	V	L	154	4.39E+01	5.70E-02	9.80E-06	7.93E+02	2.68E-02	1.10E+00	1.0		7.0E-02	6.0E-06	4.0E-03	1.0E-01
CHLORDANE (TECHNICAL)	NV	S	410	8.67E+04			5.60E-02	4.88E-05	2.00E-03	1.0	0.04	3.5E-01	1.0E-04	5.0E-04	7.0E-04
CHLOROANILINE, p-	NV	S	128	1.13E+02	7.00E-02	1.00E-05	3.90E+03	1.15E-06	4.70E-05	1.0	0.1	2.0E-01		4.0E-03	
CHLOROBENZENE	V	L	113	2.34E+02	7.20E-02	9.50E-06	4.98E+02	3.17E-03	1.30E-01	1.0				2.0E-02	5.0E-02
CHLOROETHANE	V	G	65	2.18E+01	1.10E-01	1.20E-05	6.71E+03	1.10E-02	4.50E-01	1.0					1.0E+01
CHLOROFORM	V	L	119	3.18E+01	7.70E-02	1.10E-05	7.95E+03	3.66E-03	1.50E-01	1.0		3.1E-02	2.3E-05	1.0E-02	9.8E-02
CHLOROMETHANE	V	G	50	1.32E+01	1.20E-01	1.40E-05	5.32E+03	8.78E-03	3.60E-01	1.0		1.3E-02	1.8E-06		9.0E-02
CHLOROPHENOL, 2-	V	L	129	3.06E+02	6.60E-02	9.50E-06	2.85E+04	1.12E-05	4.60E-04	1.0				5.0E-03	1.8E-02
CHROMIUM (Total)	NV	S	52							1.0					
CHROMIUM III	NV	S	52							0.013				1.5E+00	
CHROMIUM VI	NV	S	52				1.69E+06			0.025		5.0E-01	8.4E-02	3.0E-03	1.0E-04
CHRYSENE	NV	S	228	1.81E+05			2.00E-03	5.12E-06	2.10E-04	1.0	0.13	7.3E-03	1.1E-05		
COBALT	NV	S	59							1.0			9.0E-03	3.00E-04	6.00E-06
COPPER	NV	S	64							1.0				4.0E-02	
CYANIDE (Free)	V	S	27							1.0				2.0E-02	
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	NV	S	222	8.91E+01			5.97E+01	6.34E-08	2.60E-06	1.0	0.015	1.1E-01		3.0E-03	
DALAPON	NV	L	143	3.20E+00			5.02E+05	9.02E-08	3.70E-06	1.0	0.1			3.0E-02	
DIBENZO(a,h)ANTHTRACENE	NV	S	278	1.91E+06			1.03E-03	1.22E-07	5.00E-06	1.0	0.13	7.3E+00	1.2E-03		
DIBROMO,1,2- CHLOROPROPANE,3-	V	L	236	1.31E+02	3.20E-02	8.90E-06	1.23E+03	1.46E-04	6.00E-03	1.0		8.0E-01	6.0E-03	2.0E-04	2.0E-04
DIBROMOCHLOROMETHANE	V	S	208	3.18E+01	3.70E-02	1.10E-05	2.70E+03	7.80E-04	3.20E-02	1.0	0.1	8.4E-02	2.4E-05	2.0E-02	7.0E-02
DIBROMOETHANE, 1,2-	V	S	188	3.18E+01	4.30E-02	1.00E-05	3.91E+03	6.59E-04	2.70E-02	1.0		2.0E+00	6.0E-04	9.0E-03	9.0E-03
DICHLOROBENZENE, 1,2-	V	L	147	3.83E+02	5.60E-02	8.90E-06	8.00E+01	1.90E-03	7.80E-02	1.0				9.0E-02	2.0E-01
DICHLOROBENZENE, 1,3-	V	L	147	6.17E+02	6.90E-02	7.90E-06	1.56E+02	1.90E-03	7.79E-02	1.0				3.00E-02	1.1E-01
DICHLOROBENZENE, 1,4-	V	S	147	3.75E+02	5.50E-02	8.70E-06	8.13E+01	2.41E-03	9.90E-02	1.0		5.4E-03	1.1E-05	7.0E-02	8.0E-01
DICHLOROBENZIDINE, 3,3-	NV	S	253	3.19E+03			3.10E+00	5.12E-11	2.10E-09	1.0	0.1	4.5E-01	3.4E-04		

TABLE H. 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)	GI Absorption Factor GIABS (unitless)	Skin Absorption Factor ABS (unitless)	Cancer Slope Factor Oral CSFo (mg/kg-d)$^{-1}$	Cancer Unit Risk Factor (Inhalation) IUR (ug/m^3)$^{-1}$	Reference Dose Oral RfDo (mg/kg-d)	Reference Concentration (Inhalation) RfC (mg/m^3)
DICHLORODIPHENYLDICHLOROETHANE (DDD)	NV	S	320	1.18E+05			9.00E-02	6.59E-06	2.70E-04	1.0	0.1	2.4E-01	6.9E-05		
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	NV	S	318	1.18E+05			4.00E-02	4.15E-05	1.70E-03	1.0	0.1	3.4E-01	9.7E-05		
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	NV	S	354	1.69E+05			5.50E-03	8.29E-06	3.40E-04	1.0	0.03	3.4E-01	9.7E-05	5.0E-04	
DICHLOROETHANE, 1,1-	V	L	99	3.18E+01	8.40E-02	1.10E-05	5.04E+03	5.61E-03	2.30E-01	1.0		5.7E-03	1.6E-06	2.0E-01	7.0E-01
DICHLOROETHANE, 1,2-	V	L	99	3.96E+01	8.60E-02	1.10E-05	5.10E+03	1.17E-03	4.80E-02	1.0		9.1E-02	2.6E-05	6.0E-03	7.0E-03
DICHLOROETHYLENE, 1,1-	V	L	97	3.18E+01	8.60E-02	1.10E-05	2.42E+03	2.68E-02	1.10E+00	1.0				5.0E-02	2.0E-01
DICHLOROETHYLENE, Cis 1,2-	V	L	97	3.96E+01	8.80E-02	1.10E-05	3.50E+03	4.15E-03	1.70E-01	1.0				2.0E-03	7.0E-03
DICHLOROETHYLENE, Trans 1,2-	V	L	97	3.96E+01	8.80E-02	1.10E-05	3.50E+03	9.27E-03	3.80E-01	1.0				2.0E-02	6.0E-02
DICHLOROPHENOL, 2,4-	NV	S	163	4.92E+02	6.40E-02	7.40E-06	4.50E+03	2.20E-06	9.00E-05	1.0	0.1			3.0E-03	
DICHLOROPHENOXYACETIC ACID (2,4-D)	NV	S	221	2.96E+01			6.77E+02	3.41E-08	1.40E-06	1.0	0.05			1.0E-02	
DICHLOROPROPANE, 1,2-	V	L	113	6.07E+01	8.10E-02	9.50E-06	2.80E+03	2.93E-03	1.20E-01	1.0		3.6E-02	1.0E-05	9.0E-02	4.0E-03
DICHLOROPROPENE, 1,3-	V	L	111	7.22E+01	8.20E-02	9.60E-06	2.80E+03	3.66E-03	1.50E-01	1.0		1.0E-01	4.0E-06	3.0E-02	2.0E-02
DIELDRIN	NV	S	381	2.01E+04			2.50E-01	1.00E-05	4.10E-04	1.0	0.1	1.6E+01	4.6E-03	5.0E-05	
DIETHYLPHTHALATE	NV	S	222	1.05E+02			1.08E+03	6.10E-07	2.50E-05	1.0	0.1			8.0E-01	
DIMETHYLPHENOL, 2,4-	V	S	122	4.92E+02	6.20E-02	8.30E-06	7.87E+03	9.51E-07	3.90E-05	1.0	0.1			2.0E-02	7.0E-02
DIMETHYLPHTHALATE	NV	S	194	1.40E+02			5.00E+03	1.05E-07	4.31E-06	1.0	0.10			1.00E+01	
DINITROBENZENE, 1,3-	NV	S	168	3.52E+02			5.33E+02	4.88E-08	2.00E-06	1.0	0.1			1.0E-04	
DINITROPHENOL, 2,4-	NV	S	184	4.61E+02			2.79E+03	8.54E-08	3.50E-06	1.0	0.1			2.0E-03	
DINITROTOLUENE, 2,4- (2,4-DNT)	NV	S	182	5.87E+02			2.70E+02	5.37E-08	2.20E-06	1.0	0.1	3.1E-01	8.9E-05	2.0E-03	
DINITROTOLUENE, 2,6- (2,6-DNT)	NV	S	182	5.87E+02	3.70E-02	7.80E-06	3.52E+02	7.56E-07	3.10E-05	1.0	0.1			1.0E-03	
DIOXANE, 1,4-	NV	L	88	2.60E+00	8.70E-02	1.10E-05	1.00E+06	4.88E-06	2.00E-04	1.0	0.1	1.0E-01	7.7E-06	3.0E-02	3.0E+00
DIOXINS (TEQ)	NV	S	356	2.49E+05			1.20E-04	2.20E-06	9.00E-05	1.0	0.03			3.3E-09	
DIURON	NV	S	233	1.09E+02			4.20E+01	5.12E-10	2.10E-08	1.0	0.1			2.0E-03	
ENDOSULFAN	NV	S	407	6.76E+03			4.50E-01	6.59E-05	2.70E-03	1.0	0.1			6.0E-03	
ENDRIN	NV	S	381	2.01E+04			2.50E-01	6.34E-06	2.60E-04	1.0	0.1			3.0E-04	
ETHANOL	NV	L	46	3.09E-01			1.00E+06	6.29E-06	2.58E-04	1.0					
ETHYLBENZENE	V	L	106	4.46E+02	6.80E-02	8.50E-06	1.69E+02	7.80E-03	3.20E-01	1.0		1.1E-02	2.5E-06	1.0E-01	1.0E+00
FLUORANTHENE	NV	S	202	5.55E+04			2.60E-01	8.78E-06	3.60E-04	1.0	0.13			4.0E-02	
FLUORENE	V	S	166	9.16E+03	4.40E-02	7.90E-06	1.89E+00	9.51E-05	3.90E-03	1.0	0.13			4.0E-02	1.4E-01
GLYPHOSATE	NV	S	169	1.00E+00			1.20E+04	4.15E-19	1.70E-17	1.0	0.1			1.0E-01	
HEPTACHLOR	NV	S	373	4.13E+04			1.80E-01	2.93E-04	1.20E-02	1.0	0.1	4.5E+00	1.3E-03	5.0E-04	
HEPTACHLOR EPOXIDE	NV	S	389	1.01E+04			2.00E-01	2.10E-05	8.60E-04	1.0	0.1	9.1E+00	2.6E-03	1.3E-05	
HEXACHLOROBENZENE	NV	S	285	6.20E+03			6.20E-03	1.71E-03	7.00E-02	1.0	0.1	1.6E+00	4.6E-04	8.0E-04	
HEXACHLOROBUTADIENE	NV	S	261	8.45E+02			3.20E+00	1.02E-02	4.20E-01	1.0	0.1	7.8E-02	2.2E-05	1.0E-03	
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	NV	S	291	2.81E+03			8.00E+00	5.12E-06	2.10E-04	1.0	0.04	1.1E+00	3.1E-04	3.0E-04	
HEXACHLOROETHANE	NV	S	237	1.97E+02			5.00E+01	3.90E-03	1.60E-01	1.0	0.1	1.4E-02	4.0E-06	1.0E-03	
HEXAZINONE	NV	S	252	1.29E+02			3.30E+04	2.24E-12	9.20E-11	1.0	0.1			3.3E-02	
INDENO(1,2,3-cd)PYRENE	NV	S	276	1.95E+06			1.90E-04	3.41E-07	1.40E-05	1.0	0.13	7.3E-01	1.1E-04		
ISOPHORONE	NV	L	138	6.52E+01	5.30E-02	7.50E-06	1.20E+04	6.59E-06	2.70E-04	1.0	0.1	9.5E-04		2.0E-01	2.0E+00
LEAD	NV	S	207							1.0					
MERCURY	V	S	201				6.00E-02			0.07				3.0E-04	3.0E-05
METHOXYCHLOR	NV	S	346	2.69E+04			1.00E-01	2.02E-07	8.30E-06	1.0	0.1			5.0E-03	
METHYL ETHYL KETONE	V	L	72	4.51E+00	9.10E-02	1.00E-05	2.23E+05	5.61E-05	2.30E-03	1.0				6.0E-01	5.0E+00
METHYL ISOBUTYL KETONE	V	L	100	1.26E+01	7.00E-02	8.30E-06	1.90E+04	1.37E-04	5.60E-03	1.0				8.0E-02	3.0E+00
METHYL MERCURY	NV	S	216							1.0				1.0E-04	
METHYL TERT BUTYL ETHER	V	L	88	1.16E+01	7.50E-02	8.60E-06	5.10E+04	5.85E-04	2.40E-02	1.0		1.8E-03	2.6E-07		3.0E+00
METHYLENE CHLORIDE	V	L	85	2.17E+01	1.00E-01	1.30E-05	1.30E+04	3.17E-03	1.30E-01	1.0		7.5E-03	4.7E-07	6.0E-02	1.1E+00
METHYLNAPHTHALENE, 1-	V	S	142	2.26E+03	5.30E-02	7.80E-06	2.50E+01	5.12E-04	2.10E-02	1.0		2.9E-02	8.3E-06	7.0E-02	2.5E-01
METHYLNAPHTHALENE, 2-	V	S	142	2.48E+03	5.20E-02	7.80E-06	2.50E+01	5.12E-04	2.10E-02	1.0				4.0E-03	1.4E-02
MOLYBDENUM	NV	S	96							1.0				5.0E-03	
NAPHTHALENE	V	S	128	1.54E+03	6.00E-02	8.40E-06	3.10E+01	4.39E-04	1.80E-02	1.0	0.13		3.4E-05	2.0E-02	3.0E-03
NICKEL	NV	S	59							0.04				5.0E-02	1.0E-04
NITROBENZENE	V	L	123	2.26E+02	6.80E-02	9.40E-06	2.09E+03	2.39E-05	9.80E-04	1.0			4.0E-05	5.0E-04	9.0E-03

