Screening For Environmental Concerns At Sites With Contaminated Soil and Groundwater

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

Appendix 1

Prepared by:

Hawai'i Department of Health
Environmental Management Division
919 Ala Moana Blvd
Honolulu, Hawai'i 96814

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Contacts:
Roger Brewer
Hawai'i Department of Health
Environmental Management Division
Hazard Evaluation and Emergency Response
Telephone: 1-808-586-4328
E-mail: rbrewer@eha.health.state.hi.us

OR
Roxanne Kwan
Hawai'i Department of Health
Environmental Management Division
Solid and Hazard Waste Branch
Telephone: 1-808-586-4226
E-mail: rkwan@eha.health.state.hi.us

DISCLAIMER

This document, *Screening For Environmental Concerns at Sites With Contaminated Soil and Groundwater* (Interim Final, May 2005), is a technical report prepared by staff of the Hawai'i Department of Health, Environmental Management Division. It is intended to serve as a update to the 1996 HIDOH document entitled *Risk-Based Corrective Action and Decision Making at Sites With Contaminated Soil and Groundwater*. This document is not intended to establish policy or regulation. The Environmental Action Levels presented in this document and the accompanying text are specifically not intended to serve as: 1) a stand-alone decision making tool, 2) guidance for the preparation of baseline ("Tier 3") environmental assessments, 3) a rule to determine if a waste is hazardous under the state or federal regulations, or 4) a rule to determine when the release of hazardous chemicals must be reported to the overseeing regulatory agency.

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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
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

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DEVELOPMENT OF TIER 1 LOOKUP TABLES

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1

Development of Tier 1 Lookup Tables

1.1 Introduction

This document is modeled after similar documents published by the Ontario Ministry of Environment and Energy (MOEE 1996), the Massachusetts Department of Environmental Protection (MADEP 1994) and the Netherlands (Vetger 1993). Action levels for the following environmental concerns are presented (Figure 1):

Groundwater:
- Protection of human health
  - Current or potential drinking water resource;
  - Emission of subsurface vapors to building interiors;
- Protection of aquatic habitats (discharges to surface water);
- Protection against nuisance concerns (odors, etc.) and general resource degradation.

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

Shallow Soil Gas:
- Protection of human health
  - Emission of subsurface vapors to building interiors.

For use in this document, the term "soil" refers to any unconsolidated material found in the subsurface, including actual soil, saprolite, sediment, fill material, etc. 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 8).
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.

The Table A and B series summarize individual action levels complied for soil overlying groundwater for the environmental concerns noted above. The Table C series in this appendix 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 through I provide supporting action levels and other information for the earlier tables.

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

1.2 Example Selection of Tier 1 EALs for Benzene

Figure 2 illustrates the selection of final Tier 1 soil and groundwater EALs for the chemical benzene. The example assumes impacts to shallow, potentially exposed soils (e.g., ≤3 meters below ground surface) and a 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-2 of the Tier 1 lookup tables for soil and Table D-1a for groundwater (refer to Section 1.1).

The final, Tier 1 EAL for benzene in soil is selected as 0.22 mg/kg. This represents the lowest of the individual action levels for direct exposure (0.64 mg/kg), vapor emissions

to indoor air (0.53 mg/kg), terrestrial biota impacts (25 mg/kg), groundwater protection (leaching, 0.22 mg/kg) and the nuisance-based ceiling level (500 mg/kg).

The process for selection of a Tier 1 EAL for benzene in groundwater is similar (refer to Figure 2). Under the assumed site scenario, the final, Tier 1 GAL is 5.0 ug/L. This represents the lowest of individual action levels for drinking water toxicity (5.0 ug/L), vapor emissions to indoor air (1,600 ug/L), discharge to surface water (46 ug/L) and the nuisance-based ceiling level (170 ug/L, in this case the secondary drinking water MCL). Note that two action levels are presented in the lookup tables for vapor intrusion concerns (Table C-1b), one for high-permeability vadose-zone soils (1,600 ug/L) and one for low-permeability soils (5,600 ug/L). Only the screening level for sites with high-permeability vadose-zone soils is carried through for inclusion in the summary lookup tables, however (refer to Table D-1 series). The action levels for low-permeability soils are provided for reference only, to give an idea of the range of concentrations that may begin to pose vapor intrusion concerns at any given site. It is recommended that the action levels for high-permeability vadose-zone soils be used at all sites in the absence of soil gas data.

Action levels for indoor air (0.25 ug/m^3) and shallow soil gas (250 ug/m^3) are also presented (refer to Figure 2 and Chapter 4). These screening levels are independent of the source of the contamination.

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 utility and location of the site with respect to surface water bodies. The results are summarized in Tables A through D 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 indoor-air impact 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 nuisance concerns or "ceiling levels" (e.g., see Total Petroleum Hydrocarbons in Table A-1). The consideration of ceiling levels could form a basis for final cleanup standards in the selection of EALs for relatively immobile chemicals in isolated, deep soils (see Section 3.6).

1.3 Cumulative Risk

Additive risk due to the potential presence of multiple chemicals with similar target health effects is addressed under Tier 1 through use of conservative exposure assumptions (exposure frequency and duration, ingestion and inhalation rates, etc.) and target risk levels. Exposure assumptions used to develop direct-exposure and indoor-air

action levels are primarily based on parameter values presented in USEPA risk assessment guidance for Superfund sites (refer to USEPA 2004). Alternative, and in some cases less conservative, exposure assumptions are presented in the USEPA technical document *Exposure Factors Handbook* (USEPA 1997), among other examples. For example, recommended inhalation rates for residents are 11.3 m3/day for women and 15.2 m^3/day for men, in comparison to the value of 20 m^3/day used to develop the direct-exposure action levels presented in this appendix (see Appendix 2). The average time (50th percentile) spent at one residence is also stated to be 9.0 years, in contrast to the more conservative exposure duration used of 30 years. The average occupational tenure is similarly stated to be 6.6 years, in contrast to the occupational exposure duration used of 25 years. While the more conservative exposure assumptions are still generally recommended for use in site-specific risk assessments, the variance in the assumptions helps to demonstrate the overall conservative nature of the models referenced in this document.

For most carcinogens, the human health action levels presented are based on a target excess cancer risk of 10^{-6}. Exceptions to this approach are discussed in Section 3.2. 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). As stated in the National Contingency Plan, however, "The 10^{-6} level shall be used as the point of departure for determining remediation goals..." (USEPA 1994). Remediation or risk management is rarely warranted at sites where the estimated cancer risk does not exceed 10^{-6}. 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 "detailed" risk assessment could result in an increase of direct-exposure action levels by a factor of three or more while still meeting a target excess cancer risk of 10^{-6}. 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 Preliminary Remediation Goals (PRGs) for soil were developed based on a chemical-specific, target Hazard Quotient of 1.0. This was retained for use in this document. A target Hazard Quotient of 1.0 for individual chemicals is considered adequate provided that final residual levels of chemicals with similar systemic health effects do not exceed a total Hazard Index of 1.0. This may need to be more closely evaluated at sites where multiple chemicals with similar systemic effects are present (refer to discussion in USEPA PRG

document provided in Appendix 2). For reference, a compilation of chronic health effects for the chemicals listed in the EALs is provided in Table J of this appendix.

The direct-exposure action levels not consider potential synergistic effects (e.g., 1+1=3). Methods to quantitatively assess such effects have not been developed, however. Conservative target risk goals (e.g., target excess cancer risk of 10^{-6}) and exposure parameters are instead used to indirectly address this issue.

2

Groundwater Action Levels

2.1 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, HIDOH 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.

2.2 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:

- USPEPA Primary Maximum Contaminant Level (MCL);
- Risk-based goal based on USEPA Region IX tap water model.

USPEPA Primary MCLs are available for approximately half of the chemicals listed in the lookup tables. 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 model presented in the USEPA Region IX *Preliminary Remediation Goals* document (USEPA 2004) was used to calculate alternative drinking water goals (Table D-4). 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 Region IX tapwater goals 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 2.5).

2.3 Action Levels for Aquatic Habitat Protection

2.3.1 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 screening 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.

2.3.2 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 HIDOH. Final goals were selected based on the following order of preference and availability:

- 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) or 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;
- Other aquatic water quality criteria (e.g., 10% LC0, 5% LC 50);
- Toxicity-based drinking water goal.

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

For chemicals where chronic, No Adverse Effect Level goals or the equivalent were not available, alternative goals were selected and modified as noted (refer also to Table D-3a). 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. 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 (April 2000). The primary source of USEPA aquatic habitat goals was the California EPA document *A Compilation of Water Quality Goals* (RWQCBCV 2000). Other sources referenced to include: USEPA's *Water Quality Criteria Summary Concentrations* (USEPA 1996b), USEPA's *Ecotox Thresholds* (USEPA 1996c), USEPA's *National Recommended Water Quality Criteria* (USEPA 2002), U.S. Department of Energy's *Preliminary Remediation Goals for Ecological Endpoints* (USDOE 1997), and Ontario MOEE's *Rational For The Development and Application of Generic Soil, Groundwater and Sediment Criteria* (MOEE 1996).

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.

2.3.3 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 3.0).

The USEPA Ecotox goal for barium (3.9 ug/L) was not considered as a screening level for groundwater due to low confidence in the goal and comparison to 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 HIDOH. 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.

2.4 Groundwater Action Levels for Vapor Intrusion Concerns

2.4.1 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.

The action levels were generated using a computer spreadsheet model published by the U.S Environmental Protection Agency (available online, USEPA 2003a). The spreadsheet is based on a model presented in the document *Heuristic Model for Predicting the Intrusion Rate of Contaminant Vapors Into Buildings* (Johnson and Ettinger, 1991). The model considers both diffusive and convective flow of subsurface vapors into buildings. Summary text from the guidance document accompanying the spreadsheet is provided in Appendix 3, as is a sensitivity evaluation of the Johnson and Ettinger model. Example printouts of the model as used to calculate 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.

Assumptions used in the USEPA Region IX PRGs for residential and commercial/industrial exposure scenarios were retained for use in the vapor intrusion models (see Appendix 2). Action levels for all chemicals except TCE were calculated using a target risk of $1x10^{-6}$ for chemicals with carcinogenic health effects and a target

Hazard Quotient of 1.0 for chemicals with noncarcinogenic health effects. As discussed in Section 3.2, a target risk of 10^{-5} was used for TCE. For consistency purposes, default physio-chemical constants included in the spreadsheet were replaced with constants used in the USEPA PRGs models if different.

The USEPA Region IX PRG models for residential direct-exposure concerns are based on the consideration of mixed childhood and adult exposure, with more conservative assumptions for parameters related to the former category (refer to Appendix 2). The USEPA vapor intrusion model does not directly address this factor. As a means to make the models more consistent, residential indoor air target levels generated by the vapor intrusion spreadsheet were modified by a factor of 0.79 (see Appendix 2). This reduced the action levels generated by vapor intrusion model a similar degree.

All groundwater was assumed to potentially flow offsite and pass under residential areas. Final action levels are therefore based on a residential land use exposure scenario. Groundwater action levels for commercial/industrial areas are included in Table C-1a for reference but were not carried forward for use in subsequent lookup tables. Soil gas and indoor air screening levels for commercial/industrial exposure scenarios are, however, included in Table C of the summary lookup tables.

Default building characteristics presented in the spreadsheet guidance were used in the models. The thickness of the building floor was assumed to be 15 cm. For both residential land use and commercial/industrial exposure scenarios, the models assume a small (9.6m x 9.6m square), one-story building situated on mono-slab concrete base. This may be overly conservative for commercial/industrial sites with existing, larger buildings but is considered to be protective of future redevelopment of such sites. A default value of 1mm was used for the assumed perimeter crack width. For screening level evaluation of larger buildings, an assumed crack spacing of 10m is recommended.

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

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

intended for use at sites with vadose-zone soils of highly to moderately permeability. The second screening level is intended for use at sites with lower permeability soils in the vadose zone.

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

Input soil parameter values for total porosity, water-filled porosity and fraction organic carbon for the upper portion of the soil profiles were set equal to values used by USEPA Region IX in development of the PRGs (USEPA 2004). Soil moisture was assumed to be somewhat higher for the lower soil units than the upper units, at 0.30 (vs 0.15), consistent with the default recommended in the USEPA Johnson and Ettinger model guidance document. Default values presented in the spreadsheet were used for remaining soil properties. For site-specific assessments, soil moisture data should be collected within 1.5m (five feet) of the ground surface and well above the capillary fringe zone.

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

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

2.4.2 Background and Use of Johnson and Ettinger Model

2.4.2.1 Background

The Johnson and Ettinger model 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 3. 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 1996a). 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 2000 updates to the model allowed direct input of soil gas data (USEPA 2003a, including 2003 update of spreadsheet).

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

2.4.2.2 Adjustment of Action Levels

Residential indoor air action levels generated by the USEPA vapor intrusion model were adjusted to incorporate the adjusted childhood exposure inhalation factor used in the USEPA Region IX PRGs (see Appendix 1). This resulted in a reduction of the indoor air goals by a factor of approximately 20%.

Soil and groundwater action levels for vapor intrusion concerns were also adjusted to take into account expected natural biodegradation of nonchlorinated volatile chemicals. 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 Johnson and Ettinger 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 Johnson and Ettinger 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 Johnson and Ettinger 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.

2.5 Groundwater Gross Contamination Ceiling Levels

Ceiling levels selected for gross contamination concerns in groundwater are summarized in the Table G series. Ceiling levels for 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 50,000 ug/L for any chemical based on general resource degradation concerns (Tables G-1, after MADEP 1994). Taste and odor thresholds for drinking water were selected in the following order of preference and availability:

- USEPA Secondary MCLs;
- Taste and odor levels developed by Amoore and Hautala 1991 (as presented in RWQCBCV 2000);
- Odor thresholds presented in Massachusetts DEP (MADEP 1994) and Ontario MOEE (MOEE 1996) guidance documents.

With the exception of the MADEP and MOEE odor thresholds, data for each of the listed sources are summarized in the California EPA document *A Compilation of Water Quality Goals* (RWQCBCV 2000 and updates).

Ceiling levels for 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 (Tables G-2). Nuisance thresholds are intended to reflect the concentration at which a chemical in water poses unacceptable odor problems. Thresholds presented in the Massachusetts DEP and Ontario MOEE guidance documents were used as the primary sources of data. Taste and odor levels developed by Amoore and Hautala (in RWQCBCV 2000) were referred to for chemicals that lack odor thresholds in the Ontario guidance, although taste considerations for drinking water 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). 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, nuisance thresholds only). The nuisance threshold for MTBE presented in Table G-2 is based on average, upper range at which most subjects in a USEPA study could smell MTBE in water (180 ug/L), as summarized in the public health goals document for MTBE prepared by Cal EPA (CalEPA 1999a). This was selected as a nuisance screening level for MTBE in surface water. Assuming a dilution factor of ten yields the odor threshold of 1,800 ug/L for groundwater.

2.6 Other Groundwater 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 (RWQCBCV 2000). The SNARL goals largely duplicate risk-based action levels for drinking water presented in Table D-2.

TABLE 2-1. 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**

3

Soil Action Levels

3.1 Introduction

Soil action levels presented in Volume 1 were developed by compiling action levels for the environmental concerns listed below and selecting the lowest action level as the Tier 1 SAL (Figure 3-1):

- Protection of human health
  - Direct exposure
  - Emission of subsurface vapors to building interiors
- Protection of groundwater quality (leaching);
- Protection of terrestrial flora and fauna;
- Protection against nuisance concerns (odors, etc.) and general resource degradation (Ceiling Levels).

Chemical-specific action levels for each applicable environmental concern are summarized in Tables A-1 through B-2 of this appendix. Tier 1 action levels for human health concerns are based on an assumed residential exposure scenario. Alternative action levels for commercial/industrial and construction worker exposure scenarios are also provided in this appendix, as well as alternative ceiling levels for deep and/or isolated soils. Soil action levels for leaching concerns were developed to correlate with each of the four groundwater scenarios used prepare the lookup tables.

3.2 Soil Action Levels for Direct-Exposure Concerns

3.2.1 USPEA Region IX PRGs

Soil section levels for human-health, direct-exposure concerns are summarized in Tables I-1 (residential land use exposure scenario), I-2 (commercial/industrial exposure scenario) and I-3 (construction/trench worker exposure scenario). Equations and exposure assumptions used in each scenario are summarized in Appendix 2. For the purposes of this document, residential action levels for direction exposure concerns were carried forward for use in the Tier 1 lookup tables. Direct-exposure screening levels for

commercial/industrial and construction/trench worker exposure scenarios may be useful in site-specific environmental risk assessments.

The direct-exposure action levels are based on residential and commercial/industrial *Preliminary Remediation Goals* ("PRGs") developed by the USEPA Region IX (USEPA 2004). Equations and assumptions used in the PRGs are provided in Appendix 2. Assumptions used to develop direct-exposure action levels for a construction/trench worker exposure scenario are based on information compiled by the San Francisco Bay Regional Water Quality Control Board of the California EPA (RWQCBSF 2003, refer to Appendix 2).

The USEPA Region IX approach for calculation of risk-based PRGs for vinyl chloride was retained for calculation of EALs. Alternative and somewhat more conservative cancer slope factors were used for residential exposure scenarios versus commercial/industrial exposure scenarios (refer to Table H). An exposure duration time of 70 years, versus 30 years, was also used (see Appendix 2). For additional information refer to the October 2004 edition of the USEPA Region IX PRGs (USEPA 2004).

3.2.2 Target Risks

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

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

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

In the current edition of their Preliminary Remediation Goals (PRGs) document, USEPA Region IX incorporates more stringent cancer slope factors for development of PRGs for trichlorethylene (TCE) than those used in the past (USEPA 2004, refer to Table H). Due to ongoing uncertainties and debate over use of the slope factors, a target excess cancer risk of 10^{-5} was used to develop the soil, groundwater and indoor-air action levels for TCE presented in this document. Resulting action levels are an order of magnitude higher than those presented in the PRG document but approximately five-times lower than action levels used in the 1996 HIDOH document. This issue will be further evaluated in future updates of this document.

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

3.3 Soil Action Levels for Vapor Intrusion Concerns

Soil action levels for the evaluation of potential vapor intrusion and indoor-air impact concerns are presented in Table C-1b and referenced in the Table A-B series. Action levels for both residential and commercial/industrial exposure scenarios are provided, although only action levels for residential exposure are carried forward for inclusion in the Tier 1 summary lookup tables. As discussed in Chapter 4, the use of soil gas data and action levels to evaluate this concern is preferred at sites where significant releases of volatile chemicals have occurred.

A spreadsheet included with guidance published by the U.S. Environmental Protection Agency (USEPA 2003a) was used to generate soil action levels for potential indoor-air impact 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. 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. 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 indoor-air 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 Johnson and Ettinger 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 indoor-air impact concerns is strongly recommended for sites where this pathway may be of significant concern.

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

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

3.4 Soil Action Levels for Groundwater Protection

Soil action levels for groundwater protection concerns are summarized in Table E-1 (rainfall $\leq$200 cm/year) and E-2 (rainfall >200cm/year). 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.

3.4.1 Rainfall $\leq$200 cm/year

The majority of the action levels for scenarios where rainfall is $\leq$200 cm/year 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 (ug/cm^3);
C_{soil} = leaching based soil concentration (mg/kg);
C_{gw} = target groundwater screening level (ug/L).

The algorithm was developed using a combination of the computer applications SESOIL and AT123D to model leaching of chemicals from the vadose zone and subsequent migration of the leachate to groundwater, respectively. The SESOIL computer application 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. The simplified 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). A more detailed discussion of the derivation of the algorithm is provided in Appendix 5.

Action levels developed with the algorithm are reasonably similar to leaching based action levels presented in the 1996 HIDOH RBCA document that were developed using the full SESOIL application (refer to Appendix F of that document). 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.

Annual rainfall is assumed to be 110 cm (approximately 43 inches). While this is just over half of the 200 cm rainfall assumed in the 1996 HIDOH SESOIL models the assumed surface water infiltration rate of 720 mm (28 inches) is essentially identical to the earlier models. Biodegradation during migration of leachate to groundwater was considered in the earlier models but is not considered in the algorithm. The assumed shallow depth to groundwater in both models negates the significance of this parameter, however. This could cause the model to be overly conservative for non-chlorinated, petroleum compounds and sites where the depth to groundwater is greater than ten meters below the base of impacted soil. The models do, however, allow for resorption and revolatilization of chemicals from the leachate during migration based on the physio-chemical properties of the chemical and the assumed soil properties.

The SESOIL/AT123D algorithm is based on an assumed groundwater flow rate of approximately 73 meters (240 feet) per year. The depth of leachate mixing is assumed to be two meters. This, in combination with the assumed leachate infiltration rate generates a default leachate-to-groundwater dilution factor of approximately 3. Although mixing and dilution of leachate with groundwater was not considered in the 1996 models, a dilution factor of 3 is considered by USEPA to be very conservative.

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. 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 presented in the 1996 HIDOH RBCA document suggests that chemicals with sorption coefficients greater than 30,000 cm^3/g will be essentially immobile in the surface under normal soil conditions and not likely to impact groundwater. Based on modeling studies as well as field experience in general, action levels for chemicals with sorption coefficients greater than 30,000 cm^3/g were therefore set at the theoretical soil saturation level for that chemical if higher than the screening level generated by use of the SESOIL algorithm (refer to Table E-1). The equation and assumptions used to calculate the saturation levels is presented and discussed in Appendix 2. Exceptions to this approach were the chemicals pentachlorophenol and bis(2-ethylhexyl)phthalate, both of which have a solubility significantly higher than the remainder of the highly sorptive chemicals (see Table H). Leaching based action levels for these chemicals were developed using only the SESOIL algorithm described above (see Table E-1).

The majority of PCBs releases identified in the Hawai'i are related to 1242 to 1260 range Arochlors. The default koc of 33,000 cm^3/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 3.3.3 in Volume 1).

Leaching based soil action levels were developed for perchlorate (ClO_4). Perchlorate, a salt, is not significantly sorptive, volatile or biodegradable under normal conditions. Use of the SESOIL/AT123D algorithm was therefore not considered appropriate. As an alternative, a simple, chemical partitioning model presented in the USEPA Soil Screening Level Guidance document was referred to (USEPA 1996a):

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

where: C_{soil} = Soil screening level for leaching concerns;

C_{water} = Target dissolved-phase concentration of chemical;

Koc = Sorption coefficient;

foc = fraction organic carbon in soil;

$Theta_w$ = water-filled porosity;

$Theta_a$ = air-filled porosity;

H' = Dimensionless Henry's Number constant;

p_b = Soil bulk density;

DAF = Dilution/Attenuation Factor

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

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

The default water-filled porosity in the models is 0.15 and the default soil bud 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 1996a). This yielded final soil action levels for leaching concerns for perclorate of 0.007 mg/kg and 1.2 mg/kg (refer to Table E-1). Laboratory-based tests are recommended for more site-specific analysis of potential leaching of perchlorate from soil.

3.4.2 Rainfall >200 cm/year

The 1996 HIDOH RBCA document provides additional, more stringent action levels for leaching of contaminants from soil in high rainfall areas (>200cm/year). These action levels were adjusted to reflect target groundwater goals noted in Tables D-1a through D-1d for use in this document (Table E-2, adjusted soil action level = current GAL x (1996 GAL/1996 SAL). A description of the calculation of these action levels is provided in the appendices of the 1996 document. Action levels are only presented for contaminants that were originally listed in the 1996 RBCA document. Leaching based action levels for other chemicals should be derived on a site-specific basis as needed.

3.4.3 Varying Depth To Groundwater

The 1996 HIDOH RBCA document also provides alternative leaching based action levels for varying depths to groundwater from the base of contaminated soil (Appendix F, Tables 1a through 1d). These action levels can be substituted for the more conservative soil action levels used in the Tier 1 lookup tables on a site-specific basis. Soil leaching action levels must be converted to correlate with groundwater action levels used in this document. The ratio of the groundwater action level and soil action level are constant for any given chemical. To adjust the 1996 soil action levels, simply divide the current groundwater action level by the ratio of the 1996 groundwater action level and the 1996 soil leaching level (e.g., adjusted soil action level = current GAL x (1996 GAL/1996 SAL).

3.5 Soil Action Levels for Terrestrial Habitats

Soil action levels for evaluation of potential terrestrial ecotoxicity concerns are summarized in Table K. The action levels were included in selection of final SALs (refer to Tables A-1, A-2, B-1 and B-2 of this appendix). This is intended to help identify sites where residual levels of contaminants in soil could pose significant toxicity concerns for flora and fauna even after cleanup of the site to meet residential land use goals. This is primarily a concern for metals and some pesticides that are not particularly toxic to humans but can be very toxic to terrestrial flora and fauna (e.g., barium, Cr III, copper, nickel, endrin, etc.).

The soil ecotoxicity action levels were taken directly from guidance developed by the Ontario Ministry of Environment and Energy (MOEE 1996). The MOEE guidance is primarily a compilation of criteria published by environmental agencies in Canada and elsewhere and is an update to previous guidance (e.g., MOEE 1991; CCME 1994). Ecological effects-based soil values developed by the Dutch government (Vegter 1993; van den Berg 1993) were in particular reviewed for inclusion in the MOEE guidance. Earlier versions of the Canadian and Dutch guidance are presented in the U. S. Fish and Wildlife Service document *Evaluation of Soil Contamination* (USFWS 1990). Pertinent sections from the MOEE guidance are presented in Appendix 6. Action levels were available for heavy metals and some high-molecular-weight organic compounds and pesticides.

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

The ecotoxicty action levels can be eliminated from consideration in highly developed areas where no significant open spaces are anticipated in a Tier 2 assessment.

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

3.6 Soil Gross Contamination Ceiling Levels

Ceiling levels presented in each of the EAL summary tables for gross contamination of soil are intended to screen for potential odor and general nuisance concerns, restrict the presence of potentially mobile, free product in soil and limit the overall degradation of soil quality. 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.

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). This provides a relative ranking of chemicals for potential nuisance concerns.

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. Ceiling levels “shallow” soils (e.g., <3m (10 ft) below ground surface at residential sites) presented in Table F-2 were carried forward for use in the Tier 1 lookup tables. Ceiling levels for “deep” soils are provided in Table F-3 and can be used on a site-specific basis as appropriate (e.g., soil >3m below ground surface at residential sites or isolated under clean fill, pavement or a building in commercial/industrial sites).

TABLE 3-1. Environmental Concerns Considered in Soil Action Levels.

Category	[1]Direct-Exposure	[1]Vapor Emissions To Indoor Air	[2]Leaching	[3]Ecological Concerns	[4]Ceiling Values
Table A-1 Source of Drinking Water; Within 150m of Surface Water Body	**X**	**X**	**X**	**X**	**X**
Table A-2 Source of Drinking Water; NOT Within 150m of Surface Water Body	**X**	**X**	**X**	**X**	**X**
Table B-1 NOT A Source of Drinking Water; Within 150m of Surface Water Body	**X**	**X**	**X**	**X**	**X**
Table B-2 NOT A Source of Drinking Water; NOT Within 150m of Surface Water Body	**X**	**X**	**X**	**X**	**X**

1. Residential Exposure
2. Based on target groundwater goal. See Table 2-1 in text.
3. For urban areas only.
4. Nuisances, general resource degradation.

4

Indoor Air and Soil Gas Action Levels

4.1 Introduction

The USEPA spreadsheet version of the Johnson & Ettinger model for soil gas intrusion into buildings (USEPA 2003a) was used to develop indoor air and soil gas 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 soil gas-to-indoor air attenuation factors based on a comparison of vapor flow rates into a building and air flow rates through the building and 3) calculation of a soil gas screening level. A summary of these steps is provided below. A more detailed discussion of the model is provided in Appendix 3.

4.2 Indoor Air Action Levels

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

<u>Carcinogens</u>:

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

<u>Noncarcinogens</u>:

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

where:

Cia = Target indoor air concentration;

TR = Target risk (carcinogens);

THQ = Target hazard quotient (noncarcinogens);

ATc = Averaging time for carcinogens;

ATnc = Averaging time for noncarcinogens;

URF = Unit risk factor for carcinogens (carcinogens);

RfC = Reference concentration (noncarcinogens);

EF = Exposure frequency;

ED = Exposure duration.

In contrast to the USEPA Region IX PRGs, default exposure parameters incorporated into the USEPA vapor intrusion spreadsheets do not take into account childhood exposure for residential scenarios. For consistency purposes, target indoor air goals for VOCs that are carcinogens were adjusted downward by a factor of approximately 20% to take into account childhood exposure. Indoor air, soil gas, soil and groundwater action levels for vapor intrusion concerns presented in this document reflect this adjustment. This is discussed in more detail in Appendix 2, Section 3.0.

A summary of the indoor-air goals calculated is provided in Table C-3. Goals for both residential and commercial/industrial exposure scenarios are provided. With the exception of TCE (target risk 10^{-5}, see Section 3.2), the target excess cancer risk was set at 10^{-6}. For noncarcinogenic effects, the target hazard quotient was set at 1.0 (refer also to Section 1.3). Inhalation toxicity factors for volatile chemicals are summarized in Table C-3 (see also Appendix 4, VLOOKUP worksheets). Input exposure assumptions were identical to those assumed for direct-exposure models (see summary in Appendix 2 and DATAENTER worksheets in Appendix 4).

4.3 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 2.4 and DATAENTER worksheets in Appendix 4). The spreadsheet models the intrusion of soil gas situated immediately beneath the slab-on-grade foundation into the overlying building ("Soil Gas Sampling Depth Below Grade" = 15 cm). Soil underlying the building was assumed to be a very permeable fill material. Default parameter values for a "sand" soil type were used in the model.

Based on the input building characteristics and soil type, a vapor emission rate of 67 cm^3/sec was generated (Qsoil, equivalent to 4.0 liters/minute). Indoor-air exchange rates

of 1.0 times-per-hour and 2.0 times-per-hour were assumed for residences and commercial/industrial buildings, respectively. Given the assumed dimensions of 10m x 10m x 2.44 m for the modeled buildings, indoor-air exchange 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:

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

For residences, a soil gas-to-indoor air attenuation factor of approximately 0.001 (1/1000) was calculated. For commercial/industrial buildings, a soil gas-to-indoor air attenuation factor of approximately 0.0005 (1/2000) was calculated. The shallow, assumed depth to soil gas and predominance of advective flow over diffusive flow effectively negates small differences in the fate and transport of individual chemicals. This allows the calculated attenuation factors to be used in a generic fashion for all volatile chemicals. Soil-gas 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 sitC-by-site basis as needed. As a conservative measure, and for the purpose of this action 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 long-term monitoring. This issue is currently under reviewed. Additional information will be incorporated into the EAL document as available.

5

Soil And Groundwater Action Levels For TPH

5.1 Introduction

The selection of Total Petroleum Hydrocarbons (TPH) soil and groundwater action levels for use in this document is described below. 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 for leaching based soil action levels for TPH and petroleum-related compounds. Final cleanup levels should be evaluated on a site-specific basis and in conjunction with guidance from the overseeing regulatory agency.

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

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

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

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

Monocyclic Aromatic Compounds (primarily gasolines and middle distillates)

- benzene
- ethylbenzene
- toluene
- xylene

Fuel additives (primarily gasolines)

- MTBE
- other oxygenates as necessary

Polycyclic Aromatic Compounds (primarily middle distillates and residual fuels)

- 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
- methylnaphthalene (1- and 2-)
- 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.

5.2 TPH Action Levels For Groundwater

Regulatory drinking water standards for TPH and petroleum in general have not been developed. For the purposes of this document, the TPH-diesel taste and odor threshold of 100 ug/L referenced in the California EPA technical document *A Compilation of Water Quality Goals* (RWQCBCV 2000) was used as the drinking water screening level for all categories of TPH (see Table G-1). 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 screening level of 100 ug/L. For the protection of aquatic life, a screening level of 500 ug/L was selected for TPH-gasoline in freshwater and 3,700 ug/L in saltwater (see Table D-3a). A single screening level of 640 ug/L was selected for TPH-diesel and TPH-residual fuels in both freshwater and saltwater. The freshwater screening level for TPH-gasoline is based on a summary of available eco-toxicity data compiled for use at the Presidio of San Francisco under 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).

A ceiling level of 5,000 ug/L was selected for TPH gasoline in groundwater that is not a source of drinking water (Table G-2), based on guidance developed by Massachusetts DEP risk assessment guidance (MADEP 1997a,b). For middle distillates and residual fuels, a ceiling level of 2,500 ug/L was selected. This also corresponds with one-half of the approximate solubility of diesel fuel and light motor oil in fresh water (ATSDR 2001a) and is intended to address potential nuisance issues (sheens, odors, etc.) should the groundwater discharge to surface water. The solubility of gasoline in freshwater is approximately 150,000 ug/L. A ceiling level of 5,000 ug/L should therefore protect against the presence of a sheen in the absence of heavier range petroleum compounds. Ceiling levels for TPH in groundwater are also used as substitutes for acute surface water goals (see Section 2.3).

5.3 TPH Action Levels For Soil

5.3.1 TPH (gasolines, middle distillates)

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

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

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

Massachusetts selected an oral reference dose (RfD) of 0.03 mg/kg-d and an inhalation RfD of 0.14 mg/kg-d for the C11-C22 aromatics fraction, based in part on comparison to the Massachusetts RfD for pyrene. The TPH Working Group selected a slightly less conservative oral RfD of 0.04 mg/kg-d and inhalation RfD of 0.06 mg/kg-d (based on Reference Concentration of 0.20 mg/m^3) for the same carbon range group (THPWG 1998). In this document, the MADEP RfDs were used to generate direct-exposure soil action levels for TPH under residential land use, occupational and construction/trench worker exposure scenarios (see Table H). This generated direct-exposure action levels of 890 mg/kg, 4,100 mg/kg and 39,000 mg/kg, respectively (see Tables I-1, I-2 and I-3). The action levels are based on a target hazard quotient of 1.0 (see Section 3.2). Note that the construction/trench worker action levels exceed the default TPH ceiling level of 5,000 mg/kg (see below).

Massachusetts developed generic physio-chemical constants for the C11-C22 aromatics carbon range fraction based on a review of compounds included within this fraction (see Table H). These constants were adopted in this document to develop soil leaching action

levels for TPH as gasolines and middle distillates (see Table E-1) as well as direct exposure action levels (see Table I-1 through I-3). The TPH soil screening level calculated for protection of drinking water (rounded to 100 mg/kg) is coincidental with action levels presented in other technical documents prepared by local California regulatory agencies (RWQCBSF 1990; RWQCBLA 1996). Leaching based soil action levels calculated for protection of surface water habitats of 400 mg/kg for TPH-gasolines and 500 mg/kg for TPH-middle distillates based on target aquatic habitat goals are coincidental with action levels developed for use at other sites in California, including the San Francisco Airport (RWQCB 1999a).

Ceiling levels developed by Massachusetts for TPH as gasoline and diesel (latter included under "middle distillates") were modified for use in this document (MADEP 1997a,b, refer to Table H). For shallow soils, ceiling levels of 100 mg/kg and 500 mg/kg were developed for residential and industrial land-use scenarios, respectively. This is primarily based on odor and general nuisance concerns. For deep and/or isolated soils, a ceiling level of 5,000 mg/kg is generally considered appropriate to primarily intended to prevent the presence of significant, potentially mobile free product (see Table F-3). Care should be taken to avoid adverse vapor emission into buildings when high levels of gasoline or even diesel are left in place at a site. The soil gas screening levels for TPH and related compounds provided in Table C-2 can be used to evaluate this concern.

5.3.2 TPH (residual fuels)

Direct-exposure action levels developed for TPH as gasoline and as middle distillates were retained for use with TPH as residual fuels (refer to Tables I-1 through I-3). Following Massachusetts DEP guidance (MADEP 1997a,b), ceiling levels of 500 mg/kg and 2,500 mg/kg were selected for residential and commercial/industrial shallow soils, respectively. The Massachusetts DEP ceiling level of 5,000 mg/kg was used for deep soils.

The Massachusetts DEP did not develop specific action levels for leaching of heavy hydrocarbons from soil (refer to C19-C36 carbon range summary in Appendix 7). Residual fuels are by definition characterized by a predominance hydrocarbon compounds with carbon ranges greater than C24. These compounds are considered to be substantially less mobile in the subsurface that hydrocarbon compounds that make up the lighter-weight petroleum mixtures. For TPH that is characterized by a predominance of C23-C32 carbon range compounds, the Los Angeles Regional Water Board proposes a screening level of 1,000 mg/kg for protection of drinking water resources (RWQCBLA 1996). The target TPH screening level for groundwater was not specifically stated but is presumably 100 ug/L or less. As noted above, however, this action level may be excessively conservative for use at sites that are not situated directly over a source of drinking water. To address this issue, the leaching based soil action level of 5,000 mg/kg for TPH-residual fuels presented in the 1996 HIDOH RBCA document was retained for use in this document (refer to Table E-1). As noted above, a more conservative action

level may be appropriate for sites within close proximity to a producing water supply well. This should again be evaluated on a site-by-site basis.

The Los Angeles Regional Water Board did not present a similar screening level for potential leaching of TPH from soil and subsequent discharge of impacted groundwater to a body of surface water that is not a source of drinking water. A TPH action level of 640 ug/L is used for protection of aquatic habitats. Assuming a linear correlation with action levels developed by the Los Angeles Regional Water Board, this correlates to a leaching based action level for soil of 6,400 mg/kg. Due to uncertainties in the derivation LA action levels, this was reduced to the gross contamination action level for deep soils of 5,000 mg/kg (see Tables E-1 and F-3). This is also consistent with the soil action level for residual petroleum presented in the 1996 HIDOH RBCA document. As noted in the previous section, the adequacy of this screening level should be re-evaluated at sites where impacted soil is located in close proximity to a sensitive aquatic habitat.

6

Other Issues

6.1 Laboratory Reporting Levels and Background Concentrations

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

Arsenic and chromium, among other metals, may be naturally present in soils at levels above toxicity-based action levels. Based on studies conducted on soils in Hawai'i, background concentrations of total chromium in soils can range from a few parts per million to several thousand parts per million (Nakamura and Sherman, 1958, Feldman, 1979, and DPED, 1985, as referenced in Daugherty 1990). Due to this variability, final soil action levels total chromium is simply noted as "site-specific" in the lookup tables.

Similar compilations of data for background concentration of arsenic in soil were not available at the time that this document was being prepared. Based on a preliminary review of data available in site investigation reports submitted to HIDOH, background concentrations of arsenic in soils range from less than 1.0 mg/kg to greater than 20 mg/kg, with typical concentrations in the range of 5 to 15 mg/kg. This is well above the health-based, direct-exposure goals for arsenic in soil of 0.39 mg/kg for residential exposure and 1.6 mg/kg for commercial/industrial exposure (Appendix 1, Tables I-1 and I-2). Based professional judgment and for provisional use in this document, a concentration of 22 mg/kg (correlative to the noncancer, residential direct-exposure soil action level) was assumed for typical maximum, background arsenic in soil (refer to Tables A-1 through B-2). This was then used as the final soil action level for arsenic.

6.2 Reporting of Soil Data

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

From a site-investigation and risk assessment-standpoint, a difference in the reported concentration of a chemical of 10-20% is not necessarily significant. **For consistency and for comparison to soil 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 1997). Comparison of wet-weight data to direct-exposure screening 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 will generally not 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.)

6.3 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 oil and gas field discharges). 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. The laboratory should be notified of the need for a 2:1 dilution ratio prior to analysis.)

6.4 Degradation to Daughter Products

Consideration of the degradation of a chemical to more toxic daughter products, such as the breakdown of tetrachloroethylene to vinyl chloride, is an important part of site investigations. Tier 1 lookup tables generated by some regulatory agencies incorporate a very conservative assumption that the entire mass of a parent chemical will be eventually

be transformed to the daughter product at the same initial concentration (e.g., MADEP 1994, MOEE 1996). They in turn reduce the initially derived action levels for these 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. While the need to monitor for degradation byproducts is well founded, it is felt that the above approach is overly conservative in most cases and not reflective of naturally occurring conditions. In the case of tetrachlorethylene, for example, degradation to vinyl chloride and further degradation of vinyl chloride to non-toxic ethene gas (and ultimately carbon dioxide and water) can be expected to be a steady-state process at sites where degradation is occurring, removing a portion of the vinyl chloride as it is generated. At most release sites this process has already been initiated, and the already conservative action levels for individual, primary compounds are considered to be adequately protective of human health and the environment. The need to reconsider this assumption should be evaluated on a site-by-site basis.

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

7

References

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

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

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

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

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

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

CalEPA, 2001, *Interim Guidance for Evaluating Lead-Based Paint and Asbestos Containing Materials at Proposed School Sites*: California Environmental Protection Agency, Department of Toxic Substances Control, July 23, 2001, www.dtsc.ca.gov/Schools/Schools.html.

CalEPA, 2003, *Toxicity Criteria Database - Criteria for Carcinogens*: California Environmental Protection Agency, Office of Environmental Health Hazard Assessment, Standards and Criteria Work Group (January 2003), www.oehha.org/risk/ChemicalDB/index.asp.

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.

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

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

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

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

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

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

MADEP, 1997b, Revisions to the Massachusetts Contingency Plan, 310 CMR 40.000, Massachusetts Department of Environmental Protection, Bureau of Waste Site Cleanup and Office of Research and Standards, November 7, 1997, www.state.ma.us/dep/bwsc/vph_eph.htm.

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

MOEE, 1991, *Soil Clean-up Guidelines for Decommisioning 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 Vallet Water District, San Jose, California, June 14, 2001.

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

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

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

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

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

RWQCBSF, 1990, *Tri-regional Board Staff Recommendations for Preliminary Evaluation and Investigation of Underground Tank Sites*: California Environmental Protection Agency, Regional Water Quality Control Board, San Francisco Bay Area Region, August, 1990.

RWQCBSF, 1995, *Water Quality Control Plan*: California Environmental Protection Agency, Regional Water Quality Control Board, San Francisco Bay Area Region, June, 1995. www.swrcb.ca.gov/rwqcb2.

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

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

RWQCBSF, 1999a, Adoption of Revised Site Cleanup Requirements - San Francisco International Airport: California Environmental Protection Agency, Regional

Water Quality Control Board, San Francisco Bay Area Region, Board Order No. 99-045.

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

RWQCBSF, 2003, Completion of Peer Review of December 2001 Risk-Based Action 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).

SRC, 2005, Environmental Fate Database: Syracuse Research Corporation, http://www.syrres.com/esc/chemfate.htm.

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

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

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

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

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

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

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

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

USEPA, 1996b, Water Quality Criteria Summary Concentrations: U.S. Environmental Protection Agency, Office of Science and Technology.

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

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

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

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

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

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

USEPA, 2003a, *User's Guide For Evaluating Subsurface Vapor Intrusion Into Buildings*: U.S. Environmental Protection Agency Office of Emergency and Remedial Response, June 2003, http://www.epa.gov/superfund/programs/risk/airmodel/guide.pdf.

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

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

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

USFWS, 2000, Biological Opinion on California Toxics Rule: U.S. Fish and Wildlife Service, March 24, 2000.

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

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

FIGURES

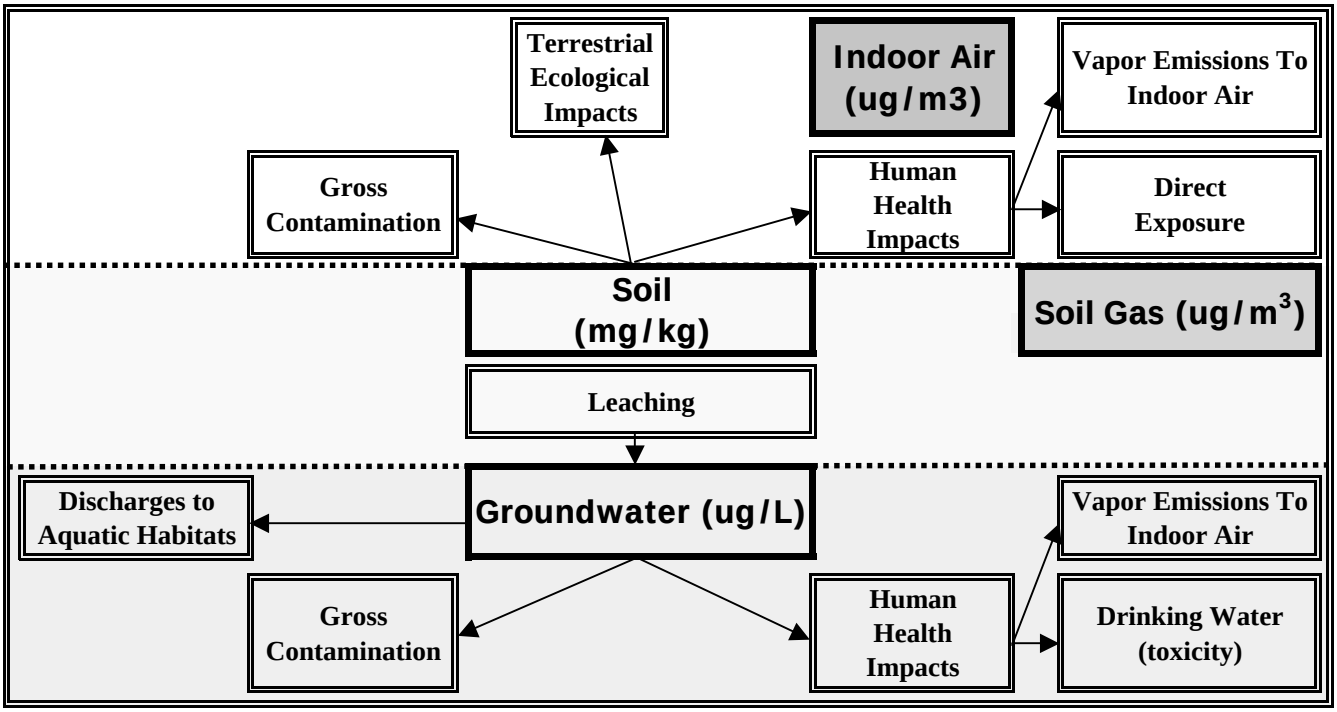

Figure 1. Summary of human health and environmental concerns considered in screening levels. Gross contamination concerns include free product, odors, tastes (drinking water) and general resource degradation. This figure is intended for Tier 1 and Tier 2 assessments only. Evaluation of environmental concerns not shown requires site-specific assessment.

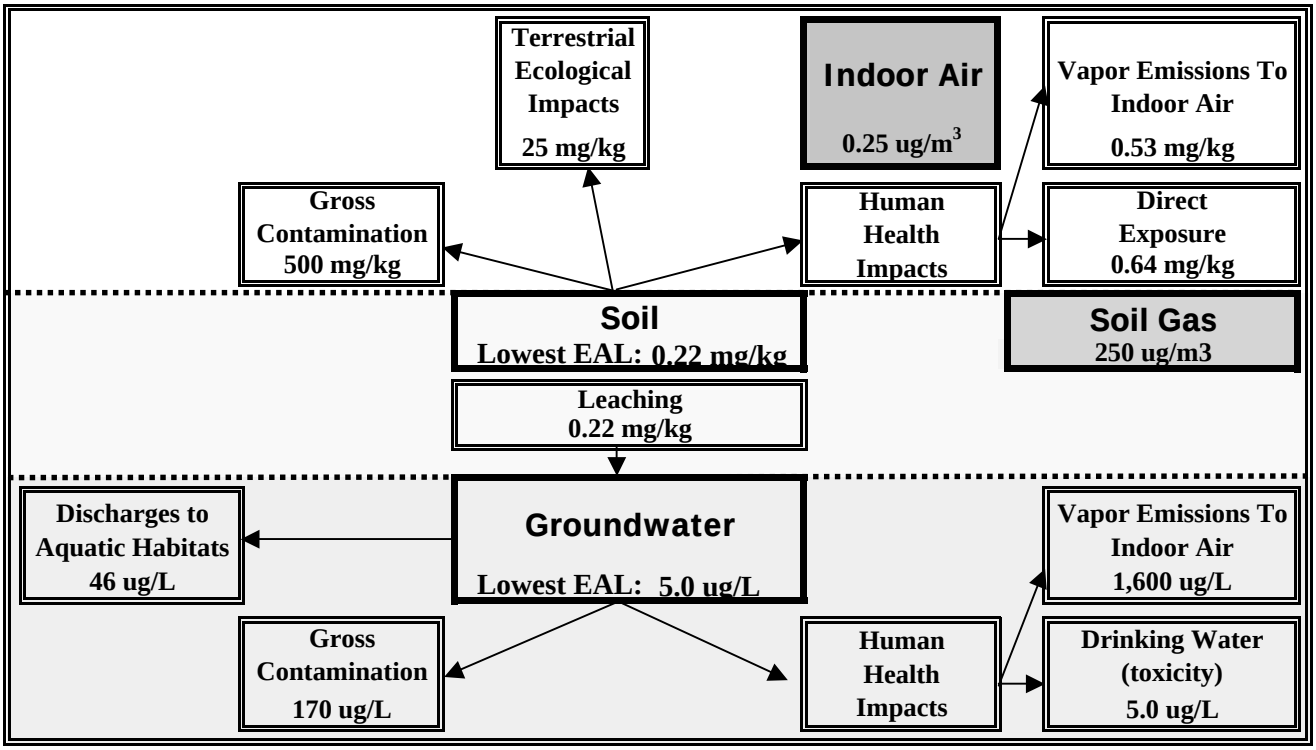

Figure 2. Summary of individual screening levels used to select final, Tier 1 soil and groundwater EALs for benzene in Volume 1, Table A. Refer Appendix 1, Table A-1 (soil), Table C-3 (indoor air and soil gas) and Table D-1a (groundwater).