TABLE H. 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)	GI Absorption Factor GIABS (unitless)	Skin Absorption Factor ABS (unitless)	Cancer Slope Factor Oral CSFo (mg/kg-d)$^{-1}$	Cancer Unit Risk Factor (Inhalation) IUR (ug/m^3)$^{-1}$	Reference Dose Oral RfDo (mg/kg-d)	Reference Concentration (Inhalation) RfC (mg/m^3)
NITROGLYCERIN	NV	L	227	1.16E+02			1.38E+03	9.76E-08	4.00E-06	1.0	0.1	1.7E-02		1.0E-04	
NITROTOLUENE, 2-	V	S	137	3.71E+02	5.90E-02	8.70E-06	6.50E+02	1.24E-05	5.10E-04	1.0		2.2E-01	6.3E-05	9.0E-04	3.2E-03
NITROTOLUENE, 3-	V	S	137	3.63E+02	7.60E-02	8.60E-06	4.19E+02	2.39E-05	9.80E-04	1.0				2.00E-02	7.0E-02
NITROTOLUENE, 4-	NV	S	137	3.63E+02	5.70E-02	8.40E-06	4.42E+02	5.61E-06	2.30E-04	1.0	0.1	1.6E-02	4.6E-06	4.0E-03	1.4E-02
PENTACHLOROPHENOL	NV	S	266	4.96E+03			1.40E+01	2.44E-08	1.00E-06	1.0	0.25	4.0E-01	5.1E-06	5.0E-03	
PENTAERYTHRITOLTETRANITRATE (PETN)	NV	S	316	1.51E+02			4.30E+01	1.20E-11	4.92E-10	1.0	0.1	4.0E-03		2.0E-03	
PERCHLORATE	NV	S	117				2.45E+05			1.0				7.0E-04	
PHENANTHRENE	V	S	178	1.40E+04	6.08E-02	7.88E-06	8.16E-01	3.93E-05	1.61E-03	1.0	0.13			4.0E-02	1.4E-01
PHENOL	NV	S	94	1.87E+02	8.30E-02	1.00E-05	8.28E+04	3.41E-07	1.40E-05	1.0	0.1			3.0E-01	2.0E-01
POLYCHLORINATED BIPHENYLS (PCBs)	NV	S	326	3.30E+04			3.20E-02	2.93E-04	1.20E-02	1.0	0.14	2.0E+00	5.7E-04	2.0E-05	
PROPICONAZOLE	NV	L	342	1.56E+03			1.10E+02	4.15E-09	1.70E-07	1.0	0.1			1.3E-02	
PYRENE	V	S	202	5.43E+04	2.80E-02	7.20E-06	1.35E-01	1.20E-05	4.90E-04	1.0	0.13			3.0E-02	1.1E-01
SELENIUM	NV	S	81							1.0				5.0E-03	2.0E-02
SILVER	NV	S	108							0.04				5.0E-03	
SIMAZINE	NV	S	202	1.47E+02			6.20E+00	9.51E-10	3.90E-08	1.0	0.1	1.2E-01		5.0E-03	
STYRENE	V	L	104	4.46E+02	7.10E-02	8.80E-06	3.10E+02	2.68E-03	1.10E-01	1.0				2.0E-01	1.0E+00
TERBACIL	NV	S	217	5.01E+01			7.10E+02	1.20E-10	4.90E-09	1.0	0.1			1.3E-02	
tert-BUTYL ALCOHOL	V	L	74	3.70E+01	9.00E-02	9.10E-06	1.00E+06	1.17E-05	4.80E-04	1.0		3.0E-03	8.6E-07		
TETRACHLOROETHANE, 1,1,1,2-	V	L	168	8.60E+01	4.80E-02	9.10E-06	1.07E+03	2.41E-03	9.90E-02	1.0		2.6E-02	7.4E-06	3.0E-02	1.1E-01
TETRACHLOROETHANE, 1,1,2,2-	V	L	168	9.49E+01	4.90E-02	9.30E-06	2.87E+03	3.66E-04	1.50E-02	1.0		2.0E-01	5.8E-05	2.0E-02	
TETRACHLOROETHYLENE	V	L	166	9.49E+01	5.00E-02	9.50E-06	2.06E+02	1.76E-02	7.20E-01	1.0		5.4E-01	5.9E-06	1.0E-02	2.7E-01
TETRACHLOROPHENOL, 2,3,4,6-	NV	S	232	2.97E+03	2.17E-02	7.10E-06	2.30E+01	8.78E-06	3.60E-04	1.0	0.1			3.0E-02	
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	NV	S	296	5.32E+02			9.44E+03	8.54E-10	3.50E-08	1.0	0.006			5.0E-02	
THALLIUM	NV	S	204							1.0				1.0E-05	
TOLUENE	V	L	92	2.34E+02	7.80E-02	9.20E-06	5.26E+02	6.59E-03	2.70E-01	1.0				8.0E-02	5.0E+00
TOXAPHENE	NV	S	414	7.72E+04			5.50E-01	6.10E-06	2.50E-04	1.0	0.1	1.1E+00	3.2E-04		
TPH (gasolines)	V	L	119	5.00E+03	7.00E-02	1.00E-05	1.50E+02	7.80E-01	3.20E+01	1.0	0.10			3.00E-02	1.26E-01
TPH (middle distillates)	V	L	201	5.00E+03	7.00E-02	1.00E-05	5.00E+00	1.00E+00	4.10E+01	1.0	0.10			2.00E-02	1.26E-01
TPH (residual fuels)	NV	L	236				5.00E+00			1.0				1.20E-01	1.26E-01
TRICHLOROBENZENE, 1,2,4-	V	S	181	1.36E+03	4.00E-02	8.40E-06	4.90E+01	1.41E-03	5.80E-02	1.0		2.9E-02	8.3E-06	1.0E-02	2.0E-03
TRICHLOROETHANE, 1,1,1-	V	L	133	4.34E+01	6.50E-02	9.60E-06	1.29E+03	1.71E-02	7.00E-01	1.0				2.0E+00	5.0E+00
TRICHLOROETHANE, 1,1,2-	V	L	133	6.07E+01	6.70E-02	1.00E-05	1.10E+03	8.29E-04	3.40E-02	1.0		5.7E-02	1.6E-05	4.0E-03	2.0E-04
TRICHLOROETHYLENE	V	L	131	6.07E+01	6.90E-02	1.00E-05	1.28E+03	9.76E-03	4.00E-01	1.0		5.9E-03	2.0E-06	5.0E-04	1.0E-02
TRICHLOROPHENOL, 2,4,5-	NV	S	198	1.78E+03	5.60E-02	6.50E-06	1.20E+03	1.61E-06	6.60E-05	1.0	0.1			1.0E-01	3.5E-01
TRICHLOROPHENOL, 2,4,6-	NV	S	198	1.78E+03	3.10E-02	8.10E-06	8.00E+02	2.68E-06	1.10E-04	1.0	0.1	1.1E-02	3.1E-06	1.0E-03	
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	NV	S	255	1.07E+02			2.78E+02	4.63E-08	1.90E-06	1.0	0.1			1.0E-02	
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	NV	S	270	1.75E+02			2.00E+02	9.02E-09	3.70E-07	1.0	0.1			8.0E-03	
TRICHLOROPROPANE, 1,2,3-	V	L	147	9.49E+01	5.70E-02	9.20E-06	1.75E+03	3.41E-04	1.40E-02	1.0		3.0E+01	8.6E-03	4.0E-03	3.0E-04
TRICHLOROPROPENE, 1,2,3-	V	L	145	1.16E+02	7.10E-02	7.90E-06	2.70E+03	2.80E-02	1.15E+00	1.0				3.00E-03	3.0E-04
TRIFLURALIN	NV	S	335	1.64E+04			1.84E-01	1.02E-04	4.20E-03	1.0	0.1	7.7E-03		7.5E-03	
TRINITROBENZENE, 1,3,5-	NV	S	213	1.68E+03			2.78E+02	3.17E-09	1.30E-07	1.0	0.019			3.0E-02	
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	NV	S	287	4.61E+03			7.40E+01	2.68E-09	1.10E-07	1.0	0.1			4.0E-03	
TRINITROTOLUENE, 2,4,6- (TNT)	NV	S	227	2.81E+03			1.30E+02	4.63E-07	1.90E-05	1.0	0.032	3.0E-02		5.0E-04	
VANADIUM	NV	S	51							0.026				5.0E-03	

TABLE H. 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)	GI Absorption Factor GIABS (unitless)	Skin Absorption Factor ABS (unitless)	Cancer Slope Factor Oral CSFo (mg/kg-d)$^{-1}$	Cancer Unit Risk Factor (Inhalation) IUR (ug/m^3)$^{-1}$	Reference Dose Oral RfDo (mg/kg-d)	Reference Concentration (Inhalation) RfC (mg/m^3)
VINYL CHLORIDE	V	G	63	2.17E+01	1.10E-01	1.20E-05	8.80E+03	2.68E-02	1.10E+00	1.0		7.2E-01	4.4E-06	3.0E-03	1.0E-01
XYLENES	V	L	106	3.75E+02	6.80E-02	8.40E-06	1.61E+02	7.07E-03	2.90E-01	1.0				2.0E+00	1.0E-01
ZINC	NV	S	67							1.0				3.0E-01	

General Notes:

Updates: Updates since March 2009 edition noted in red on color version of this table. Refer to "Updates" worksheet at front of EAL Surfer for key revisions and Appendix 9.

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.

Physio-chemical constants and toxicity factors from USEPA RSL guidance (USEPA 2011), National Library of Medicine Toxnet database (NLM 2008a), NLM ChemID Plus (NLM 2008b), ATSDR Toxprofiles (ATSDR 2006) and USDOE RAIS database (USDOE 2006), in that order or preference, unless otherwise noted. Nonvolatile pesticides Koc and Diffusivity constants primarily from ORNL RAIS database (ORNL 2006).

Constants and toxicity factors for following chemicals after 2004 USEPA IX PRGs (USEPA 2004): chloroethane (RfDo), 1,3 dichlorobenzene (all), dimethylphthalate (all), 3-nitrotoluene (all), 1,2,3-trichloropropene (all), bis(2-chloroisopropyl)ether (all).

Inhalation Unit Risk (IUR) factor volatile carcinogens calculated based on oral slope factor if not provided in USEPA RSL guidance (IUR=CSFo x 20m3/day x (1/70kg) x (1mg/1,000ug). Resulting action levels may differ from those presented in the USEPA RSL guidance. Includes: bromodichloromethane; dibromochloromethane; 1-methylnaphthalene, 2-nitrotoluene, 4-nitrotoluene, tert-butyl alcohol, 1,2,4-trichlorobenzene, 1,2,3-trichloropropane.

Reference Concentration (RfC) for volatile noncarcinogens calculated based on oral reference dose if not available in USEPA RSL guidance (USEPA 2004, RfC = RfD x 70kg x (1/20m3-d). Resulting action levels may differ from those presented in the USEPA RSL guidance. Includes: acenaphthalene, acenaphthylene, anthracene, 2-chlorophenol, bromodichloromethane, dibromochloromethane, 1,3 dichlorobenzene, 1,1 dichloroethane, cis 1,2-dichloroethylene, 2,4-dimethylphenol, fluorene, 1 & 2-methylnaphthalene, 2-nitrotoluene, 3-nitrotoluene, 4-nitrotoluene, phenanthrene, pyrene, 1,1,1,2-tetrachloroethane, 1,1,2-trichloroethane, 2,4,5-trichlorophenol.

TPH (gasoline and middle distillates). Reference Doses and Reference Concentrations based on assumed carbon range makeup of fuels and fuel vapors (see Appendix 1, Section 6).

Dioxins: Reference dose based on WHO Permissible Tolerable Intake factor (refer to: Update to Soil Action Levels for TEQ Dioxins and Recommended Soil Management Practices, HEER office Technical Memorandum, June 2010).

Notes on Individual Chemicals

Amino,2- dinitrotoluene,3,6- constants and toxicity factors based on Amino,2- dinitrotoluene,3,6-.

Antimony toxicity factors based on metallic forms.

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.)

2,4 dimethylphenol Henry's constant and koc values and solubilities for nitrotoluenes from Syracuse Research Corporation (SRC 2005).

1,4 Dioxane physio-chemical constants from "Solvent Stabilizers - White Paper" (Mohr 2001).

Dioxin, polychlorinated biphenyls and toxaphene physio-chemical constants from ATSDR 2001a.

Ethanol toxicity factors not available (refer to Section 6 in Appendix 1).

Mercury toxicity factors based on elemental mercury.

Nickel toxicity factors based on soluble salts.

Nitrotoluenes, nitrobenzenes and other nonvolatile, explosives-related chemicals physiochemical constants from US Army Corps of Engineers *Military Range Chemical Database* (Zakikhani et al., 2002; primarily data from FRAMES database).

PCB constants and toxicity factors based on Arochlor 1254. PCB solubility based on value presented in 2004 USEPA IX PRGs (USEPA 2004).

PETN physiochemical constants from National Library of Medicine ChemID Plus database (NLM 2008b). Koc estimated from Kow based on equation for miscellaneous organics in Fetter 1993. Toxicity factors not available; RDX used as surrogate based on similar chemical structure (after UTDEQ 2008).

Technical chlordane koc of 86,650 cm3/gm referenced in 2008 edition of USEPA RSLs retained based on comparison to field SPLP batch test data which indicates very low mobility.

Thallium toxicity factors based on soluble salts.

TBA physio-chemical constants from *Assessment and Management of MtBE Impacted Sites* (RWQCB 2001). Oral cancer slope factor from California EPA (CalEPA 1999b). URF for TBA based on conversion of oral CSF (URF = CSF x (70kg/20m3-day)).

TPH -Total Petroleum Hydrocarbons. Molecular weights form ATSDR (gasolines) and NIOSH (middle distillates). See Section 6 of Appendix 1 for discussion of different TPH categories.

1,2,3 Trichloropropene diffusivity coefficients not available. Constants noted based on 1,2,3 Trichloropropane.

Xylenes physio-chemical and toxicity constants based on m-xylene.

Explosives-related compounds physio-chemical constants primarily from USACE ARAMS database (Zakikhani et al, 2002); National Library of Medicine ChemIDplus Advanced database (NLM 2008b) and DOE RAIS database (DOE 2006).

PAHs acenaphthylene and phenanthrene RfDs based on fluorene; RfDs for benzo(g,h,i)perylene based on fluoranthene (after MADEP 1994). Diffusivities for acenaphthylene, and phenanthrene based on fluorene.

Vanadium toxicity factors based on metallic forms.

Zinc toxicity factors based on metallic forms.

TABLE I-1. DIRECT-EXPOSURE ACTION LEVELS
[1]UNRESTRICTED LAND USE SCENARIO

CHEMICAL	Final Action Level (mg/kg)	Basis	[2]Carcinogens (Risk = 10^{-6}) (mg/kg)	[2]Mutagens (Risk = 10^{-6}) (mg/kg)	[3]Noncarcinogens (HQ = 0.2) (mg/kg)	[3]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
ACENAPHTHENE	6.2E+02	noncarcinogenic effects			6.2E+02	3.1E+03	NA
ACENAPHTHYLENE	3.2E+02	noncarcinogenic effects			3.2E+02	1.6E+03	NA
ACETONE	1.2E+04	noncarcinogenic effects			1.2E+04	6.1E+04	1.2E+05
ALDRIN	9.2E-01	noncarcinogenic effects	2.9E+00		9.2E-01	1.8E+00	NA
AMETRYN	1.1E+02	noncarcinogenic effects			1.1E+02	5.5E+02	NA
AMINO,2- DINITROTOLUENE,4,6-	3.1E+01	noncarcinogenic effects			3.1E+01	1.5E+02	NA
AMINO,4- DINITROTOLUENE,2,6-	3.1E+01	noncarcinogenic effects			3.1E+01	1.5E+02	NA
ANTHRACENE	3.3E+03	noncarcinogenic effects			3.3E+03	1.7E+04	NA
ANTIMONY	1.6E+00	noncarcinogenic effects			1.6E+00	8.2E+00	NA
ARSENIC	2.3E+01	carcinogenic effects	2.3E+01		2.3E+01	2.3E+01	NA
ATRAZINE	2.1E+00	carcinogenic effects	2.1E+00		4.3E+02	2.1E+03	NA
BARIUM	3.1E+03	noncarcinogenic effects			3.1E+03	1.5E+04	NA
BENZENE	1.1E+00	carcinogenic effects	1.1E+00		1.7E+01	8.6E+01	1.8E+03
BENZO(a)ANTHRACENE	1.5E+00	mutagenic effects	6.2E+00	1.5E+00			NA
BENZO(a)PYRENE	1.5E-01	mutagenic effects	6.2E-01	1.5E-01			NA
BENZO(b)FLUORANTHENE	1.5E+00	mutagenic effects	6.2E+00	1.5E+00			NA
BENZO(g,h,i)PERYLENE	4.6E+02	noncarcinogenic effects			4.6E+02	2.3E+03	NA
BENZO(k)FLUORANTHENE	1.5E+01	mutagenic effects	6.2E+01	1.5E+01			NA
BERYLLIUM	3.1E+01	noncarcinogenic effects	1.4E+03		3.1E+01	1.6E+02	NA
BIPHENYL, 1,1-	1.0E+01	noncarcinogenic effects	4.9E+01		1.0E+01	5.0E+01	NA
BIS(2-CHLOROETHYL)ETHER	2.1E-01	carcinogenic effects	2.1E-01				5.0E+03
BIS(2-CHLOROISOPROPYL)ETHER	3.3E+00	carcinogenic effects	3.3E+00		3.1E+02	1.6E+03	7.9E+02
BIS(2-ETHYLHEXYL)PHTHALATE	3.5E+01	carcinogenic effects	3.5E+01		2.4E+02	1.2E+03	NA
BORON	3.1E+03	noncarcinogenic effects			3.1E+03	1.6E+04	NA
BROMODICHLOROMETHANE	2.8E-01	carcinogenic effects	2.8E-01		5.2E+01	2.6E+02	9.3E+02
BROMOFORM	6.1E+01	carcinogenic effects	6.1E+01		2.4E+02	1.2E+03	NA
BROMOMETHANE	1.6E+00	noncarcinogenic effects			1.6E+00	7.8E+00	3.5E+03
CADMIUM	1.4E+01	noncarcinogenic effects	1.8E+03		1.4E+01	7.0E+01	NA
CARBON TETRACHLORIDE	6.2E-01	carcinogenic effects	6.2E-01		2.2E+01	1.1E+02	4.5E+02
CHLORDANE (TECHNICAL)	1.6E+01	carcinogenic effects	1.6E+01			3.5E+01	NA
CHLOROANILINE, p-	2.4E+00	carcinogenic effects	2.4E+00		4.9E+01	2.4E+02	NA
CHLOROBENZENE	5.9E+01	noncarcinogenic effects			5.9E+01	2.9E+02	7.6E+02
CHLOROETHANE	2.1E+03	saturation limit			2.9E+03	1.4E+04	2.1E+03
CHLOROFORM	3.0E-01	carcinogenic effects	3.0E-01		4.2E+01	2.1E+02	2.5E+03
CHLOROMETHANE	1.7E+00	carcinogenic effects	1.7E+00		2.4E+01	1.2E+02	1.3E+03
CHLOROPHENOL, 2-	6.7E+01	noncarcinogenic effects			6.7E+01	3.4E+02	5.5E+04
CHROMIUM (Total)		not available					
CHROMIUM III	2.3E+04	noncarcinogenic effects			2.3E+04	1.2E+05	NA
CHROMIUM VI	2.9E+01	mutagenic effects	1.2E+02	2.9E+01	4.7E+01	2.3E+02	NA
CHRYSENE	1.5E+02	mutagenic effects	6.2E+02	1.5E+02			NA
COBALT	4.7E+00	noncarcinogenic effects	3.7E+02		4.7E+00	2.3E+01	NA
COPPER	6.3E+02	noncarcinogenic effects			6.3E+02	3.1E+03	NA
CYANIDE (Free)	3.1E+02	noncarcinogenic effects			3.1E+02	1.6E+03	NA
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	5.5E+00	carcinogenic effects	5.5E+00		4.5E+01	2.3E+02	NA
DALAPON	3.7E+02	noncarcinogenic effects			3.7E+02	1.8E+03	NA
DIBENZO(a,h)ANTHTRACENE	1.5E-01	mutagenic effects	6.2E-01	1.5E-01			NA
DIBROMO,1,2- CHLOROPROPANE,3-	5.7E-03	mutagenic effects	1.5E-02	5.7E-03	1.0E+00	5.1E+00	1.1E+03

TABLE I-1. DIRECT-EXPOSURE ACTION LEVELS
[1]UNRESTRICTED LAND USE SCENARIO

CHEMICAL	Final Action Level (mg/kg)	Basis	[2]Carcinogens (Risk = 10^{-6}) (mg/kg)	[2]Mutagens (Risk = 10^{-6}) (mg/kg)	[3]Noncarcinogens (HQ = 0.2) (mg/kg)	[3]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
DIBROMOCHLOROMETHANE	7.8E-01	carcinogenic effects	7.8E-01		8.3E+01	4.1E+02	NA
DIBROMOETHANE, 1,2-	3.2E-02	carcinogenic effects	3.2E-02		1.5E+01	7.3E+01	NA
DICHLOROBENZENE, 1,2-	1.9E+02	saturation limit			3.9E+02	1.9E+03	1.9E+02
DICHLOROBENZENE, 1,3-	1.9E+02	noncarcinogenic effects			1.9E+02	9.5E+02	6.0E+02
DICHLOROBENZENE, 1,4-	2.5E+00	carcinogenic effects	2.5E+00		6.9E+02	3.5E+03	NA
DICHLOROBENZIDINE, 3,3-	1.1E+00	carcinogenic effects	1.1E+00				NA
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.0E+00	carcinogenic effects	2.0E+00				NA
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.4E+00	carcinogenic effects	1.4E+00				NA
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.7E+00	carcinogenic effects	1.7E+00		7.2E+00	3.6E+01	NA
DICHLOROETHANE, 1,1-	3.3E+00	carcinogenic effects	3.3E+00		3.0E+02	1.5E+03	1.7E+03
DICHLOROETHANE, 1,2-	4.4E-01	carcinogenic effects	4.4E-01		6.7E+00	3.4E+01	1.8E+03
DICHLOROETHYLENE, 1,1-	4.9E+01	noncarcinogenic effects			4.9E+01	2.4E+02	1.2E+03
DICHLOROETHYLENE, Cis 1,2-	3.5E+00	noncarcinogenic effects			3.5E+00	1.7E+01	1.3E+03
DICHLOROETHYLENE, Trans 1,2-	2.2E+01	noncarcinogenic effects			2.2E+01	1.1E+02	1.4E+03
DICHLOROPHENOL, 2,4-	3.7E+01	noncarcinogenic effects			3.7E+01	1.8E+02	NA
DICHLOROPHENOXYACETIC ACID (2,4-D)	1.4E+02	noncarcinogenic effects			1.4E+02	6.9E+02	NA
DICHLOROPROPANE, 1,2-	8.9E-01	carcinogenic effects	8.9E-01		3.2E+00	1.6E+01	1.4E+03
DICHLOROPROPENE, 1,3-	1.7E+00	carcinogenic effects	1.7E+00		1.5E+01	7.4E+01	1.6E+03
DIELDRIN	1.5E+00	noncarcinogenic effects	3.0E+00		1.5E+00	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
DINITROBENZENE, 1,3-	1.2E+00	noncarcinogenic effects			1.2E+00	6.1E+00	NA
DINITROPHENOL, 2,4-	2.4E+01	noncarcinogenic effects			2.4E+01	1.2E+02	NA
DINITROTOLUENE, 2,4- (2,4-DNT)	1.6E+00	carcinogenic effects	1.6E+00		2.4E+01	1.2E+02	NA
DINITROTOLUENE, 2,6- (2,6-DNT)	1.2E+01	noncarcinogenic effects			1.2E+01	6.1E+01	NA
DIOXANE, 1,4-	4.9E+00	carcinogenic effects	4.9E+00		3.7E+02	1.8E+03	NA
DIOXINS (TEQ)	2.4E-04	HDOH 2010a					
DIURON	2.4E+01	noncarcinogenic effects			2.4E+01	1.2E+02	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	5.5E+01	carcinogenic effects	5.5E+01		7.1E+02	3.5E+03	4.8E+02
FLUORANTHENE	4.6E+02	noncarcinogenic effects			4.6E+02	2.3E+03	NA
FLUORENE	4.4E+02	noncarcinogenic effects			4.4E+02	2.2E+03	NA
GLYPHOSATE	1.2E+03	noncarcinogenic effects			1.2E+03	6.1E+03	NA
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	6.2E+00	carcinogenic effects	6.2E+00		1.2E+01	6.1E+01	NA
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	5.2E-01	carcinogenic effects	5.2E-01		4.2E+00	2.1E+01	NA
HEXACHLOROETHANE	1.2E+01	noncarcinogenic effects	3.5E+01		1.2E+01	6.1E+01	NA
HEXAZINONE	4.0E+02	noncarcinogenic effects			4.0E+02	2.0E+03	NA
INDENO(1,2,3-cd)PYRENE	1.5E+00	mutagenic effects	6.2E+00	1.5E+00			NA
ISOPHORONE	5.1E+02	carcinogenic effects	5.1E+02		2.4E+03	1.2E+04	NA
LEAD	2.0E+02	noncarcinogenic effects			2.0E+02		NA

TABLE I-1. DIRECT-EXPOSURE ACTION LEVELS
[1]UNRESTRICTED LAND USE SCENARIO

CHEMICAL	Final Action Level (mg/kg)	Basis	[2]Carcinogens (Risk = 10^{-6}) (mg/kg)	[2]Mutagens (Risk = 10^{-6}) (mg/kg)	[3]Noncarcinogens (HQ = 0.2) (mg/kg)	[3]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
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	5.6E+03	noncarcinogenic effects			5.6E+03	2.8E+04	2.8E+04
METHYL ISOBUTYL KETONE	1.1E+03	noncarcinogenic effects			1.1E+03	5.3E+03	3.4E+03
METHYL MERCURY	1.6E+00	noncarcinogenic effects			1.6E+00	7.8E+00	NA
METHYL TERT BUTYL ETHER	4.4E+01	carcinogenic effects	4.4E+01		3.3E+03	1.7E+04	8.9E+03
METHYLENE CHLORIDE	1.1E+01	carcinogenic effects	1.1E+01		3.5E+02	1.7E+03	3.3E+03
METHYLNAPHTHALENE, 1-	9.8E+01	carcinogenic effects	9.8E+01		8.1E+02	4.0E+03	NA
METHYLNAPHTHALENE, 2-	4.7E+01	noncarcinogenic effects			4.7E+01	2.3E+02	NA
MOLYBDENUM	7.8E+01	noncarcinogenic effects			7.8E+01	3.9E+02	NA
NAPHTHALENE	2.8E+01	noncarcinogenic effects	3.6E+01		2.8E+01	1.4E+02	NA
NICKEL	7.6E+02	noncarcinogenic effects			7.6E+02	3.8E+03	NA
NITROBENZENE	4.8E+00	carcinogenic effects	4.8E+00		7.4E+00	3.7E+01	3.0E+03
NITROGLYCERIN	1.2E+00	noncarcinogenic effects	2.9E+01		1.2E+00	6.1E+00	NA
NITROTOLUENE, 2-	1.9E+00	carcinogenic effects	1.9E+00		1.2E+01	6.2E+01	NA
NITROTOLUENE, 3-	2.5E+02	noncarcinogenic effects			2.5E+02	1.3E+03	NA
NITROTOLUENE, 4-	3.0E+01	carcinogenic effects	3.0E+01		4.9E+01	2.4E+02	NA
PENTACHLOROPHENOL	8.9E-01	carcinogenic effects	8.9E-01		4.6E+01	2.3E+02	NA
PENTAERYTHRITOLTETRANITRATE (PETN)	2.4E+01	noncarcinogenic effects	1.2E+02		2.4E+01	1.2E+02	NA
PERCHLORATE	1.1E+01	noncarcinogenic effects			1.1E+01	5.5E+01	NA
PHENANTHRENE	4.4E+02	noncarcinogenic effects			4.4E+02	2.2E+03	NA
PHENOL	3.7E+03	noncarcinogenic effects			3.7E+03	1.8E+04	NA
POLYCHLORINATED BIPHENYLS (PCBs)	1.1E+00	noncarcinogenic effects	2.2E+00		1.1E+00	1.1E+00	NA
PROPICONAZOLE	1.6E+02	noncarcinogenic effects			1.6E+02	7.9E+02	NA
PYRENE	3.4E+02	noncarcinogenic effects			3.4E+02	1.7E+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
SIMAZINE	4.0E+00	carcinogenic effects	4.0E+00		6.1E+01	3.1E+02	NA
STYRENE	8.7E+02	saturation limit			1.3E+03	6.4E+03	8.7E+02
TERBACIL	1.6E+02	noncarcinogenic effects			1.6E+02	7.9E+02	NA
tert-BUTYL ALCOHOL	8.1E+01	carcinogenic effects	8.1E+01				3.2E+05
TETRACHLOROETHANE, 1,1,1,2-	1.9E+00	carcinogenic effects	1.9E+00		1.1E+02	5.3E+02	6.8E+02
TETRACHLOROETHANE, 1,1,2,2-	5.7E-01	carcinogenic effects	5.7E-01		3.1E+02	1.6E+03	1.9E+03
TETRACHLOROETHYLENE	5.6E-01	carcinogenic effects	5.6E-01		7.5E+01	3.8E+02	1.7E+02
TETRACHLOROPHENOL, 2,3,4,6-	3.7E+02	noncarcinogenic effects			3.7E+02	1.8E+03	NA
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	7.7E+02	noncarcinogenic effects			7.7E+02	3.8E+03	NA
THALLIUM	7.8E-01	noncarcinogenic effects			7.8E-01	7.8E-01	NA
TOLUENE	8.2E+02	saturation limit			1.0E+03	5.0E+03	8.2E+02
TOXAPHENE	4.4E-01	carcinogenic effects	4.4E-01				NA
TPH (gasolines)	5.0E+02	noncarcinogenic effects			5.0E+02	5.0E+02	5.4E+03
TPH (middle distillates)	5.0E+02	noncarcinogenic effects			5.0E+02	5.0E+02	5.0E+02
TPH (residual fuels)	9.4E+03	noncarcinogenic effects			9.4E+03	9.4E+03	NA
TRICHLOROBENZENE, 1,2,4-	6.6E+00	carcinogenic effects	6.6E+00		1.2E+01	6.2E+01	NA
TRICHLOROETHANE, 1,1,1-	6.4E+02	saturation limit			1.8E+03	8.8E+03	6.4E+02
TRICHLOROETHANE, 1,1,2-	3.2E-01	noncarcinogenic effects	1.1E+00		3.2E-01	1.6E+00	5.2E+02
TRICHLOROETHYLENE	2.8E+00	carcinogenic effects	2.8E+00		3.1E+00	1.5E+01	6.9E+02

TABLE I-1. DIRECT-EXPOSURE ACTION LEVELS
[1]UNRESTRICTED LAND USE SCENARIO

CHEMICAL	Final Action Level (mg/kg)	Basis	[2]Carcinogens (Risk = 10^{-6}) (mg/kg)	[2]Mutagens (Risk = 10^{-6}) (mg/kg)	[3]Noncarcinogens (HQ = 0.2) (mg/kg)	[3]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
TRICHLOROPHENOL, 2,4,5-	1.2E+03	noncarcinogenic effects			1.2E+03	6.1E+03	NA
TRICHLOROPHENOL, 2,4,6-	1.2E+01	noncarcinogenic effects	4.4E+01		1.2E+01	6.1E+01	NA
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	1.2E+02	noncarcinogenic effects			1.2E+02	6.1E+02	NA
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	9.8E+01	noncarcinogenic effects			9.8E+01	4.9E+02	NA
TRICHLOROPROPANE, 1,2,3-	1.3E-03	mutagenic effects	3.7E-03	1.3E-03	9.7E-01	4.8E+00	1.2E+03
TRICHLOROPROPENE, 1,2,3-	1.2E-01	noncarcinogenic effects			1.2E-01	6.0E-01	2.7E+03
TRIFLURALIN	6.3E+01	carcinogenic effects	6.3E+01		9.2E+01	4.6E+02	NA
TRINITROBENZENE, 1,3,5-	4.5E+02	noncarcinogenic effects			4.5E+02	2.2E+03	NA
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.9E+01	noncarcinogenic effects			4.9E+01	2.4E+02	NA
TRINITROTOLUENE, 2,4,6- (TNT)	7.2E+00	noncarcinogenic effects	1.9E+01		7.2E+00	3.6E+01	NA
VANADIUM	7.8E+01	noncarcinogenic effects			7.8E+01	3.9E+02	NA
VINYL CHLORIDE	7.2E-02	carcinogenic effects	7.2E-02	1.1E-01	1.5E+01	7.4E+01	3.9E+03
XYLENES	1.2E+02	noncarcinogenic effects			1.2E+02	6.2E+02	3.9E+02
ZINC	4.7E+03	noncarcinogenic effects			4.7E+03	2.3E+04	NA

Primary source: USEPA Regional Screening Levels (USEPA 2011), modified as noted below and described in Appendix 1, Section 3.2.