TABLES

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 INDOOR-AIR IMPACTS (VOLATILE CHEMICALS ONLY)

C-1B. SOIL ACTION LEVELS FOR EVALUATION OF POTENTIAL INDOOR-AIR IMPACTS (VOLATILE CHEMICALS ONLY)

C-2. SHALLOW SOIL GAS ACTION LEVELS FOR EVALUATION OF POTENTIAL INDOOR-AIR IMPACTS (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)

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D-3D. SUMMARY OF HAWAI'I CHRONIC AND ACUTE SURFACE WATER (AQUATIC HABITAT) STANDARDS

D-3E. SUMMARY OF USEPA AND OTHER PUBLISHED AQUATIC HABITAT GOALS

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E-2. SOIL ACTION LEVELS FOR LEACHING CONCERNS - RAINFALL >200CM/YEAR

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

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

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

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I-1. DIRECT-EXPOSURE ACTION LEVELS, RESIDENTIAL EXPOSURE SCENARIO

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

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

J. TARGET ORGANS AND CHRONIC HEALTH EFFECTS

K. SOIL ACTION LEVELS FOR TERRESTRIAL ECOTOXICTY CONCERNS

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)								
			Gross Contamination Ceiling Value (Odors, etc.)	[2]Urban Area Ecotoxicity Criteria	Other		[1]Human Health		Groundwater Protection (Soil Leaching)
							Direct Exposure	Vapor Intrusion Concerns	Drinking Water Resource
CONTAMINANT	Final SAL	Basis	Table F-2	Table L	Value	Basis	Table I-1	Table C-1b	Table E-1
ACENAPHTHENE	1.6E+01	Groundwater Protection	1.0E+03	-			3.7E+03	1.3E+02	1.6E+01
ACENAPHTHYLENE	1.0E+02	Groundwater Protection	5.0E+02	-			1.3E+03	(Use soil gas)	1.0E+02
ACETONE	5.0E-01	Groundwater Protection	5.0E+02	-			1.4E+04	5.6E+03	5.0E-01
ALDRIN	2.9E-02	Direct Exposure	1.0E+03	3.5E-01			2.9E-02		5.0E+00
ANTHRACENE	2.8E+00	Groundwater Protection	5.0E+02	4.0E+01			2.2E+04	6.1E+00	2.8E+00
ANTIMONY	2.0E+01	Ecotoxicity	1.0E+03	2.0E+01			3.1E+01		(site-specific)
ARSENIC	2.2E+01	Background	1.0E+03	2.0E+01	2.2E+01	Background	4.2E-01		(site-specific)
BARIUM	7.5E+02	Ecotoxicity	1.0E+03	7.5E+02			5.4E+03		(site-specific)
BENZENE	2.2E-01	Groundwater Protection	5.0E+02	2.5E+01			6.4E-01	5.3E-01	2.2E-01
BENZO(a)ANTHRACENE	6.2E+00	Direct Exposure	5.0E+02	4.0E+01			6.2E+00		1.2E+01
BENZO(a)PYRENE	6.2E-01	Direct Exposure	5.0E+02	4.0E+01			6.2E-01		1.3E+02
BENZO(b)FLUORANTHENE	6.2E+00	Direct Exposure	5.0E+02	-			6.2E+00		4.6E+01
BENZO(g,h,i)PERYLENE	2.7E+01	Groundwater Protection	5.0E+02	4.0E+01			2.3E+03		2.7E+01
BENZO(k)FLUORANTHENE	3.7E+01	Groundwater Protection	5.0E+02	4.0E+01			6.2E+01		3.7E+01
BERYLLIUM	4.0E+00	Ecotoxicity	1.0E+03	4.0E+00			1.5E+02		(site-specific)
BIPHENYL, 1,1-	6.5E-01	Groundwater Protection	5.0E+02	-			3.0E+03	(Use soil gas)	6.5E-01
BIS(2-CHLOROETHYL)ETHER	1.2E-04	Groundwater Protection	5.0E+02	-			2.0E-01	6.7E-03	1.2E-04
BIS(2-CHLOROISOPROPYL)ETHER	3.0E-03	Groundwater Protection	5.0E+02	-			2.9E+00	(Use soil gas)	3.0E-03
BIS(2-ETHYLHEXYL)PHTHALATE	3.5E+01	Direct Exposure	5.0E+02	-			3.5E+01		7.8E+02
BORON	1.6E+00	Ecotoxicity	1.0E+02	1.6E+00			1.2E+04		(site-specific)
BROMODICHLOROMETHANE	3.4E-03	Groundwater Protection	1.0E+03	-			8.2E-01	2.3E-02	3.4E-03
BROMOFORM	2.2E+00	Groundwater Protection	5.0E+02	-			6.1E+01		2.2E+00
BROMOMETHANE	3.4E-01	Groundwater Protection	5.0E+02	-			3.8E+00	8.6E-01	3.4E-01
CADMIUM	1.2E+01	Ecotoxicity	1.0E+03	1.2E+01			3.9E+01		(site-specific)
CARBON TETRACHLORIDE	2.7E-02	Indoor Air Impacts	5.0E+02	-			2.5E-01	2.7E-02	1.1E+00
CHLORDANE	1.6E+00	Direct Exposure	1.0E+03	-			1.6E+00		1.5E+01
CHLOROANILINE, p-	5.3E-02	Groundwater Protection	1.0E+03	-			2.4E+02		5.3E-02
CHLOROBENZENE	3.0E+00	Groundwater Protection	5.0E+02	3.0E+01			1.5E+02	1.0E+01	3.0E+00
CHLOROETHANE	2.7E-01	Groundwater Protection	5.0E+02	-			3.0E+00	5.0E-01	2.7E-01
CHLOROFORM	1.8E-02	Indoor Air Impacts	5.0E+02	-			2.2E-01	1.8E-02	1.8E+00
CHLOROMETHANE	1.6E+01	Indoor Air Impacts	1.0E+02	-			4.6E+01	1.6E+01	2.4E+01
CHLOROPHENOL, 2-	1.2E-02	Groundwater Protection	1.0E+02	1.0E+01			6.3E+01	3.4E+00	1.2E-02
CHROMIUM (Total)	2.1E+02	Direct Exposure	1.0E+03	-			2.1E+02		(site-specific)
CHROMIUM III	7.5E+02	Ecotoxicity	1.0E+03	7.5E+02			1.2E+05		(site-specific)
CHROMIUM VI	8.0E+00	Ecotoxicity	1.0E+03	8.0E+00			3.0E+01		(site-specific)
CHRYSENE	2.3E+01	Groundwater Protection	1.0E+03	4.0E+01			6.2E+02	(Use soil gas)	2.3E+01
COBALT	4.0E+01	Ecotoxicity	1.0E+03	4.0E+01			5.2E+02		(site-specific)

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)								
			Gross Contamination Ceiling Value (Odors, etc.)	[2]Urban Area Ecotoxicity Criteria	Other		[1]Human Health		Groundwater Protection (Soil Leaching)
							Direct Exposure	Vapor Intrusion Concerns	Drinking Water Resource
CONTAMINANT	Final SAL	Basis	Table F-2	Table L	Value	Basis	Table I-1	Table C-1b	Table E-1
COPPER	2.3E+02	Ecotoxicity	1.0E+03	2.3E+02			3.1E+03		(site-specific)
CYANIDE (Free)	1.0E+02	Ceiling Value	1.0E+02	-			1.2E+03	(Use soil gas)	1.2E+04
DIBENZO(a,h)ANTHTRACENE	6.2E-01	Direct Exposure	5.0E+02	-			6.2E-01		9.9E+00
DIBROMO-3-CHLOROPROPANE, 1,2-	9.0E-04	Groundwater Protection	5.0E+02	-			4.5E-01	(Use soil gas)	9.0E-04
DIBROMOCHLOROMETHANE	1.1E-02	Groundwater Protection	1.0E+02	-			1.1E+00	1.7E-02	1.1E-02
DIBROMOETHANE, 1,2-	5.2E-05	Groundwater Protection	5.0E+02	-			3.2E-02	7.2E-04	5.2E-05
DICHLOROBENZENE, 1,2-	1.1E+00	Groundwater Protection	6.0E+02	3.0E+01			6.0E+02	3.5E+01	1.1E+00
DICHLOROBENZENE, 1,3-	2.1E+01	Groundwater Protection	1.0E+02	3.0E+01			5.3E+02	(Use soil gas)	2.1E+01
DICHLOROBENZENE, 1,4-	6.5E-02	Indoor Air Impacts	5.0E+02	3.0E+01			3.4E+00	6.5E-02	5.9E-01
DICHLOROBENZIDINE, 3,3-	4.0E-02	Groundwater Protection	5.0E+02	-			1.1E+00		4.0E-02
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.4E+00	Direct Exposure	5.0E+02	-			2.4E+00		7.5E+02
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.4E+00	Direct Exposure	5.0E+02	4.0E+00			2.4E+00		1.1E+03
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.7E+00	Direct Exposure	1.0E+03	4.0E+00			1.7E+00		4.3E+00
DICHLOROETHANE, 1,1-	1.9E+00	Groundwater Protection	5.0E+02	-			4.9E+02	8.6E+01	1.9E+00
DICHLOROETHANE, 1,2-	1.1E-03	Groundwater Protection	5.0E+02	6.0E+01			2.7E-01	1.6E-02	1.1E-03
DICHLOROETHYLENE, 1,1-	1.2E+00	Groundwater Protection	5.0E+02	-			1.2E+02	3.5E+01	1.2E+00
DICHLOROETHYLENE, Cis 1,2-	2.2E+00	Groundwater Protection	1.0E+02	-			4.2E+01	6.2E+00	2.2E+00
DICHLOROETHYLENE, Trans 1,2-	6.7E+00	Groundwater Protection	5.0E+02	-			6.9E+01	1.2E+01	6.7E+00
DICHLOROPHENOL, 2,4-	3.0E-01	Groundwater Protection	5.0E+02	1.0E+01			1.8E+02		3.0E-01
DICHLOROPROPANE, 1,2-	2.1E-02	Indoor Air Impacts	1.0E+02	-			3.4E-01	2.1E-02	1.2E-01
DICHLOROPROPENE, 1,3-	4.6E-02	Groundwater Protection	5.0E+02	-			7.7E-01	1.0E-01	4.6E-02
DIELDRIN	5.2E-03	Groundwater Protection	1.0E+03	4.0E+00			3.0E-02		5.2E-03
DIETHYLPHTHALATE	2.2E+01	Groundwater Protection	5.0E+02	-			4.9E+04		2.2E+01
DIMETHYLPHENOL, 2,4-	1.8E+00	Groundwater Protection	1.0E+02	-			1.2E+03		1.8E+00
DIMETHYLPHTHALATE	2.2E+01	Groundwater Protection	5.0E+02	-			6.1E+05		2.2E+01
DINITROPHENOL, 2,4-	2.1E-01	Groundwater Protection	5.0E+02	-			1.2E+02		2.1E-01
DINITROTOLUENE, 2,4-	2.5E-01	Groundwater Protection	5.0E+02	-			1.2E+02		2.5E-01
DIOXANE, 1,4-	3.7E-03	Groundwater Protection	5.0E+02	-			4.4E+01		3.7E-03
DIOXIN (2,3,7,8-TCDD)	3.9E-06	Direct Exposure	NA	-			3.9E-06		1.0E+06
ENDOSULFAN	1.8E-02	Groundwater Protection	5.0E+02	-			3.7E+02		1.8E-02
ENDRIN	1.0E-02	Groundwater Protection	5.0E+02	6.0E-02			1.8E+01		1.0E-02
ETHYLBENZENE	3.3E+00	Groundwater Protection	4.0E+02	-			4.0E+02	3.9E+02	3.3E+00
FLUORANTHENE	4.0E+01	Ecotoxicity	5.0E+02	4.0E+01			2.3E+03		2.5E+02
FLUORENE	1.6E+02	Indoor Air Impacts	5.0E+02	-			2.7E+03	1.6E+02	5.6E+02
HEPTACHLOR	1.1E-01	Direct Exposure	1.0E+03	-			1.1E-01		1.9E-01
HEPTACHLOR EPOXIDE	5.3E-02	Direct Exposure	1.0E+03	-			5.3E-02		2.0E-01
HEXACHLOROBENZENE	3.0E-01	Direct Exposure	5.0E+02	3.0E+01			3.0E-01		7.9E+02

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(Potentially impacted groundwater IS a current or potential drinking water resource; Surface water body IS NOT located within 150m of release site)

	(mg/kg)								
			Gross Contamination Ceiling Value (Odors, etc.)	[2]Urban Area Ecotoxicity Criteria	Other		[1]Human Health		Groundwater Protection (Soil Leaching)
							Direct Exposure	Vapor Intrusion Concerns	Drinking Water Resource
CONTAMINANT	Final SAL	Basis	Table F-2	Table L	Value	Basis	Table I-1	Table C-1b	Table E-1
HEXACHLOROBUTADIENE	4.3E+00	Groundwater Protection	5.0E+02	-			6.2E+00		4.3E+00
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	9.8E-02	Groundwater Protection	5.0E+02	2.0E+00			4.4E-01		9.8E-02
HEXACHLOROETHANE	1.6E+01	Groundwater Protection	5.0E+02	-			3.5E+01		1.6E+01
INDENO(1,2,3-cd)PYRENE	6.2E+00	Direct Exposure	5.0E+02	4.0E+01			6.2E+00		2.4E+01
LEAD	2.0E+02 (4.0E+02)	Ecotoxicity (Direct Exposure)	1.0E+03	2.0E+02			4.0E+02		(site-specific)
MERCURY	1.0E+01	Ecotoxicity	5.0E+02	1.0E+01			1.3E+01		(site-specific)
METHOXYCHLOR	1.9E+01	Groundwater Protection	5.0E+02	-			3.1E+02		1.9E+01
METHYL ETHYL KETONE	6.4E+00	Groundwater Protection	5.0E+02	-			2.2E+04	1.9E+04	6.4E+00
METHYL ISOBUTYL KETONE	3.9E+00	Groundwater Protection	1.0E+02	-			5.3E+03	1.7E+04	3.9E+00
METHYL MERCURY	6.1E+00	Direct Exposure	1.0E+02	1.0E+01			6.1E+00		(site-specific)
METHYL TERT BUTYL ETHER	2.3E-02	Groundwater Protection	1.0E+02	-			3.1E+01	1.6E+00	2.3E-02
METHYLENE CHLORIDE	6.7E-02	Groundwater Protection	5.0E+02	-			9.2E+00	9.0E-01	6.7E-02
METHYLNAPHTHALENE (total 1- & 2-)	1.2E+00	Groundwater Protection	5.0E+02	-			1.4E+03	1.1E+02	1.2E+00
MOLYBDENUM	4.0E+01	Ecotoxicity	1.0E+03	4.0E+01			3.9E+02		(site-specific)
NAPHTHALENE	1.2E+00	Groundwater Protection	5.0E+02	4.0E+01			5.5E+01	1.8E+01	1.2E+00
NICKEL	1.5E+02	Ecotoxicity	1.0E+03	1.5E+02			1.6E+03		(site-specific)
PENTACHLOROPHENOL	3.0E+00	Direct Exposure	5.0E+02	5.0E+00			3.0E+00		1.0E+06
PERCHLORATE	7.0E-03	Groundwater Protection	1.0E+03	-			7.8E+00		7.0E-03
PHENANTHRENE	1.8E+01	Groundwater Protection	5.0E+02	4.0E+01			2.8E+03	(Use soil gas)	1.8E+01
PHENOL	7.6E-02	Groundwater Protection	5.0E+02	4.0E+01			1.8E+04		7.6E-02
POLYCHLORINATED BIPHENYLS (PCBs)	1.1E+00	Direct Exposure	5.0E+02	-			1.1E+00		6.3E+00
PYRENE	8.5E+01	Indoor Air Impacts	5.0E+02	-			2.3E+03	8.5E+01	8.5E+01
SELENIUM	1.0E+01	Ecotoxicity	1.0E+03	1.0E+01			3.9E+02		(site-specific)
SILVER	2.0E+01	Ecotoxicity	1.0E+03	2.0E+01			3.9E+02		(site-specific)
STYRENE	1.5E+00	Groundwater Protection	5.0E+02	-			1.5E+03	1.5E+03	1.5E+00
tert-BUTYL ALCOHOL	2.3E-02	Groundwater Protection	1.0E+02	-			7.0E+01	(Use soil gas)	2.3E-02
TETRACHLOROETHANE, 1,1,1,2-	7.6E-03	Groundwater Protection	1.0E+02	-			3.1E+00	(Use soil gas)	7.6E-03
TETRACHLOROETHANE, 1,1,2,2-	9.9E-04	Groundwater Protection	5.0E+02	-			4.1E-01	7.2E-03	9.9E-04
TETRACHLOROETHYLENE	6.9E-02	Indoor Air Impacts	2.3E+02	-			4.8E-01	6.9E-02	7.0E-01
THALLIUM	5.2E+00	Direct Exposure	1.0E+03	-			5.2E+00		(site-specific)
TOLUENE	2.9E+00	Groundwater Protection	5.0E+02	-			6.5E+02	6.5E+02	2.9E+00
TOXAPHENE	4.0E-01	Direct Exposure	5.0E+02	-			4.0E-01		4.4E-01
TPH (gasolines)	1.0E+02 (2.0E+03)	Ceiling Value (Leaching)	1.0E+02	-			8.0E+02	(Use soil gas)	2.0E+03
TPH (middle distillates)	5.0E+02 (5.0E+03)	Ceiling Value (Leaching)	5.0E+02	-			8.0E+02	(Use soil gas)	5.0E+03
TPH (residual fuels)	5.0E+02 (5.0E+03)	Ceiling Value (Leaching)	5.0E+02	-			2.3E+03		5.0E+03
TRICHLOROBENZENE, 1,2,4-	1.6E+00	Indoor Air Impacts	5.0E+02	3.0E+01			6.1E+01	1.6E+00	2.1E+01
TRICHLOROETHANE, 1,1,1-	2.5E+01	Groundwater Protection	5.0E+02	-			1.2E+03	3.9E+02	2.5E+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)								
			Gross Contamination Ceiling Value (Odors, etc.)	[2]Urban Area Ecotoxicity Criteria	Other		[1]Human Health		Groundwater Protection (Soil Leaching)
							Direct Exposure	Vapor Intrusion Concerns	Drinking Water Resource
CONTAMINANT	Final SAL	Basis	Table F-2	Table L	Value	Basis	Table I-1	Table C-1b	Table E-1
TRICHLOROETHANE, 1,1,2-	2.6E-02	Indoor Air Impacts	1.0E+02	-			7.2E-01	2.6E-02	7.0E-02
TRICHLOROETHYLENE	3.6E-02	Indoor Air Impacts	5.0E+02	6.0E+01			5.2E-01	3.6E-02	4.6E-01
TRICHLOROPHENOL, 2,4,5-	1.6E+00	Groundwater Protection	1.0E+02	1.0E+01			2.5E+03	9.5E+01	1.6E+00
TRICHLOROPHENOL, 2,4,6-	1.2E+00	Groundwater Protection	5.0E+02	1.0E+01			6.1E+00		1.2E+00
VANADIUM	7.8E+01	Direct Exposure	1.0E+03	2.0E+02			7.8E+01		(site-specific)
VINYL CHLORIDE	3.9E-02	Indoor Air Impacts	5.0E+02	6.0E+01			1.5E-01	3.9E-02	3.4E-01
XYLENES	2.3E+00	Groundwater Protection	4.2E+02	-			2.7E+02	1.8E+02	2.3E+00
ZINC	6.0E+02	Ecotoxicity	1.0E+03	6.0E+02			2.3E+04		(site-specific)
Electrical Conductivity (mS/cm, USEPA Method 120.1 MOD)	2.0		-	-			-	-	-
Sodium Adsorption Ratio	5.0		-	-			-	-	-

Notes:

1. Assumes current or future residential land use.
2. Based primarily on phytotoxicity. Included in selection of final soil action levels if less than one-half of the residential soil screening level for human-health, direct-exposure concerns (see Table L and Section 3.9 in text).

Final Soil Action Level is lowest of ceiling value (nuisance concerns etc.), ecotoxicity, direct-exposure, indoor-air impact, and leaching action levels.
Assumes soil pH 5.0 to 9.0.
Soil data should be reported on dry-weight basis (see Section 6.2).
TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories. Use of leaching based action levels noted in parentheses may be appropriate for deep or otherwise isolated soils that do not threaten a drinking water resource or sensitive aquatic habitat. Refer to Section 2.2.2 in Volume 1.
Background arsenic in soils - assumed maximum (refer to Section 6.1 in text).

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)								
			Gross Contamination Ceiling Value (Odors, etc.)	[2]Urban Area Ecotoxicity Criteria	Other		[1]Human Health		Groundwater Protection (Soil Leaching)
							Direct Exposure	Vapor Intrusion Concerns	Drinking Water Resource
CONTAMINANT	Final SAL	Basis	Table F-2	Table L	Value	Basis	Table I-1	Table C-1b	Table E-1
ACENAPHTHENE	1.6E+01	Groundwater Protection	1.0E+03	-			3.7E+03	1.3E+02	1.6E+01
ACENAPHTHYLENE	1.3E+01	Groundwater Protection	5.0E+02	-			1.3E+03	(Use soil gas)	1.3E+01
ACETONE	5.0E-01	Groundwater Protection	5.0E+02	-			1.4E+04	5.6E+03	5.0E-01
ALDRIN	2.9E-02	Direct Exposure	1.0E+03	3.5E-01			2.9E-02		5.0E+00
ANTHRACENE	2.8E+00	Groundwater Protection	5.0E+02	4.0E+01			2.2E+04	6.1E+00	2.8E+00
ANTIMONY	2.0E+01	Ecotoxicity	1.0E+03	2.0E+01			3.1E+01		(site-specific)
ARSENIC	2.2E+01	Background	1.0E+03	2.0E+01	2.2E+01	Background	4.2E-01		(site-specific)
BARIUM	7.5E+02	Ecotoxicity	1.0E+03	7.5E+02			5.4E+03		(site-specific)
BENZENE	2.2E-01	Groundwater Protection	5.0E+02	2.5E+01			6.4E-01	5.3E-01	2.2E-01
BENZO(a)ANTHRACENE	6.2E+00	Direct Exposure	5.0E+02	4.0E+01			6.2E+00		1.2E+01
BENZO(a)PYRENE	6.2E-01	Direct Exposure	5.0E+02	4.0E+01			6.2E-01		1.3E+02
BENZO(b)FLUORANTHENE	6.2E+00	Direct Exposure	5.0E+02	-			6.2E+00		4.6E+01
BENZO(g,h,i)PERYLENE	2.7E+01	Groundwater Protection	5.0E+02	4.0E+01			2.3E+03		2.7E+01
BENZO(k)FLUORANTHENE	3.7E+01	Groundwater Protection	5.0E+02	4.0E+01			6.2E+01		3.7E+01
BERYLLIUM	4.0E+00	Ecotoxicity	1.0E+03	4.0E+00			1.5E+02		(site-specific)
BIPHENYL, 1,1-	6.5E-01	Groundwater Protection	5.0E+02	-			3.0E+03	(Use soil gas)	6.5E-01
BIS(2-CHLOROETHYL)ETHER	1.2E-04	Groundwater Protection	5.0E+02	-			2.0E-01	6.7E-03	1.2E-04
BIS(2-CHLOROISOPROPYL)ETHER	3.0E-03	Groundwater Protection	5.0E+02	-			2.9E+00	(Use soil gas)	3.0E-03
BIS(2-ETHYLHEXYL)PHTHALATE	3.5E+01	Direct Exposure	5.0E+02	-			3.5E+01		7.8E+02
BORON	1.6E+00	Ecotoxicity	1.0E+02	1.6E+00			1.2E+04		(site-specific)
BROMODICHLOROMETHANE	3.4E-03	Groundwater Protection	1.0E+03	-			8.2E-01	2.3E-02	3.4E-03
BROMOFORM	2.2E+00	Groundwater Protection	5.0E+02	-			6.1E+01		2.2E+00
BROMOMETHANE	3.4E-01	Groundwater Protection	5.0E+02	-			3.8E+00	8.6E-01	3.4E-01
CADMIUM	1.2E+01	Ecotoxicity	1.0E+03	1.2E+01			3.9E+01		(site-specific)
CARBON TETRACHLORIDE	2.7E-02	Indoor Air Impacts	5.0E+02	-			2.5E-01	2.7E-02	1.1E+00
CHLORDANE	1.6E+00	Direct Exposure	1.0E+03	-			1.6E+00		1.5E+01
CHLOROANILINE, p-	5.3E-02	Groundwater Protection	1.0E+03	-			2.4E+02		5.3E-02
CHLOROBENZENE	1.5E+00	Groundwater Protection	5.0E+02	3.0E+01			1.5E+02	1.0E+01	1.5E+00
CHLOROETHANE	2.7E-01	Groundwater Protection	5.0E+02	-			3.0E+00	5.0E-01	2.7E-01
CHLOROFORM	1.8E-02	Indoor Air Impacts	5.0E+02	-			2.2E-01	1.8E-02	1.8E+00
CHLOROMETHANE	1.6E+01	Indoor Air Impacts	1.0E+02	-			4.6E+01	1.6E+01	2.4E+01
CHLOROPHENOL, 2-	1.2E-02	Groundwater Protection	1.0E+02	1.0E+01			6.3E+01	3.4E+00	1.2E-02
CHROMIUM (Total)	2.1E+02	Direct Exposure	1.0E+03	-			2.1E+02		(site-specific)
CHROMIUM III	7.5E+02	Ecotoxicity	1.0E+03	7.5E+02			1.2E+05		(site-specific)
CHROMIUM VI	8.0E+00	Ecotoxicity	1.0E+03	8.0E+00			3.0E+01		(site-specific)
CHRYSENE	2.3E+01	Groundwater Protection	1.0E+03	4.0E+01			6.2E+02	(Use soil gas)	2.3E+01
COBALT	4.0E+01	Ecotoxicity	1.0E+03	4.0E+01			5.2E+02		(site-specific)

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)								
			Gross Contamination Ceiling Value (Odors, etc.)	[2]Urban Area Ecotoxicity Criteria	Other		[1]Human Health		Groundwater Protection (Soil Leaching)
							Direct Exposure	Vapor Intrusion Concerns	Drinking Water Resource
CONTAMINANT	Final SAL	Basis	Table F-2	Table L	Value	Basis	Table I-1	Table C-1b	Table E-1
COPPER	2.3E+02	Ecotoxicity	1.0E+03	2.3E+02			3.1E+03		(site-specific)
CYANIDE (Free)	1.0E+02	Ceiling Value	1.0E+02	-			1.2E+03	(Use soil gas)	1.2E+04
DIBENZO(a,h)ANTHTRACENE	6.2E-01	Direct Exposure	5.0E+02	-			6.2E-01		9.9E+00
DIBROMO-3-CHLOROPROPANE, 1,2-	9.0E-04	Groundwater Protection	5.0E+02	-			4.5E-01	(Use soil gas)	9.0E-04
DIBROMOCHLOROMETHANE	1.1E-02	Groundwater Protection	1.0E+02	-			1.1E+00	1.7E-02	1.1E-02
DIBROMOETHANE, 1,2-	5.2E-05	Groundwater Protection	5.0E+02	-			3.2E-02	7.2E-04	5.2E-05
DICHLOROBENZENE, 1,2-	1.1E+00	Groundwater Protection	6.0E+02	3.0E+01			6.0E+02	3.5E+01	1.1E+00
DICHLOROBENZENE, 1,3-	7.4E+00	Groundwater Protection	1.0E+02	3.0E+01			5.3E+02	(Use soil gas)	7.4E+00
DICHLOROBENZENE, 1,4-	6.5E-02	Indoor Air Impacts	5.0E+02	3.0E+01			3.4E+00	6.5E-02	5.9E-01
DICHLOROBENZIDINE, 3,3-	4.0E-02	Groundwater Protection	5.0E+02	-			1.1E+00		4.0E-02
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.4E+00	Direct Exposure	5.0E+02	-			2.4E+00		7.5E+02
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.4E+00	Direct Exposure	5.0E+02	4.0E+00			2.4E+00		1.1E+03
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.7E+00	Direct Exposure	1.0E+03	4.0E+00			1.7E+00		4.3E+00
DICHLOROETHANE, 1,1-	1.9E+00	Groundwater Protection	5.0E+02	-			4.9E+02	8.6E+01	1.9E+00
DICHLOROETHANE, 1,2-	1.1E-03	Groundwater Protection	5.0E+02	6.0E+01			2.7E-01	1.6E-02	1.1E-03
DICHLOROETHYLENE, 1,1-	1.2E+00	Groundwater Protection	5.0E+02	-			1.2E+02	3.5E+01	1.2E+00
DICHLOROETHYLENE, Cis 1,2-	2.2E+00	Groundwater Protection	1.0E+02	-			4.2E+01	6.2E+00	2.2E+00
DICHLOROETHYLENE, Trans 1,2-	6.7E+00	Groundwater Protection	5.0E+02	-			6.9E+01	1.2E+01	6.7E+00
DICHLOROPHENOL, 2,4-	3.0E-01	Groundwater Protection	5.0E+02	1.0E+01			1.8E+02		3.0E-01
DICHLOROPROPANE, 1,2-	2.1E-02	Indoor Air Impacts	1.0E+02	-			3.4E-01	2.1E-02	1.2E-01
DICHLOROPROPENE, 1,3-	4.6E-02	Groundwater Protection	5.0E+02	-			7.7E-01	1.0E-01	4.6E-02
DIELDRIN	2.3E-03	Groundwater Protection	1.0E+03	4.0E+00			3.0E-02		2.3E-03
DIETHYLPHTHALATE	3.5E-02	Groundwater Protection	5.0E+02	-			4.9E+04		3.5E-02
DIMETHYLPHENOL, 2,4-	7.3E-01	Groundwater Protection	1.0E+02	-			1.2E+03		7.3E-01
DIMETHYLPHTHALATE	3.5E-02	Groundwater Protection	5.0E+02	-			6.1E+05		3.5E-02
DINITROPHENOL, 2,4-	2.1E-01	Groundwater Protection	5.0E+02	-			1.2E+02		2.1E-01
DINITROTOLUENE, 2,4-	2.5E-01	Groundwater Protection	5.0E+02	-			1.2E+02		2.5E-01
DIOXANE, 1,4-	3.7E-03	Groundwater Protection	5.0E+02	-			4.4E+01		3.7E-03
DIOXIN (2,3,7,8-TCDD)	3.9E-06	Direct Exposure	NA	-			3.9E-06		1.0E+06
ENDOSULFAN	4.6E-03	Groundwater Protection	5.0E+02	-			3.7E+02		4.6E-03
ENDRIN	6.5E-04	Groundwater Protection	5.0E+02	6.0E-02			1.8E+01		6.5E-04
ETHYLBENZENE	3.3E+00	Groundwater Protection	4.0E+02	-			4.0E+02	3.9E+02	3.3E+00
FLUORANTHENE	4.0E+01	Ecotoxicity	5.0E+02	4.0E+01			2.3E+03		6.0E+01
FLUORENE	8.9E+00	Groundwater Protection	5.0E+02	-			2.7E+03	1.6E+02	8.9E+00
HEPTACHLOR	1.3E-02	Groundwater Protection	1.0E+03	-			1.1E-01		1.3E-02
HEPTACHLOR EPOXIDE	1.4E-02	Groundwater Protection	1.0E+03	-			5.3E-02		1.4E-02
HEXACHLOROBENZENE	3.0E-01	Direct Exposure	5.0E+02	3.0E+01			3.0E-01		7.9E+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)								
			Gross Contamination Ceiling Value (Odors, etc.)	[2]Urban Area Ecotoxicity Criteria	Other		[1]Human Health		Groundwater Protection (Soil Leaching)
							Direct Exposure	Vapor Intrusion Concerns	Drinking Water Resource
CONTAMINANT	Final SAL	Basis	Table F-2	Table L	Value	Basis	Table I-1	Table C-1b	Table E-1
HEXACHLOROBUTADIENE	4.3E+00	Groundwater Protection	5.0E+02	-			6.2E+00		4.3E+00
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	4.9E-02	Groundwater Protection	5.0E+02	2.0E+00			4.4E-01		4.9E-02
HEXACHLOROETHANE	1.6E+01	Groundwater Protection	5.0E+02	-			3.5E+01		1.6E+01
INDENO(1,2,3-cd)PYRENE	6.2E+00	Direct Exposure	5.0E+02	4.0E+01			6.2E+00		2.4E+01
LEAD	2.0E+02 (4.0E+02)	Ecotoxicity (Direct Exposure)	1.0E+03	2.0E+02			4.0E+02		(site-specific)
MERCURY	1.0E+01	Ecotoxicity	5.0E+02	1.0E+01			1.3E+01		(site-specific)
METHOXYCHLOR	1.9E+01	Groundwater Protection	5.0E+02	-			3.1E+02		1.9E+01
METHYL ETHYL KETONE	6.4E+00	Groundwater Protection	5.0E+02	-			2.2E+04	1.9E+04	6.4E+00
METHYL ISOBUTYL KETONE	3.9E+00	Groundwater Protection	1.0E+02	-			5.3E+03	1.7E+04	3.9E+00
METHYL MERCURY	6.1E+00	Direct Exposure	1.0E+02	1.0E+01			6.1E+00		(site-specific)
METHYL TERT BUTYL ETHER	2.3E-02	Groundwater Protection	1.0E+02	-			3.1E+01	1.6E+00	2.3E-02
METHYLENE CHLORIDE	6.7E-02	Groundwater Protection	5.0E+02	-			9.2E+00	9.0E-01	6.7E-02
METHYLNAPHTHALENE (total 1- & 2-)	2.5E-01	Groundwater Protection	5.0E+02	-			1.4E+03	1.1E+02	2.5E-01
MOLYBDENUM	4.0E+01	Ecotoxicity	1.0E+03	4.0E+01			3.9E+02		(site-specific)
NAPHTHALENE	1.2E+00	Groundwater Protection	5.0E+02	4.0E+01			5.5E+01	1.8E+01	1.2E+00
NICKEL	1.5E+02	Ecotoxicity	1.0E+03	1.5E+02			1.6E+03		(site-specific)
PENTACHLOROPHENOL	3.0E+00	Direct Exposure	5.0E+02	5.0E+00			3.0E+00		1.0E+06
PERCHLORATE	7.0E-03	Groundwater Protection	1.0E+03	-			7.8E+00		7.0E-03
PHENANTHRENE	1.1E+01	Groundwater Protection	5.0E+02	4.0E+01			2.8E+03	(Use soil gas)	1.1E+01
PHENOL	7.6E-02	Groundwater Protection	5.0E+02	4.0E+01			1.8E+04		7.6E-02
POLYCHLORINATED BIPHENYLS (PCBs)	1.1E+00	Direct Exposure	5.0E+02	-			1.1E+00		6.3E+00
PYRENE	8.5E+01	Indoor Air Impacts	5.0E+02	-			2.3E+03	8.5E+01	8.5E+01
SELENIUM	1.0E+01	Ecotoxicity	1.0E+03	1.0E+01			3.9E+02		(site-specific)
SILVER	2.0E+01	Ecotoxicity	1.0E+03	2.0E+01			3.9E+02		(site-specific)
STYRENE	1.5E+00	Groundwater Protection	5.0E+02	-			1.5E+03	1.5E+03	1.5E+00
tert-BUTYL ALCOHOL	2.3E-02	Groundwater Protection	1.0E+02	-			7.0E+01	(Use soil gas)	2.3E-02
TETRACHLOROETHANE, 1,1,1,2-	7.6E-03	Groundwater Protection	1.0E+02	-			3.1E+00	(Use soil gas)	7.6E-03
TETRACHLOROETHANE, 1,1,2,2-	9.9E-04	Groundwater Protection	5.0E+02	-			4.1E-01	7.2E-03	9.9E-04
TETRACHLOROETHYLENE	6.9E-02	Indoor Air Impacts	2.3E+02	-			4.8E-01	6.9E-02	7.0E-01
THALLIUM	5.2E+00	Direct Exposure	1.0E+03	-			5.2E+00		(site-specific)
TOLUENE	2.9E+00	Groundwater Protection	5.0E+02	-			6.5E+02	6.5E+02	2.9E+00
TOXAPHENE	4.2E-04	Groundwater Protection	5.0E+02	-			4.0E-01		4.2E-04
TPH (gasolines)	1.0E+02 (2.0E+03)	Ceiling Value (Leaching)	1.0E+02	-			8.0E+02	(Use soil gas)	2.0E+03
TPH (middle distillates)	5.0E+02 (5.0E+03)	Ceiling Value (Leaching)	5.0E+02	-			8.0E+02	(Use soil gas)	5.0E+03
TPH (residual fuels)	5.0E+02 (5.0E+03)	Ceiling Value (Leaching)	5.0E+02	-			2.3E+03		5.0E+03
TRICHLOROBENZENE, 1,2,4-	1.6E+00	Indoor Air Impacts	5.0E+02	3.0E+01			6.1E+01	1.6E+00	7.6E+00
TRICHLOROETHANE, 1,1,1-	7.8E+00	Groundwater Protection	5.0E+02	-			1.2E+03	3.9E+02	7.8E+00

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)								
			Gross Contamination Ceiling Value (Odors, etc.)	[2]Urban Area Ecotoxicity Criteria	Other		[1]Human Health		Groundwater Protection (Soil Leaching)
							Direct Exposure	Vapor Intrusion Concerns	Drinking Water Resource
CONTAMINANT	Final SAL	Basis	Table F-2	Table L	Value	Basis	Table I-1	Table C-1b	Table E-1
TRICHLOROETHANE, 1,1,2-	2.6E-02	Indoor Air Impacts	1.0E+02	-			7.2E-01	2.6E-02	7.0E-02
TRICHLOROETHYLENE	3.6E-02	Indoor Air Impacts	5.0E+02	6.0E+01			5.2E-01	3.6E-02	4.6E-01
TRICHLOROPHENOL, 2,4,5-	1.8E-01	Groundwater Protection	1.0E+02	1.0E+01			2.5E+03	9.5E+01	1.8E-01
TRICHLOROPHENOL, 2,4,6-	1.2E+00	Groundwater Protection	5.0E+02	1.0E+01			6.1E+00		1.2E+00
VANADIUM	7.8E+01	Direct Exposure	1.0E+03	2.0E+02			7.8E+01		(site-specific)
VINYL CHLORIDE	3.9E-02	Indoor Air Impacts	5.0E+02	6.0E+01			1.5E-01	3.9E-02	3.4E-01
XYLENES	2.3E+00	Groundwater Protection	4.2E+02	-			2.7E+02	1.8E+02	2.3E+00
ZINC	6.0E+02	Ecotoxicity	1.0E+03	6.0E+02			2.3E+04		(site-specific)
Electrical Conductivity (mS/cm, USEPA Method 120.1 MOD)	2.0		-	-			-	-	-
Sodium Adsorption Ratio	5.0		-	-			-	-	-

Notes:

1. Assumes current or future residential land use.
2. Based primarily on phytotoxicity. Included in selection of final soil action levels if less than one-half of the residential soil screening level for human-health, direct-exposure concerns (see Table L and Section 3.9 in text).

Final Soil Action Level is lowest of ceiling value (nuisance concerns etc.), ecotoxicity, direct-exposure, indoor-air impact, and leaching action levels.
Assumes soil pH 5.0 to 9.0.
Soil data should be reported on dry-weight basis (see Section 6.2).
TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories. Use of leaching based action levels noted in parentheses may be appropriate for deep or otherwise isolated soils that do not threaten a drinking water resource or sensitive aquatic habitat. Refer to Section 2.2.2 in Volume 1.
Background arsenic in soils - assumed maximum (refer to Section 6.1 in text).

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)								
			Gross Contamination Ceiling Value (Odors, etc.)	[2]Urban Area Ecotoxicity Criteria	Other		[1]Human Health		Groundwater Protection (Soil Leaching)
							Direct Exposure	Vapor Intrusion Concerns	NON-Drinking Water Resource
CONTAMINANT	Final SAL	Basis	Table F-2	Table L	Value	Basis	Table I-1	Table C-1b	Table E-1
ACENAPHTHENE	1.3E+02	Indoor Air Impacts	1.0E+03	-			3.7E+03	1.3E+02	1.6E+02
ACENAPHTHYLENE	1.3E+02	Groundwater Protection	5.0E+02	-			1.3E+03	(Use soil gas)	1.3E+02
ACETONE	5.0E-01	Groundwater Protection	5.0E+02	-			1.4E+04	5.6E+03	5.0E-01
ALDRIN	2.9E-02	Direct Exposure	1.0E+03	3.5E-01			2.9E-02		1.1E+01
ANTHRACENE	2.8E+00	Groundwater Protection	5.0E+02	4.0E+01			2.2E+04	6.1E+00	2.8E+00
ANTIMONY	2.0E+01	Ecotoxicity	1.0E+03	2.0E+01			3.1E+01		(site-specific)
ARSENIC	2.2E+01	Background	1.0E+03	2.0E+01	2.2E+01	Background	4.2E-01		(site-specific)
BARIUM	7.5E+02	Ecotoxicity	1.0E+03	7.5E+02			5.4E+03		(site-specific)
BENZENE	5.3E-01	Indoor Air Impacts	5.0E+02	2.5E+01			6.4E-01	5.3E-01	7.0E+01
BENZO(a)ANTHRACENE	6.2E+00	Direct Exposure	5.0E+02	4.0E+01			6.2E+00		1.2E+01
BENZO(a)PYRENE	6.2E-01	Direct Exposure	5.0E+02	4.0E+01			6.2E-01		1.3E+02
BENZO(b)FLUORANTHENE	6.2E+00	Direct Exposure	5.0E+02	-			6.2E+00		4.6E+01
BENZO(g,h,i)PERYLENE	2.7E+01	Groundwater Protection	5.0E+02	4.0E+01			2.3E+03		2.7E+01
BENZO(k)FLUORANTHENE	3.7E+01	Groundwater Protection	5.0E+02	4.0E+01			6.2E+01		3.7E+01
BERYLLIUM	4.0E+00	Ecotoxicity	1.0E+03	4.0E+00			1.5E+02		(site-specific)
BIPHENYL, 1,1-	6.5E+00	Groundwater Protection	5.0E+02	-			3.0E+03	(Use soil gas)	6.5E+00
BIS(2-CHLOROETHYL)ETHER	6.7E-03	Indoor Air Impacts	5.0E+02	-			2.0E-01	6.7E-03	1.3E+00
BIS(2-CHLOROISOPROPYL)ETHER	2.9E+00	Direct Exposure	5.0E+02	-			2.9E+00	(Use soil gas)	3.5E+01
BIS(2-ETHYLHEXYL)PHTHALATE	3.5E+01	Direct Exposure	5.0E+02	-			3.5E+01		7.8E+02
BORON	1.6E+00	Ecotoxicity	1.0E+02	1.6E+00			1.2E+04		(site-specific)
BROMODICHLOROMETHANE	2.3E-02	Indoor Air Impacts	1.0E+03	-			8.2E-01	2.3E-02	5.1E+00
BROMOFORM	6.1E+01	Direct Exposure	5.0E+02	-			6.1E+01		1.1E+02
BROMOMETHANE	8.6E-01	Indoor Air Impacts	5.0E+02	-			3.8E+00	8.6E-01	9.3E+01
CADMIUM	1.2E+01	Ecotoxicity	1.0E+03	1.2E+01			3.9E+01		(site-specific)
CARBON TETRACHLORIDE	2.7E-02	Indoor Air Impacts	5.0E+02	-			2.5E-01	2.7E-02	4.5E+00
CHLORDANE	1.6E+00	Direct Exposure	1.0E+03	-			1.6E+00		1.5E+01
CHLOROANILINE, p-	5.3E-02	Groundwater Protection	1.0E+03	-			2.4E+02		5.3E-02
CHLOROBENZENE	9.5E+00	Groundwater Protection	5.0E+02	3.0E+01			1.5E+02	1.0E+01	9.5E+00
CHLOROETHANE	2.7E-01	Groundwater Protection	5.0E+02	-			3.0E+00	5.0E-01	2.7E-01
CHLOROFORM	1.8E-02	Indoor Air Impacts	5.0E+02	-			2.2E-01	1.8E-02	1.8E+00
CHLOROMETHANE	1.6E+01	Indoor Air Impacts	1.0E+02	-			4.6E+01	1.6E+01	1.5E+03
CHLOROPHENOL, 2-	1.2E-01	Groundwater Protection	1.0E+02	1.0E+01			6.3E+01	3.4E+00	1.2E-01
CHROMIUM (Total)	2.1E+02	Direct Exposure	1.0E+03	-			2.1E+02		(site-specific)
CHROMIUM III	7.5E+02	Ecotoxicity	1.0E+03	7.5E+02			1.2E+05		(site-specific)
CHROMIUM VI	8.0E+00	Ecotoxicity	1.0E+03	8.0E+00			3.0E+01		(site-specific)
CHRYSENE	2.3E+01	Groundwater Protection	1.0E+03	4.0E+01			6.2E+02	(Use soil gas)	2.3E+01
COBALT	4.0E+01	Ecotoxicity	1.0E+03	4.0E+01			5.2E+02		(site-specific)
COPPER	2.3E+02	Ecotoxicity	1.0E+03	2.3E+02			3.1E+03		(site-specific)

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)								
			Gross Contamination Ceiling Value (Odors, etc.)	[2]Urban Area Ecotoxicity Criteria	Other		[1]Human Health		Groundwater Protection (Soil Leaching)
							Direct Exposure	Vapor Intrusion Concerns	NON-Drinking Water Resource
CONTAMINANT	Final SAL	Basis	Table F-2	Table L	Value	Basis	Table I-1	Table C-1b	Table E-1
CYANIDE (Free)	1.0E+02	Ceiling Value	1.0E+02	-			1.2E+03	(Use soil gas)	1.2E+04
DIBENZO(a,h)ANTHTRACENE	6.2E-01	Direct Exposure	5.0E+02	-			6.2E-01		1.4E+02
DIBROMO-3-CHLOROPROPANE, 1,2-	9.0E-04	Groundwater Protection	5.0E+02	-			4.5E-01	(Use soil gas)	9.0E-04
DIBROMOCHLOROMETHANE	1.7E-02	Indoor Air Impacts	1.0E+02	-			1.1E+00	1.7E-02	1.3E+01
DIBROMOETHANE, 1,2-	7.2E-04	Indoor Air Impacts	5.0E+02	-			3.2E-02	7.2E-04	1.5E-01
DICHLOROBENZENE, 1,2-	1.1E+01	Groundwater Protection	6.0E+02	3.0E+01			6.0E+02	3.5E+01	1.1E+01
DICHLOROBENZENE, 1,3-	3.0E+01	Ecotoxicity	1.0E+02	3.0E+01			5.3E+02	(Use soil gas)	4.2E+01
DICHLOROBENZENE, 1,4-	6.5E-02	Indoor Air Impacts	5.0E+02	3.0E+01			3.4E+00	6.5E-02	1.3E+01
DICHLOROBENZIDINE, 3,3-	1.1E+00	Direct Exposure	5.0E+02	-			1.1E+00		6.6E+01
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.4E+00	Direct Exposure	5.0E+02	-			2.4E+00		7.5E+02
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.4E+00	Direct Exposure	5.0E+02	4.0E+00			2.4E+00		1.0E+04
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.7E+00	Direct Exposure	1.0E+03	4.0E+00			1.7E+00		4.3E+00
DICHLOROETHANE, 1,1-	1.9E+00	Groundwater Protection	5.0E+02	-			4.9E+02	8.6E+01	1.9E+00
DICHLOROETHANE, 1,2-	1.6E-02	Indoor Air Impacts	5.0E+02	6.0E+01			2.7E-01	1.6E-02	1.2E+00
DICHLOROETHYLENE, 1,1-	3.5E+01	Indoor Air Impacts	5.0E+02	-			1.2E+02	3.5E+01	6.7E+02
DICHLOROETHYLENE, Cis 1,2-	6.2E+00	Indoor Air Impacts	1.0E+02	-			4.2E+01	6.2E+00	3.6E+02
DICHLOROETHYLENE, Trans 1,2-	1.2E+01	Indoor Air Impacts	5.0E+02	-			6.9E+01	1.2E+01	1.7E+02
DICHLOROPHENOL, 2,4-	3.0E+00	Groundwater Protection	5.0E+02	1.0E+01			1.8E+02		3.0E+00
DICHLOROPROPANE, 1,2-	2.1E-02	Indoor Air Impacts	1.0E+02	-			3.4E-01	2.1E-02	2.5E+00
DICHLOROPROPENE, 1,3-	1.0E-01	Indoor Air Impacts	5.0E+02	-			7.7E-01	1.0E-01	1.8E+01
DIELDRIN	3.0E-02	Direct Exposure	1.0E+03	4.0E+00			3.0E-02		8.7E-01
DIETHYLPHTHALATE	2.2E+01	Groundwater Protection	5.0E+02	-			4.9E+04		2.2E+01
DIMETHYLPHENOL, 2,4-	1.8E+00	Groundwater Protection	1.0E+02	-			1.2E+03		1.8E+00
DIMETHYLPHTHALATE	2.2E+01	Groundwater Protection	5.0E+02	-			6.1E+05		2.2E+01
DINITROPHENOL, 2,4-	6.5E-01	Groundwater Protection	5.0E+02	-			1.2E+02		6.5E-01
DINITROTOLUENE, 2,4-	1.5E+00	Groundwater Protection	5.0E+02	-			1.2E+02		1.5E+00
DIOXANE, 1,4-	3.0E+01	Groundwater Protection	5.0E+02	-			4.4E+01		3.0E+01
DIOXIN (2,3,7,8-TCDD)	3.9E-06	Direct Exposure	NA	-			3.9E-06		1.0E+06
ENDOSULFAN	1.8E-02	Groundwater Protection	5.0E+02	-			3.7E+02		1.8E-02
ENDRIN	1.0E-02	Groundwater Protection	5.0E+02	6.0E-02			1.8E+01		1.0E-02
ETHYLBENZENE	3.3E+01	Groundwater Protection	4.0E+02	-			4.0E+02	3.9E+02	3.3E+01
FLUORANTHENE	4.0E+01	Ecotoxicity	5.0E+02	4.0E+01			2.3E+03		2.5E+02
FLUORENE	1.6E+02	Indoor Air Impacts	5.0E+02	-			2.7E+03	1.6E+02	6.9E+02
HEPTACHLOR	1.1E-01	Direct Exposure	1.0E+03	-			1.1E-01		1.9E-01
HEPTACHLOR EPOXIDE	5.3E-02	Direct Exposure	1.0E+03	-			5.3E-02		2.0E-01
HEXACHLOROBENZENE	3.0E-01	Direct Exposure	5.0E+02	3.0E+01			3.0E-01		1.2E+03
HEXACHLOROBUTADIENE	6.2E+00	Direct Exposure	5.0E+02	-			6.2E+00		5.5E+01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	9.8E-02	Groundwater Protection	5.0E+02	2.0E+00			4.4E-01		9.8E-02

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)								
			Gross Contamination Ceiling Value (Odors, etc.)	[2]Urban Area Ecotoxicity Criteria	Other		[1]Human Health		Groundwater Protection (Soil Leaching)
							Direct Exposure	Vapor Intrusion Concerns	NON-Drinking Water Resource
CONTAMINANT	Final SAL	Basis	Table F-2	Table L	Value	Basis	Table I-1	Table C-1b	Table E-1
HEXACHLOROETHANE	3.5E+01	Direct Exposure	5.0E+02	-			3.5E+01		3.4E+02
INDENO(1,2,3-cd)PYRENE	6.2E+00	Direct Exposure	5.0E+02	4.0E+01			6.2E+00		2.4E+01
LEAD	2.0E+02 (4.0E+02)	Ecotoxicity (Direct Exposure)	1.0E+03	2.0E+02			4.0E+02		(site-specific)
MERCURY	1.0E+01	Ecotoxicity	5.0E+02	1.0E+01			1.3E+01		(site-specific)
METHOXYCHLOR	1.9E+01	Groundwater Protection	5.0E+02	-			3.1E+02		1.9E+01
METHYL ETHYL KETONE	1.3E+01	Groundwater Protection	5.0E+02	-			2.2E+04	1.9E+04	1.3E+01
METHYL ISOBUTYL KETONE	3.9E+00	Groundwater Protection	1.0E+02	-			5.3E+03	1.7E+04	3.9E+00
METHYL MERCURY	6.1E+00	Direct Exposure	1.0E+02	1.0E+01			6.1E+00		(site-specific)
METHYL TERT BUTYL ETHER	1.6E+00	Indoor Air Impacts	1.0E+02	-			3.1E+01	1.6E+00	8.4E+00
METHYLENE CHLORIDE	9.0E-01	Indoor Air Impacts	5.0E+02	-			9.2E+00	9.0E-01	6.5E+01
METHYLNAPHTHALENE (total 1- & 2-)	1.2E+01	Groundwater Protection	5.0E+02	-			1.4E+03	1.1E+02	1.2E+01
MOLYBDENUM	4.0E+01	Ecotoxicity	1.0E+03	4.0E+01			3.9E+02		(site-specific)
NAPHTHALENE	1.8E+01	Indoor Air Impacts	5.0E+02	4.0E+01			5.5E+01	1.8E+01	4.2E+01
NICKEL	1.5E+02	Ecotoxicity	1.0E+03	1.5E+02			1.6E+03		(site-specific)
PENTACHLOROPHENOL	3.0E+00	Direct Exposure	5.0E+02	5.0E+00			3.0E+00		1.0E+06
PERCHLORATE	1.2E+00	Groundwater Protection	1.0E+03	-			7.8E+00		1.2E+00
PHENANTHRENE	1.8E+01	Groundwater Protection	5.0E+02	4.0E+01			2.8E+03	(Use soil gas)	1.8E+01
PHENOL	4.0E+01	Ecotoxicity	5.0E+02	4.0E+01			1.8E+04		5.1E+01
POLYCHLORINATED BIPHENYLS (PCBs)	1.1E+00	Direct Exposure	5.0E+02	-			1.1E+00		1.1E+01
PYRENE	8.5E+01	Indoor Air Impacts	5.0E+02	-			2.3E+03	8.5E+01	8.5E+01
SELENIUM	1.0E+01	Ecotoxicity	1.0E+03	1.0E+01			3.9E+02		(site-specific)
SILVER	2.0E+01	Ecotoxicity	1.0E+03	2.0E+01			3.9E+02		(site-specific)
STYRENE	1.5E+01	Groundwater Protection	5.0E+02	-			1.5E+03	1.5E+03	1.5E+01
tert-BUTYL ALCOHOL	7.0E+01	Direct Exposure	1.0E+02	-			7.0E+01	(Use soil gas)	3.1E+02
TETRACHLOROETHANE, 1,1,1,2-	3.1E+00	Direct Exposure	1.0E+02	-			3.1E+00	(Use soil gas)	5.5E+01
TETRACHLOROETHANE, 1,1,2,2-	7.2E-03	Indoor Air Impacts	5.0E+02	-			4.1E-01	7.2E-03	2.7E+00
TETRACHLOROETHYLENE	6.9E-02	Indoor Air Impacts	2.3E+02	-			4.8E-01	6.9E-02	1.4E+01
THALLIUM	5.2E+00	Direct Exposure	1.0E+03	-			5.2E+00		(site-specific)
TOLUENE	2.9E+01	Groundwater Protection	5.0E+02	-			6.5E+02	6.5E+02	2.9E+01
TOXAPHENE	4.0E-01	Direct Exposure	5.0E+02	-			4.0E-01		4.4E-01
TPH (gasolines)	1.0E+02 (2.0E+03)	Ceiling Value (Leaching)	1.0E+02	-			8.0E+02	(Use soil gas)	2.0E+03
TPH (middle distillates)	5.0E+02 (5.0E+03)	Ceiling Value (Leaching)	5.0E+02	-			8.0E+02	(Use soil gas)	5.0E+03
TPH (residual fuels)	5.0E+02 (5.0E+03)	Ceiling Value (Leaching)	5.0E+02	-			2.3E+03		5.0E+03
TRICHLOROBENZENE, 1,2,4-	1.6E+00	Indoor Air Impacts	5.0E+02	3.0E+01			6.1E+01	1.6E+00	4.9E+01
TRICHLOROETHANE, 1,1,1-	3.9E+02	Indoor Air Impacts	5.0E+02	-			1.2E+03	3.9E+02	7.5E+02
TRICHLOROETHANE, 1,1,2-	2.6E-02	Indoor Air Impacts	1.0E+02	-			7.2E-01	2.6E-02	3.9E+00
TRICHLOROETHYLENE	3.6E-02	Indoor Air Impacts	5.0E+02	6.0E+01			5.2E-01	3.6E-02	6.8E+00
TRICHLOROPHENOL, 2,4,5-	1.6E+00	Groundwater Protection	1.0E+02	1.0E+01			2.5E+03	9.5E+01	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)								
			Gross Contamination Ceiling Value (Odors, etc.)	[2]Urban Area Ecotoxicity Criteria	Other		[1]Human Health		Groundwater Protection (Soil Leaching)
							Direct Exposure	Vapor Intrusion Concerns	NON-Drinking Water Resource
CONTAMINANT	Final SAL	Basis	Table F-2	Table L	Value	Basis	Table I-1	Table C-1b	Table E-1
TRICHLOROPHENOL, 2,4,6-	6.1E+00	Direct Exposure	5.0E+02	1.0E+01			6.1E+00		1.6E+02
VANADIUM	7.8E+01	Direct Exposure	1.0E+03	2.0E+02			7.8E+01		(site-specific)
VINYL CHLORIDE	3.9E-02	Indoor Air Impacts	5.0E+02	6.0E+01			1.5E-01	3.9E-02	3.8E+00
XYLENES	1.8E+02	Indoor Air Impacts	4.2E+02	-			2.7E+02	1.8E+02	2.3E+02
ZINC	6.0E+02	Ecotoxicity	1.0E+03	6.0E+02			2.3E+04		(site-specific)
Electrical Conductivity (mS/cm, USEPA Method 120.1 MOD)	2.0		-	-			-	-	-
Sodium Adsorption Ratio	5.0		-	-			-	-	-

Notes:

1. Assumes current or future residential land use.
2. Based primarily on phytotoxicity. Included in selection of final soil action levels if less than one-half of the residential soil screening level for human-health, direct-exposure concerns (see Table L and Section 3.9 in text).