Notes:

1. Based on assumed residential exposure scenario. Considered adequate for residential housing, schools, medical facilities, day-care centers, parks and other sensitive uses.

2. Carcinogens: Default target excess cancer risk = 10^{-6} unless otherwise noted. Target ECR of 10^{-5} used for Technical Chlordane, PCBs and carcinogenic PAHs (see Section 3). Aldrin, dieldrin and hexavalent chromium action levels based on target risk 10^{-4} to reflect on higher confidence in noncancer toxicity factors, as well natural background for Cr VI.

3. Noncarcinogens: Default target hazard quotient = 0.2. TPH action levels based on HQ of 1.0 (see below footnote and Sections 3.2 and 6.0 in text). Action levels for Technical Chlordane based on HQ of 1.0. Action levels for aldrin and dieldrin (breakdown product of aldrin) based on HQ of 0.5. All chemicals - Separate screening levels based on hazard quotient of 1.0 provided for reference.

4. Arsenic direct exposure soil action levels: refer to Update to Soil Action Levels for Inorganic Arsenic and Recommended Soil Management Practices, HEER office Technical Memorandum, October 2010 (HDOH 2010a).

4. TEQ dioxin action levels: Refer to *Update to Soil Action Levels for TEQ Dioxins and Recommended Soil Management Practices* , HEER office Technical Memorandum, June 2010 (HDOH 2010b).

See text for equations and assumptions used in models.

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

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 H).

TPH:Total Petroleum Hydrocarbons. See Chapter 6 of Appendix 1for discussion of different TPH categories and development of action levels.

TPHmd saturation level set to 500 mg/kg vs model-derived 150 mg/kg to address low confidence in direct exposure, vapor emission model (see Chapter 6). Direct-exposure action levels for both TPHg and TPHmd set at 500 mg/kg to consider biodegradation.

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

Direct-exposure screening level for lead based on 50% of 2011 USEPA RSL of 400 mg/kg (see text, assumes target blood level of 5 ug/dl).

TABLE I-2. DIRECT-EXPOSURE ACTION LEVELS
COMMERCIAL/INDUSTRIAL LAND USE SCENARIO

CHEMICAL	Final Action Level (mg/kg)	Basis	[1]Carcinogens (Risk = 10^{-6}) (mg/kg)	[2]Noncarcinogens (HQ = 0.2) (mg/kg)	[2]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
ACENAPHTHENE	5.3E+03	noncarcinogenic effects		5.3E+03	2.7E+04	NA
ACENAPHTHYLENE	2.2E+03	noncarcinogenic effects		2.2E+03	1.1E+04	NA
ACETONE	1.2E+05	saturation limit		1.2E+05	6.2E+05	1.2E+05
ALDRIN	9.2E+00	noncarcinogenic effects	1.0E+01	9.2E+00	1.8E+01	NA
AMETRYN	1.1E+03	noncarcinogenic effects		1.1E+03	5.5E+03	NA
AMINO,2- DINITROTOLUENE,4,6-	3.9E+02	noncarcinogenic effects		3.9E+02	2.0E+03	NA
AMINO,4- DINITROTOLUENE,2,6-	3.9E+02	noncarcinogenic effects		3.9E+02	1.9E+03	NA
ANTHRACENE	3.1E+04	noncarcinogenic effects		3.1E+04	1.6E+05	NA
ANTIMONY	1.1E+01	noncarcinogenic effects		1.1E+01	5.4E+01	NA
ARSENIC	9.5E+01	carcinogenic effects	9.5E+01	3.0E+02	3.0E+02	NA
ATRAZINE	7.5E+00	carcinogenic effects	7.5E+00	4.3E+03	2.2E+04	NA
BARIUM	4.3E+03	trench/construction worker		3.8E+04	1.9E+05	NA
BENZENE	5.4E+00	carcinogenic effects	5.4E+00	8.9E+01	4.5E+02	1.8E+03
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	1.5E+02	trench/construction worker	6.9E+03	4.0E+02	2.0E+03	NA
BIPHENYL, 1,1-	4.3E+01	noncarcinogenic effects	2.3E+02	4.3E+01	2.1E+02	NA
BIS(2-CHLOROETHYL)ETHER	1.0E+00	carcinogenic effects	1.0E+00			5.0E+03
BIS(2-CHLOROISOPROPYL)ETHER	1.6E+01	carcinogenic effects	1.6E+01	2.0E+03	1.0E+04	7.9E+02
BIS(2-ETHYLHEXYL)PHTHALATE	1.2E+02	carcinogenic effects	1.2E+02	2.5E+03	1.2E+04	NA
BORON	4.1E+04	noncarcinogenic effects		4.1E+04	2.0E+05	NA
BROMODICHLOROMETHANE	1.4E+00	carcinogenic effects	1.4E+00	2.5E+02	1.2E+03	9.3E+02
BROMOFORM	2.2E+02	carcinogenic effects	2.2E+02	2.5E+03	1.2E+04	NA
BROMOMETHANE	6.9E+00	noncarcinogenic effects		6.9E+00	3.4E+01	3.5E+03
CADMIUM	1.2E+02	trench/construction worker	9.3E+03	1.6E+02	8.0E+02	NA
CARBON TETRACHLORIDE	3.1E+00	carcinogenic effects	3.1E+00	1.2E+02	6.1E+02	4.5E+02
CHLORDANE (TECHNICAL)	6.5E+01	carcinogenic effects	6.5E+01		4.0E+02	NA
CHLOROANILINE, p-	8.6E+00	carcinogenic effects	8.6E+00	4.9E+02	2.5E+03	NA
CHLOROBENZENE	2.8E+02	noncarcinogenic effects		2.8E+02	1.4E+03	7.6E+02
CHLOROETHANE	2.1E+03	saturation limit		1.2E+04	6.0E+04	2.1E+03
CHLOROFORM	1.5E+00	carcinogenic effects	1.5E+00	2.2E+02	1.1E+03	2.5E+03
CHLOROMETHANE	8.5E+00	carcinogenic effects	8.5E+00	1.0E+02	5.1E+02	1.3E+03
CHLOROPHENOL, 2-	6.8E+02	noncarcinogenic effects		6.8E+02	3.4E+03	5.5E+04
CHROMIUM (Total)		not available				
CHROMIUM III	3.1E+05	noncarcinogenic effects		3.1E+05	1.5E+06	NA
CHROMIUM VI	4.8E+02	trench/construction worker	5.6E+02	6.1E+02	3.1E+03	NA
CHRYSENE	2.1E+03	carcinogenic effects	2.1E+03			NA
COBALT	3.8E+01	trench/construction worker	1.9E+03	6.1E+01	3.0E+02	NA
COPPER	8.2E+03	noncarcinogenic effects		8.2E+03	4.1E+04	NA
CYANIDE (Free)	4.1E+03	noncarcinogenic effects		4.1E+03	2.0E+04	NA
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	2.4E+01	carcinogenic effects	2.4E+01	5.6E+02	2.8E+03	NA
DALAPON	3.7E+03	noncarcinogenic effects		3.7E+03	1.8E+04	NA
DIBENZO(a,h)ANTHTRACENE	2.1E+00	carcinogenic effects	2.1E+00			NA
DIBROMO,1,2- CHLOROPROPANE,3-	7.4E-02	carcinogenic effects	7.4E-02	5.6E+00	2.8E+01	1.1E+03

TABLE I-2. DIRECT-EXPOSURE ACTION LEVELS
COMMERCIAL/INDUSTRIAL LAND USE SCENARIO

CHEMICAL	Final Action Level (mg/kg)	Basis	[1]Carcinogens (Risk = 10^{-6}) (mg/kg)	[2]Noncarcinogens (HQ = 0.2) (mg/kg)	[2]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
DIBROMOCHLOROMETHANE	3.6E+00	carcinogenic effects	3.6E+00	4.3E+02	2.2E+03	NA
DIBROMOETHANE, 1,2-	1.6E-01	carcinogenic effects	1.6E-01	6.6E+01	3.3E+02	NA
DICHLOROBENZENE, 1,2-	1.9E+02	saturation limit		2.0E+03	1.0E+04	1.9E+02
DICHLOROBENZENE, 1,3-	6.0E+02	saturation limit		1.1E+03	5.5E+03	6.0E+02
DICHLOROBENZENE, 1,4-	1.2E+01	carcinogenic effects	1.2E+01	5.1E+03	2.6E+04	NA
DICHLOROBENZIDINE, 3,3-	3.8E+00	carcinogenic effects	3.8E+00			NA
DICHLORODIPHENYLDICHLOROETHANE (DDD)	7.2E+00	carcinogenic effects	7.2E+00			NA
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	5.1E+00	carcinogenic effects	5.1E+00			NA
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	7.0E+00	carcinogenic effects	7.0E+00	8.5E+01	4.3E+02	NA
DICHLOROETHANE, 1,1-	1.7E+01	carcinogenic effects	1.7E+01	1.3E+03	6.7E+03	1.7E+03
DICHLOROETHANE, 1,2-	2.2E+00	carcinogenic effects	2.2E+00	3.0E+01	1.5E+02	1.8E+03
DICHLOROETHYLENE, 1,1-	2.1E+02	noncarcinogenic effects		2.1E+02	1.1E+03	1.2E+03
DICHLOROETHYLENE, Cis 1,2-	1.6E+01	noncarcinogenic effects		1.6E+01	8.0E+01	1.3E+03
DICHLOROETHYLENE, Trans 1,2-	9.7E+01	noncarcinogenic effects		9.7E+01	4.9E+02	1.4E+03
DICHLOROPHENOL, 2,4-	3.7E+02	noncarcinogenic effects		3.7E+02	1.8E+03	NA
DICHLOROPHENOXYACETIC ACID (2,4-D)	1.5E+03	noncarcinogenic effects		1.5E+03	7.7E+03	NA
DICHLOROPROPANE, 1,2-	4.4E+00	carcinogenic effects	4.4E+00	1.3E+01	6.7E+01	1.4E+03
DICHLOROPROPENE, 1,3-	8.1E+00	carcinogenic effects	8.1E+00	6.4E+01	3.2E+02	1.6E+03
DIELDRIN	1.1E+01	carcinogenic effects	1.1E+01	1.5E+01	3.1E+01	NA
DIETHYLPHTHALATE	9.9E+04	noncarcinogenic effects		9.9E+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
DINITROBENZENE, 1,3-	1.2E+01	noncarcinogenic effects		1.2E+01	6.2E+01	NA
DINITROPHENOL, 2,4-	2.5E+02	noncarcinogenic effects		2.5E+02	1.2E+03	NA
DINITROTOLUENE, 2,4- (2,4-DNT)	5.6E+00	carcinogenic effects	5.6E+00	2.5E+02	1.2E+03	NA
DINITROTOLUENE, 2,6- (2,6-DNT)	1.2E+02	noncarcinogenic effects		1.2E+02	6.2E+02	NA
DIOXANE, 1,4-	1.7E+01	carcinogenic effects	1.7E+01	3.7E+03	1.8E+04	NA
DIOXINS (TEQ)	1.5E-03	HDOH 2010a				
DIURON	2.5E+02	noncarcinogenic effects		2.5E+02	1.2E+03	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	1.5E+02	trench/construction worker	2.7E+02	4.3E+03	2.1E+04	4.8E+02
FLUORANTHENE	4.4E+03	noncarcinogenic effects		4.4E+03	2.2E+04	NA
FLUORENE	3.9E+03	noncarcinogenic effects		3.9E+03	2.0E+04	NA
GLYPHOSATE	1.2E+04	noncarcinogenic effects		1.2E+04	6.2E+04	NA
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	9.9E+01	4.9E+02	NA
HEXACHLOROBUTADIENE	2.2E+01	carcinogenic effects	2.2E+01	1.2E+02	6.2E+02	NA
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	2.1E+00	carcinogenic effects	2.1E+00	4.9E+01	2.4E+02	NA
HEXACHLOROETHANE	1.2E+02	carcinogenic effects	1.2E+02	1.2E+02	6.2E+02	NA
HEXAZINONE	4.1E+03	noncarcinogenic effects		4.1E+03	2.0E+04	NA
INDENO(1,2,3-cd)PYRENE	2.1E+01	carcinogenic effects	2.1E+01			NA
ISOPHORONE	1.8E+03	carcinogenic effects	1.8E+03	2.5E+04	1.2E+05	NA
LEAD	8.0E+02	commercial/industrial exposure		8.0E+02		NA
MERCURY	6.1E+01	noncarcinogenic effects		6.1E+01	3.1E+02	NA

TABLE I-2. DIRECT-EXPOSURE ACTION LEVELS
COMMERCIAL/INDUSTRIAL LAND USE SCENARIO

CHEMICAL	Final Action Level (mg/kg)	Basis	[1]Carcinogens (Risk = 10^{-6}) (mg/kg)	[2]Noncarcinogens (HQ = 0.2) (mg/kg)	[2]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
METHOXYCHLOR	6.2E+02	noncarcinogenic effects		6.2E+02	3.1E+03	NA
METHYL ETHYL KETONE	2.8E+04	saturation limit		4.0E+04	2.0E+05	2.8E+04
METHYL ISOBUTYL KETONE	3.4E+03	saturation limit		1.1E+04	5.3E+04	3.4E+03
METHYL MERCURY	2.0E+01	noncarcinogenic effects		2.0E+01	1.0E+02	NA
METHYL TERT BUTYL ETHER	2.2E+02	carcinogenic effects	2.2E+02	1.4E+04	7.0E+04	8.9E+03
METHYLENE CHLORIDE	5.4E+01	carcinogenic effects	5.4E+01	1.9E+03	9.7E+03	3.3E+03
METHYLNAPHTHALENE, 1-	2.9E+02	trench/construction worker	4.7E+02	6.8E+03	3.4E+04	NA
METHYLNAPHTHALENE, 2-	4.0E+02	noncarcinogenic effects		4.0E+02	2.0E+03	NA
MOLYBDENUM	1.0E+03	noncarcinogenic effects		1.0E+03	5.1E+03	NA
NAPHTHALENE	9.6E+01	trench/construction worker	1.8E+02	1.3E+02	6.3E+02	NA
NICKEL	8.7E+02	trench/construction worker		9.4E+03	4.7E+04	NA
NITROBENZENE	2.4E+01	carcinogenic effects	2.4E+01	8.8E+01	4.4E+02	3.0E+03
NITROGLYCERIN	1.2E+01	noncarcinogenic effects	1.0E+02	1.2E+01	6.2E+01	NA
NITROTOLUENE, 2-	9.0E+00	carcinogenic effects	9.0E+00	1.3E+02	6.3E+02	NA
NITROTOLUENE, 3-	2.4E+03	noncarcinogenic effects		2.4E+03	1.2E+04	NA
NITROTOLUENE, 4-	1.1E+02	carcinogenic effects	1.1E+02	4.9E+02	2.5E+03	NA
PENTACHLOROPHENOL	2.7E+00	carcinogenic effects	2.7E+00	3.9E+02	1.9E+03	NA
PENTAERYTHRITOLTETRANITRATE (PETN)	2.5E+02	noncarcinogenic effects	4.3E+02	2.5E+02	1.2E+03	NA
PERCHLORATE	1.4E+02	noncarcinogenic effects		1.4E+02	7.2E+02	NA
PHENANTHRENE	4.1E+03	noncarcinogenic effects		4.1E+03	2.1E+04	NA
PHENOL	3.7E+04	noncarcinogenic effects		3.7E+04	1.8E+05	NA
POLYCHLORINATED BIPHENYLS (PCBs)	7.4E+00	carcinogenic effects	7.4E+00	1.1E+01	1.1E+01	NA
PROPICONAZOLE	1.6E+03	noncarcinogenic effects		1.6E+03	8.0E+03	NA
PYRENE	3.3E+03	noncarcinogenic effects		3.3E+03	1.6E+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
SIMAZINE	1.4E+01	carcinogenic effects	1.4E+01	6.2E+02	3.1E+03	NA
STYRENE	8.7E+02	saturation limit		7.4E+03	3.7E+04	8.7E+02
TERBACIL	1.6E+03	noncarcinogenic effects		1.6E+03	8.0E+03	NA
tert-BUTYL ALCOHOL	3.9E+02	carcinogenic effects	3.9E+02			3.2E+05
TETRACHLOROETHANE, 1,1,1,2-	9.5E+00	carcinogenic effects	9.5E+00	5.3E+02	2.6E+03	6.8E+02
TETRACHLOROETHANE, 1,1,2,2-	2.8E+00	carcinogenic effects	2.8E+00	4.1E+03	2.0E+04	1.9E+03
TETRACHLOROETHYLENE	2.7E+00	carcinogenic effects	2.7E+00	4.7E+02	2.3E+03	1.7E+02
TETRACHLOROPHENOL, 2,3,4,6-	3.7E+03	noncarcinogenic effects		3.7E+03	1.8E+04	NA
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	9.8E+03	noncarcinogenic effects		9.8E+03	4.9E+04	NA
THALLIUM	1.0E+01	noncarcinogenic effects		1.0E+01	1.0E+01	NA
TOLUENE	8.2E+02	saturation limit		9.1E+03	4.5E+04	8.2E+02
TOXAPHENE	1.6E+00	carcinogenic effects	1.6E+00			NA
TPH (gasolines)	1.1E+03	noncarcinogenic effects		1.1E+03	1.1E+03	5.4E+03
TPH (middle distillates)	5.0E+02	saturation limit		1.0E+03	1.0E+03	5.0E+02
TPH (residual fuels)	1.2E+05	noncarcinogenic effects		1.2E+05	1.2E+05	NA
TRICHLOROBENZENE, 1,2,4-	3.2E+01	carcinogenic effects	3.2E+01	5.5E+01	2.8E+02	NA
TRICHLOROETHANE, 1,1,1-	6.4E+02	saturation limit		7.7E+03	3.8E+04	6.4E+02
TRICHLOROETHANE, 1,1,2-	1.4E+00	noncarcinogenic effects	5.3E+00	1.4E+00	6.8E+00	5.2E+02
TRICHLOROETHYLENE	1.4E+01	carcinogenic effects	1.4E+01	1.7E+01	8.7E+01	6.9E+02
TRICHLOROPHENOL, 2,4,5-	1.2E+04	noncarcinogenic effects		1.2E+04	6.2E+04	NA
TRICHLOROPHENOL, 2,4,6-	1.2E+02	noncarcinogenic effects	1.6E+02	1.2E+02	6.2E+02	NA

TABLE I-2. DIRECT-EXPOSURE ACTION LEVELS
COMMERCIAL/INDUSTRIAL LAND USE SCENARIO

CHEMICAL	Final Action Level (mg/kg)	Basis	[1]Carcinogens (Risk = 10^{-6}) (mg/kg)	[2]Noncarcinogens (HQ = 0.2) (mg/kg)	[2]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	1.2E+03	noncarcinogenic effects		1.2E+03	6.2E+03	NA
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	9.9E+02	noncarcinogenic effects		9.9E+02	4.9E+03	NA
TRICHLOROPROPANE, 1,2,3-	1.8E-02	carcinogenic effects	1.8E-02	4.1E+00	2.1E+01	1.2E+03
TRICHLOROPROPENE, 1,2,3-	5.0E-01	noncarcinogenic effects		5.0E-01	2.5E+00	2.7E+03
TRIFLURALIN	2.2E+02	carcinogenic effects	2.2E+02	9.2E+02	4.6E+03	NA
TRINITROBENZENE, 1,3,5-	5.4E+03	noncarcinogenic effects		5.4E+03	2.7E+04	NA
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.9E+02	noncarcinogenic effects		4.9E+02	2.5E+03	NA
TRINITROTOLUENE, 2,4,6- (TNT)	7.9E+01	carcinogenic effects	7.9E+01	8.4E+01	4.2E+02	NA
VANADIUM	1.0E+03	noncarcinogenic effects		1.0E+03	5.1E+03	NA
VINYL CHLORIDE	1.7E+00	carcinogenic effects	1.7E+00	7.9E+01	3.9E+02	3.9E+03
XYLENES	3.9E+02	saturation limit		5.2E+02	2.6E+03	3.9E+02
ZINC	6.1E+04	noncarcinogenic effects		6.1E+04	3.1E+05	NA

Primary source: USEPA Regional Screening Levels (USEPA 2011), modified as noted below and described in Appendix 1, Section 3.2.

Notes:

1. Carcinogens: Default target excess cancer risk = 10^{-6} unless otherwise noted. Target ECR of 10^{-5} used for Technical Chlordane, PCBs and carcinogenic PAHs (see Section 3). Aldrin, dieldrin and hexavalent chromium action levels based on target risk 10^{-4} to reflect on higher confidence in noncancer toxicity factors, as well natural background for Cr VI.

2. Noncarcinogens: Default target hazard quotient = 0.2. TPH action levels based on HQ of 1.0 (see Section 3.2 in text). Action levels for Technical Chlordane based on HQ of 1.0. Action levels for aldrin and dieldrin (breakdown product of aldrin) based on HQ of 0.5. All chemicals - Separate screening levels based on hazard quotient of 1.0 provided for reference.

3. Arsenic direct exposure soil action levels: refer to Update to Soil Action Levels for Inorganic Arsenic and Recommended Soil Management Practices, HEER office Technical Memorandum, October 2010 (HDOH 2010a).

4. TEQ dioxin action levels: Refer to Update to Soil Action Levels for TEQ Dioxins and Recommended Soil Management Practices, HEER office Technical Memorandum, June 2010 (HDOH 2010b).

See text for equations and assumptions used in models.

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

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 H).

TPH:Total Petroleum Hydrocarbons. See Chapter 6 of Appendix 1for discussion of different TPH categories and development of action levels.

TPHmd saturation level set to 500 mg/kg vs model-derived 150 mg/kg to address low confidence in direct exposure, vapor emission model (see Chapter 6)

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

Direct-exposure screening level for lead from USEPA Regional Screening Levels (USEPA 2011).

TABLE I-3. DIRECT-EXPOSURE ACTION LEVELS
CONSTRUCTION/TRENCH WORKER EXPOSURE SCENARIO

CHEMICAL	Final Action Level (mg/kg)	Basis	[1]Carcinogens (Risk = 10^{-5}) (mg/kg)	[2]Noncarcinogens (HQ = 0.2) (mg/kg)	[2]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
ACENAPHTHENE	1.1E+04	noncarcinogenic effects		1.1E+04	5.7E+04	NA
ACENAPHTHYLENE	4.0E+03	noncarcinogenic effects		4.0E+03	2.0E+04	NA
ACETONE	1.2E+05	saturation limit		2.3E+05	1.2E+06	1.2E+05
ALDRIN	2.2E+01	noncarcinogenic effects	8.4E+01	2.2E+01	4.3E+01	NA
AMETRYN	2.6E+03	noncarcinogenic effects		2.6E+03	1.3E+04	NA
AMINO,2- DINITROTOLUENE,4,6-	8.6E+02	noncarcinogenic effects		8.6E+02	4.3E+03	NA
AMINO,4- DINITROTOLUENE,2,6-	8.4E+02	noncarcinogenic effects		8.4E+02	4.2E+03	NA
ANTHRACENE	7.1E+04	noncarcinogenic effects		7.1E+04	3.5E+05	NA
ANTIMONY	2.8E+01	noncarcinogenic effects		2.8E+01	1.4E+02	NA
ARSENIC	1.3E+02	carcinogenic effects	1.3E+02	3.3E+02	3.3E+02	NA
ATRAZINE	6.3E+02	carcinogenic effects	6.3E+02	1.0E+04	5.1E+04	NA
BARIUM	4.3E+03	noncarcinogenic effects		4.3E+03	2.1E+04	NA
BENZENE	2.9E+01	carcinogenic effects	2.9E+01	1.4E+02	6.9E+02	1.8E+03
BENZO(a)ANTHRACENE	1.8E+02	carcinogenic effects	1.8E+02			NA
BENZO(a)PYRENE	1.8E+01	carcinogenic effects	1.8E+01			NA
BENZO(b)FLUORANTHENE	1.8E+02	carcinogenic effects	1.8E+02			NA
BENZO(g,h,i)PERYLENE	1.0E+04	noncarcinogenic effects		1.0E+04	5.2E+04	NA
BENZO(k)FLUORANTHENE	1.7E+03	carcinogenic effects	1.7E+03			NA
BERYLLIUM	1.5E+02	noncarcinogenic effects	1.9E+03	1.5E+02	7.5E+02	NA
BIPHENYL, 1,1-	6.2E+01	noncarcinogenic effects	1.5E+03	6.2E+01	3.1E+02	NA
BIS(2-CHLOROETHYL)ETHER	6.2E+00	carcinogenic effects	6.2E+00			5.0E+03
BIS(2-CHLOROISOPROPYL)ETHER	9.7E+01	carcinogenic effects	9.7E+01	3.2E+03	1.6E+04	7.9E+02
BIS(2-ETHYLHEXYL)PHTHALATE	5.8E+03	noncarcinogenic effects	1.0E+04	5.8E+03	2.9E+04	NA
BORON	5.9E+04	noncarcinogenic effects		5.9E+04	3.0E+05	NA
BROMODICHLOROMETHANE	7.4E+00	carcinogenic effects	7.4E+00	3.8E+02	1.9E+03	9.3E+02
BROMOFORM	5.8E+03	noncarcinogenic effects	1.8E+04	5.8E+03	2.9E+04	NA
BROMOMETHANE	1.0E+01	noncarcinogenic effects		1.0E+01	5.1E+01	3.5E+03
CADMIUM	1.2E+02	noncarcinogenic effects	2.5E+03	1.2E+02	6.0E+02	NA
CARBON TETRACHLORIDE	1.7E+01	carcinogenic effects	1.7E+01	1.9E+02	9.5E+02	4.5E+02
CHLORDANE (TECHNICAL)	5.2E+02	carcinogenic effects	5.2E+02	8.9E+02	8.9E+02	NA
CHLOROANILINE, p-	7.2E+02	carcinogenic effects	7.2E+02	1.2E+03	5.8E+03	NA
CHLOROBENZENE	4.3E+02	noncarcinogenic effects		4.3E+02	2.1E+03	7.6E+02
CHLOROETHANE	2.1E+03	saturation limit		1.8E+04	8.9E+04	2.1E+03
CHLOROFORM	8.0E+00	carcinogenic effects	8.0E+00	3.4E+02	1.7E+03	2.5E+03
CHLOROMETHANE	4.6E+01	carcinogenic effects	4.6E+01	1.5E+02	7.6E+02	1.3E+03
CHLOROPHENOL, 2-	1.3E+03	noncarcinogenic effects		1.3E+03	6.4E+03	5.5E+04
CHROMIUM (Total)		not available				
CHROMIUM III	6.6E+05	noncarcinogenic effects		6.6E+05	3.3E+06	NA
CHROMIUM VI	4.8E+02	carcinogenic effects	4.8E+02	5.4E+02	2.7E+03	NA
CHRYSENE	1.7E+04	carcinogenic effects	1.7E+04			NA
COBALT	3.8E+01	noncarcinogenic effects	5.0E+02	3.8E+01	1.9E+02	NA
COPPER	1.8E+04	noncarcinogenic effects		1.8E+04	8.8E+04	NA
CYANIDE (Free)	8.8E+03	noncarcinogenic effects		8.8E+03	4.4E+04	NA
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	1.2E+03	noncarcinogenic effects	1.9E+03	1.2E+03	6.1E+03	NA
DALAPON	8.7E+03	noncarcinogenic effects		8.7E+03	4.3E+04	NA
DIBENZO(a,h)ANTHTRACENE	1.8E+01	carcinogenic effects	1.8E+01			NA
DIBROMO,1,2- CHLOROPROPANE,3-	3.9E-01	carcinogenic effects	3.9E-01	8.6E+00	4.3E+01	1.1E+03