Final Soil Action Level is lowest of ceiling value (nuisance concerns etc.), ecotoxicity, direct-exposure, indoor-air impact, and leaching action levels.
Assumes soil pH 5.0 to 9.0.
Soil data should be reported on dry-weight basis (see Section 6.2).
TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories. Use of leaching based action levels noted in parentheses may be appropriate for deep or otherwise isolated soils that do not threaten a drinking water resource or sensitive aquatic habitat. Refer to Section 2.2.2 in Volume 1.
Background arsenic in soils - assumed maximum (refer to Section 6.1 in text).

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)								
			Gross Contamination Ceiling Value (Odors, etc.)	[2]Urban Area Ecotoxicity Criteria	Other		[1]Human Health		Groundwater Protection (Soil Leaching)
							Direct Exposure	Vapor Intrusion Concerns	NON-Drinking Water Resource
CONTAMINANT	Final SAL	Basis	Table F-2	Table L	Value	Basis	Table I-1	Table C-1b	Table E-1
ACENAPHTHENE	1.9E+01	Groundwater Protection	1.0E+03	-			3.7E+03	1.3E+02	1.9E+01
ACENAPHTHYLENE	1.3E+01	Groundwater Protection	5.0E+02	-			1.3E+03	(Use soil gas)	1.3E+01
ACETONE	5.0E-01	Groundwater Protection	5.0E+02	-			1.4E+04	5.6E+03	5.0E-01
ALDRIN	2.9E-02	Direct Exposure	1.0E+03	3.5E-01			2.9E-02		5.0E+00
ANTHRACENE	2.8E+00	Groundwater Protection	5.0E+02	4.0E+01			2.2E+04	6.1E+00	2.8E+00
ANTIMONY	2.0E+01	Ecotoxicity	1.0E+03	2.0E+01			3.1E+01		(site-specific)
ARSENIC	2.2E+01	Background	1.0E+03	2.0E+01	2.2E+01	Background	4.2E-01		(site-specific)
BARIUM	7.5E+02	Ecotoxicity	1.0E+03	7.5E+02			5.4E+03		(site-specific)
BENZENE	5.3E-01	Indoor Air Impacts	5.0E+02	2.5E+01			6.4E-01	5.3E-01	2.0E+00
BENZO(a)ANTHRACENE	6.2E+00	Direct Exposure	5.0E+02	4.0E+01			6.2E+00		1.2E+01
BENZO(a)PYRENE	6.2E-01	Direct Exposure	5.0E+02	4.0E+01			6.2E-01		1.3E+02
BENZO(b)FLUORANTHENE	6.2E+00	Direct Exposure	5.0E+02	-			6.2E+00		4.6E+01
BENZO(g,h,i)PERYLENE	2.7E+01	Groundwater Protection	5.0E+02	4.0E+01			2.3E+03		2.7E+01
BENZO(k)FLUORANTHENE	3.7E+01	Groundwater Protection	5.0E+02	4.0E+01			6.2E+01		3.7E+01
BERYLLIUM	4.0E+00	Ecotoxicity	1.0E+03	4.0E+00			1.5E+02		(site-specific)
BIPHENYL, 1,1-	6.5E+00	Groundwater Protection	5.0E+02	-			3.0E+03	(Use soil gas)	6.5E+00
BIS(2-CHLOROETHYL)ETHER	6.7E-03	Indoor Air Impacts	5.0E+02	-			2.0E-01	6.7E-03	7.8E-01
BIS(2-CHLOROISOPROPYL)ETHER	6.6E-01	Groundwater Protection	5.0E+02	-			2.9E+00	(Use soil gas)	6.6E-01
BIS(2-ETHYLHEXYL)PHTHALATE	3.5E+01	Direct Exposure	5.0E+02	-			3.5E+01		7.8E+02
BORON	1.6E+00	Ecotoxicity	1.0E+02	1.6E+00			1.2E+04		(site-specific)
BROMODICHLOROMETHANE	2.3E-02	Indoor Air Impacts	1.0E+03	-			8.2E-01	2.3E-02	5.1E+00
BROMOFORM	6.1E+01	Direct Exposure	5.0E+02	-			6.1E+01		6.9E+01
BROMOMETHANE	8.6E-01	Indoor Air Impacts	5.0E+02	-			3.8E+00	8.6E-01	6.4E+00
CADMIUM	1.2E+01	Ecotoxicity	1.0E+03	1.2E+01			3.9E+01		(site-specific)
CARBON TETRACHLORIDE	2.7E-02	Indoor Air Impacts	5.0E+02	-			2.5E-01	2.7E-02	2.1E+00
CHLORDANE	1.6E+00	Direct Exposure	1.0E+03	-			1.6E+00		1.5E+01
CHLOROANILINE, p-	5.3E-02	Groundwater Protection	1.0E+03	-			2.4E+02		5.3E-02
CHLOROBENZENE	1.5E+00	Groundwater Protection	5.0E+02	3.0E+01			1.5E+02	1.0E+01	1.5E+00
CHLOROETHANE	2.7E-01	Groundwater Protection	5.0E+02	-			3.0E+00	5.0E-01	2.7E-01
CHLOROFORM	1.8E-02	Indoor Air Impacts	5.0E+02	-			2.2E-01	1.8E-02	1.8E+00
CHLOROMETHANE	1.6E+01	Indoor Air Impacts	1.0E+02	-			4.6E+01	1.6E+01	5.0E+02
CHLOROPHENOL, 2-	1.2E-01	Groundwater Protection	1.0E+02	1.0E+01			6.3E+01	3.4E+00	1.2E-01
CHROMIUM (Total)	2.1E+02	Direct Exposure	1.0E+03	-			2.1E+02		(site-specific)
CHROMIUM III	7.5E+02	Ecotoxicity	1.0E+03	7.5E+02			1.2E+05		(site-specific)
CHROMIUM VI	8.0E+00	Ecotoxicity	1.0E+03	8.0E+00			3.0E+01		(site-specific)
CHRYSENE	2.3E+01	Groundwater Protection	1.0E+03	4.0E+01			6.2E+02	(Use soil gas)	2.3E+01
COBALT	4.0E+01	Ecotoxicity	1.0E+03	4.0E+01			5.2E+02		(site-specific)
COPPER	2.3E+02	Ecotoxicity	1.0E+03	2.3E+02			3.1E+03		(site-specific)

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)								
			Gross Contamination Ceiling Value (Odors, etc.)	[2]Urban Area Ecotoxicity Criteria	Other		[1]Human Health		Groundwater Protection (Soil Leaching)
							Direct Exposure	Vapor Intrusion Concerns	NON-Drinking Water Resource
CONTAMINANT	Final SAL	Basis	Table F-2	Table L	Value	Basis	Table I-1	Table C-1b	Table E-1
CYANIDE (Free)	1.0E+02	Ceiling Value	1.0E+02	-			1.2E+03	(Use soil gas)	1.2E+04
DIBENZO(a,h)ANTHTRACENE	6.2E-01	Direct Exposure	5.0E+02	-			6.2E-01		1.4E+02
DIBROMO-3-CHLOROPROPANE, 1,2-	9.0E-04	Groundwater Protection	5.0E+02	-			4.5E-01	(Use soil gas)	9.0E-04
DIBROMOCHLOROMETHANE	1.7E-02	Indoor Air Impacts	1.0E+02	-			1.1E+00	1.7E-02	1.3E+01
DIBROMOETHANE, 1,2-	7.2E-04	Indoor Air Impacts	5.0E+02	-			3.2E-02	7.2E-04	1.5E-01
DICHLOROBENZENE, 1,2-	1.6E+00	Groundwater Protection	6.0E+02	3.0E+01			6.0E+02	3.5E+01	1.6E+00
DICHLOROBENZENE, 1,3-	7.4E+00	Groundwater Protection	1.0E+02	3.0E+01			5.3E+02	(Use soil gas)	7.4E+00
DICHLOROBENZENE, 1,4-	6.5E-02	Indoor Air Impacts	5.0E+02	3.0E+01			3.4E+00	6.5E-02	1.8E+00
DICHLOROBENZIDINE, 3,3-	1.1E+00	Direct Exposure	5.0E+02	-			1.1E+00		6.6E+01
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.4E+00	Direct Exposure	5.0E+02	-			2.4E+00		7.5E+02
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.4E+00	Direct Exposure	5.0E+02	4.0E+00			2.4E+00		1.1E+03
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.7E+00	Direct Exposure	1.0E+03	4.0E+00			1.7E+00		4.3E+00
DICHLOROETHANE, 1,1-	1.9E+00	Groundwater Protection	5.0E+02	-			4.9E+02	8.6E+01	1.9E+00
DICHLOROETHANE, 1,2-	1.6E-02	Indoor Air Impacts	5.0E+02	6.0E+01			2.7E-01	1.6E-02	1.2E+00
DICHLOROETHYLENE, 1,1-	4.3E+00	Groundwater Protection	5.0E+02	-			1.2E+02	3.5E+01	4.3E+00
DICHLOROETHYLENE, Cis 1,2-	6.2E+00	Indoor Air Impacts	1.0E+02	-			4.2E+01	6.2E+00	1.8E+01
DICHLOROETHYLENE, Trans 1,2-	1.2E+01	Indoor Air Impacts	5.0E+02	-			6.9E+01	1.2E+01	3.9E+01
DICHLOROPHENOL, 2,4-	3.0E+00	Groundwater Protection	5.0E+02	1.0E+01			1.8E+02		3.0E+00
DICHLOROPROPANE, 1,2-	2.1E-02	Indoor Air Impacts	1.0E+02	-			3.4E-01	2.1E-02	2.5E+00
DICHLOROPROPENE, 1,3-	1.0E-01	Indoor Air Impacts	5.0E+02	-			7.7E-01	1.0E-01	1.4E+01
DIELDRIN	2.3E-03	Groundwater Protection	1.0E+03	4.0E+00			3.0E-02		2.3E-03
DIETHYLPHTHALATE	3.5E-02	Groundwater Protection	5.0E+02	-			4.9E+04		3.5E-02
DIMETHYLPHENOL, 2,4-	7.3E-01	Groundwater Protection	1.0E+02	-			1.2E+03		7.3E-01
DIMETHYLPHTHALATE	3.5E-02	Groundwater Protection	5.0E+02	-			6.1E+05		3.5E-02
DINITROPHENOL, 2,4-	2.1E-01	Groundwater Protection	5.0E+02	-			1.2E+02		2.1E-01
DINITROTOLUENE, 2,4-	8.6E-01	Groundwater Protection	5.0E+02	-			1.2E+02		8.6E-01
DIOXANE, 1,4-	3.0E+01	Groundwater Protection	5.0E+02	-			4.4E+01		3.0E+01
DIOXIN (2,3,7,8-TCDD)	3.9E-06	Direct Exposure	NA	-			3.9E-06		1.0E+06
ENDOSULFAN	4.6E-03	Groundwater Protection	5.0E+02	-			3.7E+02		4.6E-03
ENDRIN	6.5E-04	Groundwater Protection	5.0E+02	6.0E-02			1.8E+01		6.5E-04
ETHYLBENZENE	3.2E+01	Groundwater Protection	4.0E+02	-			4.0E+02	3.9E+02	3.2E+01
FLUORANTHENE	4.0E+01	Ecotoxicity	5.0E+02	4.0E+01			2.3E+03		6.0E+01
FLUORENE	8.9E+00	Groundwater Protection	5.0E+02	-			2.7E+03	1.6E+02	8.9E+00
HEPTACHLOR	1.3E-02	Groundwater Protection	1.0E+03	-			1.1E-01		1.3E-02
HEPTACHLOR EPOXIDE	1.4E-02	Groundwater Protection	1.0E+03	-			5.3E-02		1.4E-02
HEXACHLOROBENZENE	3.0E-01	Direct Exposure	5.0E+02	3.0E+01			3.0E-01		7.9E+02
HEXACHLOROBUTADIENE	6.2E+00	Direct Exposure	5.0E+02	-			6.2E+00		2.3E+01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	4.9E-02	Groundwater Protection	5.0E+02	2.0E+00			4.4E-01		4.9E-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)								
			Gross Contamination Ceiling Value (Odors, etc.)	[2]Urban Area Ecotoxicity Criteria	Other		[1]Human Health		Groundwater Protection (Soil Leaching)
							Direct Exposure	Vapor Intrusion Concerns	NON-Drinking Water Resource
CONTAMINANT	Final SAL	Basis	Table F-2	Table L	Value	Basis	Table I-1	Table C-1b	Table E-1
HEXACHLOROETHANE	3.5E+01	Direct Exposure	5.0E+02	-			3.5E+01		4.1E+01
INDENO(1,2,3-cd)PYRENE	6.2E+00	Direct Exposure	5.0E+02	4.0E+01			6.2E+00		2.4E+01
LEAD	2.0E+02 (4.0E+02)	Ecotoxicity (Direct Exposure)	1.0E+03	2.0E+02			4.0E+02		(site-specific)
MERCURY	1.0E+01	Ecotoxicity	5.0E+02	1.0E+01			1.3E+01		(site-specific)
METHOXYCHLOR	1.9E+01	Groundwater Protection	5.0E+02	-			3.1E+02		1.9E+01
METHYL ETHYL KETONE	1.3E+01	Groundwater Protection	5.0E+02	-			2.2E+04	1.9E+04	1.3E+01
METHYL ISOBUTYL KETONE	3.9E+00	Groundwater Protection	1.0E+02	-			5.3E+03	1.7E+04	3.9E+00
METHYL MERCURY	6.1E+00	Direct Exposure	1.0E+02	1.0E+01			6.1E+00		(site-specific)
METHYL TERT BUTYL ETHER	1.6E+00	Indoor Air Impacts	1.0E+02	-			3.1E+01	1.6E+00	8.4E+00
METHYLENE CHLORIDE	9.0E-01	Indoor Air Impacts	5.0E+02	-			9.2E+00	9.0E-01	3.4E+01
METHYLNAPHTHALENE (total 1- & 2-)	2.5E-01	Groundwater Protection	5.0E+02	-			1.4E+03	1.1E+02	2.5E-01
MOLYBDENUM	4.0E+01	Ecotoxicity	1.0E+03	4.0E+01			3.9E+02		(site-specific)
NAPHTHALENE	4.8E+00	Groundwater Protection	5.0E+02	4.0E+01			5.5E+01	1.8E+01	4.8E+00
NICKEL	1.5E+02	Ecotoxicity	1.0E+03	1.5E+02			1.6E+03		(site-specific)
PENTACHLOROPHENOL	3.0E+00	Direct Exposure	5.0E+02	5.0E+00			3.0E+00		1.0E+06
PERCHLORATE	1.2E+00	Groundwater Protection	1.0E+03	-			7.8E+00		1.2E+00
PHENANTHRENE	1.1E+01	Groundwater Protection	5.0E+02	4.0E+01			2.8E+03	(Use soil gas)	1.1E+01
PHENOL	1.9E+01	Groundwater Protection	5.0E+02	4.0E+01			1.8E+04		1.9E+01
POLYCHLORINATED BIPHENYLS (PCBs)	1.1E+00	Direct Exposure	5.0E+02	-			1.1E+00		6.3E+00
PYRENE	8.5E+01	Indoor Air Impacts	5.0E+02	-			2.3E+03	8.5E+01	8.5E+01
SELENIUM	1.0E+01	Ecotoxicity	1.0E+03	1.0E+01			3.9E+02		(site-specific)
SILVER	2.0E+01	Ecotoxicity	1.0E+03	2.0E+01			3.9E+02		(site-specific)
STYRENE	1.5E+01	Groundwater Protection	5.0E+02	-			1.5E+03	1.5E+03	1.5E+01
tert-BUTYL ALCOHOL	7.0E+01	Direct Exposure	1.0E+02	-			7.0E+01	(Use soil gas)	1.1E+02
TETRACHLOROETHANE, 1,1,1,2-	3.1E+00	Direct Exposure	1.0E+02	-			3.1E+00	(Use soil gas)	5.5E+00
TETRACHLOROETHANE, 1,1,2,2-	7.2E-03	Indoor Air Impacts	5.0E+02	-			4.1E-01	7.2E-03	2.7E+00
TETRACHLOROETHYLENE	6.9E-02	Indoor Air Impacts	2.3E+02	-			4.8E-01	6.9E-02	1.4E+01
THALLIUM	5.2E+00	Direct Exposure	1.0E+03	-			5.2E+00		(site-specific)
TOLUENE	9.3E+00	Groundwater Protection	5.0E+02	-			6.5E+02	6.5E+02	9.3E+00
TOXAPHENE	4.2E-04	Groundwater Protection	5.0E+02	-			4.0E-01		4.2E-04
TPH (gasolines)	1.0E+02 (2.0E+03)	Ceiling Value (Leaching)	1.0E+02	-			8.0E+02	(Use soil gas)	2.0E+03
TPH (middle distillates)	5.0E+02 (5.0E+03)	Ceiling Value (Leaching)	5.0E+02	-			8.0E+02	(Use soil gas)	5.0E+03
TPH (residual fuels)	5.0E+02 (5.0E+03)	Ceiling Value (Leaching)	5.0E+02	-			2.3E+03		5.0E+03
TRICHLOROBENZENE, 1,2,4-	1.6E+00	Indoor Air Impacts	5.0E+02	3.0E+01			6.1E+01	1.6E+00	7.6E+00
TRICHLOROETHANE, 1,1,1-	7.8E+00	Groundwater Protection	5.0E+02	-			1.2E+03	3.9E+02	7.8E+00
TRICHLOROETHANE, 1,1,2-	2.6E-02	Indoor Air Impacts	1.0E+02	-			7.2E-01	2.6E-02	3.9E+00
TRICHLOROETHYLENE	3.6E-02	Indoor Air Impacts	5.0E+02	6.0E+01			5.2E-01	3.6E-02	6.8E+00
TRICHLOROPHENOL, 2,4,5-	1.8E-01	Groundwater Protection	1.0E+02	1.0E+01			2.5E+03	9.5E+01	1.8E-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)								
			Gross Contamination Ceiling Value (Odors, etc.)	[2]Urban Area Ecotoxicity Criteria	Other		[1]Human Health		Groundwater Protection (Soil Leaching)
							Direct Exposure	Vapor Intrusion Concerns	NON-Drinking Water Resource
CONTAMINANT	Final SAL	Basis	Table F-2	Table L	Value	Basis	Table I-1	Table C-1b	Table E-1
TRICHLOROPHENOL, 2,4,6-	6.1E+00	Direct Exposure	5.0E+02	1.0E+01			6.1E+00		1.6E+02
VANADIUM	7.8E+01	Direct Exposure	1.0E+03	2.0E+02			7.8E+01		(site-specific)
VINYL CHLORIDE	3.9E-02	Indoor Air Impacts	5.0E+02	6.0E+01			1.5E-01	3.9E-02	3.8E+00
XYLENES	1.1E+01	Groundwater Protection	4.2E+02	-			2.7E+02	1.8E+02	1.1E+01
ZINC	6.0E+02	Ecotoxicity	1.0E+03	6.0E+02			2.3E+04		(site-specific)
Electrical Conductivity (mS/cm, USEPA Method 120.1 MOD)	2.0		-	-			-	-	-
Sodium Adsorption Ratio	5.0		-	-			-	-	-

Notes:

1. Assumes current or future residential land use.
2. Based primarily on phytotoxicity. Included in selection of final soil action levels if less than one-half of the residential soil screening level for human-health, direct-exposure concerns (see Table L and Section 3.9 in text).

Final Soil Action Level is lowest of ceiling value (nuisance concerns etc.), ecotoxicity, direct-exposure, indoor-air impact, and leaching action levels.
Assumes soil pH 5.0 to 9.0.
Soil data should be reported on dry-weight basis (see Section 6.2).
TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories. Use of leaching based action levels noted in parentheses may be appropriate for deep or otherwise isolated soils that do not threaten a drinking water resource or sensitive aquatic habitat. Refer to Section 2.2.2 in Volume 1.
Background arsenic in soils - assumed maximum (refer to Section 6.1 in text).

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

CONTAMINANT	Physical State		[1,4]Residential Land Use		Commercial/Industrial Land Use	
			Vadose-Zone Soil Type		Vadose-Zone Soil Type	
			[2]High Permeability	[3]Low/Moderate Permeability	[2]High Permeability	[3]Low/Moderate Permeability
			(ug/L)	(ug/L)	(ug/L)	(ug/L)
#ACENAPHTHENE	V	S	4.2E+03	4.2E+03	4.2E+03	4.2E+03
ACENAPHTHYLENE	V	S	(Use soil gas)	(Use soil gas)	(Use soil gas)	(Use soil gas)
#ACETONE	V	L	2.1E+08	2.8E+08	7.5E+08	1.0E+09
ALDRIN	NV	S				
#ANTHRACENE	V	S	4.3E+01	4.3E+01	4.3E+01	4.3E+01
ANTIMONY	NV	S				
ARSENIC	NV	S				
BARIUM	NV	S				
#BENZENE	V	L	1.6E+03	5.7E+03	6.7E+03	2.4E+04
BENZO(a)ANTHRACENE	NV	S				
BENZO(a)PYRENE	NV	S				
BENZO(b)FLUORANTHENE	NV	S				
BENZO(g,h,i)PERYLENE	NV	S				
BENZO(k)FLUORANTHENE	NV	S				
BERYLLIUM	NV	S				
BIPHENYL, 1,1-	V	S	(Use soil gas)	(Use soil gas)	(Use soil gas)	(Use soil gas)
BIS(2-CHLOROETHYL)ETHER	V	L	1.0E+02	1.4E+02	4.4E+02	5.8E+02
BIS(2-CHLOROISOPROPYL)ETHER	V	L	(Use soil gas)	(Use soil gas)	(Use soil gas)	(Use soil gas)
BIS(2-ETHYLHEXYL)PHTHALATE	NV	S				
BORON	NV	S				
BROMODICHLOROMETHANE	V	L	2.7E+02	5.1E+02	1.1E+03	2.2E+03
BROMOFORM	NV	S				
BROMOMETHANE	V	G	2.3E+03	8.0E+03	8.2E+03	2.8E+04
CADMIUM	NV	S				
CARBON TETRACHLORIDE	V	L	2.1E+01	8.9E+01	8.8E+01	3.8E+02
CHLORDANE	NV	S				
CHLOROANILINE, p-	NV	S				
CHLOROBENZENE	V	L	5.3E+04	1.7E+05	1.9E+05	4.7E+05
CHLOROETHANE	V	G	6.5E+02	2.6E+03	2.8E+03	1.1E+04
CHLOROFORM	V	L	6.2E+01	2.1E+02	2.6E+02	9.0E+02
CHLOROMETHANE	V	G	9.5E+03	4.2E+04	3.4E+04	1.5E+05
CHLOROPHENOL, 2-	V	L	2.1E+04	6.3E+04	7.5E+04	2.2E+05
CHROMIUM (Total)	NV	S				
CHROMIUM III	NV	S				
CHROMIUM VI	NV	S				
CHRYSENE	NV	S	(Use soil gas)	(Use soil gas)	(Use soil gas)	(Use soil gas)
COBALT	NV	S				
COPPER	NV	S				

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

CONTAMINANT	Physical State		[1,4]Residential Land Use		Commercial/Industrial Land Use	
			Vadose-Zone Soil Type		Vadose-Zone Soil Type	
			[2]High Permeability (ug/L)	[3]Low/Moderate Permeability (ug/L)	[2]High Permeability (ug/L)	[3]Low/Moderate Permeability (ug/L)
CYANIDE (Free)	NV	S	(Use soil gas)	(Use soil gas)	(Use soil gas)	(Use soil gas)
DIBENZO(a,h)ANTHTRACENE	NV	S				
DIBROMO-3-CHLOROPROPANE, 1,2-	V	L	(Use soil gas)	(Use soil gas)	(Use soil gas)	(Use soil gas)
DIBROMOCHLOROMETHANE	V	S	1.6E+02	3.7E+02	1.2E+03	2.7E+03
DIBROMOETHANE, 1,2-	V	S	1.6E+01	2.5E+01	6.9E+01	1.1E+02
DICHLOROBENZENE, 1,2-	V	L	1.6E+05	1.6E+05	1.6E+05	1.6E+05
DICHLOROBENZENE, 1,3-	V	L	(Use soil gas)	(Use soil gas)	(Use soil gas)	(Use soil gas)
DICHLOROBENZENE, 1,4-	V	S	4.9E+02	1.4E+03	2.1E+03	5.9E+03
DICHLOROBENZIDINE, 3,3-	NV	S				
DICHLORODIPHENYLDICHLOROETHANE (DDD)	NV	S				
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	NV	S				
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	NV	S				
DICHLOROETHANE, 1,1-	V	L	2.8E+05	9.5E+05	9.8E+05	3.4E+06
DICHLOROETHANE, 1,2-	V	L	1.3E+02	3.2E+02	5.5E+02	1.4E+03
DICHLOROETHYLENE, 1,1-	V	L	2.5E+04	1.1E+05	8.8E+04	3.7E+05
DICHLOROETHYLENE, Cis 1,2-	V	L	2.4E+04	7.7E+04	8.6E+04	2.7E+05
DICHLOROETHYLENE, Trans 1,2-	V	L	2.7E+04	9.7E+04	9.4E+04	3.4E+05
DICHLOROPHENOL, 2,4-	NV	S				
DICHLOROPROPANE, 1,2-	V	L	1.2E+02	3.6E+02	5.0E+02	1.5E+03
DICHLOROPROPENE, 1,3-	V	L	1.6E+02	6.2E+02	6.6E+02	2.6E+03
DIELDRIN	NV	S				
DIETHYLPHTHALATE	NV	S				
#DIMETHYLPHENOL, 2,4-	V	S				
DIMETHYLPHTHALATE	NV	S				
DINITROPHENOL, 2,4-	NV	S				
DINITROTOLUENE, 2,4-	NV	S				
DIOXANE, 1,4-	NV	L				
DIOXIN (2,3,7,8-TCDD)	NV	S				
ENDOSULFAN	NV	S				
ENDRIN	NV	S				
#ETHYLBENZENE	V	L	1.7E+05	1.7E+05	1.7E+05	1.7E+05
FLUORANTHENE	NV	S				
#FLUORENE	V	S	1.9E+03	1.9E+03	1.9E+03	1.9E+03
HEPTACHLOR	NV	S				
HEPTACHLOR EPOXIDE	NV	S				
HEXACHLOROBENZENE	NV	S				
HEXACHLOROBUTADIENE	NV	S				

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

CONTAMINANT	Physical State		[1,4]Residential Land Use		Commercial/Industrial Land Use	
			Vadose-Zone Soil Type		Vadose-Zone Soil Type	
			[2]High Permeability	[3]Low/Moderate Permeability	[2]High Permeability	[3]Low/Moderate Permeability
			(ug/L)	(ug/L)	(ug/L)	(ug/L)
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	NV	S				
HEXACHLOROETHANE	NV	S				
INDENO(1,2,3-cd)PYRENE	NV	S				
LEAD	NV	S				
MERCURY	NV	S				
METHOXYCHLOR	NV	S				
#METHYL ETHYL KETONE	V	L	2.7E+08	2.7E+08	2.7E+08	2.7E+08
#METHYL ISOBUTYL KETONE	V	L	1.9E+07	1.9E+07	1.9E+07	1.9E+07
METHYL MERCURY	NV	S				
METHYL TERT BUTYL ETHER	V	L	1.9E+04	3.8E+04	8.0E+04	1.6E+05
METHYLENE CHLORIDE	V	L	4.2E+03	1.2E+04	1.8E+04	5.3E+04
#METHYLNAPHTHALENE (total 1- & 2-)	V	S	2.6E+04	2.6E+04	2.6E+04	2.6E+04
MOLYBDENUM	NV	S				
#NAPHTHALENE	V	S	3.1E+04	3.1E+04	3.1E+04	3.1E+04
NICKEL	NV	S				
PENTACHLOROPHENOL	NV	S				
PERCHLORATE	NV	S				
PHENANTHRENE	V	S	(Use soil gas)	(Use soil gas)	(Use soil gas)	(Use soil gas)
PHENOL	NV	S				
POLYCHLORINATED BIPHENYLS (PCBs)	NV	S				
#PYRENE	V	S	1.4E+02	1.4E+02	1.4E+02	1.4E+02
SELENIUM	NV	S				
SILVER	NV	S				
#STYRENE	V	L	3.1E+05	3.1E+05	3.1E+05	3.1E+05
tert-BUTYL ALCOHOL			(Use soil gas)	(Use soil gas)	(Use soil gas)	(Use soil gas)
TETRACHLOROETHANE, 1,1,1,2-	V	L	(Use soil gas)	(Use soil gas)	(Use soil gas)	(Use soil gas)
TETRACHLOROETHANE, 1,1,2,2-	V	L	1.5E+02	2.5E+02	6.4E+02	1.0E+03
TETRACHLOROETHYLENE	V	L	9.9E+01	4.0E+02	4.2E+02	1.7E+03
THALLIUM	NV	S				
#TOLUENE	V	L	5.3E+05	5.3E+05	5.3E+05	5.3E+05
TOXAPHENE	NV	S				
TPH (gasolines)	V	L	(Use soil gas)	(Use soil gas)	(Use soil gas)	(Use soil gas)
TPH (middle distillates)	V	L	(Use soil gas)	(Use soil gas)	(Use soil gas)	(Use soil gas)
TPH (residual fuels)	NV	L/S				
TRICHLOROBENZENE, 1,2,4-	V	L	1.0E+04	1.8E+04	3.6E+04	6.4E+04
TRICHLOROETHANE, 1,1,1-	V	L	5.0E+05	1.3E+06	1.3E+06	1.3E+06
TRICHLOROETHANE, 1,1,2-	V	L	2.8E+02	6.3E+02	1.2E+03	2.7E+03

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

CONTAMINANT	Physical State		[1,4]Residential Land Use		Commercial/Industrial Land Use	
			Vadose-Zone Soil Type		Vadose-Zone Soil Type	
			[2]High Permeability	[3]Low/Moderate Permeability	[2]High Permeability	[3]Low/Moderate Permeability
			(ug/L)	(ug/L)	(ug/L)	(ug/L)
TRICHLOROETHYLENE	V	L	7.4E+01	2.9E+02	3.1E+02	1.2E+03
TRICHLOROPHENOL, 2,4,5-	V	S	1.2E+06	1.2E+06	1.2E+06	1.2E+06
TRICHLOROPHENOL, 2,4,6-	NV	S				
VANADIUM	NV	S				
VINYL CHLORIDE	V	G	2.2E+01	9.9E+01	2.2E+02	9.8E+02
#XYLENES	V	L	1.6E+05	1.6E+05	1.6E+05	1.6E+05
ZINC	NV	S				

Notes:

1. "Residential" action levels generally considered adequate for other sensitive uses (e.g., day-care centers, hospitals, etc.).
2. High permeability soil model: One meter dry sandy soil (92% sand, 5% silt, 3% clay) over one meter moist clayey loam (33% sand, 34% silt, 33% clay).
3. Low/Moderate permeability soil model: One meter dry loamy sand (83% sand, 11% silt, 6% clay) over one meter moist silt (7% sand, 87% silt, 6% clay).
4. For inclusion in Tier 1 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 level for high-permeability vadose zone soils and residential land use used as default for screening purposes (refer to Table D-1a and D-1b).
Action levels calculated using spreadhseet provided with *User's Guide for the Johnson and Ettinger Indoor Air model (1991) for Subsurface Vapor* Intrusion Into Buildings (USEPA 2001). 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 2002).
Target cancer risk = 1E-06 unless otherwise noted, Target Hazard Quotient = 1.0; TCE target cancer risk = 1E-05.
"#": Nonchlorinated VOCs (except MTBE) adjusted upwards by factor of ten to account for assumed biodegradation in vadose-zone prior to emission at surface.
(Use Soil Gas): Chemical constants not available for modeling. Use soil gas data to evaluate potential indoor-air impact concerns.

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

CONTAMINANT	Physical State		[1]Residential Exposure (mg/kg)	Commercial/Industrial Exposure (mg/kg)
#ACENAPHTHENE	V	S	1.3E+02	1.3E+02
ACENAPHTHYLENE	V	S	(Use soil gas)	(Use soil gas)
#ACETONE	V	L	5.6E+03	1.6E+04
ALDRIN	NV	S		
#ANTHRACENE	V	S	6.1E+00	6.1E+00
ANTIMONY	NV	S		
ARSENIC	NV	S		
BARIUM	NV	S		
#BENZENE	V	L	5.3E-01	1.9E+00
BENZO(a)ANTHRACENE	NV	S		
BENZO(a)PYRENE	NV	S		
BENZO(b)FLUORANTHENE	NV	S		
BENZO(g,h,i)PERYLENE	NV	S		
BENZO(k)FLUORANTHENE	NV	S		
BERYLLIUM	NV	S		
BIPHENYL, 1,1-	V	S	(Use soil gas)	(Use soil gas)
BIS(2-CHLOROETHYL)ETHER	V	L	6.7E-03	2.8E-02
BIS(2-CHLOROISOPROPYL)ETHER	V	L	(Use soil gas)	(Use soil gas)
BIS(2-ETHYLHEXYL)PHTHALATE	NV	S		
BORON	NV	S		
BROMODICHLOROMETHANE	V	L	2.3E-02	8.2E-02
BROMOFORM	NV	S		
BROMOMETHANE	V	G	8.6E-01	2.5E+00
CADMIUM	NV	S		
CARBON TETRACHLORIDE	V	L	2.7E-02	9.6E-02
CHLORDANE	NV	S		
CHLOROANILINE, p-	NV	S		
CHLOROBENZENE	V	L	1.0E+01	3.1E+01
CHLOROETHANE	V	G	5.0E-01	1.8E+00
CHLOROFORM	V	L	1.8E-02	6.3E-02
CHLOROMETHANE	V	G	1.6E+01	4.7E+01
CHLOROPHENOL, 2-	V	L	3.4E+00	1.2E+01
CHROMIUM (Total)	NV	S		
CHROMIUM III	NV	S		
CHROMIUM VI	NV	S		
CHRYSENE	NV	S	(Use soil gas)	(Use soil gas)
COBALT	NV	S		
COPPER	NV	S		
CYANIDE (Free)	NV	S	(Use soil gas)	(Use soil gas)
DIBENZO(a,h)ANTHTRACENE	NV	S		
DIBROMO-3-CHLOROPROPANE, 1,2-	V	L	(Use soil gas)	(Use soil gas)
DIBROMOCHLOROMETHANE	V	S	1.7E-02	1.1E-01
DIBROMOETHANE, 1,2-	V	S	7.2E-04	2.5E-03
DICHLOROBENZENE, 1,2-	V	L	3.5E+01	1.0E+02
DICHLOROBENZENE, 1,3-	V	L	(Use soil gas)	(Use soil gas)
DICHLOROBENZENE, 1,4-	V	S	6.5E-02	2.3E-01
DICHLOROBENZIDINE, 3,3-	NV	S		
DICHLORODIPHENYLDICHLOROETHANE (DDD)	NV	S		
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	NV	S		
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	NV	S		
DICHLOROETHANE, 1,1-	V	L	8.6E+01	2.5E+02

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

CONTAMINANT	Physical State		[1]Residential Exposure (mg/kg)	Commercial/Industrial Exposure (mg/kg)
DICHLOROETHANE, 1,2-	V	L	1.6E-02	5.6E-02
DICHLOROETHYLENE, 1,1-	V	L	3.5E+01	1.0E+02
DICHLOROETHYLENE, Cis 1,2-	V	L	6.2E+00	1.8E+01
DICHLOROETHYLENE, Trans 1,2-	V	L	1.2E+01	3.6E+01
DICHLOROPHENOL, 2,4-	NV	S		
DICHLOROPROPANE, 1,2-	V	L	2.1E-02	7.5E-02
DICHLOROPROPENE, 1,3-	V	L	1.0E-01	3.6E-01
DIELDRIN	NV	S		
DIETHYLPHTHALATE	NV	S		
#DIMETHYLPHENOL, 2,4-	V	S		
DIMETHYLPHTHALATE	NV	S		
DINITROPHENOL, 2,4-	NV	S		
DINITROTOLUENE, 2,4-	NV	S		
DIOXANE, 1,4-	NV	L		
DIOXIN (2,3,7,8-TCDD)	NV	S		
ENDOSULFAN	NV	S		
ENDRIN	NV	S		
#ETHYLBENZENE	V	L	3.9E+02	3.9E+02
FLUORANTHENE	NV	S		
#FLUORENE	V	S	1.6E+02	1.6E+02
HEPTACHLOR	NV	S		
HEPTACHLOR EPOXIDE	NV	S		
HEXACHLOROBENZENE	NV	S		
HEXACHLOROBUTADIENE	NV	S		
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	NV	S		
HEXACHLOROETHANE	NV	S		
INDENO(1,2,3-cd)PYRENE	NV	S		
LEAD	NV	S		
MERCURY	NV	S		
METHOXYCHLOR	NV	S		
#METHYL ETHYL KETONE	V	L	1.9E+04	3.4E+04
#METHYL ISOBUTYL KETONE	V	L	1.7E+04	1.7E+04
METHYL MERCURY	NV	S		
METHYL TERT BUTYL ETHER	V	L	1.6E+00	5.6E+00
METHYLENE CHLORIDE	V	L	9.0E-01	3.2E+00
#METHYLNAPHTHALENE (total 1- & 2-)	V	S	1.1E+02	1.1E+02
MOLYBDENUM	NV	S		
#NAPHTHALENE	V	S	1.8E+01	6.1E+01
NICKEL	NV	S		
PENTACHLOROPHENOL	NV	S		
PERCHLORATE	NV	S		
PHENANTHRENE	V	S	(Use soil gas)	(Use soil gas)
PHENOL	NV	S		
POLYCHLORINATED BIPHENYLS (PCBs)	NV	S		
#PYRENE	V	S	8.5E+01	8.5E+01
SELENIUM	NV	S		
SILVER	NV	S		
#STYRENE	V	L	1.5E+03	1.5E+03
tert-BUTYL ALCOHOL	V	L	(Use soil gas)	(Use soil gas)
TETRACHLOROETHANE, 1,1,1,2-	V	L	(Use soil gas)	(Use soil gas)
TETRACHLOROETHANE, 1,1,2,2-	V	L	7.2E-03	2.5E-02

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

CONTAMINANT	Physical State		[1]Residential Exposure (mg/kg)	Commercial/Industrial Exposure (mg/kg)
TETRACHLOROETHYLENE	V	L	6.9E-02	2.4E-01
THALLIUM	NV	S		
#TOLUENE	V	L	6.5E+02	6.5E+02
TOXAPHENE	NV	S		
TPH (gasolines)	V	L	(Use soil gas)	(Use soil gas)
TPH (middle distillates)	V	L	(Use soil gas)	(Use soil gas)
TPH (residual fuels)	NV	L/S		
TRICHLOROBENZENE, 1,2,4-	V	L	1.6E+00	5.3E+00
TRICHLOROETHANE, 1,1,1-	V	L	3.9E+02	1.1E+03
TRICHLOROETHANE, 1,1,2-	V	L	2.6E-02	9.1E-02
TRICHLOROETHYLENE	V	L	3.6E-02	1.3E-01
TRICHLOROPHENOL, 2,4,5-	V	S	9.5E+01	3.1E+02
TRICHLOROPHENOL, 2,4,6-	NV	S		
VANADIUM	NV	S		
VINYL CHLORIDE	V	G	3.9E-02	1.6E-01
#XYLENES	V	L	1.8E+02	4.2E+02
ZINC	NV	S		

Notes:

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

Action levels calculated using spreadhseet provided with *User's Guide for the Johnson and Ettinger Indoor Air Model (1991) for Subsurface Vapor Intrusion Into Buildings* (USEPA 2000 and updates).
Soil model: Two meters dry sandy soil (92% sand, 5% silt, 3% clay) directly underlying building foundation.
Physical state of chemical at ambient conditions (V - volatile, NV - nonvolatile, S -solid, L - liquid, G - gas).
Chemical considered to be "volatile" if Henry's number (atm m3/mole) >0.00001 and molecular weight <200.
Dibromochloromethane, dibromochloropropane and pyrene considered volatile for purposes of modeling (USEPA 2002).
Target cancer risk = 1E-06 unless otherwise noted, Target Hazard Quotient = 1.0; TCE target cancer risk = 1E-05.
"#": Nonchlorinated VOCs (except MTBE) adjusted upwards by factor of ten to account for assumed biodegradation in vadose-zone prior to emission at surface.
(Use Soil Gas): Chemical constants not available for modeling. Use soil gas data to evaluate potential indoor-air impact concerns.