TABLE I-3. DIRECT-EXPOSURE ACTION LEVELS
CONSTRUCTION/TRENCH WORKER EXPOSURE SCENARIO

CHEMICAL	Final Action Level (mg/kg)	Basis	[1]Carcinogens (Risk = 10^{-5}) (mg/kg)	[2]Noncarcinogens (HQ = 0.2) (mg/kg)	[2]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
DIBROMOCHLOROMETHANE	2.0E+01	carcinogenic effects	2.0E+01	6.9E+02	3.4E+03	NA
DIBROMOETHANE, 1,2-	8.6E-01	carcinogenic effects	8.6E-01	9.9E+01	4.9E+02	NA
DICHLOROBENZENE, 1,2-	1.9E+02	saturation limit		3.1E+03	1.5E+04	1.9E+02
DICHLOROBENZENE, 1,3-	6.0E+02	saturation limit		1.7E+03	8.6E+03	6.0E+02
DICHLOROBENZENE, 1,4-	6.6E+01	carcinogenic effects	6.6E+01	8.5E+03	4.3E+04	NA
DICHLOROBENZIDINE, 3,3-	3.1E+02	carcinogenic effects	3.1E+02			NA
DICHLORODIPHENYLDICHLOROETHANE (DDD)	6.0E+02	carcinogenic effects	6.0E+02			NA
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	4.2E+02	carcinogenic effects	4.2E+02			NA
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.9E+02	noncarcinogenic effects	5.6E+02	1.9E+02	9.5E+02	NA
DICHLOROETHANE, 1,1-	9.0E+01	carcinogenic effects	9.0E+01	2.0E+03	1.0E+04	1.7E+03
DICHLOROETHANE, 1,2-	1.2E+01	carcinogenic effects	1.2E+01	4.5E+01	2.2E+02	1.8E+03
DICHLOROETHYLENE, 1,1-	3.2E+02	noncarcinogenic effects		3.2E+02	1.6E+03	1.2E+03
DICHLOROETHYLENE, Cis 1,2-	2.4E+01	noncarcinogenic effects		2.4E+01	1.2E+02	1.3E+03
DICHLOROETHYLENE, Trans 1,2-	1.5E+02	noncarcinogenic effects		1.5E+02	7.3E+02	1.4E+03
DICHLOROPHENOL, 2,4-	8.7E+02	noncarcinogenic effects		8.7E+02	4.3E+03	NA
DICHLOROPHENOXYACETIC ACID (2,4-D)	3.5E+03	noncarcinogenic effects		3.5E+03	1.8E+04	NA
DICHLOROPROPANE, 1,2-	2.0E+01	noncarcinogenic effects	2.4E+01	2.0E+01	1.0E+02	1.4E+03
DICHLOROPROPENE, 1,3-	4.7E+01	carcinogenic effects	4.7E+01	9.5E+01	4.7E+02	1.6E+03
DIELDRIN	3.6E+01	noncarcinogenic effects	9.0E+01	3.6E+01	7.2E+01	NA
DIETHYLPHTHALATE	2.3E+05	noncarcinogenic effects		2.3E+05	1.2E+06	NA
DIMETHYLPHENOL, 2,4-	5.7E+03	noncarcinogenic effects		5.7E+03	2.9E+04	NA
DIMETHYLPHTHALATE	1.0E+06	maximum		2.9E+06	1.4E+07	NA
DINITROBENZENE, 1,3-	2.9E+01	noncarcinogenic effects		2.9E+01	1.4E+02	NA
DINITROPHENOL, 2,4-	5.8E+02	noncarcinogenic effects		5.8E+02	2.9E+03	NA
DINITROTOLUENE, 2,4- (2,4-DNT)	4.6E+02	carcinogenic effects	4.6E+02	5.8E+02	2.9E+03	NA
DINITROTOLUENE, 2,6- (2,6-DNT)	2.9E+02	noncarcinogenic effects		2.9E+02	1.4E+03	NA
DIOXANE, 1,4-	1.4E+03	carcinogenic effects	1.4E+03	8.7E+03	4.3E+04	NA
DIOXINS (TEQ)	1.5E-03	HDOH 2010a				
DIURON	5.8E+02	noncarcinogenic effects		5.8E+02	2.9E+03	NA
ENDOSULFAN	1.7E+03	noncarcinogenic effects		1.7E+03	8.7E+03	NA
ENDRIN	8.7E+01	noncarcinogenic effects		8.7E+01	4.3E+02	NA
ETHANOL	1.5E-03	commercial/industrial exposure				
ETHYLBENZENE	1.5E+02	carcinogenic effects	1.5E+02	6.8E+03	3.4E+04	4.8E+02
FLUORANTHENE	1.0E+04	noncarcinogenic effects		1.0E+04	5.2E+04	NA
FLUORENE	8.8E+03	noncarcinogenic effects		8.8E+03	4.4E+04	NA
GLYPHOSATE	2.9E+04	noncarcinogenic effects		2.9E+04	1.4E+05	NA
HEPTACHLOR	3.2E+01	carcinogenic effects	3.2E+01	1.4E+02	7.2E+02	NA
HEPTACHLOR EPOXIDE	3.8E+00	noncarcinogenic effects	1.6E+01	3.8E+00	1.9E+01	NA
HEXACHLOROBENZENE	9.0E+01	carcinogenic effects	9.0E+01	2.3E+02	1.2E+03	NA
HEXACHLOROBUTADIENE	2.9E+02	noncarcinogenic effects	1.8E+03	2.9E+02	1.4E+03	NA
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	1.1E+02	noncarcinogenic effects	1.6E+02	1.1E+02	5.5E+02	NA
HEXACHLOROETHANE	2.9E+02	noncarcinogenic effects	1.0E+04	2.9E+02	1.4E+03	NA
HEXAZINONE	9.6E+03	noncarcinogenic effects		9.6E+03	4.8E+04	NA
INDENO(1,2,3-cd)PYRENE	1.8E+02	carcinogenic effects	1.8E+02			NA
ISOPHORONE	5.8E+04	noncarcinogenic effects	1.5E+05	5.8E+04	2.9E+05	NA
LEAD	8.0E+02	commercial/industrial exposure				
MERCURY	8.9E+01	noncarcinogenic effects		8.9E+01	4.5E+02	NA

TABLE I-3. DIRECT-EXPOSURE ACTION LEVELS
CONSTRUCTION/TRENCH WORKER EXPOSURE SCENARIO

CHEMICAL	Final Action Level (mg/kg)	Basis	[1]Carcinogens (Risk = 10^{-5}) (mg/kg)	[2]Noncarcinogens (HQ = 0.2) (mg/kg)	[2]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
METHOXYCHLOR	1.4E+03	noncarcinogenic effects		1.4E+03	7.2E+03	NA
METHYL ETHYL KETONE	2.8E+04	saturation limit		6.5E+04	3.3E+05	2.8E+04
METHYL ISOBUTYL KETONE	3.4E+03	saturation limit		2.0E+04	9.9E+04	3.4E+03
METHYL MERCURY	4.4E+01	noncarcinogenic effects		4.4E+01	2.2E+02	NA
METHYL TERT BUTYL ETHER	1.2E+03	carcinogenic effects	1.2E+03	2.1E+04	1.0E+05	8.9E+03
METHYLENE CHLORIDE	3.0E+02	carcinogenic effects	3.0E+02	3.0E+03	1.5E+04	3.3E+03
METHYLNAPHTHALENE, 1-	2.9E+02	carcinogenic effects	2.9E+02	1.2E+04	5.9E+04	NA
METHYLNAPHTHALENE, 2-	7.0E+02	noncarcinogenic effects		7.0E+02	3.5E+03	NA
MOLYBDENUM	2.2E+03	noncarcinogenic effects		2.2E+03	1.1E+04	NA
NAPHTHALENE	9.6E+01	carcinogenic effects	9.6E+01	1.9E+02	9.4E+02	NA
NICKEL	8.7E+02	noncarcinogenic effects		8.7E+02	4.3E+03	NA
NITROBENZENE	1.3E+02	carcinogenic effects	1.3E+02	1.8E+02	8.9E+02	3.0E+03
NITROGLYCERIN	2.9E+01	noncarcinogenic effects	8.5E+03	2.9E+01	1.4E+02	NA
NITROTOLUENE, 2-	6.0E+01	carcinogenic effects	6.0E+01	2.4E+02	1.2E+03	NA
NITROTOLUENE, 3-	4.3E+03	noncarcinogenic effects		4.3E+03	2.2E+04	NA
NITROTOLUENE, 4-	1.1E+03	noncarcinogenic effects	9.0E+03	1.1E+03	5.7E+03	NA
PENTACHLOROPHENOL	2.4E+02	carcinogenic effects	2.4E+02	9.5E+02	4.8E+03	NA
PENTAERYTHRITOLTETRANITRATE (PETN)	5.8E+02	noncarcinogenic effects	3.6E+04	5.8E+02	2.9E+03	NA
PERCHLORATE	3.1E+02	noncarcinogenic effects		3.1E+02	1.5E+03	NA
PHENANTHRENE	9.3E+03	noncarcinogenic effects		9.3E+03	4.7E+04	NA
PHENOL	8.3E+04	noncarcinogenic effects		8.3E+04	4.1E+05	NA
POLYCHLORINATED BIPHENYLS (PCBs)	2.5E+01	noncarcinogenic effects	6.3E+01	2.5E+01	2.5E+01	NA
PROPICONAZOLE	3.8E+03	noncarcinogenic effects		3.8E+03	1.9E+04	NA
PYRENE	7.6E+03	noncarcinogenic effects		7.6E+03	3.8E+04	NA
SELENIUM	2.2E+03	noncarcinogenic effects		2.2E+03	1.1E+04	NA
SILVER	2.2E+03	noncarcinogenic effects		2.2E+03	1.1E+04	NA
SIMAZINE	1.2E+03	carcinogenic effects	1.2E+03	1.4E+03	7.2E+03	NA
STYRENE	8.7E+02	saturation limit		1.2E+04	5.8E+04	8.7E+02
TERBACIL	3.8E+03	noncarcinogenic effects		3.8E+03	1.9E+04	NA
tert-BUTYL ALCOHOL	2.4E+03	carcinogenic effects	2.4E+03			3.2E+05
TETRACHLOROETHANE, 1,1,1,2-	5.2E+01	carcinogenic effects	5.2E+01	8.0E+02	4.0E+03	6.8E+02
TETRACHLOROETHANE, 1,1,2,2-	1.6E+01	carcinogenic effects	1.6E+01	8.8E+03	4.4E+04	1.9E+03
TETRACHLOROETHYLENE	1.7E+01	carcinogenic effects	1.7E+01	7.5E+02	3.7E+03	1.7E+02
TETRACHLOROPHENOL, 2,3,4,6-	8.7E+03	noncarcinogenic effects		8.7E+03	4.3E+04	NA
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	2.1E+04	noncarcinogenic effects		2.1E+04	1.1E+05	NA
THALLIUM	2.2E+01	noncarcinogenic effects		2.2E+01	2.2E+01	NA
TOLUENE	8.2E+02	saturation limit		1.6E+04	8.2E+04	8.2E+02
TOXAPHENE	1.3E+02	carcinogenic effects	1.3E+02			NA
TPH (gasolines)	1.7E+03	noncarcinogenic effects		1.7E+03	1.7E+03	5.4E+03
TPH (middle distillates)	5.0E+02	saturation limit		1.5E+03	1.5E+03	5.0E+02
TPH (residual fuels)	2.5E+05	noncarcinogenic effects		2.5E+05	2.5E+05	NA
TRICHLOROBENZENE, 1,2,4-	8.2E+01	noncarcinogenic effects	1.9E+02	8.2E+01	4.1E+02	NA
TRICHLOROETHANE, 1,1,1-	6.4E+02	saturation limit		1.1E+04	5.7E+04	6.4E+02
TRICHLOROETHANE, 1,1,2-	2.0E+00	noncarcinogenic effects	2.9E+01	2.0E+00	1.0E+01	5.2E+02
TRICHLOROETHYLENE	2.7E+01	noncarcinogenic effects	7.6E+01	2.7E+01	1.4E+02	6.9E+02
TRICHLOROPHENOL, 2,4,5-	2.9E+04	noncarcinogenic effects		2.9E+04	1.4E+05	NA
TRICHLOROPHENOL, 2,4,6-	2.9E+02	noncarcinogenic effects	1.3E+04	2.9E+02	1.4E+03	NA

TABLE I-3. DIRECT-EXPOSURE ACTION LEVELS
CONSTRUCTION/TRENCH WORKER EXPOSURE SCENARIO

CHEMICAL	Final Action Level (mg/kg)	Basis	[1]Carcinogens (Risk = 10^{-5}) (mg/kg)	[2]Noncarcinogens (HQ = 0.2) (mg/kg)	[2]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	2.9E+03	noncarcinogenic effects		2.9E+03	1.4E+04	NA
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	2.3E+03	noncarcinogenic effects		2.3E+03	1.2E+04	NA
TRICHLOROPROPANE, 1,2,3-	1.0E-01	carcinogenic effects	1.0E-01	6.1E+00	3.1E+01	1.2E+03
TRICHLOROPROPENE, 1,2,3-	7.5E-01	noncarcinogenic effects		7.5E-01	3.7E+00	2.7E+03
TRIFLURALIN	2.2E+03	noncarcinogenic effects	1.9E+04	2.2E+03	1.1E+04	NA
TRINITROBENZENE, 1,3,5-	1.2E+04	noncarcinogenic effects		1.2E+04	6.0E+04	NA
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	1.2E+03	noncarcinogenic effects		1.2E+03	5.8E+03	NA
TRINITROTOLUENE, 2,4,6- (TNT)	1.9E+02	noncarcinogenic effects	6.3E+03	1.9E+02	9.5E+02	NA
VANADIUM	2.2E+03	noncarcinogenic effects		2.2E+03	1.1E+04	NA
VINYL CHLORIDE	1.0E+01	carcinogenic effects	1.0E+01	1.2E+02	6.1E+02	3.9E+03
XYLENES	3.9E+02	saturation limit		7.8E+02	3.9E+03	3.9E+02
ZINC	1.3E+05	noncarcinogenic effects		1.3E+05	6.6E+05	NA

Primary source: USEPA Regional Screening Levels (USEPA 2011), modified as noted below and described in Appendix 1, Section 3.2.

1. Carcinogens: Default target excess cancer risk = 10^{-5}. Target excess cancer risk of 10^{-6} used for volatile contaminants that are carcinogens. Aldrin, dieldrin and hexavalent chromium action levels based on target risk 10^{-4} to reflect on higher confidence in noncancer toxicity factors, as well natural background for Cr VI.

2. Noncarcinogens: Default target hazard quotient = 0.2. TPH action levels based on HQ of 1.0 (see Section 3.2 in text). Action levels for Technical Chlordane based on HQ of 1.0. Action levels for aldrin and dieldrin (breakdown product of aldrin) based on HQ of 0.5. All chemicals - Separate screening levels based on hazard quotient of 1.0 provided for reference.

3. Arsenic direct exposure soil action levels: refer to Update to Soil Action Levels for Inorganic Arsenic and Recommended Soil Management Practices, HEER office Technical Memorandum, October 2010 (HDOH 2010a).

Notes:

See text for equations and assumptions used in models.

Final action level is lowest of individual screening levels for carcinogenic effects and noncarcinogenic effects. Saturation limit used as upper limit for volatile organic compounds that are liquid at ambient conditions (see text).

Action levels for volatile chemicals may not fully consider increased vapor emissions during excavation of contaminated soil or work in trenches with poor air flow. Include actions to minimize worker exposure to VOCs and other contaminants that exceed action levels for commercial/industrial workers in Table I-2 in a worker Health and Safety Plan (e.g., PPE, good hygene, etc.).

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 H).

TPH:Total Petroleum Hydrocarbons. See Chapter 6 of Appendix 1for discussion of different TPH categories and development of action levels.

TPHmd saturation level set to 500 mg/kg vs model-derived 150 mg/kg to address low confidence in direct exposure, vapor emission model (see Chapter 6)

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

Direct-exposure screening level for lead based on USEPA Regional Screening Levels for commercial/industrial exposure scenarios (USEPA 2011).

TABLE J. 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]Mutagen	[c]Alimentary Tract	Cardiovascular	Developmental	Endocrine	Eye	Hematologic	Immune	Kidney	Nervous	Reproductive	Respiratory	[d]Skin	Other
ACENAPHTHENE	D		4,5						3					3	
ACENAPHTHYLENE	D							4,5	3					3	= Fluorene
ACETONE	D		4,5					2		4,5					
ALDRIN	B2		5								2				
AMETRYN	D		5												
AMINO,2- DINITROTOLUENE,4,6-	D		2,6				2,3	2,6				6		2,3	No data, TNT data shown
AMINO,4- DINITROTOLUENE,2,6-	D		2,6				2,3	2,6				6		2,3	No data, TNT data shown
ANTHRACENE	D								3					3	
ANTIMONY	D			3			2,3	4,6				3	1,2,3		
ARSENIC	A		2,3,5	1,3	1,2,3			2,3,5			1,2,3			1,2,3,5	
ATRAZINE	C		2	5,7	3,4,5					2		7		2	
BARIUM	D			3				4		5		4			
BENZENE	A		2		1,3			1,2,3	2		1				
BENZO(a)ANTHRACENE	B2	M							3					3	No chronic toxicity factors.
BENZO(a)PYRENE	B2	M							3			2		3	No chronic toxicity factors.
BENZO(b)FLUORANTHENE	B2	M							3					3	No chronic toxicity factors.
BENZO(g,h,i)PERYLENE	D		4,5					4,5	3	4,5				3	= Fluoranthene
BENZO(k)FLUORANTHENE	B2	M							3					3	No chronic toxicity factors.
BERYLLIUM	B1		1,5						1				1,2,3,5	2	
BIPHENYL, 1,1-	D		2							5	2				
BIS(2-CHLOROETHYL)ETHER	B2										3	3			No chronic toxicity factors.
BIS(2-CHLOROISOPROPYL)ETHER	B2							5							
BIS(2-ETHYLHEXYL)PHTHALATE	?		6,7									7			No chronic toxicity factors.
BORON	D											3,5	4		
BROMODICHLOROMETHANE	B2		3							3,5					
BROMOFORM	B2		2,3,5							3	2,3				
BROMOMETHANE	D		1,2,4,5	2			1			1,2,3	2,3		2,3,4,5		
CADMIUM	B1/D									1,2,3,4,5			1,2,3		bone loss (1,3)
CARBON TETRACHLORIDE	B2		1,3,5		1					3	1				
CHLORDANE (TECHNICAL)	B2		2,3,5						2,4		3				
CHLOROANILINE, p-	?		2,5						4	2				2	
CHLOROBENZENE	D		1,2,4,5					2		1,2,3,4	2	1			
CHLOROETHANE	B		1		1,3										
CHLOROFORM	B2		1,2,3,5		1					1,2,3					
CHLOROMETHANE	C/D				3						2	2,3			
CHLOROPHENOL, 2-	D		1,3		1							1,4,5			
CHROMIUM (Total)	-														
CHROMIUM III	D							1					1	2	
CHROMIUM VI	A	M						1				1	1,5		
CHRYSENE	B2	M							3					3	No chronic toxicity factors.
COBALT	?			2									2	2	hearing (2)
COPPER	D		7										1,3	2	
CYANIDE (Free)	D			1,3		1,3,5		3			1,4,5		3		
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	C		3		3					3					
DALAPON	D									2,5,7					
DIBENZO(a,h)ANTHTRACENE	B2	M							3					2,3	
DIBROMO-3-CHLOROPROPANE, 1,2-	B2	M	1		1					2		1,2,3,4,5	1		
DIBROMOCHLOROMETHANE	C		5												
DIBROMOETHANE, 1,2-	B2				3							3	1,2		

TABLE J. 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]Mutagen	[c]Alimentary Tract	Cardiovascular	Developmental	Endocrine	Eye	Hematologic	Immune	Kidney	Nervous	Reproductive	Respiratory	[d]Skin	Other
DICHLOROBENZENE, 1,2-	D		2							2				2	
DICHLOROBENZENE, 1,3-	D		2							2					
DICHLOROBENZENE, 1,4-	C		1,2,5					2		1,2	1,	5	1		
DICHLOROBENZIDINE, 3,3-	B2		2												No chronic toxicity factors.
DICHLORODIPHENYLDICHLOROETHANE (DDD)	B2														No chronic toxicity factors.
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	B2														No chronic toxicity factors.
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	B2		2,3,5								2	2			
DICHLOROETHANE, 1,1-	C		2							2,3,4,6					
DICHLOROETHANE, 1,2-	B2		1,												
DICHLOROETHYLENE, 1,1-	C/D		1,2,3,4,5							2	3		3		
DICHLOROETHYLENE, Cis 1,2-	D		3					3,4,6							
DICHLOROETHYLENE, Trans 1,2-	D		3					4,5					3		
DICHLOROPHENOL, 2,4-	E								4						
DICHLOROPHENOXYACETIC ACID (2,4-D)	D		5,7			7		5		5,7					
DICHLOROPROPANE, 1,2-	B2		2					2					4		
DICHLOROPROPENE, 1,3-	B2		5										3		
DIELDRIN	B2		5								2				
DIETHYLPHTHALATE	D				5							3			
DIMETHYLPHENOL, 2,4-	?							4,5			4,5				
DIMETHYLPHTHALATE	D														Information not available
DINITROBENZENE, 1,3-	D		2		2		2	2	5		2	2			
DINITROPHENOL, 2,4-	?						2,5				2				
DINITROTOLUENE, 2,4- (2,4-DNT)	D		5,6	3				2,3,5,6			3,5,6	4,6			
DINITROTOLUENE, 2,6- (2,6-DNT)	D		6	3	2			2,3,6			3	2,6			
DIOXANE, 1,4-	B2		1	1						1					
DIOXIN (2,3,7,8-TCDD)	B1?		1,3		1,3	1,3		1	3			1,3	1,3	3	No chronic toxicity factors.
DIURON	D							5							
ENDOSULFAN	?		3		3,5			5	3	3,4,5	3,5	3			
ENDRIN	D		4,5		3					5	4				
ETHANOL	D														
ETHYLBENZENE	D		1,4,5		1,3,5	1				1,4,5	2	2		2	
FLUORANTHENE	D		4,5					4,5	3	4,5				3	
FLUORENE	D							4,5	3					3	
GLYPHOSATE	D									5,7		7			
HEPTACHLOR	B2		5								6				
HEPTACHLOR EPOXIDE	B2		5								6				
HEXACHLOROBENZENE	B2		1,2,3,5			3		3	3	3	2,3	2			bones (3)
HEXACHLOROBUTADIENE	C		3							3				2	
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	B2		1							1,2,5					
HEXACHLOROETHANE	C		2,3							2,3,5					
HEXAZINONE	D				5										
INDENO(1,2,3-cd)PYRENE	B2	M							3					3	No chronic toxicity factors.
ISOPHORONE	C		1		1										
LEAD	B2		2,6	6	2,6			2,6	2,6	2,6	2,6	6			
MERCURY	D				3				1	1,2	1,2,4,5				
METHOXYCHLOR	D		2		5					2	2	2,4,5			
METHYL ETHYL KETONE	D				5							1,2			
METHYL ISOBUTYL KETONE	D										6				
METHYL MERCURY	C				5						1,5				

TABLE J. 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]Mutagen	[c]Alimentary Tract	Cardiovascular	Developmental	Endocrine	Eye	Hematologic	Immune	Kidney	Nervous	Reproductive	Respiratory	[d]Skin	Other
METHYL TERT BUTYL ETHER	?		1,5				1			1,5					
METHYLENE CHLORIDE	B2		2,5	1						2	1				
METHYLNAPHTHALENE, 1-	C							4,5	3					3	= Fluorene
METHYLNAPHTHALENE, 2-	D							4,5	3					3	= Fluorene
MOLYBDENUM	D							5							
NAPHTHALENE	C						2	2	3				1,5	3	
NICKEL	A/D		1,5					1		5			1,2	2	
NITROBENZENE	D		1,2,3,4,5,6		2	4,5,6		2,3,4,5,6		4,5,6	1,6		2	6	
NITROGLYCERIN	?														Information not available
NITROTOLUENE, 2-	?		2					2				2			
NITROTOLUENE, 3-	D							2							
NITROTOLUENE, 4-	?		2					2				2			
PENTACHLOROPHENOL	B2		1,2,3,5		1,3			3	3	2,5	2,3	1	2,3		
PENTAERYTHRITOLTETRANITRATE (PETN)	?														Information not available
PERCHLORATE	D					7		2							
PHENANTHRENE	D							4,5	3					3	= Fluorene
PHENOL	D		1,2		3,5			1		1,2	1	4	1		
POLYCHLORINATED BIPHENYLS (PCBs)	B2		1,2,3		1,3	3	5	3	1,3,5			1,2,3		3	
PROPICONAZOLE	D		5												
PYRENE	D								3	4,5					
SELENIUM	D		1,2,5	1				5			1		1,2	2,3,5	Selenosis (3,5)
SILVER	D													2,3,5	
SIMAZINE	?				4,5			5,7						2	
STYRENE	C		3,4,5					4,5			1,2,4,5		2	2	
TERBACIL	D		5			5									
tert-BUTYL ALCOHOL	?														No chronic toxicity factors.
TETRACHLOROETHANE, 1,1,1,2-	C		5							5					
TETRACHLOROETHANE, 1,1,2,2-	C		2,3								2,3				
TETRACHLOROETHYLENE	C		1,2,5							1,2					
TETRACHLOROPHENOL, 2,3,4,6-	D		1		1							1			
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	D														
THALLIUM	D		2	2			2	5			2,3	2,3		2	
TOLUENE	D		4,5		1,3					4,5	1,2,5	2	1,5		
TOXAPHENE	B2		3			3			3	3					
TPH (gasolines)	D		8					8		8	8				Decreased body weight
TPH (middle distillates)	D		8					8		8	8				Decreased body weight
TPH (residual fuels)	D		8					8		8	8				Decreased body weight
TRICHLOROBENZENE, 1,2,4-	D					4,5									
TRICHLOROETHANE, 1,1,1-	D		2,6	7							1				
TRICHLOROETHANE, 1,1,2-	C		5					6	7					2	
TRICHLOROETHYLENE	B2		2,3,6		3,6		1	3	6	2,3,6	1,2,3				
TRICHLOROPHENOL, 2,4,5-	D		1,2,4,5		1					2,4,5		1			
TRICHLOROPHENOL, 2,4,6-	B2		2												
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	D				2					5		2,5			
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	D		4,5,7												
TRICHLOROPROPANE, 1,2,3-	A2	M	3					3,5		3			3		
TRICHLOROPROPENE, 1,2,3-	D														Information not available
TRIFLURALIN	C		5					5						2	
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	D		2					2		2			2	2	

TABLE J. 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]Mutagen	[c]Alimentary Tract	Cardiovascular	Developmental	Endocrine	Eye	Hematologic	Immune	Kidney	Nervous	Reproductive	Respiratory	[d]Skin	Other
TRINITROTOLUENE, 1,3,5-	?														Information not available
TRINITROTOLUENE, 2,4,6- (TNT)	C		2,5,6				2,3	2,6				6		2,3	

TABLE J. 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]Mutagen	[c]Alimentary Tract	Cardiovascular	Developmental	Endocrine	Eye	Hematologic	Immune	Kidney	Nervous	Reproductive	Respiratory	[d]Skin	Other
VANADIUM	D		3							3			2,3		
VINYL CHLORIDE	A	M	1,2,3,5		1,3			2,3	3		3	1,3		2	No chronic toxicity factors.
XYLENES	D										1,2,3,4,5		1		
ZINC	D			1		3		1,3,4,5					1		

Notes:
a. Carcinogen type from RWQCBCV 2007; ORNL 2001 (see classification below).
b. Chemicals classified as mutagenic (M) in USEPA Regional Screening Levels guidance (USEPA 2011).
c. Includes gastro-intestinal tract, liver, spleen, gall bladder, etc.
d. Includes skin sensitization but not general dermatitis or defatting of skin.

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. CalEPA, 2005, Consolidated Table of Chronic Reference Exposure Levels: California Environmental Protection Agency, Office of Environmental Health Hazard Assessment/Air Resources Board, April 2005, http://www.arb.ca.gov/toxics/healthval/healthval.htm
2. CDC, 2007, International Chemical Safety Cards: International Programme on Chemical Safety: United Nations Environment Program, International Labour Office and World Health Organization (accessed December 2007); published through US Department of Health and Human Services, Centers for Disease Control and Prevention, http://www.cdc.gov/niosh/ipcs/icstart.html
3. ATSDR, 2007, ToxFAQs™: Agency for Toxic Substances and Disease Registry (accessed December 2007), http://www.atsdr.cdc.gov/toxfaq.html
4. Illinois, 2001, Tiered Approach to Corrective Action Objectives (TACO): Illinois Environmental Protection Agency, Title 35, Subtitle G, Chapter I, Subchapter f, Part 742, Appendix A, Table E, Similar-Acting Noncarcinogenic Chemicals (accessed December 2007), http://www.ipcb.state.il.us/SLR/IPCBandIEPAEnvironmentalRegulations-Title35.asp
5. USEPA, 2007, IRIS: U.S. Environmental Protection Agency, IRIS Database (accessed December 2007); (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
6. ORNL, 2007, Risk Assessment Information System (RAIS), Toxicity Profiles: Oak Ridge National Laboratory/U.S. Department of Energy (accessed December 2007), RAGs A Format, especially Critical Effect used for derivation of RfDs, http://risk.lsd.ornl.gov/tox/rap_toxp.shtml

7. USEPA National Primary Drinking Water Standards (March 2001): U.S. Environmental Protection Agency, Office of Water, EPA 816-F-01-007, http://www.epa.gov/safewater/consumer/pdf/mcl.pdf (selectively used)
8. TPH whole product toxicity based review of TPH Working Group petroleum carbon fraction guidance (TPHWG 1998, Volume 4) and Massachusetts DEP VPH/EPH guidance (MADEP 2002a).
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.