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

CONTAMINANT	Physical State		[2]Residential Exposure			Commercial/Industrial Land Use		
			Lowest Residential (ug/m^3)	Carcinogenic Effects (ug/m^3)	Noncarcinogenic Effects (ug/m^3)	Lowest C/I (ug/m^3)	Carcinogenic Effects (ug/m^3)	Noncarcinogenic Effects (ug/m^3)
ACENAPHTHENE	V	S	2.2E+05		2.2E+05	6.1E+05		6.1E+05
ACENAPHTHYLENE	V	S	1.5E+05		1.5E+05	4.1E+05		4.1E+05
ACETONE	V	L	3.3E+06		3.3E+06	9.2E+06		9.2E+06
ALDRIN	NV	S						
ANTHRACENE	V	S	1.1E+06		1.1E+06	3.1E+06		3.1E+06
ANTIMONY	NV	S						
ARSENIC	NV	S						
BARIUM	NV	S						
BENZENE	V	L	2.5E+02	2.5E+02	3.1E+04	1.1E+03	1.1E+03	8.8E+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	1.8E+05		1.8E+05	5.1E+05		5.1E+05
BIS(2-CHLOROETHYL)ETHER	V	L	5.6E+00	5.6E+00		2.4E+01	2.4E+01	
BIS(2-CHLOROISOPROPYL)ETHER	V	L	1.9E+02	1.9E+02	1.5E+05	8.2E+02	8.2E+02	4.1E+05
BIS(2-ETHYLHEXYL)PHTHALATE	NV	S						
BORON	NV	S						
BROMODICHLOROMETHANE	V	L	1.1E+02	1.1E+02	7.3E+04	4.6E+02	4.6E+02	2.0E+05
BROMOFORM	NV	S						
BROMOMETHANE	V	G	5.1E+03		5.1E+03	1.4E+04		1.4E+04
CADMIUM	NV	S						
CARBON TETRACHLORIDE	V	L	1.3E+02	1.3E+02	2.6E+03	5.4E+02	5.4E+02	7.2E+03
CHLORDANE	NV	S						
CHLOROANILINE, p-	NV	S						
CHLOROBENZENE	V	L	6.2E+04		6.2E+04	1.7E+05		1.7E+05
CHLOROETHANE	V	G	2.3E+03	2.3E+03	1.1E+07	9.9E+03	9.9E+03	3.0E+07
CHLOROFORM	V	L	8.3E+01	8.3E+01	5.1E+04	3.5E+02	3.5E+02	1.4E+05
CHLOROMETHANE	V	G	9.5E+04		9.5E+04	2.7E+05		2.7E+05
CHLOROPHENOL, 2-	V	L	1.8E+04		1.8E+04	5.1E+04		5.1E+04
CHROMIUM (Total)	NV	S						
CHROMIUM III	NV	S						
CHROMIUM VI	NV	S						
CHRYSENE	NV	S						
COBALT	NV	S						
COPPER	NV	S						

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

CONTAMINANT	Physical State		[2]Residential Exposure			Commercial/Industrial Land Use		
			Lowest Residential (ug/m^3)	Carcinogenic Effects (ug/m^3)	Noncarcinogenic Effects (ug/m^3)	Lowest C/I (ug/m^3)	Carcinogenic Effects (ug/m^3)	Noncarcinogenic Effects (ug/m^3)
CYANIDE (Free)	NV	S						
DIBENZO(a,h)ANTHTRACENE	NV	S						
DIBROMO-3-CHLOROPROPANE, 1,2-	V	L	2.1E+02	2.8E+03	2.1E+02	5.8E+02	1.2E+04	5.8E+02
DIBROMOCHLOROMETHANE	V	S	8.0E+01	8.0E+01	7.3E+04	3.4E+02	3.4E+02	2.0E+05
DIBROMOETHANE, 1,2-	V	S	3.4E+00	3.4E+00	9.5E+03	1.4E+01	1.4E+01	2.7E+04
DICHLOROBENZENE, 1,2-	V	L	2.1E+05		2.1E+05	5.8E+05		5.8E+05
DICHLOROBENZENE, 1,3-	V	L	1.1E+05		1.1E+05	3.1E+05		3.1E+05
DICHLOROBENZENE, 1,4-	V	S	3.1E+02	3.1E+02	1.1E+05	1.3E+03	1.3E+03	3.1E+05
DICHLOROBENZIDINE, 3,3-	NV	S						
DICHLORODIPHENYLDICHLOROETHANE (DDD)	NV	S						
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	NV	S						
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	NV	S						
DICHLOROETHANE, 1,1-	V	L	5.1E+05		5.1E+05	1.4E+06		1.4E+06
DICHLOROETHANE, 1,2-	V	L	7.4E+01	7.4E+01	5.1E+03	3.1E+02	3.1E+02	1.4E+04
DICHLOROETHYLENE, 1,1-	V	L	2.1E+05		2.1E+05	5.8E+05		5.8E+05
DICHLOROETHYLENE, Cis 1,2-	V	L	3.7E+04		3.7E+04	1.0E+05		1.0E+05
DICHLOROETHYLENE, Trans 1,2-	V	L	7.3E+04		7.3E+04	2.0E+05		2.0E+05
DICHLOROPHENOL, 2,4-	NV	S						
DICHLOROPROPANE, 1,2-	V	L	9.9E+01	9.9E+01	4.0E+03	4.2E+02	4.2E+02	1.1E+04
DICHLOROPROPENE, 1,3-	V	L	4.8E+02	4.8E+02	2.1E+04	2.0E+03	2.0E+03	5.8E+04
DIELDRIN	NV	S						
DIETHYLPHTHALATE	NV	S						
DIMETHYLPHENOL, 2,4-	V	S						
DIMETHYLPHTHALATE	NV	S						
DINITROPHENOL, 2,4-	NV	S						
DINITROTOLUENE, 2,4-	NV	S						
DIOXANE, 1,4-	NV	L						
DIOXIN (2,3,7,8-TCDD)	NV	S						
ENDOSULFAN	NV	S						
ENDRIN	NV	S						
ETHYLBENZENE	V	L	1.1E+06		1.1E+06	3.0E+06		3.0E+06
FLUORANTHENE	NV	S						
FLUORENE	V	S	1.5E+05		1.5E+05	4.1E+05		4.1E+05
HEPTACHLOR	NV	S						
HEPTACHLOR EPOXIDE	NV	S						
HEXACHLOROBENZENE	NV	S						
HEXACHLOROBUTADIENE	NV	S						
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	NV	S						

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

CONTAMINANT	Physical State		[2]Residential Exposure			Commercial/Industrial Land Use		
			Lowest Residential (ug/m^3)	Carcinogenic Effects (ug/m^3)	Noncarcinogenic Effects (ug/m^3)	Lowest C/I (ug/m^3)	Carcinogenic Effects (ug/m^3)	Noncarcinogenic Effects (ug/m^3)
HEXACHLOROETHANE	NV	S						
INDENO(1,2,3-cd)PYRENE	NV	S						
LEAD	NV	S						
MERCURY	NV	S						
METHOXYCHLOR	NV	S						
METHYL ETHYL KETONE	V	L	5.1E+06		5.1E+06	1.4E+07		1.4E+07
METHYL ISOBUTYL KETONE	V	L	3.1E+06		3.1E+06	8.8E+06		8.8E+06
METHYL MERCURY	NV	S						
METHYL TERT BUTYL ETHER	V	L	7.4E+03	7.4E+03	3.1E+06	3.1E+04	3.1E+04	8.8E+06
METHYLENE CHLORIDE	V	L	4.2E+03	4.2E+03	3.1E+06	1.8E+04	1.8E+04	8.8E+06
METHYLNAPHTHALENE (total 1- & 2-)	V	S	1.5E+05		1.5E+05	4.1E+05		4.1E+05
MOLYBDENUM	NV	S						
NAPHTHALENE	V	S	3.1E+03		3.1E+03	8.8E+03		8.8E+03
NICKEL	NV	S						
PENTACHLOROPHENOL	NV	S						
PERCHLORATE	NV	S						
PHENANTHRENE	V	S	1.5E+05		1.5E+05	4.1E+05		4.1E+05
PHENOL	NV	S						
POLYCHLORINATED BIPHENYLS (PCBs)	NV	S						
PYRENE	V	S	1.1E+05		1.1E+05	3.1E+05		3.1E+05
SELENIUM	NV	S						
SILVER	NV	S						
STYRENE	V	L	1.1E+06		1.1E+06	3.0E+06		3.0E+06
tert-BUTYL ALCOHOL	V	L	2.2E+03	2.2E+03		9.5E+03	9.5E+03	
TETRACHLOROETHANE, 1,1,1,2-	V	L	2.6E+02	2.6E+02	1.1E+05	1.1E+03	1.1E+03	3.1E+05
TETRACHLOROETHANE, 1,1,2,2-	V	L	3.4E+01	3.4E+01	2.2E+05	1.4E+02	1.4E+02	6.1E+05
TETRACHLOROETHYLENE	V	L	3.2E+02	3.2E+02	3.7E+04	1.4E+03	1.4E+03	1.0E+05
THALLIUM	NV	S						
TOLUENE	V	L	4.0E+05		4.0E+05	1.1E+06		1.1E+06
TOXAPHENE	NV	S						
TPH (gasolines)	V	L	5.1E+04		5.1E+04	1.4E+05		1.4E+05
TPH (middle distillates)	V	L	5.1E+04		5.1E+04	1.4E+05		1.4E+05
TPH (residual fuels)	NV	L/S						
TRICHLOROBENZENE, 1,2,4-	V	L	3.7E+03		3.7E+03	1.0E+04		1.0E+04
TRICHLOROETHANE, 1,1,1-	V	L	2.3E+06		2.3E+06	6.4E+06		6.4E+06
TRICHLOROETHANE, 1,1,2-	V	L	1.2E+02	1.2E+02	1.5E+04	5.1E+02	5.1E+02	4.1E+04
TRICHLOROETHYLENE	V	L	1.7E+02	1.7E+02	3.7E+04	7.2E+02	7.2E+02	1.0E+05
TRICHLOROPHENOL, 2,4,5-	V	S	3.7E+05		3.7E+05	1.0E+06		1.0E+06

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

CONTAMINANT	Physical State		[2]Residential Exposure			Commercial/Industrial Land Use		
			Lowest Residential (ug/m^3)	Carcinogenic Effects (ug/m^3)	Noncarcinogenic Effects (ug/m^3)	Lowest C/I (ug/m^3)	Carcinogenic Effects (ug/m^3)	Noncarcinogenic Effects (ug/m^3)
TRICHLOROPHENOL, 2,4,6-	NV	S						
VANADIUM	NV	S						
VINYL CHLORIDE (nonresidential exposure)	V	G	4.2E+02	4.2E+02	1.0E+05	1.8E+03	1.8E+03	2.9E+05
VINYL CHLORIDE (residential exposure)	V	G	9.3E+01	9.3E+01	1.0E+05	9.2E+02	9.2E+02	2.9E+05
XYLENES	V	L	1.1E+05		1.1E+05	3.0E+05		3.0E+05
ZINC	NV	S						

Notes:

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

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 2002).
Target cancer risk = 1E-06 unless otherwise noted, Target Hazard Quotient = 1.0; TCE target cancer risk = 1E-05.
Residential soil gas:indoor air attenuation factor = 0.001 (1/1000). Commercial/industrial soil gas:indoor air attenuation factor = 0.0005 (1/2000).
Soil gas action levels do not address mass-balance issues. May be overly conservative for sites with low permeability shallow soils or limited soil impacts and no groundwater source of VOCs.
Indoor-air sampling and/or passive vapor mitigation measures may be prudent for sites where concentrations of chemicals in soil gas approach but do not exceed screening levels.

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

CONTAMINANT	Physical State		Health-Based Action Levels: Unit Risk Factor URF $(ug/m^3)^{-1}$	Reference Concentration RfC (ug/m^3)	[1]Residential Exposure: Lowest Residential (ug/m^3)	Indoor Air (carcinogens) (ug/m^3)	Indoor Air (noncarcinogens) (ug/m^3)	Commercial/Industrial Exposure: Lowest C/I (ug/m^3)	Indoor Air (carcinogens) (ug/m^3)	Indoor Air (noncarcinogens) (ug/m^3)	50% Odor Recognition Threshold (Table F-2) (ug/m^3)
ACENAPHTHENE	V	S		2.1E+02	2.2E+02		2.2E+02	3.1E+02		3.1E+02	5.13E+02
ACENAPHTHYLENE	V	S		1.4E+02	1.5E+02		1.5E+02	2.0E+02		2.0E+02	-
ACETONE	V	L		3.2E+03	3.3E+03		3.3E+03	4.6E+03		4.6E+03	3.09E+04
ALDRIN	NV	S									2.63E+02
ANTHRACENE	V	S		1.1E+03	1.1E+03		1.1E+03	1.5E+03		1.5E+03	-
ANTIMONY	NV	S									-
ARSENIC	NV	S									-
BARIUM	NV	S									-
BENZENE	V	L	7.7E-06	3.0E+01	2.5E-01	2.5E-01	3.1E+01	5.3E-01	5.3E-01	4.4E+01	4.89E+03
BENZO(a)ANTHRACENE	NV	S									-
BENZO(a)PYRENE	NV	S									-
BENZO(b)FLUORANTHENE	NV	S									-
BENZO(g,h,i)PERYLENE	NV	S									-
BENZO(k)FLUORANTHENE	NV	S									-
BERYLLIUM	NV	S									-
BIPHENYL, 1,1-	V	S		1.8E+02	1.8E+02		1.8E+02	2.6E+02		2.6E+02	6.00E+01
BIS(2-CHLOROETHYL)ETHER	V	L	3.4E-04		5.6E-03	5.6E-03		1.2E-02	1.2E-02		2.87E+02
BIS(2-CHLOROISOPROPYL)ETHER	V	L	1.0E-05	1.4E+02	1.9E-01	1.9E-01	1.5E+02	4.1E-01	4.1E-01	2.0E+02	2.24E+03
BIS(2-ETHYLHEXYL)PHTHALATE	NV	S									-
BORON	NV	S									-
BROMODICHLOROMETHANE	V	L	1.8E-05	7.0E+01	1.1E-01	1.1E-01	7.3E+01	2.3E-01	2.3E-01	1.0E+02	1.10E+07
BROMOFORM	NV	S									1.35E+04
BROMOMETHANE	V	G		4.9E+00	5.1E+00		5.1E+00	7.2E+00		7.2E+00	8.00E+04
CADMIUM	NV	S									-
CARBON TETRACHLORIDE	V	L	1.5E-05	2.5E+00	1.3E-01	1.3E-01	2.6E+00	2.7E-01	2.7E-01	3.6E+00	6.30E+04
CHLORDANE	NV	S									8.40E+00
CHLOROANILINE, p-	NV	S									-
CHLOROBENZENE	V	L		6.0E+01	6.2E+01		6.2E+01	8.7E+01		8.7E+01	1.00E+03
CHLOROETHANE	V	G	8.3E-07	1.0E+04	2.3E+00	2.3E+00	1.1E+04	4.9E+00	4.9E+00	1.5E+04	3.80E+05
CHLOROFORM	V	L	2.3E-05	4.9E+01	8.3E-02	8.3E-02	5.1E+01	1.8E-01	1.8E-01	7.2E+01	4.22E+05
CHLOROMETHANE	V	G		9.1E+01	9.5E+01		9.5E+01	1.3E+02		1.3E+02	-
CHLOROPHENOL, 2-	V	L		1.8E+01	1.8E+01		1.8E+01	2.6E+01		2.6E+01	1.90E+01
CHROMIUM (Total)	NV	S									-
CHROMIUM III	NV	S									-
CHROMIUM VI	NV	S									-
CHRYSENE	NV	S									-
COBALT	NV	S									-
COPPER	NV	S									-
CYANIDE (Free)	NV	S									6.52E+02
DIBENZO(a,h)ANTHTRACENE	NV	S									-
DIBROMO-3-CHLOROPROPANE, 1,2-	V	L	6.9E-07	2.0E-01	2.1E-01	2.8E+00	2.1E-01	2.9E-01	6.0E+00	2.9E-01	-
DIBROMOCHLOROMETHANE	V	S	2.4E-05	7.0E+01	8.0E-02	8.0E-02	7.3E+01	1.7E-01	1.7E-01	1.0E+02	-

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

CONTAMINANT	Physical State		Health-Based Action Levels: Unit Risk Factor URF $(ug/m^3)^{-1}$	Reference Concentration RfC (ug/m^3)	Residential Exposure: Lowest Residential (ug/m^3)	Residential Exposure: Indoor Air (carcinogens) (ug/m^3)	Residential Exposure: Indoor Air (noncarcinogens) (ug/m^3)	Commercial/Industrial Exposure: Lowest C/I (ug/m^3)	Commercial/Industrial Exposure: Indoor Air (carcinogens) (ug/m^3)	Commercial/Industrial Exposure: Indoor Air (noncarcinogens) (ug/m^3)	50% Odor Recognition Threshold (Table F-2) (ug/m^3)
DIBROMOETHANE, 1,2-	V	S	5.7E-04	9.1E+00	3.4E-03	3.4E-03	9.5E+00	7.2E-03	7.2E-03	1.3E+01	2.00E+05
DICHLOROBENZENE, 1,2-	V	L		2.0E+02	2.1E+02		2.1E+02	2.9E+02		2.9E+02	3.05E+05
DICHLOROBENZENE, 1,3-	V	L		1.1E+02	1.1E+02		1.1E+02	1.5E+02		1.5E+02	-
DICHLOROBENZENE, 1,4-	V	S	6.3E-06	1.1E+02	3.1E-01	3.1E-01	1.1E+02	6.5E-01	6.5E-01	1.5E+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		4.9E+02	5.1E+02		5.1E+02	7.2E+02		7.2E+02	1.25E+05
DICHLOROETHANE, 1,2-	V	L	2.6E-05	4.9E+00	7.4E-02	7.4E-02	5.1E+00	1.6E-01	1.6E-01	7.2E+00	2.42E+03
DICHLOROETHYLENE, 1,1-	V	L		2.0E+02	2.1E+02		2.1E+02	2.9E+02		2.9E+02	2.00E+06
DICHLOROETHYLENE, Cis 1,2-	V	L		3.5E+01	3.7E+01		3.7E+01	5.1E+01		5.1E+01	-
DICHLOROETHYLENE, Trans 1,2-	V	L		7.0E+01	7.3E+01		7.3E+01	1.0E+02		. 1.0E+02	6.73E+04
DICHLOROPHENOL, 2,4-	NV	S									1.40E+03
DICHLOROPROPANE, 1,2-	V	L	1.9E-05	3.9E+00	9.9E-02	9.9E-02	4.0E+00	2.1E-01	2.1E-01	5.6E+00	1.19E+03
DICHLOROPROPENE, 1,3-	V	L	4.0E-06	2.0E+01	4.8E-01	4.8E-01	2.1E+01	1.0E+00	1.0E+00	2.9E+01	4.16E+03
DIELDRIN	NV	S									-
DIETHYLPHTHALATE	NV	S									-
DIMETHYLPHENOL, 2,4-	V	S									1.00E+00
DIMETHYLPHTHALATE	NV	S									-
DINITROPHENOL, 2,4-	NV	S									-
DINITROTOLUENE, 2,4-	NV	S									-
DIOXANE, 1,4-	NV	L									6.12E+05
DIOXIN (2,3,7,8-TCDD)	NV	S									-
ENDOSULFAN	NV	S									-
ENDRIN	NV	S									-
ETHYLBENZENE	V	L		1.0E+03	1.1E+03		1.1E+03	1.5E+03		1.5E+03	2.00E+03
FLUORANTHENE	NV	S									-
FLUORENE	V	S		1.4E+02	1.5E+02		1.5E+02	2.0E+02		2.0E+02	-
HEPTACHLOR	NV	S									3.00E+02
HEPTACHLOR EPOXIDE	NV	S									3.00E+02
HEXACHLOROBENZENE	NV	S									-
HEXACHLOROBUTADIENE	NV	S									1.20E+04
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	NV	S									-
HEXACHLOROETHANE	NV	S									-
INDENO(1,2,3-cd)PYRENE	NV	S									-
LEAD	NV	S									-
MERCURY	NV	S									-
METHOXYCHLOR	NV	S									-
METHYL ETHYL KETONE	V	L		4.9E+03	5.1E+03		5.1E+03	7.2E+03		7.2E+03	3.20E+04
METHYL ISOBUTYL KETONE	V	L		3.0E+03	3.1E+03		3.1E+03	4.4E+03		4.4E+03	4.20E+02
METHYL MERCURY	NV	S									-

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

CONTAMINANT	Physical State		Health-Based Action Levels: Unit Risk Factor URF $(ug/m^3)^{-1}$	Reference Concentration RfC (ug/m^3)	Residential Exposure: Lowest Residential (ug/m^3)	Residential Exposure: Indoor Air (carcinogens) (ug/m^3)	Residential Exposure: Indoor Air (noncarcinogens) (ug/m^3)	Commercial/Industrial Exposure: Lowest C/I (ug/m^3)	Commercial/Industrial Exposure: Indoor Air (carcinogens) (ug/m^3)	Commercial/Industrial Exposure: Indoor Air (noncarcinogens) (ug/m^3)	50% Odor Recognition Threshold (Table F-2) (ug/m^3)
METHYL TERT BUTYL ETHER	V	L	2.6E-07	3.0E+03	7.4E+00	7.4E+00	3.1E+03	1.6E+01	1.6E+01	4.4E+03	5.30E+02
METHYLENE CHLORIDE	V	L	4.6E-07	3.0E+03	4.2E+00	4.2E+00	3.1E+03	8.9E+00	8.9E+00	4.4E+03	5.60E+05
METHYLNAPHTHALENE (total 1- & 2-)	V	S		1.4E+02	1.5E+02		1.5E+02	2.0E+02		2.0E+02	6.80E+01
MOLYBDENUM	NV	S									-
NAPHTHALENE	V	S		3.0E+00	3.1E+00		3.1E+00	4.4E+00		4.4E+00	4.40E+02
NICKEL	NV	S									-
PENTACHLOROPHENOL	NV	S									-
PERCHLORATE	NV	S									-
PHENANTHRENE	V	S		1.4E+02	1.5E+02		1.5E+02	2.0E+02		2.0E+02	5.50E+01
PHENOL	NV	S									1.56E+02
POLYCHLORINATED BIPHENYLS (PCBs)	NV	S									-
PYRENE	V	S		1.1E+02	1.1E+02		1.1E+02	1.5E+02		1.5E+02	-
SELENIUM	NV	S									-
SILVER	NV	S									-
STYRENE	V	L		1.0E+03	1.1E+03		1.1E+03	1.5E+03		1.5E+03	1.36E+03
tert-BUTYL ALCOHOL	V	L	8.6E-07		2.2E+00	2.2E+00		4.8E+00	4.8E+00		-
TETRACHLOROETHANE, 1,1,1,2-	V	L	7.4E-06	1.1E+02	2.6E-01	2.6E-01	1.1E+02	5.5E-01	5.5E-01	1.5E+02	-
TETRACHLOROETHANE, 1,1,2,2-	V	L	5.7E-05	2.1E+02	3.4E-02	3.4E-02	2.2E+02	7.2E-02	7.2E-02	3.1E+02	1.05E+04
TETRACHLOROETHYLENE	V	L	6.0E-06	3.5E+01	3.2E-01	3.2E-01	3.7E+01	6.8E-01	6.8E-01	5.1E+01	3.17E+04
THALLIUM	NV	S									-
TOLUENE	V	L		3.9E+02	4.0E+02		4.0E+02	5.6E+02		5.6E+02	3.00E+04
TOXAPHENE	NV	S									-
TPH (gasolines)	V	L		4.9E+01	5.1E+01		5.1E+01	7.2E+01		7.2E+01	1.00E+02
TPH (middle distillates)	V	L		4.9E+01	5.1E+01		5.1E+01	7.2E+01		7.2E+01	1.00E+03
TPH (residual fuels)	NV	L/S									-
TRICHLOROBENZENE, 1,2,4-	V	L		3.5E+00	3.7E+00		3.7E+00	5.1E+00		5.1E+00	2.20E+04
TRICHLOROETHANE, 1,1,1-	V	L		2.2E+03	2.3E+03		2.3E+03	3.2E+03		3.2E+03	6.51E+04
TRICHLOROETHANE, 1,1,2-	V	L	1.6E-05	1.4E+01	1.2E-01	1.2E-01	1.5E+01	2.6E-01	2.6E-01	2.0E+01	-
TRICHLOROETHYLENE	V	L	1.1E-04	3.5E+01	1.7E-01	1.7E-01	3.7E+01	3.6E-01	3.6E-01	5.1E+01	1.36E+06
TRICHLOROPHENOL, 2,4,5-	V	S		3.5E+02	3.7E+02		3.7E+02	5.1E+02		5.1E+02	-
TRICHLOROPHENOL, 2,4,6-	NV	S									3.00E-01
VANADIUM	NV	S									-

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

CONTAMINANT	Physical State		Health-Based Action Levels: Unit Risk Factor URF $(ug/m^3)^{-1}$	Reference Concentration RfC (ug/m^3)	[1]Residential Exposure: Lowest Residential (ug/m^3)	Indoor Air (carcinogens) (ug/m^3)	Indoor Air (noncarcinogens) (ug/m^3)	Commercial/Industrial Exposure: Lowest C/I (ug/m^3)	Indoor Air (carcinogens) (ug/m^3)	Indoor Air (noncarcinogens) (ug/m^3)	50% Odor Recognition Threshold (Table F-2) (ug/m^3)
VINYL CHLORIDE (nonresidential exposure)	V	G	4.6E-06	1.0E+02	4.2E-01	4.2E-01	1.0E+02	8.9E-01	8.9E-01	1.5E+02	7.71E+05
VINYL CHLORIDE (residential exposure)	V	G	8.9E-06	1.0E+02	9.3E-02	9.3E-02	1.0E+02	4.6E-01	4.6E-01	1.5E+02	4.41E+02
XYLENES	V	L		1.0E+02	1.1E+02		1.1E+02	1.5E+02		1.5E+02	4.41E+02
ZINC	NV	S									-

Notes:

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

Target cancer risk = 1E-06 unless otherwise noted, Target Hazard Quotient = 1.0; TCE target cancer risk = 1E-05.
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 2002).
Calculated based on spreadhseet provided with User's Guide for the Johnson and Ettinger Indoor Air model (1991) for Subsurface Vapor Intrusion Into Buildings (USEPA 1997) using default input parameter values noted in Appendix 4 (see text for equations).
Indoor air action levels listed only for volatile chemicals included in database of referenced model spreadsheet (plus MTBE).
URFs from referenced spreadhseet (USEPA 2000). RfCs presented in spreadsheet or added as indicated in Appendix 4 (refer to footnotes to VLOOKUP worksheet).
URF for TBA based on conversion of CSF presented in Table H.
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	Groundwater Ceiling Value (Taste & Odors, etc.) Table G-1	Drinking Water Toxicity Table D-2	Vapor Intrusion Concerns Table C-1a	Aquatic Habitat Goal Table D-3b (Chronic)
ACENAPHTHENE	2.0E+01	Ceiling Value	2.0E+01	3.7E+02	4.2E+03	2.3E+01
ACENAPHTHYLENE	3.0E+01	Chronic Aquatic Habitat Goal	2.0E+03	2.4E+02	(Use soil gas)	3.0E+01
ACETONE	1.5E+03	Chronic Aquatic Habitat Goal	2.0E+04	5.5E+03	2.1E+08	1.5E+03
ALDRIN	4.0E-03	Drinking Water Toxicity	8.5E+00	4.0E-03		1.3E-01
ANTHRACENE	7.3E-01	Chronic Aquatic Habitat Goal	2.2E+01	1.8E+03	4.3E+01	7.3E-01
ANTIMONY	6.0E+00	Drinking Water Toxicity	5.0E+04	6.0E+00		3.0E+01
ARSENIC	1.0E+01	Drinking Water Toxicity	5.0E+04	1.0E+01		3.6E+01
BARIUM	2.0E+03	Chronic Aquatic Habitat Goal	5.0E+04	2.0E+03		2.0E+03
BENZENE	5.0E+00	Drinking Water Toxicity	1.7E+02	5.0E+00	1.6E+03	4.6E+01
BENZO(a)ANTHRACENE	2.7E-02	Chronic Aquatic Habitat Goal	5.0E+00	9.2E-02		2.7E-02
BENZO(a)PYRENE	1.4E-02	Chronic Aquatic Habitat Goal	1.9E+00	2.0E-01		1.4E-02
BENZO(b)FLUORANTHENE	9.2E-02	Chronic Aquatic Habitat Goal	7.0E+00	9.2E-02		9.2E-02
BENZO(g,h,i)PERYLENE	1.0E-01	Chronic Aquatic Habitat Goal	1.3E-01	1.5E+03		1.0E-01
BENZO(k)FLUORANTHENE	4.0E-01	Ceiling Value	4.0E-01	9.2E-01		3.7E+00
BERYLLIUM	2.7E+00	Chronic Aquatic Habitat Goal	5.0E+04	4.0E+00		2.7E+00
BIPHENYL, 1,1-	5.0E-01	Ceiling Value	5.0E-01	3.0E+02	(Use soil gas)	1.4E+01
BIS(2-CHLOROETHYL)ETHER	9.5E-03	Drinking Water Toxicity	3.6E+02	9.5E-03	1.0E+02	6.1E+01
BIS(2-CHLOROISOPROPYL)ETHER	2.7E-01	Drinking Water Toxicity	3.2E+02	2.7E-01	(Use soil gas)	6.1E+01
BIS(2-ETHYLHEXYL)PHTHALATE	6.0E+00	Drinking Water Toxicity	6.5E+02	6.0E+00		3.2E+01
BORON	1.6E+00	Chronic Aquatic Habitat Goal	5.0E+04	7.3E+03		1.6E+00
BROMODICHLOROMETHANE	1.8E-01	Drinking Water Toxicity	5.0E+04	1.8E-01	2.7E+02	3.2E+03
BROMOFORM	1.0E+02	Drinking Water Toxicity	5.1E+02	1.0E+02		3.2E+03
BROMOMETHANE	8.5E+00	Drinking Water Toxicity	5.0E+04	8.5E+00	2.3E+03	1.6E+02
CADMIUM	3.0E+00	Chronic 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	2.1E+01	9.8E+00
CHLORDANE	4.0E-03	Chronic Aquatic Habitat Goal	2.5E+00	2.0E+00		4.0E-03
CHLOROANILINE, p-	5.0E+00	Chronic Aquatic Habitat Goal	5.0E+04	1.5E+02		5.0E+00
CHLOROBENZENE	2.5E+01	Chronic Aquatic Habitat Goal	5.0E+01	1.0E+02	5.3E+04	2.5E+01
CHLOROETHANE	3.9E+00	Chronic Aquatic Habitat Goal	1.6E+01	3.9E+00	6.5E+02	3.9E+00
CHLOROFORM	6.2E+01	Indoor Air Impacts	2.4E+03	1.0E+02	6.2E+01	6.2E+02
CHLOROMETHANE	1.6E+02	Drinking Water Toxicity	5.0E+04	1.6E+02	9.5E+03	3.2E+03
CHLOROPHENOL, 2-	1.8E-01	Ceiling Value	1.8E-01	3.0E+01	2.1E+04	1.4E+02
CHROMIUM (Total)	7.4E+01	Chronic Aquatic Habitat Goal	5.0E+04	1.0E+02		7.4E+01
CHROMIUM III	7.4E+01	Chronic Aquatic Habitat Goal	5.0E+04	5.5E+04		7.4E+01
CHROMIUM VI	1.1E+01	Chronic Aquatic Habitat Goal	5.0E+04	1.1E+02		1.1E+01
CHRYSENE	3.5E-01	Chronic Aquatic Habitat Goal	8.0E-01	9.2E+00	(Use soil gas)	3.5E-01
COBALT	3.0E+00	Chronic Aquatic Habitat Goal	5.0E+04	7.3E+02		3.0E+00
COPPER	2.9E+00	Chronic Aquatic Habitat Goal	1.0E+03	1.3E+03		2.9E+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	Groundwater Ceiling Value (Taste & Odors, etc.) Table G-1	Drinking Water Toxicity Table D-2	Vapor Intrusion Concerns Table C-1a	Aquatic Habitat Goal Table D-3b (Chronic)
CYANIDE (Free)	1.0E+00	Chronic Aquatic Habitat Goal	1.7E+02	2.0E+02	(Use soil gas)	1.0E+00
DIBENZO(a,h)ANTHTRACENE	9.2E-03	Drinking Water Toxicity	2.5E-01	9.2E-03		7.5E+00
DIBROMO-3-CHLOROPROPANE, 1,2-	4.0E-02	Chronic Aquatic Habitat Goal	1.0E+01	4.0E-02	(Use soil gas)	4.0E-02
DIBROMOCHLOROMETHANE	1.3E-01	Drinking Water Toxicity	5.0E+04	1.3E-01	1.6E+02	3.2E+03
DIBROMOETHANE, 1,2-	5.6E-03	Drinking Water Toxicity	5.0E+04	5.6E-03	1.6E+01	1.4E+03
DICHLOROBENZENE, 1,2-	1.0E+01	Ceiling Value	1.0E+01	6.0E+02	1.6E+05	1.4E+01
DICHLOROBENZENE, 1,3-	6.5E+01	Chronic Aquatic Habitat Goal	5.0E+04	1.8E+02	(Use soil gas)	6.5E+01
DICHLOROBENZENE, 1,4-	5.0E+00	Ceiling Value	5.0E+00	7.5E+01	4.9E+02	1.5E+01
DICHLOROBENZIDINE, 3,3-	1.5E-01	Drinking Water Toxicity	1.6E+03	1.5E-01		2.5E+02
DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.0E-03	Chronic Aquatic Habitat Goal	8.0E+01	2.8E-01		1.0E-03
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.0E-03	Chronic Aquatic Habitat Goal	2.0E+01	2.8E-01		1.0E-03
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.0E-03	Chronic Aquatic Habitat Goal	1.5E+00	2.0E-01		1.0E-03
DICHLOROETHANE, 1,1-	4.7E+01	Chronic Aquatic Habitat Goal	5.0E+04	8.0E+02	2.8E+05	4.7E+01
DICHLOROETHANE, 1,2-	1.2E-01	Drinking Water Toxicity	7.0E+03	1.2E-01	1.3E+02	1.0E+04
DICHLOROETHYLENE, 1,1-	7.0E+00	Drinking Water Toxicity	1.5E+03	7.0E+00	2.5E+04	2.5E+01
DICHLOROETHYLENE, Cis 1,2-	7.0E+01	Drinking Water Toxicity	5.0E+04	7.0E+01	2.4E+04	5.9E+02
DICHLOROETHYLENE, Trans 1,2-	1.0E+02	Drinking Water Toxicity	2.6E+02	1.0E+02	2.7E+04	5.9E+02
DICHLOROPHENOL, 2,4-	3.0E-01	Ceiling Value	3.0E-01	1.1E+02		1.8E+02
DICHLOROPROPANE, 1,2-	5.0E+00	Drinking Water Toxicity	1.0E+01	5.0E+00	1.2E+02	1.5E+03
DICHLOROPROPENE, 1,3-	4.0E-01	Drinking Water Toxicity	5.0E+04	4.0E-01	1.6E+02	1.2E+02
DIELDRIN	1.9E-03	Chronic Aquatic Habitat Goal	4.1E+01	4.2E-03		1.9E-03
DIETHYLPHTHALATE	1.5E+00	Chronic Aquatic Habitat Goal	5.0E+04	2.9E+04		1.5E+00
DIMETHYLPHENOL, 2,4-	1.1E+02	Chronic Aquatic Habitat Goal	4.0E+02	7.3E+02		1.1E+02
DIMETHYLPHTHALATE	1.5E+00	Chronic Aquatic Habitat Goal	5.0E+04	3.7E+05		1.5E+00
DINITROPHENOL, 2,4-	7.3E+01	Drinking Water Toxicity	5.0E+04	7.3E+01		7.5E+01
DINITROTOLUENE, 2,4-	3.4E+01	Drinking Water Toxicity	5.0E+04	3.4E+01		1.2E+02
DIOXANE, 1,4-	6.1E+00	Drinking Water Toxicity	5.0E+04	6.1E+00		3.4E+05
DIOXIN (2,3,7,8-TCDD)	5.0E-06	Chronic Aquatic Habitat Goal	7.0E+03	3.0E-05		5.0E-06
ENDOSULFAN	8.7E-03	Chronic Aquatic Habitat Goal	7.5E+01	2.2E+02		8.7E-03
ENDRIN	2.3E-03	Chronic Aquatic Habitat Goal	4.1E+01	2.0E+00		2.3E-03
ETHYLBENZENE	3.0E+01	Ceiling Value	3.0E+01	7.0E+02	1.7E+05	2.9E+02
FLUORANTHENE	8.0E+00	Chronic Aquatic Habitat Goal	1.3E+02	1.5E+03		8.0E+00
FLUORENE	3.9E+00	Chronic Aquatic Habitat Goal	9.5E+02	2.4E+02	1.9E+03	3.9E+00
HEPTACHLOR	3.6E-03	Chronic Aquatic Habitat Goal	2.0E+01	4.0E-01		3.6E-03
HEPTACHLOR EPOXIDE	3.6E-03	Chronic Aquatic Habitat Goal	1.8E+02	2.0E-01		3.6E-03
HEXACHLOROBENZENE	1.0E+00	Drinking Water Toxicity	5.5E+01	1.0E+00		3.7E+00
HEXACHLOROBUTADIENE	8.6E-01	Drinking Water Toxicity	6.0E+00	8.6E-01		4.7E+00
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	8.0E-02	Chronic Aquatic Habitat Goal	3.5E+03	2.0E-01		8.0E-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	Groundwater Ceiling Value (Taste & Odors, etc.) Table G-1	Drinking Water Toxicity Table D-2	Vapor Intrusion Concerns Table C-1a	Aquatic Habitat Goal Table D-3b (Chronic)
HEXACHLOROETHANE	4.8E+00	Drinking Water Toxicity	1.0E+01	4.8E+00		1.2E+01
INDENO(1,2,3-cd)PYRENE	9.2E-02	Chronic Aquatic Habitat Goal	2.7E-01	9.2E-02		9.2E-02
LEAD	5.6E+00	Chronic Aquatic Habitat Goal	5.0E+04	1.5E+01		5.6E+00
MERCURY	2.5E-02	Chronic Aquatic Habitat Goal	5.0E+04	2.0E+00		2.5E-02
METHOXYCHLOR	3.0E-02	Chronic Aquatic Habitat Goal	2.0E+01	4.0E+01		3.0E-02
METHYL ETHYL KETONE	7.0E+03	Drinking Water Toxicity	8.4E+03	7.0E+03	2.7E+08	1.4E+04
METHYL ISOBUTYL KETONE	1.7E+02	Chronic Aquatic Habitat Goal	1.3E+03	2.0E+03	1.9E+07	1.7E+02
METHYL MERCURY	3.0E-03	Chronic Aquatic Habitat Goal	5.0E+04	3.7E+00		3.0E-03
METHYL TERT BUTYL ETHER	5.0E+00	Ceiling Value	5.0E+00	1.1E+01	1.9E+04	8.0E+03
METHYLENE CHLORIDE	4.3E+00	Drinking Water Toxicity	9.1E+03	4.3E+00	4.2E+03	2.2E+03
METHYLNAPHTHALENE (total 1- & 2-)	2.1E+00	Chronic Aquatic Habitat Goal	1.0E+01	2.4E+02	2.6E+04	2.1E+00
MOLYBDENUM	1.8E+02	Drinking Water Toxicity	5.0E+04	1.8E+02		2.4E+02
NAPHTHALENE	6.2E+00	Drinking Water Toxicity	2.1E+01	6.2E+00	3.1E+04	2.4E+01
NICKEL	5.0E+00	Chronic Aquatic Habitat Goal	5.0E+04	1.0E+02		5.0E+00
PENTACHLOROPHENOL	1.0E+00	Drinking Water Toxicity	3.0E+01	1.0E+00		7.9E+00
PERCHLORATE	3.7E+00	Drinking Water Toxicity	5.0E+04	3.7E+00		6.0E+02
PHENANTHRENE	4.6E+00	Chronic Aquatic Habitat Goal	4.1E+02	2.4E+02	(Use soil gas)	4.6E+00
PHENOL	5.0E+00	Ceiling Value	5.0E+00	1.1E+04		1.3E+03
POLYCHLORINATED BIPHENYLS (PCBs)	1.4E-02	Chronic Aquatic Habitat Goal	1.6E+01	5.0E-01		1.4E-02
PYRENE	2.0E+00	Chronic Aquatic Habitat Goal	6.8E+01	1.8E+02	1.4E+02	2.0E+00
SELENIUM	5.0E+00	Chronic Aquatic Habitat Goal	5.0E+04	5.0E+01		5.0E+00
SILVER	1.0E+00	Chronic Aquatic Habitat Goal	1.0E+02	1.8E+02		1.0E+00
STYRENE	1.0E+01	Ceiling Value	1.0E+01	1.0E+02	3.1E+05	1.0E+02
tert-BUTYL ALCOHOL	3.7E+00	Drinking Water Toxicity	5.0E+04	3.7E+00	(Use soil gas)	1.8E+04
TETRACHLOROETHANE, 1,1,1,2-	4.3E-01	Drinking Water Toxicity	5.0E+04	4.3E-01	(Use soil gas)	3.1E+02
TETRACHLOROETHANE, 1,1,2,2-	5.6E-02	Drinking Water Toxicity	5.0E+02	5.6E-02	1.5E+02	4.2E+02
TETRACHLOROETHYLENE	5.0E+00	Drinking Water Toxicity	1.7E+02	5.0E+00	9.9E+01	1.2E+02
THALLIUM	2.0E+00	Drinking Water Toxicity	5.0E+04	2.0E+00		2.0E+01
TOLUENE	4.0E+01	Ceiling Value	4.0E+01	1.0E+03	5.3E+05	1.3E+02
TOXAPHENE	2.0E-04	Chronic Aquatic Habitat Goal	1.4E+02	3.0E+00		2.0E-04
TPH (gasolines)	1.0E+02	Ceiling Value	1.0E+02	1.0E+02	(Use soil gas)	5.0E+02
TPH (middle distillates)	1.0E+02	Ceiling Value	1.0E+02	1.0E+02	(Use soil gas)	6.4E+02
TPH (residual fuels)	1.0E+02	Ceiling Value	1.0E+02	1.0E+03		6.4E+02
TRICHLOROBENZENE, 1,2,4-	2.5E+01	Chronic Aquatic Habitat Goal	3.0E+03	7.0E+01	1.0E+04	2.5E+01
TRICHLOROETHANE, 1,1,1-	6.2E+01	Chronic Aquatic Habitat Goal	9.7E+02	2.0E+02	5.0E+05	6.2E+01
TRICHLOROETHANE, 1,1,2-	5.0E+00	Drinking Water Toxicity	5.0E+04	5.0E+00	2.8E+02	4.7E+03
TRICHLOROETHYLENE	5.0E+00	Drinking Water Toxicity	3.1E+02	5.0E+00	7.4E+01	3.6E+02
TRICHLOROPHENOL, 2,4,5-	1.1E+01	Chronic Aquatic Habitat Goal	2.0E+02	6.1E+02	1.2E+06	1.1E+01

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	Groundwater Ceiling Value (Taste & Odors, etc.) Table G-1	Drinking Water Toxicity Table D-2	Vapor Intrusion Concerns Table C-1a	Aquatic Habitat Goal Table D-3b (Chronic)
TRICHLOROPHENOL, 2,4,6-	3.7E+00	Drinking Water Toxicity	1.0E+02	3.7E+00		4.9E+02
VANADIUM	1.9E+01	Chronic Aquatic Habitat Goal	5.0E+04	3.7E+01		1.9E+01
VINYL CHLORIDE	2.0E+00	Drinking Water Toxicity	3.4E+03	2.0E+00	2.2E+01	7.8E+02
XYLENES	2.0E+01	Ceiling Value	2.0E+01	1.0E+04	1.6E+05	1.0E+02
ZINC	2.2E+01	Chronic Aquatic Habitat Goal	5.0E+03	1.1E+04		2.2E+01

Notes:

1. Lowest of Ceiling Value, Indoor-Air Impact goal and chronic Aquatic Habitat goal. Used to develop soil leaching levels for protection of groundwater quality (see Table E-1).

(Use Soil Gas): Use soil gas data to evaluate potential indoor-air impact concerns.
TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.
sol - solubility threshold
Ceiling Level: Taste and odor threshold, 1/2 solubility or 50000 ug/L maximum, whichever is lower. Intended to limit general groundwater resource degradation and address nuisance concerns.
Human Toxicity: Based on primary maximum concentration levels (MCLs) or equivalent; considered protective of human health.
Indoor Air Impact: Addresses potential emission of volatile chemicals from groundwater and subsequent impact on indoor air. Action level for very permeable (e.g., sandy) vadose-zone soils used.
Aquatic Habitat Goal: Addresses potential discharge of groundwater to surface waterbody and subsequent impact on aquatic life. Potential dilution upon discharge to surface water not considered.
Method detection limits and background concentrations replace final action 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	Groundwater Ceiling Value (Taste & Odors, etc.) Table G-1	Drinking Water Toxicity Table D-2	Vapor Intrusion Concerns Table C-1a	Aquatic Habitat Goal Table D-3c (Acute)
ACENAPHTHENE	2.0E+01	Ceiling Value	2.0E+01	3.7E+02	4.2E+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	Acute Aquatic Habitat Goal	2.0E+04	5.5E+03	2.1E+08	1.5E+03
ALDRIN	4.0E-03	Drinking Water Toxicity	8.5E+00	4.0E-03		1.3E+00
ANTHRACENE	7.3E-01	Acute 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		1.5E+03
ARSENIC	1.0E+01	Drinking Water Toxicity	5.0E+04	1.0E+01		6.9E+01
BARIUM	2.0E+03	Acute Aquatic Habitat Goal	5.0E+04	2.0E+03		2.0E+03
BENZENE	5.0E+00	Drinking Water Toxicity	1.7E+02	5.0E+00	1.6E+03	1.7E+03
BENZO(a)ANTHRACENE	2.7E-02	Acute Aquatic Habitat Goal	5.0E+00	9.2E-02		2.7E-02
BENZO(a)PYRENE	1.4E-02	Acute Aquatic Habitat Goal	1.9E+00	2.0E-01		1.4E-02
BENZO(b)FLUORANTHENE	9.2E-02	Acute Aquatic Habitat Goal	7.0E+00	9.2E-02		9.2E-02
BENZO(g,h,i)PERYLENE	1.0E-01	Acute Aquatic Habitat Goal	1.3E-01	1.5E+03		1.0E-01
BENZO(k)FLUORANTHENE	4.0E-01	Ceiling Value	4.0E-01	9.2E-01		3.7E+00
BERYLLIUM	4.0E+00	Drinking Water Toxicity	5.0E+04	4.0E+00		4.3E+01
BIPHENYL, 1,1-	5.0E-01	Ceiling Value	5.0E-01	3.0E+02	(Use soil gas)	1.4E+01
BIS(2-CHLOROETHYL)ETHER	9.5E-03	Drinking Water Toxicity	3.6E+02	9.5E-03	1.0E+02	2.4E+05
BIS(2-CHLOROISOPROPYL)ETHER	2.7E-01	Drinking Water Toxicity	3.2E+02	2.7E-01	(Use soil gas)	2.4E+05
BIS(2-ETHYLHEXYL)PHTHALATE	6.0E+00	Drinking Water Toxicity	6.5E+02	6.0E+00		3.2E+01
BORON	1.6E+00	Acute Aquatic Habitat Goal	5.0E+04	7.3E+03		1.6E+00
BROMODICHLOROMETHANE	1.8E-01	Drinking Water Toxicity	5.0E+04	1.8E-01	2.7E+02	1.1E+04
BROMOFORM	1.0E+02	Drinking Water Toxicity	5.1E+02	1.0E+02		1.1E+04
BROMOMETHANE	8.5E+00	Drinking Water Toxicity	5.0E+04	8.5E+00	2.3E+03	1.1E+04
CADMIUM	3.0E+00	Acute 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	2.1E+01	1.2E+04
CHLORDANE	9.0E-02	Acute Aquatic Habitat Goal	2.5E+00	2.0E+00		9.0E-02
CHLOROANILINE, p-	5.0E+00	Acute Aquatic Habitat Goal	5.0E+04	1.5E+02		5.0E+00
CHLOROBENZENE	5.0E+01	Ceiling Value	5.0E+01	1.0E+02	5.3E+04	1.6E+02
CHLOROETHANE	3.9E+00	Acute Aquatic Habitat Goal	1.6E+01	3.9E+00	6.5E+02	3.9E+00
CHLOROFORM	6.2E+01	Indoor Air Impacts	2.4E+03	1.0E+02	6.2E+01	9.6E+03
CHLOROMETHANE	1.6E+02	Drinking Water Toxicity	5.0E+04	1.6E+02	9.5E+03	1.1E+04
CHLOROPHENOL, 2-	1.8E-01	Ceiling Value	1.8E-01	3.0E+01	2.1E+04	1.4E+03
CHROMIUM (Total)	7.4E+01	Acute Aquatic Habitat Goal	5.0E+04	1.0E+02		7.4E+01
CHROMIUM III	5.7E+02	Acute Aquatic Habitat Goal	5.0E+04	5.5E+04		5.7E+02
CHROMIUM VI	1.6E+01	Acute Aquatic Habitat Goal	5.0E+04	1.1E+02		1.6E+01
CHRYSENE	3.5E-01	Acute Aquatic Habitat Goal	8.0E-01	9.2E+00	(Use soil gas)	3.5E-01
COBALT	3.0E+00	Acute Aquatic Habitat Goal	5.0E+04	7.3E+02		3.0E+00
COPPER	2.9E+00	Acute Aquatic Habitat Goal	1.0E+03	1.3E+03		2.9E+00
CYANIDE (Free)	1.0E+00	Acute Aquatic Habitat Goal	1.7E+02	2.0E+02	(Use soil gas)	1.0E+00

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	Groundwater Ceiling Value (Taste & Odors, etc.) Table G-1	Drinking Water Toxicity Table D-2	Vapor Intrusion Concerns Table C-1a	Aquatic Habitat Goal Table D-3c (Acute)
DIBENZO(a,h)ANTHTRACENE	9.2E-03	Drinking Water Toxicity	2.5E-01	9.2E-03		7.5E+00
DIBROMO-3-CHLOROPROPANE, 1,2-	4.0E-02	Acute Aquatic Habitat Goal	1.0E+01	4.0E-02	(Use soil gas)	4.0E-02
DIBROMOCHLOROMETHANE	1.3E-01	Drinking Water Toxicity	5.0E+04	1.3E-01	1.6E+02	1.1E+04
DIBROMOETHANE, 1,2-	5.6E-03	Drinking Water Toxicity	5.0E+04	5.6E-03	1.6E+01	1.4E+03
DICHLOROBENZENE, 1,2-	1.0E+01	Ceiling Value	1.0E+01	6.0E+02	1.6E+05	3.7E+02
DICHLOROBENZENE, 1,3-	1.8E+02	Drinking Water Toxicity	5.0E+04	1.8E+02	(Use soil gas)	3.7E+02
DICHLOROBENZENE, 1,4-	5.0E+00	Ceiling Value	5.0E+00	7.5E+01	4.9E+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	8.0E+01	2.8E-01		6.0E-01
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.8E-01	Drinking Water Toxicity	2.0E+01	2.8E-01		1.4E+01
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.3E-02	Acute Aquatic Habitat Goal	1.5E+00	2.0E-01		1.3E-02
DICHLOROETHANE, 1,1-	4.7E+01	Acute Aquatic Habitat Goal	5.0E+04	8.0E+02	2.8E+05	4.7E+01
DICHLOROETHANE, 1,2-	1.2E-01	Drinking Water Toxicity	7.0E+03	1.2E-01	1.3E+02	3.8E+04
DICHLOROETHYLENE, 1,1-	7.0E+00	Drinking Water Toxicity	1.5E+03	7.0E+00	2.5E+04	3.9E+03
DICHLOROETHYLENE, Cis 1,2-	7.0E+01	Drinking Water Toxicity	5.0E+04	7.0E+01	2.4E+04	1.2E+04
DICHLOROETHYLENE, Trans 1,2-	1.0E+02	Drinking Water Toxicity	2.6E+02	1.0E+02	2.7E+04	1.2E+04
DICHLOROPHENOL, 2,4-	3.0E-01	Ceiling Value	3.0E-01	1.1E+02		6.7E+02
DICHLOROPROPANE, 1,2-	5.0E+00	Drinking Water Toxicity	1.0E+01	5.0E+00	1.2E+02	3.4E+03
DICHLOROPROPENE, 1,3-	4.0E-01	Drinking Water Toxicity	5.0E+04	4.0E-01	1.6E+02	2.6E+02
DIELDRIN	4.2E-03	Drinking Water Toxicity	4.1E+01	4.2E-03		7.1E-01
DIETHYLPHTHALATE	9.4E+02	Acute Aquatic Habitat Goal	5.0E+04	2.9E+04		9.4E+02
DIMETHYLPHENOL, 2,4-	2.7E+02	Acute Aquatic Habitat Goal	4.0E+02	7.3E+02		2.7E+02
DIMETHYLPHTHALATE	9.4E+02	Acute Aquatic Habitat Goal	5.0E+04	3.7E+05		9.4E+02
DINITROPHENOL, 2,4-	7.3E+01	Drinking Water Toxicity	5.0E+04	7.3E+01		2.3E+02
DINITROTOLUENE, 2,4-	3.4E+01	Drinking Water Toxicity	5.0E+04	3.4E+01		2.0E+02
DIOXANE, 1,4-	6.1E+00	Drinking Water Toxicity	5.0E+04	6.1E+00		6.7E+06
DIOXIN (2,3,7,8-TCDD)	3.0E-05	Drinking Water Toxicity	7.0E+03	3.0E-05		3.0E-03
ENDOSULFAN	3.4E-02	Acute Aquatic Habitat Goal	7.5E+01	2.2E+02		3.4E-02
ENDRIN	3.7E-02	Acute Aquatic Habitat Goal	4.1E+01	2.0E+00		3.7E-02
ETHYLBENZENE	3.0E+01	Ceiling Value	3.0E+01	7.0E+02	1.7E+05	4.3E+02
FLUORANTHENE	4.0E+01	Acute Aquatic Habitat Goal	1.3E+02	1.5E+03		4.0E+01
FLUORENE	2.4E+02	Drinking Water Toxicity	9.5E+02	2.4E+02	1.9E+03	3.0E+02
HEPTACHLOR	5.3E-02	Acute Aquatic Habitat Goal	2.0E+01	4.0E-01		5.3E-02
HEPTACHLOR EPOXIDE	5.3E-02	Acute Aquatic Habitat Goal	1.8E+02	2.0E-01		5.3E-02
HEXACHLOROBENZENE	1.0E+00	Drinking Water Toxicity	5.5E+01	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	Acute Aquatic Habitat Goal	3.5E+03	2.0E-01		1.6E-01
HEXACHLOROETHANE	4.8E+00	Drinking Water Toxicity	1.0E+01	4.8E+00		3.1E+02
INDENO(1,2,3-cd)PYRENE	9.2E-02	Acute Aquatic Habitat Goal	2.7E-01	9.2E-02		9.2E-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	Groundwater Ceiling Value (Taste & Odors, etc.) Table G-1	Drinking Water Toxicity Table D-2	Vapor Intrusion Concerns Table C-1a	Aquatic Habitat Goal Table D-3c (Acute)
LEAD	1.5E+01	Drinking Water Toxicity	5.0E+04	1.5E+01		2.9E+01
MERCURY	2.0E+00	Drinking Water Toxicity	5.0E+04	2.0E+00		2.1E+00
METHOXYCHLOR	3.0E-02	Acute Aquatic Habitat Goal	2.0E+01	4.0E+01		3.0E-02
METHYL ETHYL KETONE	7.0E+03	Drinking Water Toxicity	8.4E+03	7.0E+03	2.7E+08	1.4E+04
METHYL ISOBUTYL KETONE	1.7E+02	Acute Aquatic Habitat Goal	1.3E+03	2.0E+03	1.9E+07	1.7E+02
METHYL MERCURY	3.0E-03	Acute Aquatic Habitat Goal	5.0E+04	3.7E+00		3.0E-03
METHYL TERT BUTYL ETHER	5.0E+00	Ceiling Value	5.0E+00	1.1E+01	1.9E+04	8.0E+03
METHYLENE CHLORIDE	4.3E+00	Drinking Water Toxicity	9.1E+03	4.3E+00	4.2E+03	1.1E+04
METHYLNAPHTHALENE (total 1- & 2-)	1.0E+01	Ceiling Value	1.0E+01	2.4E+02	2.6E+04	3.0E+02
MOLYBDENUM	1.8E+02	Drinking Water Toxicity	5.0E+04	1.8E+02		2.4E+02
NAPHTHALENE	6.2E+00	Drinking Water Toxicity	2.1E+01	6.2E+00	3.1E+04	7.7E+02
NICKEL	5.0E+00	Acute Aquatic Habitat Goal	5.0E+04	1.0E+02		5.0E+00
PENTACHLOROPHENOL	1.0E+00	Drinking Water Toxicity	3.0E+01	1.0E+00		1.3E+01
PERCHLORATE	3.7E+00	Drinking Water Toxicity	5.0E+04	3.7E+00		6.0E+02
PHENANTHRENE	7.7E+00	Acute Aquatic Habitat Goal	4.1E+02	2.4E+02	(Use soil gas)	7.7E+00
PHENOL	5.0E+00	Ceiling Value	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
PYRENE	2.0E+00	Acute Aquatic Habitat Goal	6.8E+01	1.8E+02	1.4E+02	2.0E+00
SELENIUM	2.0E+01	Acute Aquatic Habitat Goal	5.0E+04	5.0E+01		2.0E+01
SILVER	1.0E+00	Acute Aquatic Habitat Goal	1.0E+02	1.8E+02		1.0E+00
STYRENE	1.0E+01	Ceiling Value	1.0E+01	1.0E+02	3.1E+05	1.0E+02
tert-BUTYL ALCOHOL	3.7E+00	Drinking Water Toxicity	5.0E+04	3.7E+00	(Use soil gas)	1.8E+05
TETRACHLOROETHANE, 1,1,1,2-	4.3E-01	Drinking Water Toxicity	5.0E+04	4.3E-01	(Use soil gas)	3.1E+03
TETRACHLOROETHANE, 1,1,2,2-	5.6E-02	Drinking Water Toxicity	5.0E+02	5.6E-02	1.5E+02	3.0E+03
TETRACHLOROETHYLENE	5.0E+00	Drinking Water Toxicity	1.7E+02	5.0E+00	9.9E+01	1.8E+03
THALLIUM	2.0E+00	Drinking Water Toxicity	5.0E+04	2.0E+00		4.7E+02
TOLUENE	4.0E+01	Ceiling Value	4.0E+01	1.0E+03	5.3E+05	5.8E+03
TOXAPHENE	2.1E-01	Acute Aquatic Habitat Goal	1.4E+02	3.0E+00		2.1E-01
TPH (gasolines)	1.0E+02	Ceiling Value	1.0E+02	1.0E+02	(Use soil gas)	5.0E+03
TPH (middle distillates)	1.0E+02	Ceiling Value	1.0E+02	1.0E+02	(Use soil gas)	2.5E+03
TPH (residual fuels)	1.0E+02	Ceiling Value	1.0E+02	1.0E+03		2.5E+03
TRICHLOROBENZENE, 1,2,4-	7.0E+01	Drinking Water Toxicity	3.0E+03	7.0E+01	1.0E+04	1.6E+02
TRICHLOROETHANE, 1,1,1-	2.0E+02	Drinking Water Toxicity	9.7E+02	2.0E+02	5.0E+05	6.0E+03
TRICHLOROETHANE, 1,1,2-	5.0E+00	Drinking Water Toxicity	5.0E+04	5.0E+00	2.8E+02	6.0E+03
TRICHLOROETHYLENE	5.0E+00	Drinking Water Toxicity	3.1E+02	5.0E+00	7.4E+01	7.0E+02
TRICHLOROPHENOL, 2,4,5-	1.0E+02	Acute Aquatic Habitat Goal	2.0E+02	6.1E+02	1.2E+06	1.0E+02
TRICHLOROPHENOL, 2,4,6-	3.7E+00	Drinking Water Toxicity	1.0E+02	3.7E+00		4.9E+02
VANADIUM	1.9E+01	Acute Aquatic Habitat Goal	5.0E+04	3.7E+01		1.9E+01
VINYL CHLORIDE	2.0E+00	Drinking Water Toxicity	3.4E+03	2.0E+00	2.2E+01	7.8E+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	Groundwater Ceiling Value (Taste & Odors, etc.) Table G-1	Drinking Water Toxicity Table D-2	Vapor Intrusion Concerns Table C-1a	Aquatic Habitat Goal Table D-3c (Acute)
XYLENES	2.0E+01	Ceiling Value	2.0E+01	1.0E+04	1.6E+05	2.0E+03
ZINC	2.2E+01	Acute Aquatic Habitat Goal	5.0E+03	1.1E+04		2.2E+01

Notes:

1. Lowest of Ceiling Value, Indoor-Air Impact goal and acute Aquatic Habitat goal. Used to develop soil leaching levels for protection of groundwater quality (see Table E-1).

(Use Soil Gas): Use soil gas data to evaluate potential indoor-air impact concerns.
TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.
sol - solubility threshold
Ceiling Level: Taste and odor threshold, 1/2 solubility or 50000 ug/L maximum, whichever is lower. Intended to limit general groundwater resource degradation and address nuisance concerns.
Human Toxicity: Based on primary maximum concentration levels (MCLs) or equivalent; considered protective of human health.
Indoor Air Impact: Addresses potential emission of volatile chemicals from groundwater and subsequent impact on indoor air. Action level for very permeable (e.g., sandy) vadose-zone soils used.
Aquatic Habitat Goal: Addresses potential discharge of groundwater to surface waterbody and subsequent impact on aquatic life. Potential dilution upon discharge to surface water not considered.
Method detection limits and background concentrations replace final action 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	Groundwater Ceiling Value (Odors, etc.) Table G-2	Vapor Intrusion Concerns Table C-1a	Aquatic Habitat Goal Table D-3b (Chronic)
ACENAPHTHENE	2.3E+01	Aquatic Habitat Goal	2.0E+02	4.2E+03	2.3E+01
ACENAPHTHYLENE	3.0E+01	Aquatic Habitat Goal	2.0E+03	(Use soil gas)	3.0E+01
ACETONE	1.5E+03	Aquatic Habitat Goal	5.0E+04	2.1E+08	1.5E+03
ALDRIN	1.3E-01	Aquatic Habitat Goal	8.5E+00		1.3E-01
ANTHRACENE	7.3E-01	Aquatic Habitat Goal	2.2E+01	4.3E+01	7.3E-01
ANTIMONY	3.0E+01	Aquatic Habitat Goal	5.0E+04		3.0E+01
ARSENIC	3.6E+01	Aquatic Habitat Goal	5.0E+04		3.6E+01
BARIUM	2.0E+03	Aquatic Habitat Goal	5.0E+04		2.0E+03
BENZENE	4.6E+01	Aquatic Habitat Goal	2.0E+04	1.6E+03	4.6E+01
BENZO(a)ANTHRACENE	2.7E-02	Aquatic Habitat Goal	5.0E+00		2.7E-02
BENZO(a)PYRENE	1.4E-02	Aquatic Habitat Goal	1.9E+00		1.4E-02
BENZO(b)FLUORANTHENE	9.2E-02	Aquatic Habitat Goal	7.0E+00		9.2E-02
BENZO(g,h,i)PERYLENE	1.0E-01	Aquatic Habitat Goal	1.3E-01		1.0E-01
BENZO(k)FLUORANTHENE	4.0E-01	Ceiling Value	4.0E-01		3.7E+00
BERYLLIUM	2.7E+00	Aquatic Habitat Goal	5.0E+04		2.7E+00
BIPHENYL, 1,1-	5.0E+00	Ceiling Value	5.0E+00	(Use soil gas)	1.4E+01
BIS(2-CHLOROETHYL)ETHER	6.1E+01	Aquatic Habitat Goal	3.6E+03	1.0E+02	6.1E+01
BIS(2-CHLOROISOPROPYL)ETHER	6.1E+01	Aquatic Habitat Goal	3.2E+03	(Use soil gas)	6.1E+01
BIS(2-ETHYLHEXYL)PHTHALATE	3.2E+01	Aquatic Habitat Goal	6.5E+02		3.2E+01
BORON	1.6E+00	Aquatic Habitat Goal	5.0E+04		1.6E+00
BROMODICHLOROMETHANE	2.7E+02	Indoor Air Impacts	5.0E+04	2.7E+02	3.2E+03
BROMOFORM	3.2E+03	Aquatic Habitat Goal	5.1E+03		3.2E+03
BROMOMETHANE	1.6E+02	Aquatic Habitat Goal	5.0E+04	2.3E+03	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	2.1E+01	9.8E+00
CHLORDANE	4.0E-03	Aquatic Habitat Goal	2.5E+01		4.0E-03
CHLOROANILINE, p-	5.0E+00	Aquatic Habitat Goal	5.0E+04		5.0E+00
CHLOROBENZENE	2.5E+01	Aquatic Habitat Goal	5.0E+02	5.3E+04	2.5E+01
CHLOROETHANE	3.9E+00	Aquatic Habitat Goal	1.6E+02	6.5E+02	3.9E+00
CHLOROFORM	6.2E+01	Indoor Air Impacts	2.4E+04	6.2E+01	6.2E+02
CHLOROMETHANE	3.2E+03	Aquatic Habitat Goal	5.0E+04	9.5E+03	3.2E+03
CHLOROPHENOL, 2-	1.8E+00	Ceiling Value	1.8E+00	2.1E+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	8.0E-01	(Use soil gas)	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

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	Groundwater Ceiling Value (Odors, etc.)	Vapor Intrusion Concerns	Aquatic Habitat Goal
			Table G-2	Table C-1a	Table D-3b (Chronic)
CYANIDE (Free)	1.0E+00	Aquatic Habitat Goal	1.7E+03	(Use soil gas)	1.0E+00
DIBENZO(a,h)ANTHTRACENE	2.5E-01	Ceiling Value	2.5E-01		7.5E+00
DIBROMO-3-CHLOROPROPANE, 1,2-	4.0E-02	Aquatic Habitat Goal	1.0E+02	(Use soil gas)	4.0E-02
DIBROMOCHLOROMETHANE	1.6E+02	Indoor Air Impacts	5.0E+04	1.6E+02	3.2E+03
DIBROMOETHANE, 1,2-	1.6E+01	Indoor Air Impacts	5.0E+04	1.6E+01	1.4E+03
DICHLOROBENZENE, 1,2-	1.4E+01	Aquatic Habitat Goal	1.0E+02	1.6E+05	1.4E+01
DICHLOROBENZENE, 1,3-	6.5E+01	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	6.5E+01
DICHLOROBENZENE, 1,4-	1.5E+01	Aquatic Habitat Goal	1.1E+02	4.9E+02	1.5E+01
DICHLOROBENZIDINE, 3,3-	2.5E+02	Aquatic Habitat Goal	1.6E+03		2.5E+02
DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.0E-03	Aquatic Habitat Goal	8.0E+01		1.0E-03
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.0E-03	Aquatic Habitat Goal	2.0E+01		1.0E-03
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.0E-03	Aquatic Habitat Goal	1.5E+00		1.0E-03
DICHLOROETHANE, 1,1-	4.7E+01	Aquatic Habitat Goal	5.0E+04	2.8E+05	4.7E+01
DICHLOROETHANE, 1,2-	1.3E+02	Indoor Air Impacts	5.0E+04	1.3E+02	1.0E+04
DICHLOROETHYLENE, 1,1-	2.5E+01	Aquatic Habitat Goal	1.5E+04	2.5E+04	2.5E+01
DICHLOROETHYLENE, Cis 1,2-	5.9E+02	Aquatic Habitat Goal	5.0E+04	2.4E+04	5.9E+02
DICHLOROETHYLENE, Trans 1,2-	5.9E+02	Aquatic Habitat Goal	2.6E+03	2.7E+04	5.9E+02
DICHLOROPHENOL, 2,4-	3.0E+00	Ceiling Value	3.0E+00		1.8E+02
DICHLOROPROPANE, 1,2-	1.0E+02	Ceiling Value	1.0E+02	1.2E+02	1.5E+03
DICHLOROPROPENE, 1,3-	1.2E+02	Aquatic Habitat Goal	5.0E+04	1.6E+02	1.2E+02
DIELDRIN	1.9E-03	Aquatic Habitat Goal	9.3E+01		1.9E-03
DIETHYLPHTHALATE	1.5E+00	Aquatic Habitat Goal	5.0E+04		1.5E+00
DIMETHYLPHENOL, 2,4-	1.1E+02	Aquatic Habitat Goal	4.0E+03		1.1E+02
DIMETHYLPHTHALATE	1.5E+00	Aquatic Habitat Goal	5.0E+04		1.5E+00
DINITROPHENOL, 2,4-	7.5E+01	Aquatic Habitat Goal	5.0E+04		7.5E+01
DINITROTOLUENE, 2,4-	1.2E+02	Aquatic Habitat Goal	5.0E+04		1.2E+02
DIOXANE, 1,4-	5.0E+04	Ceiling Value	5.0E+04		3.4E+05
DIOXIN (2,3,7,8-TCDD)	5.0E-06	Aquatic Habitat Goal	7.0E+03		5.0E-06
ENDOSULFAN	8.7E-03	Aquatic Habitat Goal	7.5E+01		8.7E-03
ENDRIN	2.3E-03	Aquatic Habitat Goal	1.3E+02		2.3E-03
ETHYLBENZENE	2.9E+02	Aquatic Habitat Goal	3.0E+02	1.7E+05	2.9E+02
FLUORANTHENE	8.0E+00	Aquatic Habitat Goal	1.3E+02		8.0E+00
FLUORENE	3.9E+00	Aquatic Habitat Goal	9.5E+02	1.9E+03	3.9E+00
HEPTACHLOR	3.6E-03	Aquatic Habitat Goal	2.8E+01		3.6E-03
HEPTACHLOR EPOXIDE	3.6E-03	Aquatic Habitat Goal	1.8E+02		3.6E-03
HEXACHLOROBENZENE	3.7E+00	Aquatic Habitat Goal	5.5E+01		3.7E+00
HEXACHLOROBUTADIENE	4.7E+00	Aquatic Habitat Goal	6.0E+01		4.7E+00
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	8.0E-02	Aquatic Habitat Goal	3.5E+03		8.0E-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	Groundwater Ceiling Value (Odors, etc.) Table G-2	Vapor Intrusion Concerns Table C-1a	Aquatic Habitat Goal Table D-3b (Chronic)
HEXACHLOROETHANE	1.2E+01	Aquatic Habitat Goal	1.0E+02		1.2E+01
INDENO(1,2,3-cd)PYRENE	9.2E-02	Aquatic Habitat Goal	2.7E-01		9.2E-02
LEAD	5.6E+00	Aquatic Habitat Goal	5.0E+04		5.6E+00
MERCURY	2.5E-02	Aquatic Habitat Goal	5.0E+04		2.5E-02
METHOXYCHLOR	3.0E-02	Aquatic Habitat Goal	2.0E+01		3.0E-02
METHYL ETHYL KETONE	1.4E+04	Aquatic Habitat Goal	5.0E+04	2.7E+08	1.4E+04
METHYL ISOBUTYL KETONE	1.7E+02	Aquatic Habitat Goal	1.3E+04	1.9E+07	1.7E+02
METHYL MERCURY	3.0E-03	Aquatic Habitat Goal	5.0E+04		3.0E-03
METHYL TERT BUTYL ETHER	1.8E+03	Ceiling Value	1.8E+03	1.9E+04	8.0E+03
METHYLENE CHLORIDE	2.2E+03	Aquatic Habitat Goal	5.0E+04	4.2E+03	2.2E+03
METHYLNAPHTHALENE (total 1- & 2-)	2.1E+00	Aquatic Habitat Goal	1.0E+02	2.6E+04	2.1E+00
MOLYBDENUM	2.4E+02	Aquatic Habitat Goal	5.0E+04		2.4E+02
NAPHTHALENE	2.4E+01	Aquatic Habitat Goal	2.1E+02	3.1E+04	2.4E+01
NICKEL	5.0E+00	Aquatic Habitat Goal	5.0E+04		5.0E+00
PENTACHLOROPHENOL	7.9E+00	Aquatic Habitat Goal	5.9E+03		7.9E+00
PERCHLORATE	6.0E+02	Aquatic Habitat Goal	5.0E+04		6.0E+02
PHENANTHRENE	4.6E+00	Aquatic Habitat Goal	4.1E+02	(Use soil gas)	4.6E+00
PHENOL	1.3E+03	Aquatic Habitat Goal	5.0E+04		1.3E+03
POLYCHLORINATED BIPHENYLS (PCBs)	1.4E-02	Aquatic Habitat Goal	1.6E+01		1.4E-02
PYRENE	2.0E+00	Aquatic Habitat Goal	6.8E+01	1.4E+02	2.0E+00
SELENIUM	5.0E+00	Aquatic Habitat Goal	5.0E+04		5.0E+00
SILVER	1.0E+00	Aquatic Habitat Goal	5.0E+04		1.0E+00
STYRENE	1.0E+02	Aquatic Habitat Goal	1.1E+02	3.1E+05	1.0E+02
tert-BUTYL ALCOHOL	1.8E+04	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	1.8E+04
TETRACHLOROETHANE, 1,1,1,2-	3.1E+02	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	3.1E+02
TETRACHLOROETHANE, 1,1,2,2-	1.5E+02	Indoor Air Impacts	5.0E+03	1.5E+02	4.2E+02
TETRACHLOROETHYLENE	9.9E+01	Indoor Air Impacts	3.0E+03	9.9E+01	1.2E+02
THALLIUM	2.0E+01	Aquatic Habitat Goal	5.0E+04		2.0E+01
TOLUENE	1.3E+02	Aquatic Habitat Goal	4.0E+02	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	3.0E+04	1.0E+04	2.5E+01
TRICHLOROETHANE, 1,1,1-	6.2E+01	Aquatic Habitat Goal	5.0E+04	5.0E+05	6.2E+01
TRICHLOROETHANE, 1,1,2-	2.8E+02	Indoor Air Impacts	5.0E+04	2.8E+02	4.7E+03
TRICHLOROETHYLENE	7.4E+01	Indoor Air Impacts	5.0E+04	7.4E+01	3.6E+02
TRICHLOROPHENOL, 2,4,5-	1.1E+01	Aquatic Habitat Goal	2.0E+03	1.2E+06	1.1E+01

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	Groundwater Ceiling Value (Odors, etc.)	Vapor Intrusion Concerns	Aquatic Habitat Goal
			Table G-2	Table C-1a	Table D-3b (Chronic)
TRICHLOROPHENOL, 2,4,6-	4.9E+02	Aquatic Habitat Goal	1.0E+03		4.9E+02
VANADIUM	1.9E+01	Aquatic Habitat Goal	5.0E+04		1.9E+01
VINYL CHLORIDE	2.2E+01	Indoor Air Impacts	3.4E+04	2.2E+01	7.8E+02
XYLENES	1.0E+02	Aquatic Habitat Goal	5.3E+03	1.6E+05	1.0E+02
ZINC	2.2E+01	Aquatic Habitat Goal	5.0E+04		2.2E+01

Notes:

1. Lowest of Ceiling Value, Indoor-Air Impact goal and chronic Aquatic Habitat goal. Used to develop soil leaching levels for protection of groundwater quality (see Table E-1).

(Use Soil Gas): Use soil gas data to evaluate potential indoor-air impact concerns.
TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.
sol - solubility threshold
Ceiling Level: Odor/nuisance threshold, 1/2 solubility or 50000 ug/L maximum, whichever is lower. Intended to limit general groundwater resource degradation and address nuisance concerns.
Indoor Air Impact: Addresses potential emission of volatile chemicals from groundwater and subsequent impact on indoor air. Action level for very permeable (e.g., sandy) vadose zone soils used.
Aquatic Habitat Goal: Addresses potential discharge of groundwater to surface waterbody and subsequent impact on aquatic life. Potential dilution upon discharge to surface water not considered.
Method detection limits and background concentrations replace final action 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	Groundwater Ceiling Value (Odors, etc.) Table G-2	Vapor Intrusion Concerns Table C-1a	Aquatic Habitat Goal Table D-3c (Acute)
ACENAPHTHENE	2.0E+02	Ceiling Value	2.0E+02	4.2E+03	3.2E+02
ACENAPHTHYLENE	3.0E+02	Acute Aquatic Habitat Goal	2.0E+03	(Use soil gas)	3.0E+02
ACETONE	1.5E+03	Acute Aquatic Habitat Goal	5.0E+04	2.1E+08	1.5E+03
ALDRIN	1.3E+00	Acute Aquatic Habitat Goal	8.5E+00		1.3E+00
ANTHRACENE	7.3E-01	Acute Aquatic Habitat Goal	2.2E+01	4.3E+01	7.3E-01
ANTIMONY	1.5E+03	Acute Aquatic Habitat Goal	5.0E+04		1.5E+03
ARSENIC	6.9E+01	Acute Aquatic Habitat Goal	5.0E+04		6.9E+01
BARIUM	2.0E+03	Acute Aquatic Habitat Goal	5.0E+04		2.0E+03
BENZENE	1.6E+03	Indoor Air Impacts	2.0E+04	1.6E+03	1.7E+03
BENZO(a)ANTHRACENE	2.7E-02	Acute Aquatic Habitat Goal	5.0E+00		2.7E-02
BENZO(a)PYRENE	1.4E-02	Acute Aquatic Habitat Goal	1.9E+00		1.4E-02
BENZO(b)FLUORANTHENE	9.2E-02	Acute Aquatic Habitat Goal	7.0E+00		9.2E-02
BENZO(g,h,i)PERYLENE	1.0E-01	Acute Aquatic Habitat Goal	1.3E-01		1.0E-01
BENZO(k)FLUORANTHENE	4.0E-01	Ceiling Value	4.0E-01		3.7E+00
BERYLLIUM	4.3E+01	Acute Aquatic Habitat Goal	5.0E+04		4.3E+01
BIPHENYL, 1,1-	5.0E+00	Ceiling Value	5.0E+00	(Use soil gas)	1.4E+01
BIS(2-CHLOROETHYL)ETHER	1.0E+02	Indoor Air Impacts	3.6E+03	1.0E+02	2.4E+05
BIS(2-CHLOROISOPROPYL)ETHER	3.2E+03	Ceiling Value	3.2E+03	(Use soil gas)	2.4E+05
BIS(2-ETHYLHEXYL)PHTHALATE	3.2E+01	Acute Aquatic Habitat Goal	6.5E+02		3.2E+01
BORON	1.6E+00	Acute Aquatic Habitat Goal	5.0E+04		1.6E+00
BROMODICHLOROMETHANE	2.7E+02	Indoor Air Impacts	5.0E+04	2.7E+02	1.1E+04
BROMOFORM	5.1E+03	Ceiling Value	5.1E+03		1.1E+04
BROMOMETHANE	2.3E+03	Indoor Air Impacts	5.0E+04	2.3E+03	1.1E+04
CADMIUM	3.0E+00	Acute Aquatic Habitat Goal	5.0E+04		3.0E+00
CARBON TETRACHLORIDE	2.1E+01	Indoor Air Impacts	5.2E+03	2.1E+01	1.2E+04
CHLORDANE	9.0E-02	Acute Aquatic Habitat Goal	2.5E+01		9.0E-02
CHLOROANILINE, p-	5.0E+00	Acute Aquatic Habitat Goal	5.0E+04		5.0E+00
CHLOROBENZENE	1.6E+02	Acute Aquatic Habitat Goal	5.0E+02	5.3E+04	1.6E+02
CHLOROETHANE	3.9E+00	Acute Aquatic Habitat Goal	1.6E+02	6.5E+02	3.9E+00
CHLOROFORM	6.2E+01	Indoor Air Impacts	2.4E+04	6.2E+01	9.6E+03
CHLOROMETHANE	9.5E+03	Indoor Air Impacts	5.0E+04	9.5E+03	1.1E+04
CHLOROPHENOL, 2-	1.8E+00	Ceiling Value	1.8E+00	2.1E+04	1.4E+03
CHROMIUM (Total)	7.4E+01	Acute Aquatic Habitat Goal	5.0E+04		7.4E+01
CHROMIUM III	5.7E+02	Acute Aquatic Habitat Goal	5.0E+04		5.7E+02
CHROMIUM VI	1.6E+01	Acute Aquatic Habitat Goal	5.0E+04		1.6E+01
CHRYSENE	3.5E-01	Acute Aquatic Habitat Goal	8.0E-01	(Use soil gas)	3.5E-01
COBALT	3.0E+00	Acute Aquatic Habitat Goal	5.0E+04		3.0E+00
COPPER	2.9E+00	Acute Aquatic Habitat Goal	5.0E+04		2.9E+00
CYANIDE (Free)	1.0E+00	Acute Aquatic Habitat Goal	1.7E+03	(Use soil gas)	1.0E+00

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	Groundwater Ceiling Value (Odors, etc.) Table G-2	Vapor Intrusion Concerns Table C-1a	Aquatic Habitat Goal Table D-3c (Acute)
DIBENZO(a,h)ANTHTRACENE	2.5E-01	Ceiling Value	2.5E-01		7.5E+00
DIBROMO-3-CHLOROPROPANE, 1,2-	4.0E-02	Acute Aquatic Habitat Goal	1.0E+02	(Use soil gas)	4.0E-02
DIBROMOCHLOROMETHANE	1.6E+02	Indoor Air Impacts	5.0E+04	1.6E+02	1.1E+04
DIBROMOETHANE, 1,2-	1.6E+01	Indoor Air Impacts	5.0E+04	1.6E+01	1.4E+03
DICHLOROBENZENE, 1,2-	1.0E+02	Ceiling Value	1.0E+02	1.6E+05	3.7E+02
DICHLOROBENZENE, 1,3-	3.7E+02	Acute Aquatic Habitat Goal	5.0E+04	(Use soil gas)	3.7E+02
DICHLOROBENZENE, 1,4-	1.1E+02	Ceiling Value	1.1E+02	4.9E+02	3.7E+02
DICHLOROBENZIDINE, 3,3-	2.5E+02	Acute Aquatic Habitat Goal	1.6E+03		2.5E+02
DICHLORODIPHENYLDICHLOROETHANE (DDD)	6.0E-01	Acute Aquatic Habitat Goal	8.0E+01		6.0E-01
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.4E+01	Acute Aquatic Habitat Goal	2.0E+01		1.4E+01
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.3E-02	Acute Aquatic Habitat Goal	1.5E+00		1.3E-02
DICHLOROETHANE, 1,1-	4.7E+01	Acute Aquatic Habitat Goal	5.0E+04	2.8E+05	4.7E+01
DICHLOROETHANE, 1,2-	1.3E+02	Indoor Air Impacts	5.0E+04	1.3E+02	3.8E+04
DICHLOROETHYLENE, 1,1-	3.9E+03	Acute Aquatic Habitat Goal	1.5E+04	2.5E+04	3.9E+03
DICHLOROETHYLENE, Cis 1,2-	1.2E+04	Acute Aquatic Habitat Goal	5.0E+04	2.4E+04	1.2E+04
DICHLOROETHYLENE, Trans 1,2-	2.6E+03	Ceiling Value	2.6E+03	2.7E+04	1.2E+04
DICHLOROPHENOL, 2,4-	3.0E+00	Ceiling Value	3.0E+00		6.7E+02
DICHLOROPROPANE, 1,2-	1.0E+02	Ceiling Value	1.0E+02	1.2E+02	3.4E+03
DICHLOROPROPENE, 1,3-	1.6E+02	Indoor Air Impacts	5.0E+04	1.6E+02	2.6E+02
DIELDRIN	7.1E-01	Acute Aquatic Habitat Goal	9.3E+01		7.1E-01
DIETHYLPHTHALATE	9.4E+02	Acute Aquatic Habitat Goal	5.0E+04		9.4E+02
DIMETHYLPHENOL, 2,4-	2.7E+02	Acute Aquatic Habitat Goal	4.0E+03		2.7E+02
DIMETHYLPHTHALATE	9.4E+02	Acute Aquatic Habitat Goal	5.0E+04		9.4E+02
DINITROPHENOL, 2,4-	2.3E+02	Acute Aquatic Habitat Goal	5.0E+04		2.3E+02
DINITROTOLUENE, 2,4-	2.0E+02	Acute Aquatic Habitat Goal	5.0E+04		2.0E+02
DIOXANE, 1,4-	5.0E+04	Ceiling Value	5.0E+04		6.7E+06
DIOXIN (2,3,7,8-TCDD)	3.0E-03	Acute Aquatic Habitat Goal	7.0E+03		3.0E-03
ENDOSULFAN	3.4E-02	Acute Aquatic Habitat Goal	7.5E+01		3.4E-02
ENDRIN	3.7E-02	Acute Aquatic Habitat Goal	1.3E+02		3.7E-02
ETHYLBENZENE	3.0E+02	Ceiling Value	3.0E+02	1.7E+05	4.3E+02
FLUORANTHENE	4.0E+01	Acute Aquatic Habitat Goal	1.3E+02		4.0E+01
FLUORENE	3.0E+02	Acute Aquatic Habitat Goal	9.5E+02	1.9E+03	3.0E+02
HEPTACHLOR	5.3E-02	Acute Aquatic Habitat Goal	2.8E+01		5.3E-02
HEPTACHLOR EPOXIDE	5.3E-02	Acute Aquatic Habitat Goal	1.8E+02		5.3E-02
HEXACHLOROBENZENE	6.0E+00	Acute Aquatic Habitat Goal	5.5E+01		6.0E+00
HEXACHLOROBUTADIENE	1.1E+01	Acute Aquatic Habitat Goal	6.0E+01		1.1E+01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	1.6E-01	Acute Aquatic Habitat Goal	3.5E+03		1.6E-01
HEXACHLOROETHANE	1.0E+02	Ceiling Value	1.0E+02		3.1E+02
INDENO(1,2,3-cd)PYRENE	9.2E-02	Acute Aquatic Habitat Goal	2.7E-01		9.2E-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	Groundwater Ceiling Value (Odors, etc.) Table G-2	Vapor Intrusion Concerns Table C-1a	Aquatic Habitat Goal Table D-3c (Acute)
LEAD	2.9E+01	Acute Aquatic Habitat Goal	5.0E+04		2.9E+01
MERCURY	2.1E+00	Acute Aquatic Habitat Goal	5.0E+04		2.1E+00
METHOXYCHLOR	3.0E-02	Acute Aquatic Habitat Goal	2.0E+01		3.0E-02
METHYL ETHYL KETONE	1.4E+04	Acute Aquatic Habitat Goal	5.0E+04	2.7E+08	1.4E+04
METHYL ISOBUTYL KETONE	1.7E+02	Acute Aquatic Habitat Goal	1.3E+04	1.9E+07	1.7E+02
METHYL MERCURY	3.0E-03	Acute Aquatic Habitat Goal	5.0E+04		3.0E-03
METHYL TERT BUTYL ETHER	1.8E+03	Ceiling Value	1.8E+03	1.9E+04	8.0E+03
METHYLENE CHLORIDE	4.2E+03	Indoor Air Impacts	5.0E+04	4.2E+03	1.1E+04
METHYLNAPHTHALENE (total 1- & 2-)	1.0E+02	Ceiling Value	1.0E+02	2.6E+04	3.0E+02
MOLYBDENUM	2.4E+02	Acute Aquatic Habitat Goal	5.0E+04		2.4E+02
NAPHTHALENE	2.1E+02	Ceiling Value	2.1E+02	3.1E+04	7.7E+02
NICKEL	5.0E+00	Acute Aquatic Habitat Goal	5.0E+04		5.0E+00
PENTACHLOROPHENOL	1.3E+01	Acute Aquatic Habitat Goal	5.9E+03		1.3E+01
PERCHLORATE	6.0E+02	Acute Aquatic Habitat Goal	5.0E+04		6.0E+02
PHENANTHRENE	7.7E+00	Acute Aquatic Habitat Goal	4.1E+02	(Use soil gas)	7.7E+00
PHENOL	3.4E+03	Acute Aquatic Habitat Goal	5.0E+04		3.4E+03
POLYCHLORINATED BIPHENYLS (PCBs)	2.0E+00	Acute Aquatic Habitat Goal	1.6E+01		2.0E+00
PYRENE	2.0E+00	Acute Aquatic Habitat Goal	6.8E+01	1.4E+02	2.0E+00
SELENIUM	2.0E+01	Acute Aquatic Habitat Goal	5.0E+04		2.0E+01
SILVER	1.0E+00	Acute Aquatic Habitat Goal	5.0E+04		1.0E+00
STYRENE	1.0E+02	Acute Aquatic Habitat Goal	1.1E+02	3.1E+05	1.0E+02
tert-BUTYL ALCOHOL	5.0E+04	Ceiling Value	5.0E+04	(Use soil gas)	1.8E+05
TETRACHLOROETHANE, 1,1,1,2-	3.1E+03	Acute Aquatic Habitat Goal	5.0E+04	(Use soil gas)	3.1E+03
TETRACHLOROETHANE, 1,1,2,2-	1.5E+02	Indoor Air Impacts	5.0E+03	1.5E+02	3.0E+03
TETRACHLOROETHYLENE	9.9E+01	Indoor Air Impacts	3.0E+03	9.9E+01	1.8E+03
THALLIUM	4.7E+02	Acute Aquatic Habitat Goal	5.0E+04		4.7E+02
TOLUENE	4.0E+02	Ceiling Value	4.0E+02	5.3E+05	5.8E+03
TOXAPHENE	2.1E-01	Acute Aquatic Habitat Goal	1.4E+02		2.1E-01
TPH (gasolines)	5.0E+03	Ceiling Value	5.0E+03	(Use soil gas)	5.0E+03
TPH (middle distillates)	2.5E+03	Ceiling Value	2.5E+03	(Use soil gas)	2.5E+03
TPH (residual fuels)	2.5E+03	Ceiling Value	2.5E+03		2.5E+03
TRICHLOROBENZENE, 1,2,4-	1.6E+02	Acute Aquatic Habitat Goal	3.0E+04	1.0E+04	1.6E+02
TRICHLOROETHANE, 1,1,1-	6.0E+03	Acute Aquatic Habitat Goal	5.0E+04	5.0E+05	6.0E+03
TRICHLOROETHANE, 1,1,2-	2.8E+02	Indoor Air Impacts	5.0E+04	2.8E+02	6.0E+03
TRICHLOROETHYLENE	7.4E+01	Indoor Air Impacts	5.0E+04	7.4E+01	7.0E+02
TRICHLOROPHENOL, 2,4,5-	1.0E+02	Acute Aquatic Habitat Goal	2.0E+03	1.2E+06	1.0E+02
TRICHLOROPHENOL, 2,4,6-	4.9E+02	Acute Aquatic Habitat Goal	1.0E+03		4.9E+02
VANADIUM	1.9E+01	Acute Aquatic Habitat Goal	5.0E+04		1.9E+01
VINYL CHLORIDE	2.2E+01	Indoor Air Impacts	3.4E+04	2.2E+01	7.8E+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	Groundwater Ceiling Value (Odors, etc.) Table G-2	Vapor Intrusion Concerns Table C-1a	Aquatic Habitat Goal Table D-3c (Acute)
XYLENES	2.0E+03	Acute Aquatic Habitat Goal	5.3E+03	1.6E+05	2.0E+03
ZINC	2.2E+01	Acute Aquatic Habitat Goal	5.0E+04		2.2E+01

Notes:

1. Lowest of Ceiling Value, Indoor-Air Impact goal and acute Aquatic Habitat goal. Used to develop soil leaching levels for protection of groundwater quality (see Table E-1).

(Use Soil Gas): Use soil gas data to evaluate potential indoor-air impact concerns.
TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.
sol - solubility threshold
Ceiling Level: Odor/nuisance threshold, 1/2 solubility or 50000 ug/L maximum, whichever is lower. Intended to limit general groundwater resource degradation and address nuisance concerns.
Indoor Air Impact: Addresses potential emission of volatile chemicals from groundwater and subsequent impact on indoor air. Action level for very permeable (e.g., sandy) vadose zone soils used.
Aquatic Habitat Goal: Addresses potential discharge of groundwater to surface waterbody and subsequent impact on aquatic life. Potential dilution upon discharge to surface water not considered.
Method detection limits and background concentrations replace final screening level as appropriate.

TABLE D-2. SUMMARY OF DRINKING WATER ACTION LEVELS FOR HUMAN TOXICITY
(ug/L)

CONTAMINANT	Final Action Level	Basis	USEPA Primary MCL	USEPA Region IX Tapwater Goal (Table D-4)	Basis
ACENAPHTHENE	3.7E+02	noncarcinogenic effects		3.7E+02	noncarcinogenic effects
ACENAPHTHYLENE	2.4E+02	noncarcinogenic effects		2.4E+02	noncarcinogenic effects
ACETONE	5.5E+03	noncarcinogenic effects		5.5E+03	noncarcinogenic effects
ALDRIN	4.0E-03	carcinogenic effects		4.0E-03	carcinogenic effects
ANTHRACENE	1.8E+03	noncarcinogenic effects		1.8E+03	noncarcinogenic effects
ANTIMONY	6.0E+00	HI DOH Primary MCL	6.0E+00	1.5E+01	noncarcinogenic effects
ARSENIC	1.0E+01	HI DOH Primary MCL	1.0E+01	4.5E-02	carcinogenic effects
BARIUM	2.0E+03	HI DOH Primary MCL	2.0E+03	2.6E+03	noncarcinogenic effects
BENZENE	5.0E+00	HI DOH Primary MCL	5.0E+00	3.5E-01	carcinogenic effects
BENZO(a)ANTHRACENE	9.2E-02	carcinogenic effects		9.2E-02	carcinogenic effects
BENZO(a)PYRENE	2.0E-01	HI DOH 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	HI DOH Primary MCL	4.0E+00	7.3E+01	noncarcinogenic effects
BIPHENYL, 1,1-	3.0E+02	noncarcinogenic effects		3.0E+02	noncarcinogenic effects
BIS(2-CHLOROETHYL)ETHER	9.5E-03	carcinogenic effects		9.5E-03	carcinogenic effects
BIS(2-CHLOROISOPROPYL)ETHER	2.7E-01	carcinogenic effects		2.7E-01	carcinogenic effects
BIS(2-ETHYLHEXYL)PHTHALATE	6.0E+00	HI DOH Primary MCL	6.0E+00	4.8E+00	carcinogenic effects
BORON	7.3E+03	noncarcinogenic effects		7.3E+03	noncarcinogenic effects
BROMODICHLOROMETHANE	1.8E-01	carcinogenic effects		1.8E-01	carcinogenic effects
BROMOFORM	1.0E+02	HI DOH Primary MCL	1.0E+02	8.5E+00	carcinogenic effects
BROMOMETHANE	8.5E+00	noncarcinogenic effects		8.5E+00	noncarcinogenic effects
CADMIUM	5.0E+00	HI DOH Primary MCL	5.0E+00	1.8E+01	noncarcinogenic effects
CARBON TETRACHLORIDE	5.0E+00	HI DOH Primary MCL	5.0E+00	1.7E-01	carcinogenic effects
CHLORDANE	2.0E+00	HI DOH Primary MCL	2.0E+00	1.9E-01	carcinogenic effects
CHLOROANILINE, p-	1.5E+02	noncarcinogenic effects		1.5E+02	noncarcinogenic effects
CHLOROBENZENE	1.0E+02	HI DOH Primary MCL	1.0E+02	1.1E+02	noncarcinogenic effects
CHLOROETHANE	3.9E+00	carcinogenic effects		3.9E+00	carcinogenic effects
CHLOROFORM	1.0E+02	HI DOH Primary MCL	1.0E+02	1.7E-01	carcinogenic effects
CHLOROMETHANE	1.6E+02	noncarcinogenic effects		1.6E+02	noncarcinogenic effects
CHLOROPHENOL, 2-	3.0E+01	noncarcinogenic effects		3.0E+01	noncarcinogenic effects
CHROMIUM (Total)	1.0E+02	HI DOH Primary MCL	1.0E+02	0.0E+00	carcinogenic effects
CHROMIUM III	5.5E+04	noncarcinogenic effects		5.5E+04	noncarcinogenic effects

TABLE D-2. SUMMARY OF DRINKING WATER ACTION LEVELS FOR HUMAN TOXICITY (ug/L)

CONTAMINANT	Final Action Level	Basis	USEPA Primary MCL	USEPA Region IX Tapwater Goal (Table D-4)	Basis
CHROMIUM VI	1.1E+02	noncarcinogenic effects		1.1E+02	noncarcinogenic effects
CHRYSENE	9.2E+00	carcinogenic effects		9.2E+00	carcinogenic effects
COBALT	7.3E+02	noncarcinogenic effects		7.3E+02	noncarcinogenic effects
COPPER	1.3E+03	HI DOH Primary MCL	1.3E+03	1.5E+03	noncarcinogenic effects
CYANIDE (Free)	2.0E+02	HI DOH Primary MCL	2.0E+02	7.3E+02	noncarcinogenic effects
DIBENZO(a,h)ANTHTRACENE	9.2E-03	carcinogenic effects		9.2E-03	carcinogenic effects
DIBROMO-3-CHLOROPROPANE, 1,2-	4.0E-02	HI DOH Primary MCL	4.0E-02	4.8E-02	carcinogenic effects
DIBROMOCHLOROMETHANE	1.3E-01	carcinogenic effects		1.3E-01	carcinogenic effects
DIBROMOETHANE, 1,2-	5.6E-03	carcinogenic effects		5.6E-03	carcinogenic effects
DICHLOROBENZENE, 1,2-	6.0E+02	HI DOH 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	HI DOH Primary MCL	7.5E+01	5.0E-01	carcinogenic effects
DICHLOROBENZIDINE, 3,3-	1.5E-01	carcinogenic effects		1.5E-01	carcinogenic effects
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.8E-01	carcinogenic effects		2.8E-01	carcinogenic effects
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.8E-01	carcinogenic effects		2.8E-01	carcinogenic effects
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	2.0E-01	carcinogenic effects		2.0E-01	carcinogenic effects
DICHLOROETHANE, 1,1-	8.0E+02	noncarcinogenic effects		8.0E+02	noncarcinogenic effects
DICHLOROETHANE, 1,2-	1.2E-01	carcinogenic effects		1.2E-01	carcinogenic effects
DICHLOROETHYLENE, 1,1-	7.0E+00	HI DOH Primary MCL	7.0E+00	3.4E+02	noncarcinogenic effects
DICHLOROETHYLENE, Cis 1,2-	7.0E+01	HI DOH Primary MCL	7.0E+01	6.1E+01	noncarcinogenic effects
DICHLOROETHYLENE, Trans 1,2-	1.0E+02	HI DOH Primary MCL	1.0E+02	1.2E+02	noncarcinogenic effects
DICHLOROPHENOL, 2,4-	1.1E+02	noncarcinogenic effects		1.1E+02	noncarcinogenic effects
DICHLOROPROPANE, 1,2-	5.0E+00	HI DOH Primary MCL	5.0E+00	1.6E-01	carcinogenic effects
DICHLOROPROPENE, 1,3-	4.0E-01	carcinogenic effects		4.0E-01	carcinogenic effects
DIELDRIN	4.2E-03	carcinogenic effects		4.2E-03	carcinogenic effects
DIETHYLPHTHALATE	2.9E+04	noncarcinogenic effects		2.9E+04	noncarcinogenic effects
DIMETHYLPHENOL, 2,4-	7.3E+02	noncarcinogenic effects		7.3E+02	noncarcinogenic effects
DIMETHYLPHTHALATE	3.7E+05	noncarcinogenic effects		3.7E+05	noncarcinogenic effects
DINITROPHENOL, 2,4-	7.3E+01	noncarcinogenic effects		7.3E+01	noncarcinogenic effects
DINITROTOLUENE, 2,4-	3.4E+01	carcinogenic effects		3.4E+01	carcinogenic effects
DIOXANE, 1,4-	6.1E+00	carcinogenic effects		6.1E+00	carcinogenic effects
DIOXIN (2,3,7,8-TCDD)	3.0E-05	HI DOH Primary MCL	3.0E-05	4.5E-07	carcinogenic effects
ENDOSULFAN	2.2E+02	noncarcinogenic effects		2.2E+02	noncarcinogenic effects
ENDRIN	2.0E+00	HI DOH Primary MCL	2.0E+00	1.1E+01	noncarcinogenic effects

TABLE D-2. SUMMARY OF DRINKING WATER ACTION LEVELS FOR HUMAN TOXICITY (ug/L)

CONTAMINANT	Final Action Level	Basis	USEPA Primary MCL	USEPA Region IX Tapwater Goal (Table D-4)	Basis
ETHYLBENZENE	7.0E+02	HI DOH Primary MCL	7.0E+02	1.3E+03	noncarcinogenic effects
FLUORANTHENE	1.5E+03	noncarcinogenic effects		1.5E+03	noncarcinogenic effects
FLUORENE	2.4E+02	noncarcinogenic effects		2.4E+02	noncarcinogenic effects
HEPTACHLOR	4.0E-01	HI DOH Primary MCL	4.0E-01	1.5E-02	carcinogenic effects
HEPTACHLOR EPOXIDE	2.0E-01	HI DOH Primary MCL	2.0E-01	7.4E-03	carcinogenic effects
HEXACHLOROBENZENE	1.0E+00	HI DOH 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	HI DOH Primary MCL	2.0E-01	5.2E-02	carcinogenic effects
HEXACHLOROETHANE	4.8E+00	carcinogenic effects		4.8E+00	carcinogenic effects
INDENO(1,2,3-cd)PYRENE	9.2E-02	carcinogenic effects		9.2E-02	carcinogenic effects
LEAD	1.5E+01	HI DOH Primary MCL	1.5E+01	0.0E+00	carcinogenic effects
MERCURY	2.0E+00	HI DOH Primary MCL	2.0E+00	5.8E+00	noncarcinogenic effects
METHOXYCHLOR	4.0E+01	HI DOH Primary MCL	4.0E+01	1.8E+02	noncarcinogenic effects
METHYL ETHYL KETONE	7.0E+03	noncarcinogenic effects		7.0E+03	noncarcinogenic effects
METHYL ISOBUTYL KETONE	2.0E+03	noncarcinogenic effects		2.0E+03	noncarcinogenic effects
METHYL MERCURY	3.7E+00	noncarcinogenic effects		3.7E+00	noncarcinogenic effects
METHYL TERT BUTYL ETHER	1.1E+01	carcinogenic effects		1.1E+01	carcinogenic effects
METHYLENE CHLORIDE	4.3E+00	carcinogenic effects		4.3E+00	carcinogenic effects
METHYLNAPHTHALENE (total 1- & 2-)	2.4E+02	noncarcinogenic effects		2.4E+02	noncarcinogenic effects
MOLYBDENUM	1.8E+02	noncarcinogenic effects		1.8E+02	noncarcinogenic effects
NAPHTHALENE	6.2E+00	noncarcinogenic effects		6.2E+00	noncarcinogenic effects
NICKEL	1.0E+02	HI DOH Primary MCL	1.0E+02	7.3E+02	noncarcinogenic effects
PENTACHLOROPHENOL	1.0E+00	HI DOH Primary MCL	1.0E+00	5.6E-01	carcinogenic effects
PERCHLORATE	3.7E+00	noncarcinogenic effects		3.7E+00	noncarcinogenic effects
PHENANTHRENE	2.4E+02	noncarcinogenic effects		2.4E+02	noncarcinogenic effects
PHENOL	1.1E+04	noncarcinogenic effects		1.1E+04	noncarcinogenic effects
POLYCHLORINATED BIPHENYLS (PCBs)	5.0E-01	HI DOH Primary MCL	5.0E-01	3.4E-02	carcinogenic effects
PYRENE	1.8E+02	noncarcinogenic effects		1.8E+02	noncarcinogenic effects
SELENIUM	5.0E+01	HI DOH Primary MCL	5.0E+01	1.8E+02	noncarcinogenic effects
SILVER	1.8E+02	noncarcinogenic effects		1.8E+02	noncarcinogenic effects
STYRENE	1.0E+02	HI DOH Primary MCL	1.0E+02	1.6E+03	noncarcinogenic effects
tert-BUTYL ALCOHOL	3.7E+00	carcinogenic effects		3.7E+00	carcinogenic effects
TETRACHLOROETHANE, 1,1,1,2-	4.3E-01	carcinogenic effects		4.3E-01	carcinogenic effects
TETRACHLOROETHANE, 1,1,2,2-	5.6E-02	carcinogenic effects		5.6E-02	carcinogenic effects