TABLE K. [1]NATURAL BACKGROUND CONCENTRATIONS OF METALS IN SOIL

CHEMICAL PARAMETER	Range (mg/kg)	[2]Upper Bound (mg/kg)	[3]Background Threshold Value (mg/kg)	[4]Selected Action Level (mg/kg)
ACENAPHTHENE				
ACENAPHTHYLENE				
ACETONE				
ALDRIN				
AMETRYN				
AMINO,2- DINITROTOLUENE,4,6-				
AMINO,4- DINITROTOLUENE,2,6-				
ANTHRACENE				
ANTIMONY	0.004-2.4	2.4E+00	2.4E+00	2.4E+00
ARSENIC	0.3-50	2.4E+01	5.0E+01	2.4E+01
ATRAZINE				
BARIUM	4.5-926	6.9E+02	9.3E+02	6.9E+02
BENZENE				
BENZO(a)ANTHRACENE				
BENZO(a)PYRENE				
BENZO(b)FLUORANTHENE				
BENZO(g,h,i)PERYLENE				
BENZO(k)FLUORANTHENE				
BERYLLIUM	0.05-3.8	3.0E+00	3.8E+00	3.0E+00
BIPHENYL, 1,1-				
BIS(2-CHLOROETHYL)ETHER				
BIS(2-CHLOROISOPROPYL)ETHER				
BIS(2-ETHYLHEXYL)PHTHALATE				
BORON				
BROMODICHLOROMETHANE				
BROMOFORM				
BROMOMETHANE				
CADMIUM	0.02-17	2.3E+00	1.7E+01	2.3E+00
CARBON TETRACHLORIDE				
CHLORDANE (TECHNICAL)				
CHLOROANILINE, p-				
CHLOROBENZENE				
CHLOROETHANE				
CHLOROFORM				
CHLOROMETHANE				
CHLOROPHENOL, 2-				
CHROMIUM (Total)	8.52-3,180	1.1E+03	3.2E+03	1.1E+03
CHROMIUM III				
CHROMIUM VI				
CHRYSENE				
COBALT	0.69-113	8.0E+01	1.1E+02	8.0E+01
COPPER	2.4-450	2.5E+02	4.5E+02	2.5E+02

TABLE K. [1]NATURAL BACKGROUND CONCENTRATIONS OF METALS IN SOIL

CHEMICAL PARAMETER	Range (mg/kg)	[2]Upper Bound (mg/kg)	[3]Background Threshold Value (mg/kg)	[4]Selected Action Level (mg/kg)
CYANIDE (Free)				
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)				
DALAPON				
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-				
DICHLOROETHYLENE, Trans 1,2-				
DICHLOROPHENOL, 2,4-				
DICHLOROPHENOXYACETIC ACID (2,4-D)				
DICHLOROPROPANE, 1,2-				
DICHLOROPROPENE, 1,3-				
DIELDRIN				
DIETHYLPHTHALATE				
DIMETHYLPHENOL, 2,4-				
DIMETHYLPHTHALATE				
DINITROBENZENE, 1,3-				
DINITROPHENOL, 2,4-				
DINITROTOLUENE, 2,4- (2,4-DNT)				
DINITROTOLUENE, 2,6- (2,6-DNT)				
DIOXANE, 1,4-				
DIOXINS (TEQ)				2.0E-05
DIURON				
ENDOSULFAN				
ENDRIN				
ETHANOL				
ETHYLBENZENE				
FLUORANTHENE				
FLUORENE				
GLYPHOSATE				
HEPTACHLOR				
HEPTACHLOR EPOXIDE				
HEXACHLOROBENZENE				

TABLE K. [1]NATURAL BACKGROUND CONCENTRATIONS OF METALS IN SOIL

CHEMICAL PARAMETER	Range (mg/kg)	[2]Upper Bound (mg/kg)	[3]Background Threshold Value (mg/kg)	[4]Selected Action Level (mg/kg)
HEXACHLOROBUTADIENE				
HEXACHLOROCYCLOHEXANE (gamma) LINDANE				
HEXACHLOROETHANE				
HEXAZINONE				
INDENO(1,2,3-cd)PYRENE				
ISOPHORONE				
LEAD	0.76-73	7.3E+01	7.3E+01	7.3E+01
MERCURY	<0.017-1.4	7.2E-01	1.4E+00	7.2E-01
METHOXYCHLOR				
METHYL ETHYL KETONE				
METHYL ISOBUTYL KETONE				
METHYL MERCURY				
METHYL TERT BUTYL ETHER				
METHYLENE CHLORIDE				
METHYLNAPHTHALENE, 1-				
METHYLNAPHTHALENE, 2-				
MOLYBDENUM	0.06-4.0	4.0E+00	4.0E+00	4.0E+00
NAPHTHALENE				
NICKEL	2.1-767	4.1E+02	7.7E+02	4.1E+02
NITROBENZENE				
NITROGLYCERIN				
NITROTOLUENE, 2-				
NITROTOLUENE, 3-				
NITROTOLUENE, 4-				
PENTACHLOROPHENOL				
PENTAERYTHRITOLTETRANITRATE (PETN)				
PERCHLORATE				
PHENANTHRENE				
PHENOL				
POLYCHLORINATED BIPHENYLS (PCBs)				
PROPICONAZOLE				
PYRENE				
SELENIUM	0.24-12	7.1E+00	1.2E+01	7.1E+00
SILVER	0.02-1.5	1.5E+00	1.5E+00	1.5E+00
SIMAZINE				
STYRENE				
TERBACIL				
tert-BUTYL ALCOHOL				
TETRACHLOROETHANE, 1,1,1,2-				
TETRACHLOROETHANE, 1,1,2,2-				
TETRACHLOROETHYLENE				
TETRACHLOROPHENOL, 2,3,4,6-				
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)				
THALLIUM	<0.25-15	2.5E-01	1.5E+01	2.5E-01

TABLE K. [1]NATURAL BACKGROUND CONCENTRATIONS OF METALS IN SOIL

CHEMICAL PARAMETER	Range (mg/kg)	[2]Upper Bound (mg/kg)	[3]Background Threshold Value (mg/kg)	[4]Selected Action Level (mg/kg)
TOLUENE				
TOXAPHENE				
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-				
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)				
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)				
TRICHLOROPROPANE, 1,2,3-				
TRICHLOROPROPENE, 1,2,3-				
TRIFLURALIN				
TRINITROBENZENE, 1,3,5-				
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)				
TRINITROTOLUENE, 2,4,6- (TNT)				
VANADIUM	0.25-1,090	7.7E+02	1.1E+03	7.7E+02
VINYL CHLORIDE				
XYLENES				
ZINC	3.6-1,200	3.5E+02	1.2E+03	3.5E+02
Electrical Conductivity (mS/cm, USEPA Method 120.1 MOD)				
Sodium Adsorption Ratio				

Primary Reference: Evaluation of Background Metal Concentrations in Soils of the Hawaiian Islands (HDOH 2011a). Refer to Appendix 1, Section 6.1.

Notes:

1. Excludes samples with known or suspected anthropogenic contamination (see primary reference).
2. Upper Bound concentration selected based on evaluation of univariate sample data plots.
3. Background Threshold Value set to maximum-reported concentration, excluding samples with suspected anthropogenic contamination.
4. Selected action level based on Upper Bound concentration unless otherwise noted.

5. BTV for arsenic based on profession judgment (widespread use as herbicide; clear break from anticipated, natural background not apparent on univariate graphs).

6. BTV for lead set equal to selected, Upper Bound concentration (common contamination of soil with leaded paint or auto exhaust from leaded gasoline; clear break from anticipated, natural background not apparent on univariate graphs).

TABLE L. SOIL ECOTOXICITY ACTION LEVELS

(Discontinued as of Fall 2011 due to low confidence in use of published action levels in Hawai'i. See text Section 3.5.)

	Urban Area Ecotoxicity Criteria (mg/kg)	
CHEMICAL PARAMETER	Residential Areas	Commercial/ Industrial areas
ACENAPHTHENE	site-specific	site-specific
ACENAPHTHYLENE	site-specific	site-specific
ACETONE	site-specific	site-specific
ALDRIN	site-specific	site-specific
AMETRYN	site-specific	site-specific
AMINO,2- DINITROTOLUENE,4,6-	site-specific	site-specific
AMINO,4- DINITROTOLUENE,2,6-	site-specific	site-specific
ANTHRACENE	site-specific	site-specific
ANTIMONY	site-specific	site-specific
ARSENIC	site-specific	site-specific
ATRAZINE	site-specific	site-specific
BARIUM	site-specific	site-specific
BENZENE	site-specific	site-specific
BENZO(a)ANTHRACENE	site-specific	site-specific
BENZO(a)PYRENE	site-specific	site-specific
BENZO(b)FLUORANTHENE	site-specific	site-specific
BENZO(g,h,i)PERYLENE	site-specific	site-specific
BENZO(k)FLUORANTHENE	site-specific	site-specific
BERYLLIUM	site-specific	site-specific
BIPHENYL, 1,1-	site-specific	site-specific
BIS(2-CHLOROETHYL)ETHER	site-specific	site-specific
BIS(2-CHLOROISOPROPYL)ETHER	site-specific	site-specific
BIS(2-ETHYLHEXYL)PHTHALATE	site-specific	site-specific
BORON	site-specific	site-specific
BROMODICHLOROMETHANE	site-specific	site-specific
BROMOFORM	site-specific	site-specific
BROMOMETHANE	site-specific	site-specific
CADMIUM	site-specific	site-specific
CARBON TETRACHLORIDE	site-specific	site-specific
CHLORDANE (TECHNICAL)	site-specific	site-specific
CHLOROANILINE, p-	site-specific	site-specific
CHLOROBENZENE	site-specific	site-specific
CHLOROETHANE	site-specific	site-specific
CHLOROFORM	site-specific	site-specific
CHLOROMETHANE	site-specific	site-specific
CHLOROPHENOL, 2-	site-specific	site-specific
CHROMIUM (Total)	site-specific	site-specific
CHROMIUM III	site-specific	site-specific
CHROMIUM VI	site-specific	site-specific
CHRYSENE	site-specific	site-specific
COBALT	site-specific	site-specific
COPPER	site-specific	site-specific
CYANIDE (Free)	site-specific	site-specific
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	site-specific	site-specific
DALAPON	site-specific	site-specific
DIBENZO(a,h)ANTHTRACENE	site-specific	site-specific
DIBROMO,1,2- CHLOROPROPANE,3-	site-specific	site-specific
DIBROMOCHLOROMETHANE	site-specific	site-specific
DIBROMOETHANE, 1,2-	site-specific	site-specific
DICHLOROBENZENE, 1,2-	site-specific	site-specific

TABLE L. SOIL ECOTOXICITY ACTION LEVELS

(Discontinued as of Fall 2011 due to low confidence in use of published action levels in Hawai'i. See text Section 3.5.)

	Urban Area Ecotoxicity Criteria (mg/kg)	
CHEMICAL PARAMETER	Residential Areas	Commercial/ Industrial areas
DICHLOROBENZENE, 1,3-	site-specific	site-specific
DICHLOROBENZENE, 1,4-	site-specific	site-specific
DICHLOROBENZIDINE, 3,3-	site-specific	site-specific
DICHLORODIPHENYLDICHLOROETHANE (DDD)	site-specific	site-specific
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	site-specific	site-specific
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	site-specific	site-specific
DICHLOROETHANE, 1,1-	site-specific	site-specific
DICHLOROETHANE, 1,2-	site-specific	site-specific
DICHLOROETHYLENE, 1,1-	site-specific	site-specific
DICHLOROETHYLENE, Cis 1,2-	site-specific	site-specific
DICHLOROETHYLENE, Trans 1,2-	site-specific	site-specific
DICHLOROPHENOL, 2,4-	site-specific	site-specific
DICHLOROPHENOXYACETIC ACID (2,4-D)	site-specific	site-specific
DICHLOROPROPANE, 1,2-	site-specific	site-specific
DICHLOROPROPENE, 1,3-	site-specific	site-specific
DIELDRIN	site-specific	site-specific
DIETHYLPHTHALATE	site-specific	site-specific
DIMETHYLPHENOL, 2,4-	site-specific	site-specific
DIMETHYLPHTHALATE	site-specific	site-specific
DINITROBENZENE, 1,3-	site-specific	site-specific
DINITROPHENOL, 2,4-	site-specific	site-specific
DINITROTOLUENE, 2,4- (2,4-DNT)	site-specific	site-specific
DINITROTOLUENE, 2,6- (2,6-DNT)	site-specific	site-specific
DIOXANE, 1,4-	site-specific	site-specific
DIOXINS (TEQ)	site-specific	site-specific
DIURON	site-specific	site-specific
ENDOSULFAN	site-specific	site-specific
ENDRIN	site-specific	site-specific
ETHANOL	site-specific	site-specific
ETHYLBENZENE	site-specific	site-specific
FLUORANTHENE	site-specific	site-specific
FLUORENE	site-specific	site-specific
GLYPHOSATE	site-specific	site-specific
HEPTACHLOR	site-specific	site-specific
HEPTACHLOR EPOXIDE	site-specific	site-specific
HEXACHLOROBENZENE	site-specific	site-specific
HEXACHLOROBUTADIENE	site-specific	site-specific
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	site-specific	site-specific
HEXACHLOROETHANE	site-specific	site-specific
HEXAZINONE	site-specific	site-specific
INDENO(1,2,3-cd)PYRENE	site-specific	site-specific
ISOPHORONE	site-specific	site-specific
LEAD	site-specific	site-specific
MERCURY	site-specific	site-specific
METHOXYCHLOR	site-specific	site-specific
METHYL ETHYL KETONE	site-specific	site-specific
METHYL ISOBUTYL KETONE	site-specific	site-specific
METHYL MERCURY	site-specific	site-specific
METHYL TERT BUTYL ETHER	site-specific	site-specific
METHYLENE CHLORIDE	site-specific	site-specific
METHYLNAPHTHALENE, 1-	site-specific	site-specific
METHYLNAPHTHALENE, 2-	site-specific	site-specific

TABLE L. SOIL ECOTOXICITY ACTION LEVELS

(Discontinued as of Fall 2011 due to low confidence in use of published action levels in Hawai'i. See text Section 3.5.)

	Urban Area Ecotoxicity Criteria (mg/kg)	
CHEMICAL PARAMETER	Residential Areas	Commercial/ Industrial areas
MOLYBDENUM	site-specific	site-specific
NAPHTHALENE	site-specific	site-specific
NICKEL	site-specific	site-specific
NITROBENZENE	site-specific	site-specific
NITROGLYCERIN	site-specific	site-specific
NITROTOLUENE, 2-	site-specific	site-specific
NITROTOLUENE, 3-	site-specific	site-specific
NITROTOLUENE, 4-	site-specific	site-specific
PENTACHLOROPHENOL	site-specific	site-specific
PENTAERYTHRITOLTETRANITRATE (PETN)	site-specific	site-specific
PERCHLORATE	site-specific	site-specific
PHENANTHRENE	site-specific	site-specific
PHENOL	site-specific	site-specific
POLYCHLORINATED BIPHENYLS (PCBs)	site-specific	site-specific
PROPICONAZOLE	site-specific	site-specific
PYRENE	site-specific	site-specific
SELENIUM	site-specific	site-specific
SILVER	site-specific	site-specific
SIMAZINE	site-specific	site-specific
STYRENE	site-specific	site-specific
TERBACIL	site-specific	site-specific
tert-BUTYL ALCOHOL	site-specific	site-specific
TETRACHLOROETHANE, 1,1,1,2-	site-specific	site-specific
TETRACHLOROETHANE, 1,1,2,2-	site-specific	site-specific
TETRACHLOROETHYLENE	site-specific	site-specific
TETRACHLOROPHENOL, 2,3,4,6-	site-specific	site-specific
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	site-specific	site-specific
THALLIUM	site-specific	site-specific
TOLUENE	site-specific	site-specific
TOXAPHENE	site-specific	site-specific
TPH (gasolines)	site-specific	site-specific
TPH (middle distillates)	site-specific	site-specific
TPH (residual fuels)	site-specific	site-specific
TRICHLOROBENZENE, 1,2,4-	site-specific	site-specific
TRICHLOROETHANE, 1,1,1-	site-specific	site-specific
TRICHLOROETHANE, 1,1,2-	site-specific	site-specific
TRICHLOROETHYLENE	site-specific	site-specific
TRICHLOROPHENOL, 2,4,5-	site-specific	site-specific
TRICHLOROPHENOL, 2,4,6-	site-specific	site-specific
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	site-specific	site-specific
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	site-specific	site-specific
TRICHLOROPROPANE, 1,2,3-	site-specific	site-specific
TRICHLOROPROPENE, 1,2,3-	site-specific	site-specific
TRIFLURALIN	site-specific	site-specific
TRINITROBENZENE, 1,3,5-	site-specific	site-specific
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	site-specific	site-specific
TRINITROTOLUENE, 2,4,6- (TNT)	site-specific	site-specific
VANADIUM	site-specific	site-specific

TABLE L. SOIL ECOTOXICITY ACTION LEVELS

(Discontinued as of Fall 2011 due to low confidence in use of published action levels in Hawai'i. See text Section 3.5.)

	Urban Area Ecotoxicity Criteria (mg/kg)	
CHEMICAL PARAMETER	Residential Areas	Commercial/ Industrial areas
VINYL CHLORIDE	site-specific	site-specific
XYLENES	site-specific	site-specific
ZINC	site-specific	site-specific
Electrical Conductivity (mS/cm, USEPA Method 120.1 MOD)	-	-
Sodium Adsorption Ratio	-	-

Discontinued in Fall 2011. Site specific, ecological risk assessment recommended at sites where anthropogenic contamination identified and sensitive, terrestrial ecological habitats could be threatened.