TABLE D-2. SUMMARY OF DRINKING WATER ACTION LEVELS FOR HUMAN TOXICITY (ug/L)

CONTAMINANT	Final Action Level	Basis	USEPA Primary MCL	USEPA Region IX Tapwater Goal (Table D-4)	Basis
TETRACHLOROETHYLENE	5.0E+00	HI DOH Primary MCL	5.0E+00	1.0E-01	carcinogenic effects
THALLIUM	2.0E+00	HI DOH Primary MCL	2.0E+00	2.4E+00	noncarcinogenic effects
TOLUENE	1.0E+03	HI DOH Primary MCL	1.0E+03	7.2E+02	noncarcinogenic effects
TOXAPHENE	3.0E+00	HI DOH Primary MCL	3.0E+00	5.6E-02	carcinogenic effects
TPH (gasolines)	1.0E+02	noncarcinogenic effects		1.0E+02	noncarcinogenic effects
TPH (middle distillates)	1.0E+02	noncarcinogenic effects		1.0E+02	noncarcinogenic effects
TPH (residual fuels)	1.0E+03	noncarcinogenic effects		1.0E+03	noncarcinogenic effects
TRICHLOROBENZENE, 1,2,4-	7.0E+01	HI DOH Primary MCL	7.0E+01	7.2E+00	noncarcinogenic effects
TRICHLOROETHANE, 1,1,1-	2.0E+02	HI DOH Primary MCL	2.0E+02	3.2E+03	noncarcinogenic effects
TRICHLOROETHANE, 1,1,2-	5.0E+00	HI DOH Primary MCL	5.0E+00	2.0E-01	carcinogenic effects
TRICHLOROETHYLENE	5.0E+00	HI DOH Primary MCL	5.0E+00	2.8E-02	carcinogenic effects
TRICHLOROPHENOL, 2,4,5-	6.1E+02	noncarcinogenic effects		6.1E+02	noncarcinogenic effects
TRICHLOROPHENOL, 2,4,6-	3.7E+00	noncarcinogenic effects		3.7E+00	noncarcinogenic effects
VANADIUM	3.7E+01	noncarcinogenic effects		3.7E+01	noncarcinogenic effects
VINYL CHLORIDE	2.0E+00	HI DOH Primary MCL	2.0E+00	8.1E-02	carcinogenic effects
XYLENES	1.0E+04	HI DOH Primary MCL	1.0E+04	2.1E+02	noncarcinogenic effects
ZINC	1.1E+04	noncarcinogenic effects		1.1E+04	noncarcinogenic effects

Notes:
Used for development of groundwater and soil screening levels.
TPH -Total Petroleum Hydrocarbons. Default toxicity-based action levels rounded to 100 ug/L or 1,000 ug/L, as shown. See text for TPH category discussion.
USEPA MCL: USEPA Primary Maximum Concentration Level.
Final health-based action level for drinking water: USEPA Primary MCL or USEPA Region IX Tapwater goal if no Primary MCL

TABLE D-3a. SUMMARY OF AQUATIC HABITAT GOALS

	Freshwater		Marine	
CONTAMINANT	Chronic Aquatic Toxicity (ug/L)	Acute Aquatic Toxicity (ug/L)	Chronic Aquatic Toxicity (ug/L)	Acute Aquatic Toxicity (ug/L)
ACENAPHTHENE	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
ACETONE	1.5E+03	1.5E+03	1.5E+03	1.5E+03
ALDRIN	3.0E-01	3.0E+00	1.3E-01	1.3E+00
ANTHRACENE	7.3E-01	7.3E-01	7.3E-01	7.3E-01
ANTIMONY	3.0E+01	3.0E+03	5.0E+02	1.5E+03
ARSENIC	1.9E+02	3.6E+02	3.6E+01	6.9E+01
BARIUM	2.0E+03	2.0E+03	2.0E+03	2.0E+03
BENZENE	4.6E+01	1.8E+03	3.5E+02	1.7E+03
BENZO(a)ANTHRACENE	2.7E-02	2.7E-02	2.7E-02	2.7E-02
BENZO(a)PYRENE	3.7E+00	3.7E+00	3.7E+00	3.7E+00
BENZO(b)FLUORANTHENE	1.4E-02	1.4E-02	1.4E-02	1.4E-02
BENZO(g,h,i)PERYLENE	1.0E-01	1.0E-01	1.0E-01	1.0E-01
BENZO(k)FLUORANTHENE	9.2E-02	9.2E-02	9.2E-02	9.2E-02
BERYLLIUM	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
BIS(2-CHLOROETHYL)ETHER	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
BIS(2-ETHYLHEXYL)PHTHALATE	3.2E+01	3.2E+01	3.2E+01	3.2E+01
BORON	1.6E+00	1.6E+00	1.6E+00	1.6E+00
BROMODICHLOROMETHANE	3.2E+03	1.1E+04	3.2E+03	1.2E+04
BROMOFORM	3.2E+03	1.1E+04	3.2E+03	1.2E+04
BROMOMETHANE	1.6E+02	1.1E+04	3.2E+03	1.2E+04
CADMIUM	3.0E+00	3.0E+00	9.3E+00	4.3E+01
CARBON TETRACHLORIDE	9.8E+00	1.2E+04	3.2E+03	1.6E+04
CHLORDANE	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
CHLOROBENZENE	2.5E+01	2.5E+02	6.5E+01	1.6E+02
CHLOROETHANE	3.9E+00	3.9E+00	3.9E+00	3.9E+00
CHLOROFORM	6.2E+02	9.6E+03	3.2E+03	1.2E+04
CHLOROMETHANE	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
CHROMIUM (Total)	7.4E+01	7.4E+01	1.0E+04	1.0E+04
CHROMIUM III	7.4E+01	5.7E+02	7.4E+01	1.0E+04
CHROMIUM VI	1.1E+01	1.6E+01	5.0E+01	1.1E+03
CHRYSENE	3.5E-01	3.5E-01	3.5E-01	3.5E-01
COBALT	3.0E+00	3.0E+00	3.0E+00	3.0E+00
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
DIBENZO(a,h)ANTHTRACENE	7.5E+00	7.5E+00	7.5E+00	7.5E+00
DIBROMO-3-CHLOROPROPANE, 1,2-	3.2E+03	1.1E+04	3.2E+03	1.2E+04
DIBROMOCHLOROMETHANE	4.0E-02	4.0E-02	4.0E-02	4.0E-02
DIBROMOETHANE, 1,2-	1.4E+03	1.4E+03	1.4E+03	1.4E+03
DICHLOROBENZENE, 1,2-	1.4E+01	3.7E+02	6.5E+01	6.6E+02
DICHLOROBENZENE, 1,3-	7.1E+01	3.7E+02	6.5E+01	6.6E+02
DICHLOROBENZENE, 1,4-	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

TABLE D-3a. SUMMARY OF AQUATIC HABITAT GOALS

	Freshwater		Marine	
CONTAMINANT	Chronic Aquatic Toxicity (ug/L)	Acute Aquatic Toxicity (ug/L)	Chronic Aquatic Toxicity (ug/L)	Acute Aquatic Toxicity (ug/L)
DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.0E-03	6.0E-01	1.0E-03	3.6E+00
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.0E-03	1.1E+03	1.0E-03	1.4E+01
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	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
DICHLOROETHANE, 1,2-	1.0E+04	3.9E+04	1.0E+04	3.8E+04
DICHLOROETHYLENE, 1,1-	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	2.2E+05
DICHLOROETHYLENE, Trans 1,2-	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
DICHLOROPROPANE, 1,2-	2.9E+03	7.7E+03	1.5E+03	3.4E+03
DICHLOROPROPENE, 1,3-	1.2E+02	2.0E+03	1.2E+02	2.6E+02
DIELDRIN	1.9E-03	2.5E+00	1.9E-03	7.1E-01
DIETHYLPHTHALATE	1.5E+00	9.4E+02	1.7E+00	2.9E+03
DIMETHYLPHENOL, 2,4-	1.5E+00	9.4E+02	1.7E+00	2.9E+03
DIMETHYLPHTHALATE	5.3E+02	7.0E+02	1.1E+02	2.7E+02
DINITROPHENOL, 2,4-	7.5E+01	2.3E+02	7.5E+01	4.9E+03
DINITROTOLUENE, 2,4-	1.2E+02	3.3E+02	1.9E+02	2.0E+02
DIOXANE, 1,4-	3.4E+05	6.7E+06	5.0E+05	1.0E+07
DIOXIN (2,3,7,8-TCDD)	5.0E-06	3.0E-03	5.0E-06	3.0E-03
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
ETHYLBENZENE	2.9E+02	1.1E+04	2.9E+02	4.3E+02
FLUORANTHENE	8.1E+00	1.3E+03	8.0E+00	4.0E+01
FLUORENE	3.9E+00	3.0E+02	3.9E+00	3.0E+02
HEPTACHLOR	3.8E-03	5.2E-01	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	6.5E+01	1.6E+02
HEXACHLOROBUTADIENE	4.7E+00	3.0E+01	4.7E+00	1.1E+01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	8.0E-02	2.0E+00	8.0E-02	1.6E-01
HEXACHLOROETHANE	1.2E+01	3.3E+02	1.2E+01	3.1E+02
INDENO(1,2,3-cd)PYRENE	9.2E-02	9.2E-02	9.2E-02	9.2E-02
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	3.0E-02	3.0E-02
METHYL ETHYL KETONE	1.7E+02	1.7E+02	1.7E+02	1.7E+02
METHYL ISOBUTYL KETONE	3.0E-03	3.0E-03	3.0E-03	3.0E-03
METHYL MERCURY	6.6E+04	6.6E+04	8.0E+03	8.0E+03
METHYL TERT BUTYL ETHER	2.1E+00	3.0E+02	2.1E+00	3.0E+02
METHYLENE CHLORIDE	1.4E+04	1.4E+04	1.4E+04	1.4E+04
METHYLNAPHTHALENE (total 1- & 2-)	2.2E+03	1.1E+04	3.2E+03	1.2E+04
MOLYBDENUM	2.4E+02	2.4E+02	2.4E+02	2.4E+02
NAPHTHALENE	2.4E+01	7.7E+02	2.4E+01	7.8E+02
NICKEL	5.0E+00	5.0E+00	8.3E+00	7.5E+01
PENTACHLOROPHENOL	1.3E+01	2.0E+01	7.9E+00	1.3E+01
PERCHLORATE	6.0E+02	6.0E+02	6.0E+02	6.0E+02
PHENANTHRENE	6.3E+00	3.0E+01	4.6E+00	7.7E+00
PHENOL	1.3E+03	3.4E+03	1.3E+03	5.8E+03

TABLE D-3a. SUMMARY OF AQUATIC HABITAT GOALS

CONTAMINANT	Freshwater		Marine	
	Chronic Aquatic Toxicity (ug/L)	Acute Aquatic Toxicity (ug/L)	Chronic Aquatic Toxicity (ug/L)	Acute Aquatic Toxicity (ug/L)
POLYCHLORINATED BIPHENYLS (PCBs)	1.4E-02	2.0E+00	3.0E-02	1.0E+01
PYRENE	2.0E+00	2.0E+00	2.0E+00	2.0E+00
SELENIUM	5.0E+00	2.0E+01	7.1E+01	3.0E+02
SILVER	1.0E+00	1.0E+00	1.0E+00	2.3E+00
STYRENE	1.0E+02	1.0E+02	1.0E+02	1.0E+02
tert-BUTYL ALCOHOL	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
TETRACHLOROETHANE, 1,1,2,2-	4.2E+02	9.3E+03	4.2E+02	3.0E+03
TETRACHLOROETHYLENE	1.2E+02	1.8E+03	1.5E+02	3.4E+03
THALLIUM	2.0E+01	4.7E+02	2.0E+01	7.1E+02
TOLUENE	1.3E+02	5.8E+03	2.5E+03	6.3E+03
TOXAPHENE	2.0E-04	7.3E-01	2.0E-04	2.1E-01
TPH (gasolines)	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
TPH (residual fuels)	6.4E+02	2.5E+03	6.4E+02	2.5E+03
TRICHLOROBENZENE, 1,2,4-	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	1.0E+04
TRICHLOROETHANE, 1,1,2-	4.7E+03	6.0E+03	4.7E+03	6.0E+03
TRICHLOROETHYLENE	3.6E+02	1.5E+04	3.6E+02	7.0E+02
TRICHLOROPHENOL, 2,4,5-	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
VANADIUM	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
XYLENES	1.0E+02	2.0E+03	1.0E+02	2.0E+03
ZINC	2.2E+01	2.2E+01	8.6E+01	9.5E+01
Electrical Conductivity (mS/cm, USEPA Method 120.1 MOD)	not applicable	not applicable	not applicable	not applicable
Sodium Adsorption Ratio	not applicable	not applicable	not applicable	not applicable

Notes:

Reference: Appendix 1, Table D-3b (chronic) and D-3c (acute).

For estuary environments use lowest of lowest of freshwater and marine goals.

TABLE D-3b. SUMMARY OF SELECTED CHRONIC AQUATIC HABITAT GOALS
(ug/l)

CONTAMINANT	[1]Lowest Chronic Aquatic Habitat Goal	Basis	Lowest Freshwater Chronic Aquatic Habitat Goal	Basis	Lowest Saltwater Chronic Aquatic Habitat Goal	Basis
ACENAPHTHENE	2.3E+01	USEPA Ecotox FW Chronic	2.3E+01	USEPA Ecotox FW Chronic	4.0E+01	USEPA Ecotox SW Chronic
ACENAPHTHYLENE	3.0E+01	10% USEPA SW Acute LOEL	3.0E+01	10% USEPA SW Acute LOEL	3.0E+01	10% USEPA SW Acute LOEL
ACETONE	1.5E+03	USDOE FW Chronic PRG	1.5E+03	USDOE FW Chronic PRG	1.5E+03	USDOE FW Chronic PRG
ALDRIN	1.3E-01	10% HI DOH SW Acute	3.0E-01	10% HI DOH FW Acute	1.3E-01	10% HI DOH SW Acute
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	HI DOH SW Chronic	1.9E+02	HI DOH FW Chronic	3.6E+01	HI DOH SW Chronic
BARIUM	2.0E+03	=Drinking Water (Table D-2)	2.0E+03	=Drinking Water (Table D-2)	2.0E+03	=Drinking Water (Table D-2)
BENZENE	4.6E+01	USEPA Ecotox FW Chronic	4.6E+01	USEPA Ecotox FW Chronic	3.5E+02	50% USEPA SW Chronic LOEL
BENZO(a)ANTHRACENE	2.7E-02	USDOE FW Chronic PRG	2.7E-02	USDOE FW Chronic PRG	2.7E-02	USDOE FW Chronic PRG
BENZO(a)PYRENE	1.4E-02	USEPA Ecotox FW Chronic	1.4E-02	USEPA Ecotox FW Chronic	1.4E-02	USEPA Ecotox FW Chronic
BENZO(b)FLUORANTHENE	9.2E-02	=Drinking Water (Table D-2)	9.2E-02	=Drinking Water (Table D-2)	9.2E-02	=Drinking Water (Table D-2)
BENZO(g,h,i)PERYLENE	1.0E-01	50% MOEE FW Chronic LOEL	1.0E-01	50% MOEE FW Chronic LOEL	1.0E-01	50% MOEE FW Chronic LOEL
BENZO(k)FLUORANTHENE	3.7E+00	50% MOEE FW Chronic LOEL	3.7E+00	50% MOEE FW Chronic LOEL	3.7E+00	50% MOEE FW Chronic LOEL
BERYLLIUM	2.7E+00	50% USEPA FW Chronic LOEL	2.7E+00	50% USEPA FW Chronic LOEL	2.7E+00	50% USEPA FW Chronic LOEL
BIPHENYL, 1,1-	1.4E+01	USEPA Ecotox FW Chronic	1.4E+01	USEPA Ecotox FW Chronic	1.4E+01	USEPA Ecotox FW Chronic
BIS(2-CHLOROETHYL)ETHER	6.1E+01	50% USEPA FW Chronic LOEL	6.1E+01	50% USEPA FW Chronic LOEL	6.1E+01	50% USEPA FW Chronic LOEL
BIS(2-CHLOROISOPROPYL)ETHER	6.1E+01	50% USEPA FW Chronic LOEL	6.1E+01	50% USEPA FW Chronic LOEL	6.1E+01	50% USEPA FW Chronic LOEL
BIS(2-ETHYLHEXYL)PHTHALATE	3.2E+01	USEPA Ecotox FW Chronic	3.2E+01	USEPA Ecotox FW Chronic	3.2E+01	USEPA Ecotox FW Chronic
BORON	1.6E+00	USDOE FW Chronic PRG	1.6E+00	USDOE FW Chronic PRG	1.6E+00	USDOE FW Chronic PRG
BROMODICHLOROMETHANE	3.2E+03	50% USEPA SW Chronic LOEL	3.2E+03	50% USEPA SW Chronic LOEL	3.2E+03	50% USEPA SW Chronic LOEL
BROMOFORM	3.2E+03	50% USEPA SW Chronic LOEL	3.2E+03	50% USEPA SW Chronic LOEL	3.2E+03	50% USEPA SW Chronic LOEL
BROMOMETHANE	1.6E+02	50% MOEE FW Chronic LOEL	1.6E+02	50% MOEE FW Chronic LOEL	3.2E+03	50% USEPA SW Chronic LOEL
CADMIUM	3.0E+00	HI DOH FW Chronic	3.0E+00	HI DOH FW Chronic	9.3E+00	HI DOH SW Chronic
CARBON TETRACHLORIDE	9.8E+00	USDOE FW Chronic PRG	9.8E+00	USDOE FW Chronic PRG	3.2E+03	50% USEPA SW Chronic LOEL
CHLORDANE	4.0E-03	HI DOH SW Chronic	4.3E-03	HI DOH FW Chronic	4.0E-03	HI DOH SW Chronic
CHLOROANILINE, p-	5.0E+00	50% MOEE FW Chronic LOEL	5.0E+00	50% MOEE FW Chronic LOEL	5.0E+00	50% MOEE FW Chronic LOEL
CHLOROBENZENE	2.5E+01	50% USEPA FW Chronic LOEL	2.5E+01	50% USEPA FW Chronic LOEL	6.5E+01	50% USEPA SW Chronic LOEL
CHLOROETHANE	3.9E+00	=Drinking Water (Table D-2)	3.9E+00	=Drinking Water (Table D-2)	3.9E+00	=Drinking Water (Table D-2)
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	HI DOH FW Chronic	1.1E+01	HI DOH FW Chronic	5.0E+01	HI DOH SW Chronic
CHRYSENE	3.5E-01	50% MOEE FW Chronic LOEL	3.5E-01	50% MOEE FW Chronic LOEL	3.5E-01	50% MOEE FW Chronic LOEL
COBALT	3.0E+00	USEPA Ecotox FW Chronic	3.0E+00	USEPA Ecotox FW Chronic	3.0E+00	USEPA Ecotox FW Chronic
COPPER	2.9E+00	HI DOH SW Chronic	6.0E+00	HI DOH FW Chronic	2.9E+00	HI DOH SW Chronic
CYANIDE (Free)	1.0E+00	HI DOH SW Chronic	5.2E+00	HI DOH FW Chronic	1.0E+00	HI DOH SW Chronic
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-3-CHLOROPROPANE, 1,2-	4.0E-02	=Drinking Water (Table D-2)	4.0E-02	=Drinking Water (Table D-2)	4.0E-02	=Drinking Water (Table D-2)
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

TABLE D-3b. SUMMARY OF SELECTED CHRONIC AQUATIC HABITAT GOALS
(ug/l)

CONTAMINANT	[1]Lowest Chronic Aquatic Habitat Goal	Basis	Lowest Freshwater Chronic Aquatic Habitat Goal	Basis	Lowest Saltwater Chronic Aquatic Habitat Goal	Basis
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	HI DOH FW Chronic	1.0E-03	HI DOH FW Chronic	1.0E-03	HI DOH SW Chronic
DICHLOROETHANE, 1,1-	4.7E+01	USEPA Ecotox FW Chronic	4.7E+01	USEPA Ecotox FW Chronic	4.7E+01	USEPA Ecotox FW Chronic
DICHLOROETHANE, 1,2-	1.0E+04	50% USEPA FW Chronic LOEL	1.0E+04	50% USEPA FW Chronic LOEL	1.0E+04	50% USEPA FW Chronic LOEL
DICHLOROETHYLENE, 1,1-	2.5E+01	USDOE FW Chronic PRG	2.5E+01	USDOE FW Chronic PRG	2.5E+01	USDOE FW Chronic PRG
DICHLOROETHYLENE, Cis 1,2-	5.9E+02	USDOE FW Chronic PRG	5.9E+02	USDOE FW Chronic PRG	5.9E+02	USDOE FW Chronic PRG
DICHLOROETHYLENE, Trans 1,2-	5.9E+02	USDOE FW Chronic PRG	5.9E+02	USDOE FW Chronic PRG	5.9E+02	USDOE FW Chronic PRG
DICHLOROPHENOL, 2,4-	1.8E+02	50% USEPA FW Chronic LOEL	1.8E+02	50% USEPA FW Chronic LOEL	1.8E+02	50% USEPA FW Chronic LOEL
DICHLOROPROPANE, 1,2-	1.5E+03	50% USEPA SW Chronic LOEL	2.9E+03	50% USEPA FW Chronic LOEL	1.5E+03	50% USEPA SW Chronic LOEL
DICHLOROPROPENE, 1,3-	1.2E+02	50% USEPA FW Chronic LOEL	1.2E+02	50% USEPA FW Chronic LOEL	1.2E+02	50% USEPA FW Chronic LOEL
DIELDRIN	1.9E-03	HI DOH FW Chronic	1.9E-03	HI DOH FW Chronic	1.9E-03	HI DOH SW Chronic
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
DINITROPHENOL, 2,4-	7.5E+01	50% USEPA FW Chronic LOEL	7.5E+01	50% USEPA FW Chronic LOEL	7.5E+01	50% USEPA FW Chronic LOEL
DINITROTOLUENE, 2,4-	1.2E+02	50% USEPA FW Chronic LOEL	1.2E+02	50% USEPA FW Chronic LOEL	1.9E+02	50% USEPA SW Chronic LOEL
DIOXANE, 1,4-	3.4E+05	5% Acute FW LC 50	3.4E+05	5% Acute FW LC 50	5.0E+05	5% Acute SW LC 50
DIOXIN (2,3,7,8-TCDD)	5.0E-06	50% USEPA FW Chronic LOEL	5.0E-06	50% USEPA FW Chronic LOEL	5.0E-06	50% USEPA FW Chronic LOEL
ENDOSULFAN	8.7E-03	HI DOH SW Chronic	5.6E-02	HI DOH FW Chronic	8.7E-03	HI DOH SW Chronic
ENDRIN	2.3E-03	HI DOH FW Chronic	2.3E-03	HI DOH FW Chronic	2.3E-03	HI DOH SW Chronic
ETHYLBENZENE	2.9E+02	USEPA Ecotox FW Chronic	2.9E+02	USEPA Ecotox FW Chronic	2.9E+02	USEPA Ecotox FW Chronic
FLUORANTHENE	8.0E+00	50% USEPA SW Chronic LOEL	8.1E+00	USEPA Ecotox FW Chronic	8.0E+00	50% USEPA SW Chronic LOEL
FLUORENE	3.9E+00	USEPA Ecotox FW Chronic	3.9E+00	USEPA Ecotox FW Chronic	3.9E+00	USEPA Ecotox FW Chronic
HEPTACHLOR	3.6E-03	HI DOH SW Chronic	3.8E-03	HI DOH FW Chronic	3.6E-03	HI DOH SW Chronic
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	HI DOH FW Chronic	8.0E-02	HI DOH FW Chronic	8.0E-02	HI DOH FW Chronic
HEXACHLOROETHANE	1.2E+01	USEPA Ecotox FW Chronic	1.2E+01	USEPA Ecotox FW Chronic	1.2E+01	USEPA Ecotox FW Chronic
INDENO(1,2,3-cd)PYRENE	9.2E-02	=Drinking Water (Table D-2)	9.2E-02	=Drinking Water (Table D-2)	9.2E-02	=Drinking Water (Table D-2)
LEAD	5.6E+00	HI DOH SW Chronic	2.9E+01	HI DOH FW Chronic	5.6E+00	HI DOH SW Chronic
MERCURY	2.5E-02	HI DOH SW Chronic	5.5E-01	HI DOH FW Chronic	2.5E-02	HI DOH SW Chronic
METHOXYCHLOR	3.0E-02	HI DOH FW Chronic	3.0E-02	HI DOH FW Chronic	3.0E-02	HI DOH SW Chronic
METHYL ETHYL KETONE	1.4E+04	USDOE FW Chronic PRG	1.4E+04	USDOE FW Chronic PRG	1.4E+04	USDOE FW Chronic PRG
METHYL ISOBUTYL KETONE	1.7E+02	USDOE FW Chronic PRG	1.7E+02	USDOE FW Chronic PRG	1.7E+02	USDOE FW Chronic PRG
METHYL MERCURY	3.0E-03	USEPA Ecotox FW Chronic	3.0E-03	USEPA Ecotox FW Chronic	3.0E-03	USEPA Ecotox FW Chronic
METHYL TERT BUTYL ETHER	8.0E+03	CalEPA SW Chronic	6.6E+04	CA FW Chronic	8.0E+03	CalEPA SW Chronic
METHYLENE CHLORIDE	2.2E+03	USDOE FW Chronic PRG	2.2E+03	USDOE FW Chronic PRG	3.2E+03	50% USEPA SW Chronic LOEL

TABLE D-3b. SUMMARY OF SELECTED CHRONIC AQUATIC HABITAT GOALS
(ug/l)

CONTAMINANT	[1]Lowest Chronic Aquatic Habitat Goal	Basis	Lowest Freshwater Chronic Aquatic Habitat Goal	Basis	Lowest Saltwater Chronic Aquatic Habitat Goal	Basis
METHYLNAPHTHALENE (total 1- & 2-)	2.1E+00	USDOE FW Chronic PRG	2.1E+00	USDOE FW Chronic PRG	2.1E+00	USDOE FW Chronic PRG
MOLYBDENUM	2.4E+02	USEPA Ecotox FW Chronic	2.4E+02	USEPA Ecotox FW Chronic	2.4E+02	USEPA Ecotox FW Chronic
NAPHTHALENE	2.4E+01	USEPA Ecotox FW Chronic	2.4E+01	USEPA Ecotox FW Chronic	2.4E+01	USEPA Ecotox FW Chronic
NICKEL	5.0E+00	HI DOH FW Chronic	5.0E+00	HI DOH FW Chronic	8.3E+00	HI DOH SW Chronic
PENTACHLOROPHENOL	7.9E+00	USEPA SW CCC	1.3E+01	HI DOH FW Chronic	7.9E+00	USEPA SW CCC
PERCHLORATE	6.0E+02	USEPA Ecotox FW Chronic	6.0E+02	USEPA Ecotox FW Chronic	6.0E+02	USEPA Ecotox FW Chronic
PHENANTHRENE	4.6E+00	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	HI DOH FW Chronic	1.4E-02	HI DOH FW Chronic	3.0E-02	HI DOH SW Chronic
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	HI DOH FW Chronic	5.0E+00	HI DOH FW Chronic	7.1E+01	HI DOH SW Chronic
SILVER	1.0E+00	HI DOH FW Chronic	1.0E+00	HI DOH FW Chronic	1.0E+00	HI DOH FW Chronic
STYRENE	1.0E+02	=Drinking Water (Table D-2)	1.0E+02	=Drinking Water (Table D-2)	1.0E+02	=Drinking Water (Table D-2)
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	HI DOH SW Chronic
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	HI DOH FW Chronic	2.0E-04	HI DOH FW Chronic	2.0E-04	HI DOH SW Chronic
TPH (gasolines)	5.0E+02	CA FW Chronic	5.0E+02	CA FW Chronic	3.7E+03	CalEPA 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
VANADIUM	1.9E+01	USEPA Ecotox FW Chronic	1.9E+01	USEPA Ecotox FW Chronic	1.9E+01	USEPA Ecotox FW Chronic

TABLE D-3b. SUMMARY OF SELECTED CHRONIC AQUATIC HABITAT GOALS
(ug/l)

CONTAMINANT	[1]Lowest Chronic Aquatic Habitat Goal	Basis	Lowest Freshwater Chronic Aquatic Habitat Goal	Basis	Lowest Saltwater Chronic Aquatic Habitat Goal	Basis
VINYL CHLORIDE	7.8E+02	USDOE FW Chronic PRG	7.8E+02	USDOE FW Chronic PRG	7.8E+02	USDOE FW Chronic PRG
XYLENES	1.0E+02	5% Acute SW LC 50	1.0E+02	5% Acute SW LC 50	1.0E+02	5% Acute SW LC 50
ZINC	2.2E+01	HI DOH FW Chronic	2.2E+01	HI DOH FW Chronic	8.6E+01	HI DOH SW Chronic

Notes:

1. Lowest Chronic Goal = Lowest of Freshwater vs Saltwater chronic goals. Used for development of groundwater and soil action levels.
Aquatic Habitat Goals: Addresses potential impact on freshwater or saltwater aquatic habitats.
See text for prioritization and selection of aquatic habitat quality goals. Hawai'I DOH standard for potential bioaccumulation of chemicals in fish (and other aquatic organisms) and subsequent consumption by humans not considered for groundwater action levels (refer to Table D-4).
Drinking water goal substituted as aquatic habitat goal if later was not available (see text).
AWQC: Aquatic Water Quality Criteria
CCC: Criterion for Continuous Concentration
CMC: Criterion for Maximum Concentration
HI DOH: Hawai'I Administrative Rules, Title 11, Chapter 54, Section 11-54-04: Basic Water Quality Criteria, April 2000.
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-3c. SUMMARY OF SELECTED ACUTE AQUATIC HABITAT GOALS
(ug/l)

CONTAMINANT	[1]Lowest Acute Aquatic Habitat Goal	Basis	Lowest Freshwater Acute Aquatic Habitat Goal	Basis	Lowest Saltwater Acute Aquatic Habitat Goal	Basis
ACENAPHTHENE	3.2E+02	HI DOH SW Acute	5.7E+02	HI DOH FW Acute	3.2E+02	HI DOH SW Acute
ACENAPHTHYLENE	3.0E+02	USEPA SW Acute LOEL	3.0E+02	USEPA SW Acute LOEL	3.0E+02	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+00	HI DOH SW Acute	3.0E+00	HI DOH FW Acute	1.3E+00	HI DOH SW Acute
ANTHRACENE	7.3E-01	USDOE FW Chronic PRG	7.3E-01	USDOE FW Chronic PRG	7.3E-01	USDOE FW Chronic PRG
ANTIMONY	1.5E+03	USEPA SW CMC	3.0E+03	HI DOH FW Acute	1.5E+03	USEPA SW CMC
ARSENIC	6.9E+01	HI DOH SW Acute	3.6E+02	HI DOH FW Acute	6.9E+01	HI DOH SW Acute
BARIUM	2.0E+03	=Drinking Water (Table D-2)	2.0E+03	=Drinking Water (Table D-2)	2.0E+03	=Drinking Water (Table D-2)
BENZENE	1.7E+03	HI DOH SW Acute	1.8E+03	HI DOH FW Acute	1.7E+03	HI DOH SW Acute
BENZO(a)ANTHRACENE	2.7E-02	USDOE FW Chronic PRG	2.7E-02	USDOE FW Chronic PRG	2.7E-02	USDOE FW Chronic PRG
BENZO(a)PYRENE	1.4E-02	USEPA Ecotox FW Chronic	1.4E-02	USEPA Ecotox FW Chronic	1.4E-02	USEPA Ecotox FW Chronic
BENZO(b)FLUORANTHENE	9.2E-02	=Drinking Water (Table D-2)	9.2E-02	=Drinking Water (Table D-2)	9.2E-02	=Drinking Water (Table D-2)
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	4.3E+01	HI DOH FW Acute	4.3E+01	HI DOH FW Acute	4.3E+01	HI DOH FW Acute
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	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	USEPA Ecotox FW Chronic	3.2E+01	USEPA Ecotox FW Chronic	3.2E+01	USEPA Ecotox FW Chronic
BORON	1.6E+00	USDOE FW Chronic PRG	1.6E+00	USDOE FW Chronic PRG	1.6E+00	USDOE FW Chronic PRG
BROMODICHLOROMETHANE	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	HI DOH FW Acute	3.0E+00	HI DOH FW Acute	4.3E+01	HI DOH SW Acute
CARBON TETRACHLORIDE	1.2E+04	HI DOH FW Acute	1.2E+04	HI DOH FW Acute	1.6E+04	HI DOH SW Acute
CHLORDANE	9.0E-02	HI DOH SW Acute	2.4E+00	HI DOH FW Acute	9.0E-02	HI DOH SW Acute
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	1.6E+02	USEPA SW Acute LOEL	2.5E+02	USEPA FW Acute LOEL	1.6E+02	USEPA SW Acute LOEL
CHLOROETHANE	3.9E+00	=Drinking Water (Table D-2)	3.9E+00	=Drinking Water (Table D-2)	3.9E+00	=Drinking Water (Table D-2)
CHLOROFORM	9.6E+03	HI DOH FW Acute	9.6E+03	HI DOH FW Acute	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	HI DOH FW Acute	1.4E+03	HI DOH FW Acute	1.4E+03	HI DOH FW Acute
CHROMIUM (Total)	7.4E+01	=Cr III	7.4E+01	=Cr III	1.0E+04	=Cr III
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	HI DOH FW Acute	1.6E+01	HI DOH FW Acute	1.1E+03	HI DOH SW Acute
CHRYSENE	3.5E-01	50% MOEE FW Chronic LOEL	3.5E-01	50% MOEE FW Chronic LOEL	3.5E-01	50% MOEE FW Chronic LOEL
COBALT	3.0E+00	USEPA Ecotox FW Chronic	3.0E+00	USEPA Ecotox FW Chronic	3.0E+00	USEPA Ecotox FW Chronic
COPPER	2.9E+00	HI DOH SW Acute	6.0E+00	HI DOH FW Acute	2.9E+00	HI DOH SW Acute
CYANIDE (Free)	1.0E+00	HI DOH SW Acute	2.2E+01	HI DOH FW Acute	1.0E+00	HI DOH SW Acute

TABLE D-3c. SUMMARY OF SELECTED ACUTE AQUATIC HABITAT GOALS
(ug/l)

CONTAMINANT	[1]Lowest Acute Aquatic Habitat Goal	Basis	Lowest Freshwater Acute Aquatic Habitat Goal	Basis	Lowest Saltwater Acute Aquatic Habitat Goal	Basis
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-3-CHLOROPROPANE, 1,2-	4.0E-02	=Drinking Water (Table D-2)	4.0E-02	=Drinking Water (Table D-2)	4.0E-02	=Drinking Water (Table D-2)
DIBROMOCHLOROMETHANE	1.1E+04	USEPA FW Acute LOEL	1.1E+04	USEPA FW Acute LOEL	1.2E+04	USEPA SW Acute 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-	3.7E+02	HI DOH FW Acute	3.7E+02	HI DOH FW Acute	6.6E+02	HI DOH SW Acute
DICHLOROBENZENE, 1,3-	3.7E+02	HI DOH FW Acute	3.7E+02	HI DOH FW Acute	6.6E+02	HI DOH SW Acute
DICHLOROBENZENE, 1,4-	3.7E+02	HI DOH FW Acute	3.7E+02	HI DOH FW Acute	6.6E+02	HI DOH SW Acute
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)	6.0E-01	USEPA FW Acute LOEL	6.0E-01	USEPA FW Acute LOEL	3.6E+00	USEPA SW Acute LOEL
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.4E+01	USEPA SW Acute LOEL	1.1E+03	USEPA FW Acute LOEL	1.4E+01	USEPA SW Acute LOEL
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.3E-02	HI DOH SW Acute	1.1E+00	HI DOH FW Acute	1.3E-02	HI DOH SW Acute
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-	3.8E+04	HI DOH SW Acute	3.9E+04	HI DOH FW Acute	3.8E+04	HI DOH SW Acute
DICHLOROETHYLENE, 1,1-	3.9E+03	HI DOH FW Acute	3.9E+03	HI DOH FW Acute	7.5E+04	HI DOH SW Acute
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	HI DOH FW Acute	6.7E+02	HI DOH FW Acute	6.7E+02	HI DOH FW Acute
DICHLOROPROPANE, 1,2-	3.4E+03	HI DOH SW Acute	7.7E+03	HI DOH FW Acute	3.4E+03	HI DOH SW Acute
DICHLOROPROPENE, 1,3-	2.6E+02	HI DOH SW Acute	2.0E+03	HI DOH FW Acute	2.6E+02	HI DOH SW Acute
DIELDRIN	7.1E-01	HI DOH SW Acute	2.5E+00	HI DOH FW Acute	7.1E-01	HI DOH SW Acute
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	HI DOH FW Acute	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
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-	2.0E+02	HI DOH SW Acute	3.3E+02	USEPA FW Acute LOEL	2.0E+02	HI DOH SW Acute
DIOXANE, 1,4-	6.7E+06	FW LC50	6.7E+06	FW LC50	1.0E+07	SW LC50
DIOXIN (2,3,7,8-TCDD)	3.0E-03	HI DOH FW Acute	3.0E-03	HI DOH FW Acute	3.0E-03	HI DOH FW Acute
ENDOSULFAN	3.4E-02	HI DOH SW Acute	2.2E-01	HI DOH FW Acute	3.4E-02	HI DOH SW Acute
ENDRIN	3.7E-02	HI DOH SW Acute	1.8E-01	HI DOH FW Acute	3.7E-02	HI DOH SW Acute
ETHYLBENZENE	4.3E+02	USEPA SW Acute LOEL	1.1E+04	HI DOH FW Acute	4.3E+02	USEPA SW Acute LOEL
FLUORANTHENE	4.0E+01	USEPA SW Acute LOEL	1.3E+03	HI DOH FW Acute	4.0E+01	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
HEPTACHLOR	5.3E-02	HI DOH SW Acute	5.2E-01	HI DOH FW Acute	5.3E-02	HI DOH SW Acute
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	1.6E+02	USEPA SW Acute LOEL
HEXACHLOROBUTADIENE	1.1E+01	HI DOH SW Acute	3.0E+01	HI DOH FW Acute	1.1E+01	HI DOH SW Acute
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	1.6E-01	HI DOH SW Acute	2.0E+00	HI DOH FW Acute	1.6E-01	HI DOH SW Acute
HEXACHLOROETHANE	3.1E+02	HI DOH SW Acute	3.3E+02	HI DOH FW Acute	3.1E+02	HI DOH SW Acute
INDENO(1,2,3-cd)PYRENE	9.2E-02	=Drinking Water (Table D-2)	9.2E-02	=Drinking Water (Table D-2)	9.2E-02	=Drinking Water (Table D-2)

TABLE D-3c. SUMMARY OF SELECTED ACUTE AQUATIC HABITAT GOALS
(ug/l)

CONTAMINANT	[1]Lowest Acute Aquatic Habitat Goal	Basis	Lowest Freshwater Acute Aquatic Habitat Goal	Basis	Lowest Saltwater Acute Aquatic Habitat Goal	Basis
LEAD	2.9E+01	HI DOH FW Acute	2.9E+01	HI DOH FW Acute	1.4E+02	HI DOH SW Acute
MERCURY	2.1E+00	HI DOH SW Acute	2.4E+00	HI DOH FW Acute	2.1E+00	HI DOH SW Acute
METHOXYCHLOR	3.0E-02	USEPA SW CMC	3.0E-02	USEPA SW CMC	3.0E-02	USEPA SW CMC
METHYL ETHYL KETONE	1.4E+04	USDOE FW Chronic PRG	1.4E+04	USDOE FW Chronic PRG	1.4E+04	USDOE FW Chronic PRG
METHYL ISOBUTYL KETONE	1.7E+02	USDOE FW Chronic PRG	1.7E+02	USDOE FW Chronic PRG	1.7E+02	USDOE FW Chronic PRG
METHYL MERCURY	3.0E-03	USEPA Ecotox FW Chronic	3.0E-03	USEPA Ecotox FW Chronic	3.0E-03	USEPA Ecotox FW Chronic
METHYL TERT BUTYL ETHER	8.0E+03	CalEPA SW Chronic	6.6E+04	CA FW Chronic	8.0E+03	CalEPA SW Chronic
METHYLENE CHLORIDE	1.1E+04	USEPA FW Acute LOEL	1.1E+04	USEPA FW Acute LOEL	1.2E+04	USEPA SW Acute LOEL
METHYLNAPHTHALENE (total 1- & 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	USEPA Ecotox FW Chronic	2.4E+02	USEPA Ecotox FW Chronic	2.4E+02	USEPA Ecotox FW Chronic
NAPHTHALENE	7.7E+02	HI DOH FW Acute	7.7E+02	HI DOH FW Acute	7.8E+02	HI DOH SW Acute
NICKEL	5.0E+00	HI DOH FW Acute	5.0E+00	HI DOH FW Acute	7.5E+01	HI DOH SW Acute
PENTACHLOROPHENOL	1.3E+01	HI DOH SW Acute	2.0E+01	HI DOH FW Acute	1.3E+01	HI DOH SW Acute
PERCHLORATE	6.0E+02	USEPA Ecotox FW Chronic	6.0E+02	USEPA Ecotox FW Chronic	6.0E+02	USEPA Ecotox FW Chronic
PHENANTHRENE	7.7E+00	USEPA SW CMC	3.0E+01	USEPA FW CMC	7.7E+00	USEPA SW CMC
PHENOL	3.4E+03	HI DOH FW Acute	3.4E+03	HI DOH FW Acute	5.8E+03	USEPA SW Acute LOEL
POLYCHLORINATED BIPHENYLS (PCBs)	2.0E+00	HI DOH FW Acute	2.0E+00	HI DOH FW Acute	1.0E+01	HI DOH SW Acute
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	2.0E+01	HI DOH FW Acute	2.0E+01	HI DOH FW Acute	3.0E+02	HI DOH SW Acute
SILVER	1.0E+00	HI DOH FW Acute	1.0E+00	HI DOH FW Acute	2.3E+00	HI DOH SW Acute
STYRENE	1.0E+02	=Drinking Water (Table D-2)	1.0E+02	=Drinking Water (Table D-2)	1.0E+02	=Drinking Water (Table D-2)
tert-BUTYL ALCOHOL	1.8E+05	FW LC0	1.8E+05	FW LC0	1.8E+05	10% Acute FW LC0
TETRACHLOROETHANE, 1,1,1,2-	3.1E+03	HI DOH FW Acute	3.1E+03	HI DOH FW Acute	3.1E+03	HI DOH FW Acute
TETRACHLOROETHANE, 1,1,2,2-	3.0E+03	HI DOH SW Acute	9.3E+03	USEPA FW Acute LOEL	3.0E+03	HI DOH SW Acute
TETRACHLOROETHYLENE	1.8E+03	HI DOH FW Acute	1.8E+03	HI DOH FW Acute	3.4E+03	HI DOH SW Acute
THALLIUM	4.7E+02	HI DOH FW Acute	4.7E+02	HI DOH FW Acute	7.1E+02	HI DOH SW Acute
TOLUENE	5.8E+03	HI DOH FW Acute	5.8E+03	HI DOH FW Acute	6.3E+03	USEPA SW Acute LOEL
TOXAPHENE	2.1E-01	HI DOH SW Acute	7.3E-01	HI DOH FW Acute	2.1E-01	HI DOH SW Acute
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	HI DOH FW Acute	6.0E+03	HI DOH FW Acute	1.0E+04	HI DOH SW Acute
TRICHLOROETHANE, 1,1,2-	6.0E+03	HI DOH FW Acute	6.0E+03	HI DOH FW Acute	6.0E+03	HI DOH FW Acute
TRICHLOROETHYLENE	7.0E+02	HI DOH SW Acute	1.5E+04	HI DOH FW Acute	7.0E+02	HI DOH SW Acute
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	50% USEPA FW Chronic LOEL	4.9E+02	50% USEPA FW Chronic LOEL	4.9E+02	50% USEPA FW Chronic LOEL
VANADIUM	1.9E+01	USEPA Ecotox FW Chronic	1.9E+01	USEPA Ecotox FW Chronic	1.9E+01	USEPA Ecotox FW Chronic
VINYL CHLORIDE	7.8E+02	USDOE FW Chronic PRG	7.8E+02	USDOE FW Chronic PRG	7.8E+02	USDOE FW Chronic PRG

TABLE D-3c. SUMMARY OF SELECTED ACUTE AQUATIC HABITAT GOALS
(ug/l)

CONTAMINANT	[1]Lowest Acute Aquatic Habitat Goal	Basis	Lowest Freshwater Acute Aquatic Habitat Goal	Basis	Lowest Saltwater Acute Aquatic Habitat Goal	Basis
XYLENES	2.0E+03	SW LC50	2.0E+03	SW LC50	2.0E+03	SW LC50
ZINC	2.2E+01	HI DOH FW Acute	2.2E+01	HI DOH FW Acute	9.5E+01	HI DOH SW Acute

Notes:

1. Lowest Goal = Lowest of Freshwater vs Saltwater chronic goals.
Aquatic Habitat Goals: Addresses potential impact on freshwater or saltwater aquatic habitats.
See text for prioritization and selection of surface water quality goals. Hawai'I DOH standard for potential bioaccumulation of chemicals
Chronic surface water goal refered to if no acute goal available (see Table D-3a (chronic))
AWQC: Aquatic Water Quality Criteria
CCC: Criterion for Continuous Concentration
CMC: Criterion for Maximum Concentration
HI DOH: Hawai'I Administrative Rules, Title 11, Chapter 54, Section 11-54-04: Basic Water Quality Criteria, April 2000.
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-3d. SUMMARY OF HAWAI'I CHRONIC AND ACUTE SURFACE WATER (AQUATIC HABITAT) STANDARDS
(ug/l)

	Freshwater		Saltwater	
CONTAMINANT	Chronic	Acute	Chronic	Acute
ACENAPHTHENE		5.7E+02		3.2E+02
ACENAPHTHYLENE				
ACETONE				
ALDRIN		3.0E+00		1.3E+00
ANTHRACENE				
ANTIMONY		3.0E+03		
ARSENIC	1.9E+02	3.6E+02	3.6E+01	6.9E+01
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	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				

TABLE D-3d. SUMMARY OF HAWAI'I CHRONIC AND ACUTE SURFACE WATER (AQUATIC HABITAT) STANDARDS (ug/l)

	Freshwater		Saltwater	
CONTAMINANT	Chronic	Acute	Chronic	Acute
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
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-				
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		
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				
DINITROPHENOL, 2,4-				
DINITROTOLUENE, 2,4-				2.0E+02
DIOXANE, 1,4-				
DIOXIN (2,3,7,8-TCDD)		3.0E-03		
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
ETHYLBENZENE		1.1E+04		
FLUORANTHENE		1.3E+03		
FLUORENE				
HEPTACHLOR	3.8E-03	5.2E-01	3.6E-03	5.3E-02

TABLE D-3d. SUMMARY OF HAWAI'I CHRONIC AND ACUTE SURFACE WATER (AQUATIC HABITAT) STANDARDS
(ug/l)

	Freshwater		Saltwater	
CONTAMINANT	Chronic	Acute	Chronic	Acute
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
INDENO(1,2,3-cd)PYRENE				
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 (total 1- & 2-)				
MOLYBDENUM				
NAPHTHALENE		7.7E+02		7.8E+02
NICKEL	5.0E+00	5.0E+00	8.3E+00	7.5E+01
PENTACHLOROPHENOL	1.3E+01	2.0E+01		1.3E+01
PERCHLORATE				
PHENANTHRENE				
PHENOL		3.4E+03		
POLYCHLORINATED BIPHENYLS (PCBs)	1.4E-02	2.0E+00	3.0E-02	1.0E+01
PYRENE				
SELENIUM	5.0E+00	2.0E+01	7.1E+01	3.0E+02
SILVER	1.0E+00	1.0E+00		2.3E+00
STYRENE				
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
THALLIUM		4.7E+02		7.1E+02
TOLUENE		5.8E+03		
TOXAPHENE	2.0E-04	7.3E-01	2.0E-04	2.1E-01
TPH (gasolines)				
TPH (middle distillates)				

TABLE D-3d. SUMMARY OF HAWAI'I CHRONIC AND ACUTE SURFACE WATER (AQUATIC HABITAT) STANDARDS (ug/l)

	Freshwater		Saltwater	
CONTAMINANT	Chronic	Acute	Chronic	Acute
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-				
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, April 2000.

Acute freshwater standard for dinitrotoluene and saltwater standards for antimony, ethylbenzene, phenol and toluene not used due to higher, more recent USEPA chronic goals.

TABLE D-3e. SUMMARY OF USEPA AND OTHER PUBLISHED AQUATIC HABITAT GOALS
(ug/l)

	Freshwater									Marine								
CONTAMINANT	USEPA CCC	USEPA Chronic LOEL	USEPA CMC	USEPA Acute LOEL	Ecotox Chronic Threshold (AWQC, FCV Or Tier II)	Other Acute	Basis	Other Chronic	Basis	USEPA CCC	USEPA Chronic LOEL	USEPA 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					
ACETONE								1.5E+03	USDOE FW Chronic PRG									
ALDRIN			3.0E+00									1.3E+00						
ANTHRACENE								7.3E-01	USDOE FW Chronic PRG									
ANTIMONY	3.0E+01		8.8E+01							5.0E+02		1.5E+03						
ARSENIC	1.5E+02		3.4E+02		1.9E+02					3.6E+01		6.9E+01		3.6E+01				
BARIUM																		
BENZENE				5.3E+03	4.6E+01						7.0E+02		5.1E+03					
BENZO(a)ANTHRACENE								2.7E-02	USDOE FW Chronic PRG									
BENZO(a)PYRENE					1.4E-02													
BENZO(b)FLUORANTHENE																		
BENZO(g,h,i)PERYLENE								1.0E-01	50% MOEE FW Chronic LOEL									
BENZO(k)FLUORANTHENE								3.7E+00	50% MOEE FW Chronic LOEL									
BERYLLIUM		5.3E+00		1.3E+02	5.1E+00													
BIPHENYL, 1,1-					1.4E+01													
BIS(2-CHLOROETHYL)ETHER		1.2E+02		2.4E+05														
BIS(2-CHLOROISOPROPYL)ETHER		1.2E+02		2.4E+05														
BIS(2-ETHYLHEXYL)PHTHALATE					3.2E+01													
BORON								1.6E+00	USDOE FW Chronic PRG									
BROMODICHLOROMETHANE				1.1E+04							6.4E+03		1.2E+04					
BROMOFORM				1.1E+04							6.4E+03		1.2E+04					
BROMOMETHANE				1.1E+04				1.6E+02	50% MOEE FW Chronic LOEL		6.4E+03		1.2E+04					
CADMIUM	2.5E-01		2.0E+00		1.0E+00					8.8E+00		4.0E+01		9.3E+00				
CARBON TETRACHLORIDE				3.5E+04				9.8E+00	USDOE FW Chronic PRG		6.4E+03		5.0E+04					
CHLORDANE	4.3E-03		2.4E+00							4.0E-03		9.0E-02						
CHLOROANILINE, p-								5.0E+00	50% MOEE FW Chronic LOEL									
CHLOROBENZENE		5.0E+01		2.5E+02	1.3E+02						1.3E+02		1.6E+02					
CHLOROETHANE																		
CHLOROFORM		1.2E+03		2.9E+04				2.8E+01	USDOE FW Chronic PRG		6.4E+03		1.2E+04					
CHLOROMETHANE				1.1E+04							6.4E+03		1.2E+04					
CHLOROPHENOL, 2-				4.4E+03														
CHROMIUM (Total)								7.4E+01	=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									
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				
DIBENZO(a,h)ANTHTRACENE								7.5E+00	50% MOEE FW Chronic LOEL									
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+03				1.0E-03	=DDT				1.4E+01				1.0E-03	=DDT
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.0E-03		1.1E+00		1.3E-02					1.0E-03		1.3E-01						
DICHLOROETHANE, 1,1-					4.7E+01													
DICHLOROETHANE, 1,2-		2.0E+04		1.2E+05				9.1E+02	USDOE FW Chronic PRG				1.13E+05					
DICHLOROETHYLENE, 1,1-				1.2E+04				2.5E+01	USDOE FW Chronic PRG				2.24E+05					
DICHLOROETHYLENE, Cis 1,2-				1.2E+04				5.9E+02	USDOE FW Chronic PRG				2.24E+05					
DICHLOROETHYLENE, Trans 1,2-				1.2E+04				5.9E+02	USDOE FW Chronic PRG				2.24E+05					
DICHLOROPHENOL, 2,4-		3.7E+02		2.0E+03														
DICHLOROPROPANE, 1,2-		5.7E+03		2.3E+04							3.0E+03		1.03E+04					
DICHLOROPROPENE, 1,3-		2.4E+02		6.1E+03									7.9E+02					

TABLE D-3e. SUMMARY OF USEPA AND OTHER PUBLISHED AQUATIC HABITAT GOALS
(ug/l)

	Freshwater									Marine								
CONTAMINANT	USEPA CCC	USEPA Chronic LOEL	USEPA CMC	USEPA Acute LOEL	Ecotox Chronic Threshold (AWQC, FCV Or Tier II)	Other Acute	Basis	Other Chronic	Basis	USEPA CCC	USEPA Chronic LOEL	USEPA CMC	USEPA Acute LOEL	Ecotox Chronic Threshold (AWQC, FCV Or Tier II)	Other Acute	Basis	Other Chronic	Basis
DIELDRIN	5.6E-02		2.4E-01		6.2E-02					1.9E-03		7.1E-01		1.1E-01				
DIETHYLPHTHALATE		3.0E+00		9.4E+02	2.2E+02						3.4E+00		2.94E+03					
DIMETHYLPHENOL, 2,4-	5.3E+02		1.3E+03							1.1E+02		2.7E+02						
DIMETHYLPHTHALATE		3.0E+00		9.4E+02							3.4E+00		2.94E+03					
DINITROPHENOL, 2,4-		1.5E+02		2.3E+02									4.85E+03					
DINITROTOLUENE, 2,4-		2.3E+02		3.3E+02							3.7E+02		5.9E+02					
DIOXANE, 1,4-						6.7E+06	FW LC50	3.4E+05	5% Acute FW LC 50						1.0E+07	SW LC50	5.0E+05	5% Acute SW LC 50
DIOXIN (2,3,7,8-TCDD)		1.0E-05		1.0E-02														
ENDOSULFAN	5.6E-02		2.2E-01		5.6E-02					8.7E-03		3.4E-02						
ENDRIN	3.6E-02		8.6E-02		6.1E-02					2.3E-03		3.7E-02		1.0E-02				
ETHYLBENZENE				3.2E+04	2.9E+02								4.3E+02					
FLUORANTHENE				3.98E+03	8.1E+00						1.6E+01		4.0E+01	1.1E+01				
FLUORENE					3.9E+00								3.0E+02					
HEPTACHLOR	3.8E-03		5.2E-01		6.9E-03					3.6E-03		5.3E-02						
HEPTACHLOR EPOXIDE	3.8E-03		5.2E-01							3.6E-03		5.3E-02						
HEXACHLOROBENZENE	3.7E+00		6.0E+00								1.3E+02		1.6E+02					
HEXACHLOROBUTADIENE		9.3E+00		9.0E+01									3.2E+01					
HEXACHLOROCYCLOHEXANE (gamma) LINDANE			9.5E-01		8.0E-02							1.6E-01						
HEXACHLOROETHANE		5.4E+02		9.8E+02	1.2E+01								9.4E+02					
INDENO(1,2,3-cd)PYRENE																		
LEAD	2.5E+00		6.5E+01		2.5E+00					8.1E+00		2.1E+02		8.1E+00				
MERCURY	7.7E-01		1.4E+00		1.3E+00					9.4E-01		1.8E+00		1.1E+00				
METHOXYCHLOR			3.0E-02		1.9E-02							3.0E-02						
METHYL ETHYL KETONE								1.4E+04	USDOE FW Chronic PRG									
METHYL ISOBUTYL KETONE								1.7E+02	USDOE FW Chronic PRG									
METHYL MERCURY					3.0E-03												8.0E+03	CalEPA SW Chronic
METHYL TERT BUTYL ETHER								6.6E+04	CA FW Chronic		6.4E+03		1.2E+04					
METHYLENE CHLORIDE				1.1E+04				2.2E+03	USDOE FW Chronic PRG				3.0E+02					
METHYLNAPHTHALENE (total 1- & 2-)								2.1E+00	USDOE FW Chronic PRG									
MOLYBDENUM					2.4E+02								2.4E+03					
NAPHTHALENE		6.2E+02		2.3E+03	2.4E+01					8.2E+00		7.4E+01		8.2E+00				
NICKEL	5.2E+01		4.7E+02		1.6E+02					7.9E+00		1.3E+01		7.9E+00				
PENTACHLOROPHENOL	1.5E+01		1.9E+01		1.3E+01													
PERCHLORATE					6.0E+02					4.6E+00		7.7E+00		8.3E+00				
PHENANTHRENE	6.3E+00		3.0E+01		6.3E+00								5.8E+03					
PHENOL		2.56E+03		1.02E+04						3.0E-02								
POLYCHLORINATED BIPHENYLS (PCBs)	1.4E-02				1.9E-01													
PYRENE								2.0E+00	50% MOEE FW Chronic LOEL									
SELENIUM	5.0E+00				5.0E+00					7.1E+01		2.9E+02		7.1E+01				
SILVER			3.2E+00									1.9E+00						
STYRENE																		
tert-BUTYL ALCOHOL						1.8E+05	FW LC0	1.8E+04	10% Acute FW LC0									
TETRACHLOROETHANE, 1,1,1,2-				9.32E+03									9.02E+03					
TETRACHLOROETHANE, 1,1,2,2-		2.4E+03		9.32E+03	4.2E+02						4.5E+02		1.02E+04					
TETRACHLOROETHYLENE		8.4E+02		5.28E+03	1.2E+02								2.13E+03					
THALLIUM		4.0E+01		1.4E+03							5.0E+03		6.3E+03					
TOLUENE				1.75E+04	1.3E+02					2.0E-04		2.1E-01		2.1E-01				
TOXAPHENE	2.0E-04		7.3E-01		1.1E-02										5.0E+03	Ceiling Level	3.7E+03	CalEPA SW Chronic
TPH (gasolines)						5.0E+03	Ceiling Level	5.0E+02	CA FW Chronic						2.5E+03	Ceiling Level		
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									
TRICHLOROBENZENE, 1,2,4-		5.0E+01		2.5E+02	1.1E+02						1.29E+02		1.6E+02					
TRICHLOROETHANE, 1,1,1-				1.8E+04	6.2E+01								3.12E+04					
TRICHLOROETHANE, 1,1,2-		9.4E+03		1.8E+04														
TRICHLOROETHYLENE		2.19E+04		4.5E+04	3.6E+02								2.0E+03					
TRICHLOROPHENOL, 2,4,5-	6.3E+01		1.0E+02							1.1E+01		2.4E+02						
TRICHLOROPHENOL, 2,4,6-		9.7E+02																
VANADIUM					1.9E+01													

TABLE D-3e. SUMMARY OF USEPA AND OTHER PUBLISHED AQUATIC HABITAT GOALS
(ug/l)

	Freshwater									Marine								
CONTAMINANT	USEPA CCC	USEPA Chronic LOEL	USEPA CMC	USEPA Acute LOEL	Ecotox Chronic Threshold (AWQC, FCV Or Tier II)	Other Acute	Basis	Other Chronic	Basis	USEPA CCC	USEPA Chronic LOEL	USEPA CMC	USEPA Acute LOEL	Ecotox Chronic Threshold (AWQC, FCV Or Tier II)	Other Acute	Basis	Other Chronic	Basis
VINYL CHLORIDE								7.82E+02	USDOE FW Chronic PRG									
XYLENES															2.0E+03	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 (1996b,c); MOEE (1996), USDOE (1997). USEPA criteria summarized in *A Compilation of Water Quality Goals*, CalEPA RWQCB Central Valley Region (RWQCBCV 2000).

Notes:
Used for development of groundwater and soil screening levels.
See text for prioritization and selection of surface water quality screening levels.
Lowest Chronic Aquatic Habitat Goal: Addresses potential impact on freshwater or marine aquatic life.
Acute LOEL, CMC and LC0 goals divided by a factor of ten if selected as lowest action level. LC 50 divided by factor of twenty.
1,4 Dioxane: LC 50 values for presented in "Solvent Stabilizers White Paper" (Mohr 2001).
Methyl tert-Butyl Ether: Interim aquatic surface water criteria proposed by California Region 2 Water Quality Control Board (RWQCBSF, 1998a).
Perchlorate: Chronic goal from "Perchlorate Environmental Contamination (draft)" (USEPA 1998).
tert Buytl Alcohol (TBA): Chronic aquatic goal based on in-house review of USEPA ECOTOX database for TBA (USEPA 2003). Ten percent of LC0 concentration for Lepomis macrochirus (Bluegill) selected as most conservative goal of data presented.
TPH screening levels: Gasoline freshwater screening level based on studies carried out for Presidio of San Francisco (RWQCBSF 1998b). Gasoline screening level for saltwater and diesel and residual fuels screening levels in general based on studies carried out for San Francisco Airport (RWQCBSF 1999). Acute action levels based on TPH ceiling levels. See Appendix 1, Chapter 5.
Xylenes: Acute freshwater and saltwater based on review on data in UK Marine SAC summary (UKSAC 2003). Confidence in USDOE PRG and USEPA Ecotox goals low.
AWQC: Aquatic Water Quality Criteria
CCC: Criterion for Continuous Concentration
CMC: Criterion for Maximum Concentration
FCV: Final Chronic Value
FW: Freshwater
LOEL: Lowest Observed Effects Level
MOEE: Ontario Ministry of Environment and Energy (MOEE 1996)
PRG: USDOE Preliminary Remediation Goal for ecological concerns.
SW: Saltwater
TPH Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.
USDOE: U. S. Department of Energy
USEPA: U.S. Environmental Protection Agency

TABLE D-3f. 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
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
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	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				

TABLE D-3f. 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
CYANIDE (Free)	2.2E+05	USEPA Aquatic Organism Consumption		2.2E+05
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
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
DINITROPHENOL, 2,4-	5.3E+03	USEPA Aquatic Organism Consumption		5.3E+03
DINITROTOLUENE, 2,4-	3.0E+00	HI DOH Fish Consumption	3.0E+00	3.4E+00
DIOXANE, 1,4-				
DIOXIN (2,3,7,8-TCDD)	5.0E-09	HI DOH Fish Consumption	5.0E-09	5.1E-09
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
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
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
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

TABLE D-3f. 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
HEXACHLOROETHANE	2.9E+00	HI DOH Fish Consumption	2.9E+00	3.3E+00
INDENO(1,2,3-cd)PYRENE	1.8E-02	USEPA Aquatic Organism Consumption		1.8E-02
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 (total 1- & 2-)				
MOLYBDENUM				
NAPHTHALENE				
NICKEL	3.3E+01	HI DOH Fish Consumption	3.3E+01	4.6E+03
PENTACHLOROPHENOL	3.0E+00	USEPA Aquatic Organism Consumption		3.0E+00
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
PYRENE	4.0E+03	USEPA Aquatic Organism Consumption		4.0E+03
SELENIUM				
SILVER				
STYRENE				
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
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

TABLE D-3f. 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
TRICHLOROPHENOL, 2,4,6-	1.2E+00	HI DOH Fish Consumption	1.2E+00	
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, April 2000.
2. USEPA National Recommended Water Quality Criteria: 2002, EPA-822-R-02-047.

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-4. USEPA REGION IX
TAP WATER GOALS
(ug/l)

CONTAMINANT	Lowest Tapwater Goal (ug/L	Basis	Tap Water Goal (Noncarcinogenic Effects)	Tap Water Goal (Carcinogenic Effects)
ACENAPHTHENE	3.7E+02	noncarcinogenic effects	3.7E+02	
ACENAPHTHYLENE	2.4E+02	noncarcinogenic effects	2.4E+02	
ACETONE	5.5E+03	noncarcinogenic effects	5.5E+03	
ALDRIN	4.0E-03	carcinogenic effects	1.1E+00	4.0E-03
ANTHRACENE	1.8E+03	noncarcinogenic effects	1.8E+03	
ANTIMONY	1.5E+01	noncarcinogenic effects	1.5E+01	
ARSENIC	4.5E-02	carcinogenic effects	1.1E+01	4.5E-02
BARIUM	2.6E+03	noncarcinogenic effects	2.6E+03	
BENZENE	3.5E-01	carcinogenic effects	4.4E+01	3.5E-01
BENZO(a)ANTHRACENE	9.2E-02	carcinogenic effects		9.2E-02
BENZO(a)PYRENE	9.2E-03	carcinogenic effects		9.2E-03
BENZO(b)FLUORANTHENE	9.2E-02	carcinogenic effects		9.2E-02
BENZO(g,h,i)PERYLENE	1.5E+03	noncarcinogenic effects	1.5E+03	
BENZO(k)FLUORANTHENE	9.2E-01	carcinogenic effects		9.2E-01
BERYLLIUM	7.3E+01	noncarcinogenic effects	7.3E+01	
BIPHENYL, 1,1-	3.0E+02	noncarcinogenic effects	3.0E+02	
BIS(2-CHLOROETHYL)ETHER	9.5E-03	carcinogenic effects		9.5E-03
BIS(2-CHLOROISOPROPYL)ETHER	2.7E-01	carcinogenic effects	2.4E+02	2.7E-01
BIS(2-ETHYLHEXYL)PHTHALATE	4.8E+00	carcinogenic effects	7.3E+02	4.8E+00
BORON	7.3E+03	noncarcinogenic effects	7.3E+03	
BROMODICHLOROMETHANE	1.8E-01	carcinogenic effects	1.2E+02	1.8E-01
BROMOFORM	8.5E+00	carcinogenic effects	7.3E+02	8.5E+00
BROMOMETHANE	8.5E+00	noncarcinogenic effects	8.5E+00	
CADMIUM	1.8E+01	noncarcinogenic effects	1.8E+01	
CARBON TETRACHLORIDE	1.7E-01	carcinogenic effects	4.3E+00	1.7E-01
CHLORDANE	1.9E-01	carcinogenic effects	1.8E+01	1.9E-01
CHLOROANILINE, p-	1.5E+02	noncarcinogenic effects	1.5E+02	
CHLOROBENZENE	1.1E+02	noncarcinogenic effects	1.1E+02	
CHLOROETHANE	3.9E+00	carcinogenic effects	8.6E+03	3.9E+00
CHLOROFORM	1.7E-01	carcinogenic effects	8.0E+01	1.7E-01
CHLOROMETHANE	1.6E+02	noncarcinogenic effects	1.6E+02	
CHLOROPHENOL, 2-	3.0E+01	noncarcinogenic effects	3.0E+01	
CHROMIUM (Total)	0.0E+00	carcinogenic effects		
CHROMIUM III	5.5E+04	noncarcinogenic effects	5.5E+04	
CHROMIUM VI	1.1E+02	noncarcinogenic effects	1.1E+02	
CHRYSENE	9.2E+00	carcinogenic effects		9.2E+00
COBALT	7.3E+02	noncarcinogenic effects	7.3E+02	
COPPER	1.5E+03	noncarcinogenic effects	1.5E+03	
CYANIDE (Free)	7.3E+02	noncarcinogenic effects	7.3E+02	
DIBENZO(a,h)ANTHTRACENE	9.2E-03	carcinogenic effects		9.2E-03
DIBROMO-3-CHLOROPROPANE, 1,2-	4.8E-02	carcinogenic effects	3.5E-01	4.8E-02
DIBROMOCHLOROMETHANE	1.3E-01	carcinogenic effects	1.2E+02	1.3E-01
DIBROMOETHANE, 1,2-	5.6E-03	carcinogenic effects	1.8E+01	5.6E-03
DICHLOROBENZENE, 1,2-	3.7E+02	noncarcinogenic effects	3.7E+02	
DICHLOROBENZENE, 1,3-	1.8E+02	noncarcinogenic effects	1.8E+02	
DICHLOROBENZENE, 1,4-	5.0E-01	carcinogenic effects	1.8E+02	5.0E-01
DICHLOROBENZIDINE, 3,3-	1.5E-01	carcinogenic effects		1.5E-01
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.8E-01	carcinogenic effects		2.8E-01
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.8E-01	carcinogenic effects		2.8E-01
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	2.0E-01	carcinogenic effects	1.8E+01	2.0E-01
DICHLOROETHANE, 1,1-	8.0E+02	noncarcinogenic effects	8.0E+02	
DICHLOROETHANE, 1,2-	1.2E-01	carcinogenic effects	1.0E+01	1.2E-01

TABLE D-4. USEPA REGION IX
TAP WATER GOALS
(ug/l)

CONTAMINANT	Lowest Tapwater Goal (ug/L	Basis	Tap Water Goal (Noncarcinogenic Effects)	Tap Water Goal (Carcinogenic Effects)
DICHLOROETHYLENE, 1,1-	3.4E+02	noncarcinogenic effects	3.4E+02	
DICHLOROETHYLENE, Cis 1,2-	6.1E+01	noncarcinogenic effects	6.1E+01	
DICHLOROETHYLENE, Trans 1,2-	1.2E+02	noncarcinogenic effects	1.2E+02	
DICHLOROPHENOL, 2,4-	1.1E+02	noncarcinogenic effects	1.1E+02	
DICHLOROPROPANE, 1,2-	1.6E-01	carcinogenic effects	6.7E+00	1.6E-01
DICHLOROPROPENE, 1,3-	4.0E-01	carcinogenic effects	4.0E+01	4.0E-01
DIELDRIN	4.2E-03	carcinogenic effects	1.8E+00	4.2E-03
DIETHYLPHTHALATE	2.9E+04	noncarcinogenic effects	2.9E+04	
DIMETHYLPHENOL, 2,4-	7.3E+02	noncarcinogenic effects	7.3E+02	
DIMETHYLPHTHALATE	3.7E+05	noncarcinogenic effects	3.7E+05	
DINITROPHENOL, 2,4-	7.3E+01	noncarcinogenic effects	7.3E+01	
DINITROTOLUENE, 2,4-	3.4E+01	carcinogenic effects	7.3E+01	3.4E+01
DIOXANE, 1,4-	6.1E+00	carcinogenic effects		6.1E+00
DIOXIN (2,3,7,8-TCDD)	4.5E-07	carcinogenic effects		4.5E-07
ENDOSULFAN	2.2E+02	noncarcinogenic effects	2.2E+02	
ENDRIN	1.1E+01	noncarcinogenic effects	1.1E+01	
ETHYLBENZENE	1.3E+03	noncarcinogenic effects	1.3E+03	
FLUORANTHENE	1.5E+03	noncarcinogenic effects	1.5E+03	
FLUORENE	2.4E+02	noncarcinogenic effects	2.4E+02	
HEPTACHLOR	1.5E-02	carcinogenic effects	1.8E+01	1.5E-02
HEPTACHLOR EPOXIDE	7.4E-03	carcinogenic effects	4.7E-01	7.4E-03
HEXACHLOROBENZENE	4.2E-02	carcinogenic effects	2.9E+01	4.2E-02
HEXACHLOROBUTADIENE	8.6E-01	carcinogenic effects	1.1E+01	8.6E-01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	5.2E-02	carcinogenic effects	1.1E+01	5.2E-02
HEXACHLOROETHANE	4.8E+00	carcinogenic effects	3.7E+01	4.8E+00
INDENO(1,2,3-cd)PYRENE	9.2E-02	carcinogenic effects		9.2E-02
LEAD	0.0E+00	carcinogenic effects		
MERCURY	5.8E+00	noncarcinogenic effects	5.8E+00	
METHOXYCHLOR	1.8E+02	noncarcinogenic effects	1.8E+02	
METHYL ETHYL KETONE	7.0E+03	noncarcinogenic effects	7.0E+03	
METHYL ISOBUTYL KETONE	2.0E+03	noncarcinogenic effects	2.0E+03	
METHYL MERCURY	3.7E+00	noncarcinogenic effects	3.7E+00	
METHYL TERT BUTYL ETHER	1.1E+01	carcinogenic effects	5.2E+03	1.1E+01
METHYLENE CHLORIDE	4.3E+00	carcinogenic effects	1.6E+03	4.3E+00
METHYLNAPHTHALENE (total 1- & 2-)	2.4E+02	noncarcinogenic effects	2.4E+02	
MOLYBDENUM	1.8E+02	noncarcinogenic effects	1.8E+02	
NAPHTHALENE	6.2E+00	noncarcinogenic effects	6.2E+00	
NICKEL	7.3E+02	noncarcinogenic effects	7.3E+02	
PENTACHLOROPHENOL	5.6E-01	carcinogenic effects	1.1E+03	5.6E-01
PERCHLORATE	3.7E+00	noncarcinogenic effects	3.7E+00	
PHENANTHRENE	2.4E+02	noncarcinogenic effects	2.4E+02	
PHENOL	1.1E+04	noncarcinogenic effects	1.1E+04	
POLYCHLORINATED BIPHENYLS (PCBs)	3.4E-02	carcinogenic effects	7.3E-01	3.4E-02
PYRENE	1.8E+02	noncarcinogenic effects	1.8E+02	
SELENIUM	1.8E+02	noncarcinogenic effects	1.8E+02	
SILVER	1.8E+02	noncarcinogenic effects	1.8E+02	
STYRENE	1.6E+03	noncarcinogenic effects	1.6E+03	
tert-BUTYL ALCOHOL	3.7E+00	carcinogenic effects		3.7E+00
TETRACHLOROETHANE, 1,1,1,2-	4.3E-01	carcinogenic effects	1.8E+02	4.3E-01
TETRACHLOROETHANE, 1,1,2,2-	5.6E-02	carcinogenic effects	3.7E+02	5.6E-02
TETRACHLOROETHYLENE	1.0E-01	carcinogenic effects	6.1E+01	1.0E-01
THALLIUM	2.4E+00	noncarcinogenic effects	2.4E+00	

TABLE D-4. USEPA REGION IX
TAP WATER GOALS
(ug/l)

CONTAMINANT	Lowest Tapwater Goal (ug/L	Basis	Tap Water Goal (Noncarcinogenic Effects)	Tap Water Goal (Carcinogenic Effects)
TOLUENE	7.2E+02	noncarcinogenic effects	7.2E+02	
TOXAPHENE	5.6E-02	carcinogenic effects		5.6E-02
TPH (gasolines)	9.3E+01	noncarcinogenic effects	9.3E+01	
TPH (middle distillates)	9.3E+01	noncarcinogenic effects	9.3E+01	
TPH (residual fuels)	1.1E+03	noncarcinogenic effects	1.1E+03	
TRICHLOROBENZENE, 1,2,4-	7.2E+00	noncarcinogenic effects	7.2E+00	
TRICHLOROETHANE, 1,1,1-	3.2E+03	noncarcinogenic effects	3.2E+03	
TRICHLOROETHANE, 1,1,2-	2.0E-01	carcinogenic effects	2.4E+01	2.0E-01
TRICHLOROETHYLENE	2.8E-02	carcinogenic effects	9.5E+00	2.8E-02
TRICHLOROPHENOL, 2,4,5-	6.1E+02	noncarcinogenic effects	6.1E+02	
TRICHLOROPHENOL, 2,4,6-	3.7E+00	noncarcinogenic effects	3.7E+00	6.1E+00
VANADIUM	3.7E+01	noncarcinogenic effects	3.7E+01	
VINYL CHLORIDE	8.1E-02	carcinogenic effects	7.2E+01	8.1E-02
XYLENES	2.1E+02	noncarcinogenic effects	2.1E+02	
ZINC	1.1E+04	noncarcinogenic effects	1.1E+04	

References:
Calculated using Tap Water equations in USEPA Region IX Preliminary Remediation Goals document (USEPA 2002).

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 gasoline and middle distillates tapwater goals round to 100 ug/L. TPH residual fuels goal rounded to 1,000 ug/L.

TABLE E-1. SOIL ACTION LEVELS FOR LEACHING CONCERNS - RAINFALL ≤200 cm/year

					Target Groundwater Concentrations				Soil Leaching Action Levels			
					Drinking Water IS Threatened		Drinking Water NOT Threatened		Drinking Water IS Threatened		Drinking Water NOT Threatened	
	Organic Carbon Coefficient (Koc)	Henry's Law Constant (H)	Dilution/ Atenuation Factor (DAF)	Saturation Limit	Target Groundwater Concentration (Surface Water Within 150m; Table D-1a)	Target Groundwater Concentration (Surface Water NOT Within 150m; Table D-1b)	Target Groundwater Concentration (Surface Water Within 150m; Table D-1c)	Target Groundwater Concentration (Surface Water NOT Within 150m; Table D-1d)	Soil Leaching Action Level (Surface Water Within 150m)	Soil Leaching Action Level (Surface Water NOT Within 150m)	Soil Leaching Action Level (Surface Water Within 150m)	Soil Leaching Action Level (Surface Water NOT Within 150m)
CONTAMINANT	(cm^3/g)	(atm-m^3/mol)		(mg/kg)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
ACENAPHTHENE	4.90E+03	1.55E-04	8.14E+02	1.3E+02	2.0E+01	2.0E+01	2.3E+01	2.0E+02	1.6E+01	1.6E+01	1.9E+01	1.6E+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	5.75E-01	3.88E-05	3.36E-01	1.0E+05	1.5E+03	1.5E+03	1.5E+03	1.5E+03	5.0E-01	5.0E-01	5.0E-01	5.0E-01
#ALDRIN	4.90E+04	4.96E-05	8.13E+03	5.0E+00	4.0E-03	4.0E-03	1.3E-01	1.3E+00	5.0E+00	5.0E+00	5.0E+00	1.1E+01
ANTHRACENE	2.35E+04	6.50E-05	3.90E+03	6.1E+00	7.3E-01	7.3E-01	7.3E-01	7.3E-01	2.8E+00	2.8E+00	2.8E+00	2.8E+00
ANTIMONY					6.0E+00	6.0E+00	3.0E+01	1.5E+03	(site-specific)	(site-specific)	(site-specific)	(site-specific)
ARSENIC					1.0E+01	1.0E+01	3.6E+01	6.9E+01	(site-specific)	(site-specific)	(site-specific)	(site-specific)
BARIUM					2.0E+03	2.0E+03	2.0E+03	2.0E+03	(site-specific)	(site-specific)	(site-specific)	(site-specific)
BENZENE	5.89E+01	5.55E-03	4.42E+01	8.7E+02	5.0E+00	5.0E+00	4.6E+01	1.6E+03	2.2E-01	2.2E-01	2.0E+00	7.0E+01
#BENZO(a)ANTHRACENE	2.00E+05	1.00E-06	3.32E+04	1.2E+01	2.7E-02	2.7E-02	2.7E-02	2.7E-02	1.2E+01	1.2E+01	1.2E+01	1.2E+01
#BENZO(a)PYRENE	5.50E+06	4.90E-07	9.13E+05	1.3E+02	1.4E-02	1.4E-02	1.4E-02	1.4E-02	1.3E+02	1.3E+02	1.3E+02	1.3E+02
#BENZO(b)FLUORANTHENE	5.50E+05	1.22E-05	9.13E+04	4.6E+01	9.2E-02	9.2E-02	9.2E-02	9.2E-02	4.6E+01	4.6E+01	4.6E+01	4.6E+01
#BENZO(g,h,i)PERYLENE	1.60E+06	1.44E-07	2.66E+05	2.5E+00	1.0E-01	1.0E-01	1.0E-01	1.0E-01	2.7E+01	2.7E+01	2.7E+01	2.7E+01
#BENZO(k)FLUORANTHENE	5.50E+05	3.87E-05	9.13E+04	2.6E+00	4.0E-01	4.0E-01	4.0E-01	4.0E-01	3.7E+01	3.7E+01	3.7E+01	3.7E+01
BERYLLIUM					2.7E+00	4.0E+00	2.7E+00	4.3E+01	(site-specific)	(site-specific)	(site-specific)	(site-specific)
BIPHENYL, 1,1-	7.76E+03	3.00E-04	1.29E+03	3.5E+02	5.0E-01	5.0E-01	5.0E+00	5.0E+00	6.5E-01	6.5E-01	6.5E+00	6.5E+00
BIS(2-CHLOROETHYL)ETHER	7.60E+01	1.80E-05	1.27E+01	9.6E+03	9.5E-03	9.5E-03	6.1E+01	1.0E+02	1.2E-04	1.2E-04	7.8E-01	1.3E+00
BIS(2-CHLOROISOPROPYL)ETHER	6.10E+01	1.13E-04	1.08E+01	7.9E+02	2.7E-01	2.7E-01	6.1E+01	3.2E+03	3.0E-03	3.0E-03	6.6E-01	3.5E+01
BIS(2-ETHYLHEXYL)PHTHALATE	1.00E+05	3.00E-07	1.66E+04	7.8E+02	6.0E+00	6.0E+00	3.2E+01	3.2E+01	7.8E+02	7.8E+02	7.8E+02	7.8E+02
BORON					1.6E+00	1.6E+00	1.6E+00	1.6E+00	(site-specific)	(site-specific)	(site-specific)	(site-specific)
BROMODICHLOROMETHANE	5.50E+01	1.60E-03	1.91E+01	3.0E+03	1.8E-01	1.8E-01	2.7E+02	2.7E+02	3.4E-03	3.4E-03	5.1E+00	5.1E+00
BROMOFORM	1.10E+02	5.32E-04	2.16E+01	2.4E+03	1.0E+02	1.0E+02	3.2E+03	5.1E+03	2.2E+00	2.2E+00	6.9E+01	1.1E+02
BROMOMETHANE	9.00E+00	6.24E-03	4.02E+01	3.1E+03	8.5E+00	8.5E+00	1.6E+02	2.3E+03	3.4E-01	3.4E-01	6.4E+00	9.3E+01
CADMIUM					3.0E+00	3.0E+00	3.0E+00	3.0E+00	(site-specific)	(site-specific)	(site-specific)	(site-specific)
CARBON TETRACHLORIDE	1.74E+02	3.04E-02	2.18E+02	1.1E+03	5.0E+00	5.0E+00	9.8E+00	2.1E+01	1.1E+00	1.1E+00	2.1E+00	4.5E+00
#CHLORDANE	4.40E+04	4.79E-05	7.30E+03	1.5E+01	4.0E-03	9.0E-02	4.0E-03	9.0E-02	1.5E+01	1.5E+01	1.5E+01	1.5E+01
CHLOROANILINE, p-	6.40E+01	3.31E-07	1.06E+01	1.3E+03	5.0E+00	5.0E+00	5.0E+00	5.0E+00	5.3E-02	5.3E-02	5.3E-02	5.3E-02
CHLOROBENZENE	2.19E+02	3.70E-03	5.93E+01	6.8E+02	2.5E+01	5.0E+01	2.5E+01	1.6E+02	1.5E+00	3.0E+00	1.5E+00	9.5E+00
CHLOROETHANE	1.47E+01	1.10E-02	7.07E+01	1.6E+03	3.9E+00	3.9E+00	3.9E+00	3.9E+00	2.7E-01	2.7E-01	2.7E-01	2.7E-01
CHLOROFORM	3.98E+01	3.67E-03	2.94E+01	2.9E+03	6.2E+01	6.2E+01	6.2E+01	6.2E+01	1.8E+00	1.8E+00	1.8E+00	1.8E+00
CHLOROMETHANE	3.50E+01	2.40E-02	1.55E+02	4.1E+03	1.6E+02	1.6E+02	3.2E+03	9.5E+03	2.4E+01	2.4E+01	5.0E+02	1.5E+03
CHLOROPHENOL, 2-	3.98E+02	3.91E-04	6.85E+01	5.5E+04	1.8E-01	1.8E-01	1.8E+00	1.8E+00	1.2E-02	1.2E-02	1.2E-01	1.2E-01
CHROMIUM (Total)					7.4E+01	7.4E+01	7.4E+01	7.4E+01	(site-specific)	(site-specific)	(site-specific)	(site-specific)
CHROMIUM III					7.4E+01	5.7E+02	7.4E+01	5.7E+02	(site-specific)	(site-specific)	(site-specific)	(site-specific)
CHROMIUM VI					1.1E+01	1.6E+01	1.1E+01	1.6E+01	(site-specific)	(site-specific)	(site-specific)	(site-specific)
#CHRYSENE	4.00E+05	9.46E-05	6.64E+04	3.8E+00	3.5E-01	3.5E-01	3.5E-01	3.5E-01	2.3E+01	2.3E+01	2.3E+01	2.3E+01
COBALT					3.0E+00	3.0E+00	3.0E+00	3.0E+00	(site-specific)	(site-specific)	(site-specific)	(site-specific)
COPPER					2.9E+00	2.9E+00	2.9E+00	2.9E+00	(site-specific)	(site-specific)	(site-specific)	(site-specific)
CYANIDE (Free)	9.20E+00	1.90E+03	1.18E+07	1.0E+06	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.2E+04	1.2E+04	1.2E+04	1.2E+04
#DIBENZO(a,h)ANTHTRACENE	3.30E+06	7.30E-08	5.48E+05	9.9E+00	9.2E-03	9.2E-03	2.5E-01	2.5E-01	9.9E+00	9.9E+00	1.4E+02	1.4E+02
DIBROMO-3-CHLOROPROPANE, 1,2-	1.30E+02	1.47E-04	2.25E+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	4.68E+02	8.50E-04	8.30E+01	1.3E+04	1.3E-01	1.3E-01	1.6E+02	1.6E+02	1.1E-02	1.1E-02	1.3E+01	1.3E+01
DIBROMOETHANE, 1,2-	4.40E+01	3.20E-04	9.29E+00	1.2E+03	5.6E-03	5.6E-03	1.6E+01	1.6E+01	5.2E-05	5.2E-05	1.5E-01	1.5E-01
DICHLOROBENZENE, 1,2-	6.17E+02	1.90E-03	1.14E+02	6.0E+02	1.0E+01	1.0E+01	1.4E+01	1.0E+02	1.1E+00	1.1E+00	1.6E+00	1.1E+01
DICHLOROBENZENE, 1,3-	6.17E+02	1.90E-03	1.14E+02	6.0E+02	6.5E+01	1.8E+02	6.5E+01	3.7E+02	7.4E+00	2.1E+01	7.4E+00	4.2E+01
DICHLOROBENZENE, 1,4-	6.17E+02	2.43E-03	1.18E+02	2.8E+02	5.0E+00	5.0E+00	1.5E+01	1.1E+02	5.9E-01	5.9E-01	1.8E+00	1.3E+01
DICHLOROBENZIDINE, 3,3-	1.60E+03	8.33E-07	2.66E+02	3.0E+01	1.5E-01	1.5E-01	2.5E+02	2.5E+02	4.0E-02	4.0E-02	6.6E+01	6.6E+01
#DICHLORODIPHENYLDICHLOROETHANE (DDD)	7.80E+05	7.96E-06	1.29E+05	7.5E+02	1.0E-03	2.8E-01	1.0E-03	6.0E-01	7.5E+02	7.5E+02	7.5E+02	7.5E+02
#DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	4.40E+06	6.80E-05	7.30E+05	1.1E+03	1.0E-03	2.8E-01	1.0E-03	1.4E+01	1.1E+03	1.1E+03	1.1E+03	1.0E+04
#DICHLORODIPHENYLTRICHLOROETHANE (DDT)	2.40E+05	3.89E-05	3.98E+04	4.3E+00	1.0E-03	1.3E-02	1.0E-03	1.3E-02	4.3E+00	4.3E+00	4.3E+00	4.3E+00
DICHLOROETHANE, 1,1-	3.16E+01	5.62E-03	4.01E+01	1.7E+03	4.7E+01	4.7E+01	4.7E+01	4.7E+01	1.9E+00	1.9E+00	1.9E+00	1.9E+00
DICHLOROETHANE, 1,2-	1.74E+01	9.79E-04	8.97E+00	1.8E+03	1.2E-01	1.2E-01	1.3E+02	1.3E+02	1.1E-03	1.1E-03	1.2E+00	1.2E+00
DICHLOROETHYLENE, 1,1-	5.89E+01	2.61E-02	1.72E+02	1.5E+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

TABLE E-1. SOIL ACTION LEVELS FOR LEACHING CONCERNS - RAINFALL ≤200 cm/year

					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)
DICHLOROETHYLENE, Cis 1,2-	3.55E+01	4.08E-03	3.12E+01	1.2E+03	7.0E+01	7.0E+01	5.9E+02	1.2E+04	2.2E+00	2.2E+00	1.8E+01	3.6E+02
DICHLOROETHYLENE, Trans 1,2-	5.25E+01	9.38E-03	6.69E+01	3.1E+03	1.0E+02	1.0E+02	5.9E+02	2.6E+03	6.7E+00	6.7E+00	3.9E+01	1.7E+02
DICHLOROPHENOL, 2,4-	6.00E+03	2.80E-06	9.96E+02	1.6E+05	3.0E-01	3.0E-01	3.0E+00	3.0E+00	3.0E-01	3.0E-01	3.0E+00	3.0E+00
DICHLOROPROPANE, 1,2-	4.37E+01	2.80E-03	2.46E+01	1.1E+03	5.0E+00	5.0E+00	1.0E+02	1.0E+02	1.2E-01	1.2E-01	2.5E+00	2.5E+00
DICHLOROPROPENE, 1,3-	4.57E+01	1.77E-02	1.17E+02	1.4E+03	4.0E-01	4.0E-01	1.2E+02	1.6E+02	4.6E-02	4.6E-02	1.4E+01	1.8E+01
DIELDRIN	7.40E+03	5.84E-05	1.23E+03	8.3E+00	1.9E-03	4.2E-03	1.9E-03	7.1E-01	2.3E-03	5.2E-03	2.3E-03	8.7E-01
DIETHYLPHTHALATE	1.40E+02	1.14E-06	2.32E+01	8.4E+02	1.5E+00	9.4E+02	1.5E+00	9.4E+02	3.5E-02	2.2E+01	3.5E-02	2.2E+01
DIMETHYLPHENOL, 2,4-	4.00E+01	2.00E-06	6.65E+00	2.7E+03	1.1E+02	2.7E+02	1.1E+02	2.7E+02	7.3E-01	1.8E+00	7.3E-01	1.8E+00
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
DINITROPHENOL, 2,4-	1.70E+01	6.45E-10	2.82E+00	1.1E+03	7.3E+01	7.3E+01	7.5E+01	2.3E+02	2.1E-01	2.1E-01	2.1E-01	6.5E-01
DINITROTOLUENE, 2,4-	4.50E+01	4.50E-06	7.50E+00	1.0E+02	3.4E+01	3.4E+01	1.2E+02	2.0E+02	2.5E-01	2.5E-01	8.6E-01	1.5E+00
DIOXANE, 1,4-	3.50E+00	3.00E-06	6.00E-01	1.2E+05	6.1E+00	6.1E+00	5.0E+04	5.0E+04	3.7E-03	3.7E-03	3.0E+01	3.0E+01
DIOXIN (2,3,7,8-TCDD)	1.30E+07	8.10E-05	2.16E+06	1.0E+06	5.0E-06	3.0E-05	5.0E-06	3.0E-03	1.0E+06	1.0E+06	1.0E+06	1.0E+06
ENDOSULFAN	3.20E+03	1.00E-05	5.31E+02	2.9E+00	8.7E-03	3.4E-02	8.7E-03	3.4E-02	4.6E-03	1.8E-02	4.6E-03	1.8E-02
ENDRIN	1.70E+03	7.51E-06	2.82E+02	2.7E+00	2.3E-03	3.7E-02	2.3E-03	3.7E-02	6.5E-04	1.0E-02	6.5E-04	1.0E-02
ETHYLBENZENE	3.63E+02	7.88E-03	1.09E+02	4.0E+02	3.0E+01	3.0E+01	2.9E+02	3.0E+02	3.3E+00	3.3E+00	3.2E+01	3.3E+01
#FLUORANTHENE	3.80E+04	6.50E-06	6.31E+03	6.0E+01	8.0E+00	4.0E+01	8.0E+00	4.0E+01	6.0E+01	2.5E+02	6.0E+01	2.5E+02
FLUORENE	1.38E+04	7.70E-05	2.29E+03	1.6E+02	3.9E+00	2.4E+02	3.9E+00	3.0E+02	8.9E+00	5.6E+02	8.9E+00	6.9E+02
HEPTACHLOR	2.20E+04	1.48E-03	3.66E+03	7.4E+00	3.6E-03	5.3E-02	3.6E-03	5.3E-02	1.3E-02	1.9E-01	1.3E-02	1.9E-01
HEPTACHLOR EPOXIDE	2.30E+04	3.16E-05	3.82E+03	4.8E+01	3.6E-03	5.3E-02	3.6E-03	5.3E-02	1.4E-02	2.0E-01	1.4E-02	2.0E-01
#HEXACHLOROBENZENE	1.20E+06	1.70E-03	1.99E+05	7.9E+02	1.0E+00	1.0E+00	3.7E+00	6.0E+00	7.9E+02	7.9E+02	7.9E+02	1.2E+03
HEXACHLOROBUTADIENE	2.90E+04	2.56E-02	4.97E+03	3.5E+02	8.6E-01	8.6E-01	4.7E+00	1.1E+01	4.3E+00	4.3E+00	2.3E+01	5.5E+01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	3.70E+03	4.93E-07	6.14E+02	1.6E+02	8.0E-02	1.6E-01	8.0E-02	1.6E-01	4.9E-02	9.8E-02	4.9E-02	9.8E-02
HEXACHLOROETHANE	2.00E+04	9.85E-03	3.38E+03	6.0E+03	4.8E+00	4.8E+00	1.2E+01	1.0E+02	1.6E+01	1.6E+01	4.1E+01	3.4E+02
#INDENO(1,2,3-cd)PYRENE	1.60E+06	6.95E-08	2.66E+05	5.1E+00	9.2E-02	9.2E-02	9.2E-02	9.2E-02	2.4E+01	2.4E+01	2.4E+01	2.4E+01
LEAD					5.6E+00	1.5E+01	5.6E+00	2.9E+01	(site-specific)	(site-specific)	(site-specific)	(site-specific)
MERCURY					2.5E-02	2.0E+00	2.5E-02	2.1E+00	(site-specific)	(site-specific)	(site-specific)	(site-specific)
#METHOXYCHLOR	7.90E+04	1.58E-05	1.31E+04	1.9E+01	3.0E-02	3.0E-02	3.0E-02	3.0E-02	1.9E+01	1.9E+01	1.9E+01	1.9E+01
METHYL ETHYL KETONE	4.50E+00	2.74E-05	9.17E-01	3.4E+04	7.0E+03	7.0E+03	1.4E+04	1.4E+04	6.4E+00	6.4E+00	1.3E+01	1.3E+01
METHYL ISOBUTYL KETONE	1.34E+02	1.40E-04	2.31E+01	1.7E+04	1.7E+02	1.7E+02	1.7E+02	1.7E+02	3.9E+00	3.9E+00	3.9E+00	3.9E+00
METHYL MERCURY					3.0E-03	3.0E-03	3.0E-03	3.0E-03	(site-specific)	(site-specific)	(site-specific)	(site-specific)
METHYL TERT BUTYL ETHER	6.00E+00	5.87E-04	4.64E+00	2.1E+04	5.0E+00	5.0E+00	1.8E+03	1.8E+03	2.3E-02	2.3E-02	8.4E+00	8.4E+00
METHYLENE CHLORIDE	1.11E+01	2.19E-03	1.54E+01	2.4E+03	4.3E+00	4.3E+00	2.2E+03	4.2E+03	6.7E-02	6.7E-02	3.4E+01	6.5E+01
METHYLNAPHTHALENE (total 1- & 2-)	7.20E+02	2.90E-04	1.21E+02	1.1E+02	2.1E+00	1.0E+01	2.1E+00	1.0E+02	2.5E-01	1.2E+00	2.5E-01	1.2E+01
MOLYBDENUM					1.8E+02	1.8E+02	2.4E+02	2.4E+02	(site-specific)	(site-specific)	(site-specific)	(site-specific)
NAPHTHALENE	1.19E+03	4.83E-04	2.01E+02	2.2E+02	6.2E+00	6.2E+00	2.4E+01	2.1E+02	1.2E+00	1.2E+00	4.8E+00	4.2E+01
NICKEL					5.0E+00	5.0E+00	5.0E+00	5.0E+00	(site-specific)	(site-specific)	(site-specific)	(site-specific)
PENTACHLOROPHENOL	3.20E+04	2.80E-06	5.31E+03	1.0E+06	1.0E+00	1.0E+00	7.9E+00	1.3E+01	1.0E+06	1.0E+06	1.0E+06	1.0E+06
PERCHLORATE					3.7E+00	3.7E+00	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	7.7E+00	4.6E+00	7.7E+00	1.1E+01	1.8E+01	1.1E+01	1.8E+01
PHENOL	9.10E+01	1.30E-06	1.51E+01	5.2E+04	5.0E+00	5.0E+00	1.3E+03	3.4E+03	7.6E-02	7.6E-02	1.9E+01	5.1E+01
#POLYCHLORINATED BIPHENYLS (PCBs)	3.30E+04	5.20E-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
#PYRENE	1.05E+05	1.10E-05	1.74E+04	8.5E+01	2.0E+00	2.0E+00	2.0E+00	2.0E+00	8.5E+01	8.5E+01	8.5E+01	8.5E+01
SELENIUM					5.0E+00	2.0E+01	5.0E+00	2.0E+01	(site-specific)	(site-specific)	(site-specific)	(site-specific)
SILVER					1.0E+00	1.0E+00	1.0E+00	1.0E+00	(site-specific)	(site-specific)	(site-specific)	(site-specific)
STYRENE	7.76E+02	2.75E-03	1.46E+02	1.5E+03	1.0E+01	1.0E+01	1.0E+02	1.0E+02	1.5E+00	1.5E+00	1.5E+01	1.5E+01
tert-BUTYL ALCOHOL	3.70E+01	1.17E-05	6.21E+00	3.2E+05	3.7E+00	3.7E+00	1.8E+04	5.0E+04	2.3E-02	2.3E-02	1.1E+02	3.1E+02
TETRACHLOROETHANE, 1,1,1,2-	9.37E+01	3.45E-04	1.77E+01	2.0E+03	4.3E-01	4.3E-01	3.1E+02	3.1E+03	7.6E-03	7.6E-03	5.5E+00	5.5E+01
TETRACHLOROETHANE, 1,1,2,2-	9.37E+01	3.45E-04	1.77E+01	2.0E+03	5.6E-02	5.6E-02	1.5E+02	1.5E+02	9.9E-04	9.9E-04	2.7E+00	2.7E+00
TETRACHLOROETHYLENE	1.55E+02	1.84E-02	1.40E+02	2.3E+02	5.0E+00	5.0E+00	9.9E+01	9.9E+01	7.0E-01	7.0E-01	1.4E+01	1.4E+01
THALLIUM					2.0E+00	2.0E+00	2.0E+01	4.7E+02	(site-specific)	(site-specific)	(site-specific)	(site-specific)
TOLUENE	1.82E+02	6.64E-03	7.14E+01	6.5E+02	4.0E+01	4.0E+01	1.3E+02	4.0E+02	2.9E+00	2.9E+00	9.3E+00	2.9E+01

TABLE E-1. SOIL ACTION LEVELS FOR LEACHING CONCERNS - RAINFALL ≤200 cm/year

					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)
TOXAPHENE	4.90E+03	2.10E-01	2.12E+03	9.3E+01	2.0E-04	2.1E-01	2.0E-04	2.1E-01	4.2E-04	4.4E-01	4.2E-04	4.4E-01
TPH (gasolines)	5.00E+03	7.20E-04	8.34E+02	4.5E+03	1.0E+02	1.0E+02	5.0E+02	5.0E+03	8.3E+01	8.3E+01	4.2E+02	4.2E+03
TPH (middle distillates)	5.00E+03	7.20E-04	8.34E+02	1.5E+02	1.0E+02	1.0E+02	6.4E+02	2.5E+03	8.3E+01	8.3E+01	5.3E+02	2.1E+03
TPH (residual fuels)					1.0E+02	1.0E+02	6.4E+02	2.5E+03	(site-specific)	(site-specific)	(site-specific)	(site-specific)
TRICHLOROBENZENE, 1,2,4-	1.78E+03	1.42E-03	3.04E+02	3.2E+03	2.5E+01	7.0E+01	2.5E+01	1.6E+02	7.6E+00	2.1E+01	7.6E+00	4.9E+01
TRICHLOROETHANE, 1,1,1-	1.10E+02	1.72E-02	1.25E+02	1.2E+03	6.2E+01	2.0E+02	6.2E+01	6.0E+03	7.8E+00	2.5E+01	7.8E+00	7.5E+02
TRICHLOROETHANE, 1,1,2-	5.01E+01	9.13E-04	1.40E+01	1.8E+03	5.0E+00	5.0E+00	2.8E+02	2.8E+02	7.0E-02	7.0E-02	3.9E+00	3.9E+00
TRICHLOROETHYLENE	1.66E+02	1.03E-02	9.15E+01	1.3E+03	5.0E+00	5.0E+00	7.4E+01	7.4E+01	4.6E-01	4.6E-01	6.8E+00	6.8E+00
TRICHLOROPHENOL, 2,4,5-	8.90E+01	2.18E-04	1.61E+01	7.6E+02	1.1E+01	1.0E+02	1.1E+01	1.0E+02	1.8E-01	1.6E+00	1.8E-01	1.6E+00
TRICHLOROPHENOL, 2,4,6-	2.00E+03	4.00E-06	3.32E+02	9.7E+03	3.7E+00	3.7E+00	4.9E+02	4.9E+02	1.2E+00	1.2E+00	1.6E+02	1.6E+02
VANADIUM					1.9E+01	1.9E+01	1.9E+01	1.9E+01	(site-specific)	(site-specific)	(site-specific)	(site-specific)
VINYL CHLORIDE	1.86E+01	2.70E-02	1.71E+02	1.2E+03	2.0E+00	2.0E+00	2.2E+01	2.2E+01	3.4E-01	3.4E-01	3.8E+00	3.8E+00
XYLENES	4.07E+02	7.34E-03	1.13E+02	4.2E+02	2.0E+01	2.0E+01	1.0E+02	2.0E+03	2.3E+00	2.3E+00	1.1E+01	2.3E+02
ZINC					2.2E+01	2.2E+01	2.2E+01	2.2E+01	(site-specific)	(site-specific)	(site-specific)	(site-specific)

Notes:

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

#: Leaching model used considered to be excessively conservative for highly sorptive chemicals. For chemicals with koc values greater than 30,000 cm^3/g, theoretical soil saturation level ("sat") used in place of leaching model screening level if higher (see text). Soil saturation levels calculated using equation presented in USEPA Region IX PRG guidance (USEPA 2002, see Appendix 2). Exceptions include bis(2-ethylhexyl)phthalate and pentachlorophenol (see text).

TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories. TPH action levels presented in 1996 HIDOH RBCA document used in final lookup tables (refer to Tables A-1 through B-2 and Section 5.3 in text).

Use of above model-generated TPH action levels (or appproved alternatives) may be requried in highly sensitive areas. Refer to Section 2.2.2 in Volume 1 text.

Physio-Chemical constants for chemicals from USEPA Region IX (USEPA 2002) or Ontario MOEE (MOEE 1996) when not available.

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).

Soil Action Levels for TPH rounded to nearest 100 mg/kg (gasolines, middle distillates) or 1,000 mg/kg (residual fuels).

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

TPH action levels for sites that do not threaten drinking water resources and are not within 150m of a surface water body adjusted to reflect action levels presented in 1996 HIDOH RBCA document. Used as default soil action levels for leaching concerns in final tables (see Tables A-1 through B-2 and Section 5.3 in text).

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

TABLE E-2. SOIL ACTION LEVELS FOR LEACHING CONCERNS - RAINFALL >200cm/year

				Adjusted 1996 HIDOH RBCA Action Levels For High Rainfall Areas							
				Target Groundwater Concentrations				Soil Leaching Action Levels			
	1996 HIDOH RBCA (Rainfall >200 cm/yr)			Drinking Water IS Threatened		Drinking Water NOT Threatened		Drinking Water IS Threatened		Drinking Water NOT Threatened	
CONTAMINANT	Groundwater IS a Drinking Water Source (ug/L)	Soil Leaching Action Level (mg/kg)	GAL:SAL ratio	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											
ACENAPHTHYLENE											
ACETONE	6.1E+02	6.00E-02	1.0E+04	1.5E+03	1.5E+03	1.5E+03	1.5E+03	1.5E-01	1.5E-01	1.5E-01	1.5E-01
#ALDRIN											
ANTHRACENE											
ANTIMONY											
ARSENIC											
BARIUM											
BENZENE	5.0E+00	2.00E-03	2.5E+03	5.0E+00	5.0E+00	4.6E+01	1.6E+03	2.0E-03	2.0E-03	1.8E-02	6.4E-01
#BENZO(a)ANTHRACENE											
#BENZO(a)PYRENE											
#BENZO(b)FLUORANTHENE											
#BENZO(g,h,i)PERYLENE											
#BENZO(k)FLUORANTHENE											
BERYLLIUM											
BIPHENYL, 1,1-											
BIS(2-CHLOROETHYL)ETHER											
BIS(2-CHLOROISOPROPYL)ETHER											
BIS(2-ETHYLHEXYL)PHTHALATE											
BORON											
BROMODICHLOROMETHANE											
BROMOFORM											
BROMOMETHANE											
CADMIUM											
CARBON TETRACHLORIDE	5.0E+00	2.40E-02	2.1E+02	5.0E+00	5.0E+00	9.8E+00	2.1E+01	2.4E-02	2.4E-02	4.7E-02	1.0E-01
#CHLORDANE											
CHLOROANILINE, p-											
CHLOROBENZENE	1.0E+02	5.00E-02	2.0E+03	2.5E+01	5.0E+01	2.5E+01	1.6E+02	1.3E-02	2.5E-02	1.3E-02	8.0E-02
CHLOROETHANE											
CHLOROFORM	1.6E-01	1.00E-04	1.6E+03	6.2E+01	6.2E+01	6.2E+01	6.2E+01	3.9E-02	3.9E-02	3.9E-02	3.9E-02
CHLOROMETHANE											
CHLOROPHENOL, 2-											
CHROMIUM (Total)											
CHROMIUM III											
CHROMIUM VI											
#CHRYSENE											
COBALT											
COPPER											
CYANIDE (Free)											
#DIBENZO(a,h)ANTHTRACENE											
1,2-DIBROMO-3-CHLOROPROPANE											
DIBROMOCHLOROMETHANE											
DIBROMOETHANE, 1,2-											
DICHLOROBENZENE, 1,2-											
DICHLOROBENZENE, 1,3-											
DICHLOROBENZENE, 1,4-											
DICHLOROBENZIDINE, 3,3-											

TABLE E-2. SOIL ACTION LEVELS FOR LEACHING CONCERNS - RAINFALL >200cm/year

				Adjusted 1996 HIDOH RBCA Action Levels For High Rainfall Areas							
				Target Groundwater Concentrations				Soil Leaching Action Levels			
	1996 HIDOH RBCA (Rainfall >200 cm/yr)			Drinking Water IS Threatened		Drinking Water NOT Threatened		Drinking Water IS Threatened		Drinking Water NOT Threatened	
CONTAMINANT	Groundwater IS a Drinking Water Source (ug/L)	Soil Leaching Action Level (mg/kg)	GAL:SAL ratio	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)
#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-											
DICHLOROPROPANE, 1,2-											
DICHLOROPROPENE, 1,3-											
DIELDRIN											
DIETHYLPHTHALATE											
DIMETHYLPHENOL, 2,4-											
DIMETHYLPHTHALATE											
DINITROPHENOL, 2,4-											
DINITROTOLUENE, 2,4-											
1,4 DIOXANE											
DIOXIN (2,3,7,8-TCDD)											
ENDOSULFAN											
ENDRIN											
ETHYLBENZENE	1.4E+02	1.30E-01	1.1E+03	3.0E+01	3.0E+01	2.9E+02	3.0E+02	2.8E-02	2.8E-02	2.7E-01	2.8E-01
#FLUORANTHENE											
FLUORENE											
HEPTACHLOR											
HEPTACHLOR EPOXIDE											
#HEXACHLOROBENZENE											
HEXACHLOROBUTADIENE											
HEXACHLOROCYCLOHEXANE (gamma) LINDANE											
HEXACHLOROETHANE											
#INDENO(1,2,3-cd)PYRENE											
LEAD											
MERCURY											
#METHOXYCHLOR											
METHYL ETHYL KETONE											
METHYL ISOBUTYL KETONE											
METHYL MERCURY											
METHYL TERT BUTYL ETHER											
METHYLENE CHLORIDE	4.3E+00	2.40E-03	1.8E+03	7.0E+03	7.0E+03	1.4E+04	1.4E+04	3.9E+00	3.9E+00	7.8E+00	7.8E+00
METHYLNAPHTHALENE (total 1- & 2-)											
MOLYBDENUM											
NAPHTHALENE											
NICKEL											
PENTACHLOROPHENOL											
PERCHLORATE											
PHENANTHRENE											

TABLE E-2. SOIL ACTION LEVELS FOR LEACHING CONCERNS - RAINFALL >200cm/year

				Adjusted 1996 HIDOH RBCA Action Levels For High Rainfall Areas							
				Target Groundwater Concentrations				Soil Leaching Action Levels			
	1996 HIDOH RBCA (Rainfall >200 cm/yr)			Drinking Water IS Threatened		Drinking Water NOT Threatened		Drinking Water IS Threatened		Drinking Water NOT Threatened	
	Groundwater IS a Drinking Water Source	Soil Leaching Action Level	GAL:SAL	Target Groundwater Concentration (Surface Water Within 150m; Table D-1a)	Target Groundwater Concentration (Surface Water NOT Within 150m; Table D-1b)	Target Groundwater Concentration (Surface Water Within 150m; Table D-1c)	Target Groundwater Concentration (Surface Water NOT Within 150m; Table D-1d)	Soil Leaching Action Level (Surface Water Within 150m)	Soil Leaching Action Level (Surface Water NOT Within 150m)	Soil Leaching Action Level (Surface Water Within 150m)	Soil Leaching Action Level (Surface Water NOT Within 150m)
CONTAMINANT	(ug/L)	(mg/kg)	ratio	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
PHENOL											
#POLYCHLORINATED BIPHENYLS (PCBs)											
#PYRENE											
SELENIUM											
SILVER											
STYRENE											
tert-BUTYL ALCOHOL											
TETRACHLOROETHANE, 1,1,1,2-											
TETRACHLOROETHANE, 1,1,2,2-											
TETRACHLOROETHYLENE	5.0E+00	4.00E-02	1.3E+02	5.0E+00	5.0E+00	9.9E+01	9.9E+01	4.0E-02	4.0E-02	7.9E-01	7.9E-01
THALLIUM											
TOLUENE	1.0E+03	2.60E+00	3.8E+02	4.0E+01	4.0E+01	1.3E+02	4.0E+02	1.0E-01	1.0E-01	3.4E-01	1.0E+00
TOXAPHENE											
TPH (gasolines)											
TPH (middle distillates)											
TPH (residual fuels)											
TRICHLOROBENZENE, 1,2,4-											
TRICHLOROETHANE, 1,1,1-	2.0E+02	6.00E-02	6.0E+03	6.2E+01	2.0E+02	6.2E+01	6.0E+03	1.0E-02	3.3E-02	1.0E-02	1.0E+00
TRICHLOROETHANE, 1,1,2-											
TRICHLOROETHYLENE	5.0E+00	4.00E-03	7.0E+02	5.0E+00	5.0E+00	7.4E+01	7.4E+01	7.1E-03	7.1E-03	1.1E-01	1.1E-01
TRICHLOROPHENOL, 2,4,5-											
TRICHLOROPHENOL, 2,4,6-											
VANADIUM											
VINYL CHLORIDE											
XYLENES	1.0E+04	8.10E+00	1.0E+04	2.0E+01	2.0E+01	1.0E+02	2.0E+03	2.0E-03	2.0E-03	1.0E-02	2.0E-01
ZINC											

Notes:
1996 HIDOH groundwater target concentrations and correlative soil leaching action levels in high rainfall areas from Table 1c in Apendix F of 1996 document.
Adjusted soil leaching levels = Target Groundwater Concentration/1996 GAL:SAL ratio.
Soil leaching action levels only generated for relatively mobile contaminants modeled in 1996 HIDOH RBCA document

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

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

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

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

CONTAMINANT	[1]Final Residential Ceiling Level	Final Industrial/ Commercial Ceiling Level	[1]Raw Residential Ceiling Level	Raw Industrial/ Commercial Ceiling Level	Soil Saturation Limit (mg/kg)	Vapor Pressure (VP) (Torr @ 20-30 °C)	50 Percentile Odor Recognition Threshold (ORT) (ug/m^3)	50 Percentile Odor Recognition Threshold (ORT) (ppm-v)	Odor Index
ACENAPHTHENE	1.0E+03	2.5E+03	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	1.0E+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
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	-	-	-	-
BARIUM	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-
BENZENE	5.0E+02	8.7E+02	5.0E+02	1.0E+03	8.7E+02	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	9.6E+03	7.1E-01	2.87E+02	4.9E-02	1.45E+01
BIS(2-CHLOROISOPROPYL)ETHER	5.0E+02	7.9E+02	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	1.0E+03	2.5E+03	1.0E+03	2.5E+03	3.0E+03	5.00E+01	1.10E+07	1.68E+03	2.98E-02
BROMOFORM	5.0E+02	1.0E+03	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	3.1E+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	5.0E+02	1.0E+03	5.0E+02	1.0E+03	1.1E+03	1.13E+02	6.30E+04	1.00E+01	1.13E+01
CHLORDANE	1.0E+03	2.5E+03	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	6.8E+02	5.0E+02	1.0E+03	6.8E+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	1.6E+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	2.9E+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	4.1E+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)	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-
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
DIBENZO(a,h)ANTHTRACENE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.0E-10	-	-	-

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

CONTAMINANT	[1]Final Residential Ceiling Level	Final Industrial/ Commercial Ceiling Level	[1]Raw Residential Ceiling Level	Raw Industrial/ Commercial Ceiling Level	Soil Saturation Limit (mg/kg)	Vapor Pressure (VP) (Torr @ 20-30 °C)	50 Percentile Odor Recognition Threshold (ORT) (ug/m^3)	50 Percentile Odor Recognition Threshold (ORT) (ppm-v)	Odor Index
DIBROMO-3-CHLOROPROPANE, 1,2-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	8.00E-01	-	-	-
DIBROMOCHLOROMETHANE	1.0E+02	5.0E+02	1.0E+02	5.0E+02	1.1E+03	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
DICHLOROBENZENE, 1,2-	6.0E+02	6.0E+02	1.0E+03	2.5E+03	6.0E+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	1.5E+03	5.91E+02	2.00E+06	5.00E+02	1.18E+00
DICHLOROETHYLENE, Cis 1,2-	1.0E+02	5.0E+02	1.0E+02	5.0E+02	1.2E+03	2.15E+02	-	-	-
DICHLOROETHYLENE, Trans 1,2-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	3.1E+03	3.31E+02	6.73E+04	1.70E+01	1.95E+01
DICHLOROPHENOL, 2,4-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	6.7E-02	1.40E+03	2.10E-01	3.19E-01
DICHLOROPROPANE, 1,2-	1.0E+02	5.0E+02	1.0E+02	5.0E+02	1.1E+03	4.20E+01	1.19E+03	2.50E-01	1.68E+02
DICHLOROPROPENE, 1,3-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	1.4E+03	4.30E+01	4.16E+03	1.00E+00	4.30E+01
DIELDRIN	1.0E+03	2.5E+03	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	-	-	-
DINITROPHENOL, 2,4-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.5E-05	-	-	-
DINITROTOLUENE, 2,4-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	5.1E-03	-	-	-
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
DIOXIN (2,3,7,8-TCDD)	NA	NA	no criteria	no criteria	NA	-	-	-	-
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	-	-	-
ETHYLBENZENE	4.0E+02	4.0E+02	5.0E+02	1.0E+03	4.0E+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	-	-	-
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	-	-	-
INDENO(1,2,3-cd)PYRENE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.0E-06	-	-	-
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	-	-	-

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

CONTAMINANT	[1]Final Residential Ceiling Level	Final Industrial/ Commercial Ceiling Level	[1]Raw Residential Ceiling Level	Raw Industrial/ Commercial Ceiling Level	Soil Saturation Limit (mg/kg)	Vapor Pressure (VP) (Torr @ 20-30 °C)	50 Percentile Odor Recognition Threshold (ORT) (ug/m^3)	50 Percentile Odor Recognition Threshold (ORT) (ppm-v)	Odor Index
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	1.7E+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	NA	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	2.1E+04	-	-	-	-
METHYL TERT BUTYL ETHER	1.0E+02	5.0E+02	1.0E+02	5.0E+02	NA	2.45E+02	5.30E+02	1.30E-01	1.88E+03
METHYLENE CHLORIDE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	3.4E+04	4.29E+02	5.60E+05	1.60E+02	2.68E+00
METHYLNAPHTHALENE (total 1- & 2-)	5.0E+02	1.0E+03	5.0E+02	1.0E+03	2.4E+03	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	-	-	-	-
PENTACHLOROPHENOL	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.1E-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	-	-	-
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	-	-	-	-
STYRENE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	1.5E+03	5.00E+00	1.36E+03	3.00E-01	1.67E+01
tert-BUTYL ALCOHOL	1.0E+02	5.0E+02	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	2.0E+03	1.20E+01	-	-	-
TETRACHLOROETHANE, 1,1,2,2-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	2.0E+03	4.00E+00	1.05E+04	1.50E+00	2.67E+00
TETRACHLOROETHYLENE	2.3E+02	2.3E+02	5.0E+02	1.0E+03	2.3E+02	1.90E+01	3.17E+04	4.68E+00	4.06E+00
THALLIUM	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-
TOLUENE	5.0E+02	6.5E+02	5.0E+02	1.0E+03	6.5E+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	-	3.00E+02	1.00E+02	2.22E-02	1.35E+04
TPH (middle distillates)	5.0E+02	1.0E+03	5.0E+02	1.0E+03	-	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	-	-	-	-	-
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	1.0E+03	5.0E+02	1.0E+03	1.2E+03	1.00E+02	6.51E+04	1.20E+01	8.33E+00
TRICHLOROETHANE, 1,1,2-	1.0E+02	5.0E+02	1.0E+02	5.0E+02	1.8E+03	2.25E+01	-	-	-
TRICHLOROETHYLENE	5.0E+02	1.3E+03	5.0E+02	2.5E+03	1.3E+03	7.70E+01	1.36E+06	2.49E+02	3.09E-01
TRICHLOROPHENOL, 2,4,5-	1.0E+02	5.0E+02	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
VANADIUM	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-

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

CONTAMINANT	[1]Final Residential Ceiling Level	Final Industrial/ Commercial Ceiling Level	[1]Raw Residential Ceiling Level	Raw Industrial/ Commercial Ceiling Level	Soil Saturation Limit (mg/kg)	Vapor Pressure (VP) (Torr @ 20-30 °C)	50 Percentile Odor Recognition Threshold (ORT) (ug/m^3)	50 Percentile Odor Recognition Threshold (ORT) (ppm-v)	Odor Index
VINYL CHLORIDE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	1.2E+03	2.58E+03	7.71E+05	2.94E+02	8.78E+00
XYLENES	4.2E+02	4.2E+02	5.0E+02	1.0E+03	4.2E+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. "Residential Land Use" screening levels generally considered adequate for other sensitive uses (e.g., day-care centers, hospitals, etc.).

Odor Index = VP/ORT in ppm-v
Physio-chemical constants Ontario MOEE (MOEE 1996) except as noted.
Physio-chemical constants for cloroethane and chloromethane from ATSDR Toxicological Profiles (ATSDR 2001).
Odor Recognition Threshold in parts per million - volume (ppm-v = (concentration in mg/m3) x (24/molecular weight)).
TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.
Ceiling Level: Based on comparison of vapor pressure and odor index to Table 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).
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); ORT values from ATSDR (2001a).

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

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

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

CONTAMINANT	[1]Final Residential Ceiling Level	Final Industrial/ Commercial Ceiling Level	[1]Raw Residential Ceiling Level	Raw Industrial/ Commercial Ceiling Level	Soil Saturation Limit (mg/kg)	Vapor Pressure (VP) (Torr @ 20-30 °C)	50 Percentile Odor Recognition Threshold (ORT) (ug/m^3)	50 Percentile Odor Recognition Threshold (ORT) (ppm-v)	Odor Index
ACENAPHTHENE	2.5E+03	5.0E+03	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	1.0E+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
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	-	-	-	-
BARIUM	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
BENZENE	8.7E+02	8.7E+02	1.0E+03	2.5E+03	8.7E+02	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	9.6E+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	2.5E+03	3.0E+03	2.5E+03	5.0E+03	3.0E+03	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	3.1E+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	1.0E+03	1.1E+03	1.0E+03	2.5E+03	1.1E+03	1.13E+02	6.30E+04	1.00E+01	1.13E+01
CHLORDANE	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	6.8E+02	6.8E+02	1.0E+03	2.5E+03	6.8E+02	1.18E+01	1.00E+03	2.20E-01	5.36E+01
CHLOROETHANE	1.0E+03	1.6E+03	1.0E+03	2.5E+03	1.6E+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	2.9E+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	4.1E+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)	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
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
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. COMPONENTS FOR DEEP SOIL GROSS CONTAMINATION CEILING LEVELS (mg/kg)

CONTAMINANT	[1]Final Residential Ceiling Level	Final Industrial/ Commercial Ceiling Level	[1]Raw Residential Ceiling Level	Raw Industrial/ Commercial Ceiling Level	Soil Saturation Limit (mg/kg)	Vapor Pressure (VP) (Torr @ 20-30 °C)	50 Percentile Odor Recognition Threshold (ORT) (ug/m^3)	50 Percentile Odor Recognition Threshold (ORT) (ppm-v)	Odor Index
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-	6.0E+02	6.0E+02	2.5E+03	5.0E+03	6.0E+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	1.5E+03	1.0E+03	2.5E+03	1.5E+03	5.91E+02	2.00E+06	5.00E+02	1.18E+00
DICHLOROETHYLENE, Cis 1,2-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	1.2E+03	2.15E+02	-	-	-
DICHLOROETHYLENE, Trans 1,2-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	3.1E+03	3.31E+02	6.73E+04	1.70E+01	1.95E+01
DICHLOROPHENOL, 2,4-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	6.70E-02	1.40E+03	2.10E-01	3.19E-01
DICHLOROPROPANE, 1,2-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	1.1E+03	4.20E+01	1.19E+03	2.50E-01	1.68E+02
DICHLOROPROPENE, 1,3-	1.0E+03	1.4E+03	1.0E+03	2.5E+03	1.4E+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	-	-	-
DINITROPHENOL, 2,4-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.50E-05	-	-	-
DINITROTOLUENE, 2,4-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	5.10E-03	-	-	-
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
DIOXIN (2,3,7,8-TCDD)	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	-	-	-	-
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	-	-	-
ETHYLBENZENE	4.0E+02	4.0E+02	1.0E+03	2.5E+03	4.0E+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	-	-	-
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	-	-	-
INDENO(1,2,3-cd)PYRENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.00E-06	-	-	-
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	3.4E+04	1.00E+02	3.20E+04	1.10E+01	9.09E+00
METHYL ISOBUTYL KETONE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	1.7E+04	1.00E+01	4.20E+02	1.00E-01	1.00E+02

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

CONTAMINANT	[1]Final Residential Ceiling Level	Final Industrial/ Commercial Ceiling Level	[1]Raw Residential Ceiling Level	Raw Industrial/ Commercial Ceiling Level	Soil Saturation Limit (mg/kg)	Vapor Pressure (VP) (Torr @ 20-30 °C)	50 Percentile Odor Recognition Threshold (ORT) (ug/m^3)	50 Percentile Odor Recognition Threshold (ORT) (ppm-v)	Odor Index
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	2.1E+04	2.45E+02	5.30E+02	1.30E-01	1.88E+03
METHYLENE CHLORIDE	1.0E+03	2.4E+03	1.0E+03	2.5E+03	2.4E+03	4.29E+02	5.60E+05	1.60E+02	2.68E+00
METHYLNAPHTHALENE (total 1- & 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	-	-	-	-
PENTACHLOROPHENOL	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.10E-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	-	-	-
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	-	-	-	-
STYRENE	1.0E+03	1.5E+03	1.0E+03	2.5E+03	1.5E+03	5.00E+00	1.36E+03	3.00E-01	1.67E+01
tert-BUTYL ALCOHOL	5.0E+02	1.0E+03	5.0E+02	1.0E+03	3.2E+05	4.20E+01	-	-	-
TETRACHLOROETHANE, 1,1,1,2-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	2.0E+03	1.20E+01	-	-	-
TETRACHLOROETHANE, 1,1,2,2-	1.0E+03	2.0E+03	1.0E+03	2.5E+03	2.0E+03	4.00E+00	1.05E+04	1.50E+00	2.67E+00
TETRACHLOROETHYLENE	2.3E+02	2.3E+02	1.0E+03	2.5E+03	2.3E+02	1.90E+01	3.17E+04	4.68E+00	4.06E+00
THALLIUM	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
TOLUENE	6.5E+02	6.5E+02	1.0E+03	2.5E+03	6.5E+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	NA	3.00E+02	1.00E+02	2.22E-02	1.35E+04
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-	1.0E+03	1.2E+03	1.0E+03	2.5E+03	1.2E+03	1.00E+02	6.51E+04	1.20E+01	8.33E+00
TRICHLOROETHANE, 1,1,2-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	1.8E+03	2.25E+01	-	-	-
TRICHLOROETHYLENE	1.3E+03	1.3E+03	2.5E+03	5.0E+03	1.3E+03	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
VANADIUM	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-

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

CONTAMINANT	[1]Final Residential Ceiling Level	Final Industrial/ Commercial Ceiling Level	[1]Raw Residential Ceiling Level	Raw Industrial/ Commercial Ceiling Level	Soil Saturation Limit (mg/kg)	Vapor Pressure (VP) (Torr @ 20-30 °C)	50 Percentile Odor Recognition Threshold (ORT) (ug/m^3)	50 Percentile Odor Recognition Threshold (ORT) (ppm-v)	Odor Index
VINYL CHLORIDE	1.0E+03	1.2E+03	1.0E+03	2.5E+03	1.2E+03	2.58E+03	7.71E+05	2.94E+02	8.78E+00
XYLENES	4.2E+02	4.2E+02	1.0E+03	2.5E+03	4.2E+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. "Residential Land Use" screening levels generally considered adequate for other sensitive uses (e.g., day-care centers, hospitals, etc.).

Odor Index = VP/ORT in ppm-v
Physio-chemical constants Ontario MOEE (MOEE 1996) except as noted.
Physio-chemical constants for cloroethane and chloromethane from ATSDR Toxicological Profiles (ATSDR 2001).
Odor Recognition Threshold in parts per million - volume (ppm-v = (concentration in mg/m3) x (24/molecular weight)).
TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.
Ceiling Level: Based on comparison of vapor pressure and odor index to Table 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).

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 CEILING LEVELS
(groundwater IS a current or potential source of drinking water)
(ug/L)

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

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

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

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

CONTAMINANT	Final Ceiling Level	Basis	Solubility (1/2)	Taste And Odor Threshold	Basis	Upper Limit
HEPTACHLOR EPOXIDE	1.8E+02	Solubility	1.8E+02	-	-	5.0E+04
HEXACHLOROBENZENE	5.5E+01	Solubility	5.5E+01	3.0E+03	Ontario MOEE	5.0E+04
HEXACHLOROBUTADIENE	6.0E+00	Taste & Odors	1.0E+03	6.0E+00	Ontario MOEE	5.0E+04
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	3.5E+03	Solubility	3.5E+03	1.2E+04	Ontario MOEE	5.0E+04
HEXACHLOROETHANE	1.0E+01	Taste & Odors	2.5E+04	1.0E+01	Amoore & Hautala	5.0E+04
INDENO(1,2,3-cd)PYRENE	2.7E-01	Solubility	2.7E-01	-	-	5.0E+04
LEAD	5.0E+04	Upper Limit		-	-	5.0E+04
MERCURY	5.0E+04	Upper Limit		-	-	5.0E+04
METHOXYCHLOR	2.0E+01	Solubility	2.0E+01	4.7E+03	Amoore & Hautala	5.0E+04
METHYL ETHYL KETONE	8.4E+03	Taste & Odors	1.3E+08	8.4E+03	Amoore & Hautala	5.0E+04
METHYL ISOBUTYL KETONE	1.3E+03	Taste & Odors	9.5E+06	1.3E+03	Amoore & Hautala	5.0E+04
METHYL MERCURY	5.0E+04	Upper Limit		-	-	5.0E+04
METHYL TERT BUTYL ETHER	5.0E+00	Taste & Odors	7.5E+07	5.0E+00	Cal DHS 2nd MCL	5.0E+04
METHYLENE CHLORIDE	9.1E+03	Taste & Odors	6.6E+06	9.1E+03	Ontario MOEE	5.0E+04
METHYLNAPHTHALENE (total 1- & 2-)	1.0E+01	Taste & Odors	1.3E+04	1.0E+01	Ontario MOEE	5.0E+04
MOLYBDENUM	5.0E+04	Upper Limit		-	-	5.0E+04
NAPHTHALENE	2.1E+01	Taste & Odors	1.6E+04	2.1E+01	Amoore & Hautala	5.0E+04
NICKEL	5.0E+04	Upper Limit		-	-	5.0E+04
PENTACHLOROPHENOL	3.0E+01	Taste & Odors	7.0E+06	3.0E+01	Amoore & Hautala	5.0E+04
PERCHLORATE	5.0E+04	Upper Limit	1.0E+08	-	-	5.0E+04
PHENANTHRENE	4.1E+02	Solubility	4.1E+02	1.0E+03	Ontario MOEE	5.0E+04
PHENOL	5.0E+00	Taste & Odors	4.0E+07	5.0E+00	Cal DHS AL	5.0E+04
POLYCHLORINATED BIPHENYLS (PCBs)	1.6E+01	Solubility	1.6E+01	-	-	5.0E+04
PYRENE	6.8E+01	Solubility	6.8E+01	-	-	5.0E+04
SELENIUM	5.0E+04	Upper Limit		-	-	5.0E+04
SILVER	1.0E+02	Taste & Odors		1.0E+02	USEPA 2nd MCL	5.0E+04
STYRENE	1.0E+01	Taste & Odors	1.6E+05	1.0E+01	USEPA 2nd MCL	5.0E+04
tert-BUTYL ALCOHOL	5.0E+04	Upper Limit	5.0E+08	-	-	5.0E+04
TETRACHLOROETHANE, 1,1,1,2-	5.0E+04	Upper Limit	1.5E+06	-	-	5.0E+04
TETRACHLOROETHANE, 1,1,2,2-	5.0E+02	Taste & Odors	1.5E+06	5.0E+02	Amoore & Hautala	5.0E+04
TETRACHLOROETHYLENE	1.7E+02	Taste & Odors	1.0E+05	1.7E+02	Amoore & Hautala	5.0E+04
THALLIUM	5.0E+04	Upper Limit		-	-	5.0E+04
TOLUENE	4.0E+01	Taste & Odors	2.6E+05	4.0E+01	USEPA 2nd MCL	5.0E+04
TOXAPHENE	1.4E+02	Taste & Odors	1.5E+03	1.4E+02	USEPA 2nd MCL	5.0E+04
TPH (gasolines)	1.0E+02	Taste & Odors	7.5E+04	1.0E+02	USEPA SNARL	5.0E+04
TPH (middle distillates)	1.0E+02	Taste & Odors	2.5E+03	1.0E+02	USEPA SNARL	5.0E+04

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

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

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

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

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

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

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

CONTAMINANT	Final Ceiling Level	Basis	Solubility (1/2)	Nuisance/Odor Threshold	Basis	Upper Limit
COPPER	5.0E+04	Upper Limit		-	-	5.0E+04
CYANIDE (Free)	1.7E+03	Nuisance/Odors	5.0E+08	1.7E+03	Ontario MOEE	5.0E+04
DIBENZO(a,h)ANTHTRACENE	2.5E-01	Solubility	2.5E-01	-	-	5.0E+04
DIBROMO-3-CHLOROPROPANE, 1,2-	1.0E+02	Nuisance/Odors	6.0E+05	1.0E+02	Amoore & Hautala	5.0E+04
DIBROMOCHLOROMETHANE	5.0E+04	Upper Limit	2.2E+06	-	-	5.0E+04
DIBROMOETHANE, 1,2-	5.0E+04	Upper Limit	1.7E+06	-	-	5.0E+04
DICHLOROBENZENE, 1,2-	1.0E+02	Nuisance/Odors	7.8E+04	1.0E+02	Ontario MOEE	5.0E+04
DICHLOROBENZENE, 1,3-	5.0E+04	Upper Limit	7.8E+04	-	-	5.0E+04
DICHLOROBENZENE, 1,4-	1.1E+02	Nuisance/Odors	3.7E+04	1.1E+02	Ontario MOEE	5.0E+04
DICHLOROBENZIDINE, 3,3-	1.6E+03	Solubility	1.6E+03	-	-	5.0E+04
DICHLORODIPHENYLDICHLOROETHANE (DDD)	8.0E+01	Solubility	8.0E+01	-	-	5.0E+04
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.0E+01	Solubility	2.0E+01	-	-	5.0E+04
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.5E+00	Solubility	1.5E+00	3.5E+03	Ontario MOEE	5.0E+04
DICHLOROETHANE, 1,1-	5.0E+04	Upper Limit	2.5E+06	-	-	5.0E+04
DICHLOROETHANE, 1,2-	5.0E+04	Upper Limit	4.3E+06	2.0E+05	Ontario MOEE	5.0E+04
DICHLOROETHYLENE, 1,1-	1.5E+04	Nuisance/Odors	1.1E+06	1.5E+04	Amoore & Hautala	5.0E+04
DICHLOROETHYLENE, Cis 1,2-	5.0E+04	Upper Limit	1.8E+06	-	-	5.0E+04
DICHLOROETHYLENE, Trans 1,2-	2.6E+03	Nuisance/Odors	3.2E+06	2.6E+03	Ontario MOEE	5.0E+04
DICHLOROPHENOL, 2,4-	3.0E+00	Nuisance/Odors	2.3E+06	3.0E+00	Ontario MOEE	5.0E+04
DICHLOROPROPANE, 1,2-	1.0E+02	Nuisance/Odors	1.4E+06	1.0E+02	Ontario MOEE	5.0E+04
DICHLOROPROPENE, 1,3-	5.0E+04	Upper Limit	1.4E+06	-	-	5.0E+04
DIELDRIN	9.3E+01	Solubility	9.3E+01	4.1E+02	Ontario MOEE	5.0E+04
DIETHYLPHTHALATE	5.0E+04	Upper Limit	4.5E+05	-	-	5.0E+04
DIMETHYLPHENOL, 2,4-	4.0E+03	Nuisance/Odors	3.9E+06	4.0E+03	Ontario MOEE	5.0E+04
DIMETHYLPHTHALATE	5.0E+04	Upper Limit	2.5E+06	-	-	5.0E+04
DINITROPHENOL, 2,4-	5.0E+04	Upper Limit	2.8E+06	-	-	5.0E+04
DINITROTOLUENE, 2,4-	5.0E+04	Upper Limit	1.4E+05	-	-	5.0E+04
DIOXANE, 1,4-	5.0E+04	Upper Limit	5.0E+08	-	-	5.0E+04
DIOXIN (2,3,7,8-TCDD)	7.0E+03	Solubility	7.0E+03	-	-	5.0E+04
ENDOSULFAN	7.5E+01	Solubility	7.5E+01	-	-	5.0E+04
ENDRIN	1.3E+02	Solubility	1.3E+02	4.1E+02	Ontario MOEE	5.0E+04
ETHYLBENZENE	3.0E+02	Nuisance/Odors	8.5E+04	3.0E+02	USEPA 2nd MCL	5.0E+04
FLUORANTHENE	1.3E+02	Solubility	1.3E+02	-	-	5.0E+04
FLUORENE	9.5E+02	Solubility	9.5E+02	-	-	5.0E+04
HEPTACHLOR	2.8E+01	Solubility	2.8E+01	2.0E+02	Ontario MOEE	5.0E+04
HEPTACHLOR EPOXIDE	1.8E+02	Solubility	1.8E+02	-	-	5.0E+04
HEXACHLOROBENZENE	5.5E+01	Solubility	5.5E+01	3.0E+04	Ontario MOEE	5.0E+04

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

CONTAMINANT	Final Ceiling Level	Basis	Solubility (1/2)	Nuisance/Odor Threshold	Basis	Upper Limit
HEXACHLOROBUTADIENE	6.0E+01	Nuisance/Odors	1.0E+03	6.0E+01	Ontario MOEE	5.0E+04
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	3.5E+03	Solubility	3.5E+03	1.2E+05	Ontario MOEE	5.0E+04
HEXACHLOROETHANE	1.0E+02	Nuisance/Odors	2.5E+04	1.0E+02	Ontario MOEE	5.0E+04
INDENO(1,2,3-cd)PYRENE	2.7E-01	Solubility	2.7E-01	-	-	5.0E+04
LEAD	5.0E+04	Upper Limit		-	-	5.0E+04
MERCURY	5.0E+04	Upper Limit		-	-	5.0E+04
METHOXYCHLOR	2.0E+01	Solubility	2.0E+01	4.7E+04	Ontario MOEE	5.0E+04
METHYL ETHYL KETONE	5.0E+04	Upper Limit	1.3E+08	8.4E+04	Amoore & Hautala	5.0E+04
METHYL ISOBUTYL KETONE	1.3E+04	Nuisance/Odors	9.5E+06	1.3E+04	Amoore & Hautala	5.0E+04
METHYL MERCURY	5.0E+04	Upper Limit		-	-	5.0E+04
METHYL TERT BUTYL ETHER	1.8E+03	Nuisance/Odors	7.5E+07	1.8E+03	CalDHS	5.0E+04
METHYLENE CHLORIDE	5.0E+04	Upper Limit	6.6E+06	9.1E+04	Ontario MOEE	5.0E+04
METHYLNAPHTHALENE (total 1- & 2-)	1.0E+02	Nuisance/Odors	1.3E+04	1.0E+02	Ontario MOEE	5.0E+04
MOLYBDENUM	5.0E+04	Upper Limit		-	-	5.0E+04
NAPHTHALENE	2.1E+02	Nuisance/Odors	1.6E+04	2.1E+02	Ontario MOEE	5.0E+04
NICKEL	5.0E+04	Upper Limit		-	-	5.0E+04
PENTACHLOROPHENOL	5.9E+03	Nuisance/Odors	7.0E+06	5.9E+03	Ontario MOEE	5.0E+04
PERCHLORATE	5.0E+04	Upper Limit	1.0E+08	-	-	5.0E+04
PHENANTHRENE	4.1E+02	Solubility	4.1E+02	1.0E+04	Ontario MOEE	5.0E+04
PHENOL	5.0E+04	Upper Limit	4.0E+07	7.9E+04	Ontario MOEE	5.0E+04
POLYCHLORINATED BIPHENYLS (PCBs)	1.6E+01	Solubility	1.6E+01	-	-	5.0E+04
PYRENE	6.8E+01	Solubility	6.8E+01	-	-	5.0E+04
SELENIUM	5.0E+04	Upper Limit		-	-	5.0E+04
SILVER	5.0E+04	Upper Limit		-	-	5.0E+04
STYRENE	1.1E+02	Nuisance/Odors	1.6E+05	1.1E+02	Ontario MOEE	5.0E+04
tert-BUTYL ALCOHOL	5.0E+04	Upper Limit	5.0E+08	-	-	5.0E+04
TETRACHLOROETHANE, 1,1,1,2-	5.0E+04	Upper Limit	1.5E+06	-	-	5.0E+04
TETRACHLOROETHANE, 1,1,2,2-	5.0E+03	Nuisance/Odors	1.5E+06	5.0E+03	Ontario MOEE	5.0E+04
TETRACHLOROETHYLENE	3.0E+03	Nuisance/Odors	1.0E+05	3.0E+03	Ontario MOEE	5.0E+04
THALLIUM	5.0E+04	Upper Limit		-	-	5.0E+04
TOLUENE	4.0E+02	Nuisance/Odors	2.6E+05	4.0E+02	Ontario MOEE	5.0E+04
TOXAPHENE	1.4E+02	Nuisance/Odors	1.5E+03	1.4E+02	USEPA 2nd MCL	5.0E+04
TPH (gasolines)	5.0E+03	Nuisance/Odors	7.5E+04	5.0E+03	MADEP	5.0E+04
TPH (middle distillates)	2.5E+03	Solubility	2.5E+03	5.0E+03	MADEP	5.0E+04
TPH (residual fuels)	2.5E+03	Solubility	2.5E+03	5.0E+03	MADEP	5.0E+04
TRICHLOROBENZENE, 1,2,4-	3.0E+04	Nuisance/Odors	1.5E+05	3.0E+04	USEPA (1995)	5.0E+04
TRICHLOROETHANE, 1,1,1-	5.0E+04	Upper Limit	6.7E+05	5.0E+05	Ontario MOEE	5.0E+04

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

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

References:
Unless otherwise noted, criteria for nuisance odor threshhold from Ontario MOEE (MOEE 1996) OR data from Amoore and Hautala (1983) as presented in *A Compilation of Water Quality Goals* if not available *(RWQCBCV 2000)*.
Upper limit of 50000 ug/L intended to limit general groundwater resource degradation (MOEE 1996).
1/2 solubility based on solubility constants in USEPA Region IX (USEPA 2004) or Ontario MOEE (MOEE 1996) if not available.
Odor threshold for MTBE based on average, upper range at which most subjects could smell MTBE in water (CalEPA 1999).

Notes:
Nuisance Odor Thresholds assume ten-fold attenuation/dilution of chemical in groundwater upon discharge to surface water.
Ceiling Level: lowest of 1/2 solubility, odor/taste threshhold and 50000 ug/L maximum level (intended to limit general groundwater resource degradation).
TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.
TPH ceiling level after Massachusetts DEP (MADEP 1997a).

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

CONTAMINANT	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 ($atm\text{-}m^3/mol$)	Henry's Law constant H' (unitless)	Skin Absorption Factor ABS (unitless)	Cancer Slope Factor Oral CSFo $(mg/kg\text{-}d)^{-1}$	Cancer Slope Factor Inhaled CSFi $(mg/kg\text{-}d)^{-1}$	Reference Dose Oral RfDo (mg/kg-d)	Reference Dose Inhaled RfDi (mg/kg-d)
ACENAPHTHENE	V	S	154	4.90E+03	4.21E-02	7.69E-06	4.24E+00	1.55E-04	6.36E-03				6.0E-02	6.0E-02
ACENAPHTHYLENE	V	S	152	2.50E+03	6.08E-02	7.88E-06	3.93E+00	1.45E-03	5.95E-02				4.0E-02	4.0E-02
ACETONE	V	L	58	5.75E-01	1.24E-01	1.14E-05	1.00E+06	3.88E-05	1.59E-03				9.0E-01	9.0E-01
ALDRIN	NV	S	365	4.90E+04			1.70E-02	4.96E-05	2.03E-03	0.10	1.7E+01	1.7E+01	3.0E-05	3.0E-05
ANTHRACENE	V	S	178	2.35E+04	3.24E-02	7.74E-06	4.34E-02	6.50E-05	2.67E-03				3.0E-01	3.0E-01
ANTIMONY	NV	S	122										4.0E-04	
ARSENIC	NV	S	75							0.0004	1.5E+00	1.5E+01	3.0E-04	
BARIUM	NV	S	137										7.0E-02	1.4E-04
BENZENE	V	L	78	5.89E+01	8.80E-02	9.80E-06	1.75E+03	5.55E-03	2.28E-01		5.5E-02	2.7E-02	4.0E-03	8.6E-03
BENZO(a)ANTHRACENE	NV	S	228	2.00E+05			1.00E-02	1.00E-06	4.10E-05	0.13	7.3E-01	7.3E-01		
BENZO(a)PYRENE	NV	S	252	5.50E+06			3.80E-03	4.90E-07	2.01E-05	0.13	7.30E+00	7.30E+00		
BENZO(b)FLUORANTHENE	NV	S	252	5.50E+05			1.40E-02	1.22E-05	5.00E-04	0.13	7.3E-01	7.3E-01		
BENZO(g,h,i)PERYLENE	NV	S	276	1.60E+06			2.60E-04	1.44E-07	5.90E-06	0.13			4.0E-02	4.0E-02
BENZO(k)FLUORANTHENE	NV	S	252	5.50E+05			8.00E-04	3.87E-05	1.59E-03	0.13	7.3E-02	7.30E-02		
BERYLLIUM	NV	S	9									8.4E+00	2.0E-03	5.7E-06
BIPHENYL, 1,1-	V	S	150	7.76E+03	4.04E-02	8.20E-06	7.50E+00	3.00E-04	1.23E-02				5.0E-02	5.0E-02
BIS(2-CHLOROETHYL)ETHER	V	L	142	7.60E+01	6.92E-02	7.53E-06	1.72E+04	1.80E-05	7.38E-04		1.1E+00	1.2E+00		
BIS(2-CHLOROISOPROPYL)ETHER	V	L	171	6.10E+01	6.31E-02	6.40E-06	1.70E+03	1.13E-04	4.63E-03		7.0E-02	3.5E-02	4.0E-02	4.0E-02
BIS(2-ETHYLHEXYL)PHTHALATE	NV	S	391	1.00E+05			1.30E+00	3.00E-07	1.23E-05	0.10	1.4E-02	1.4E-02	2.0E-02	2.2E-02
BORON	NV	S	11							0.10			2.0E-01	5.7E-03
BROMODICHLOROMETHANE	V	L	164	5.50E+01	2.98E-02	1.06E-05	6.74E+03	1.60E-03	6.56E-02		6.2E-02	6.2E-02	2.0E-02	2.0E-02
BROMOFORM	NV	S	253	1.10E+02			3.20E+03	5.32E-04	2.18E-02	0.10	7.9E-03	3.9E-03	2.0E-02	2.0E-02
BROMOMETHANE	V	G	95	9.00E+00	7.28E-02	1.21E-05	1.52E+04	6.24E-03	2.56E-01				1.4E-03	1.4E-03
CADMIUM	NV	S	112							0.001		6.3E+00	5.0E-04	
CARBON TETRACHLORIDE	V	L	154	1.74E+02	7.80E-02	8.80E-06	7.93E+02	3.04E-02	1.25E+00		1.3E-01	5.3E-02	7.0E-04	7.0E-04
CHLORDANE	NV	S	410	4.40E+04			5.60E-02	4.79E-05	1.96E-03	0.04	3.5E-01	3.5E-01	5.0E-04	2.0E-04
CHLOROANILINE, p-	NV	S	128	6.40E+01			2.60E+03	3.31E-07	1.36E-05	0.10			4.0E-03	4.0E-03
CHLOROBENZENE	V	L	113	2.19E+02	7.30E-02	8.70E-06	4.72E+02	3.70E-03	1.52E-01				2.0E-02	1.7E-02
CHLOROETHANE	V	G	65	1.47E+01	1.04E-01	1.15E-05	5.70E+03	1.10E-02	4.51E-01		2.9E-03	2.9E-03	4.0E-01	2.9E+00
CHLOROFORM	V	L	119	3.98E+01	1.04E-01	1.00E-05	7.92E+03	3.67E-03	1.50E-01			8.1E-02	1.0E-02	1.4E-02
CHLOROMETHANE	V	G	51	3.50E+01	1.10E-01	6.50E-06	8.20E+03	2.40E-02	9.84E-01				2.6E-02	2.6E-02
CHLOROPHENOL, 2-	V	L	132	3.98E+02	5.01E-01	9.46E-06	2.20E+04	3.91E-04	1.60E-02				5.0E-03	5.0E-03
CHROMIUM (Total)	NV	S	52									4.2E+01		
CHROMIUM III	NV	S	52										1.5E+00	
CHROMIUM VI	NV	S	52									3.0E+02	3.0E-03	2.2E-06
CHRYSENE	NV	S	228	4.00E+05	2.48E-02	6.21E-06	1.60E-03	9.46E-05	3.88E-03	0.13	7.3E-03	7.3E-03		
COBALT	NV	S	59									9.8E+00	2.0E-02	5.7E-6
COPPER	NV	S	64										4.0E-02	
CYANIDE (Free)	NV	S	26	9.20E+00	1.80E-01	1.80E-05	1.00E+06	1.90E+03	7.79E+04	0.10			2.0E-02	
DIBENZO(a,h)ANTHTRACENE	NV	S	278	3.30E+06			5.00E-04	7.30E-08	2.99E-06	0.13	7.3E+00	7.3E+00		
DIBROMO-3-CHLOROPROPANE, 1,2-	V	L	236	1.30E+02	2.12E-02	7.00E-06	1.20E+03	1.47E-04	6.03E-03		1.4E+00	2.4E-03	5.7E-05	5.7E-05
DIBROMOCHLOROMETHANE	V	S	208	4.68E+02	9.60E-02	1.00E-05	4.40E+03	8.50E-04	3.49E-02		8.4E-02	8.4E-02	2.0E-02	2.0E-02
DIBROMOETHANE, 1,2-	V	S	188	4.40E+01	7.33E-02	8.06E-06	3.40E+03	3.20E-04	1.31E-02		2.0E+00	2.0E+00	9.0E-03	2.6E-03
DICHLOROBENZENE, 1,2-	V	L	147	6.17E+02	6.90E-02	7.90E-06	1.56E+02	1.90E-03	7.79E-02				9.0E-02	5.7E-02
DICHLOROBENZENE, 1,3-	V	L	147	6.17E+02	6.90E-02	7.90E-06	1.56E+02	1.90E-03	7.79E-02				3.0E-02	3.0E-02

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

CONTAMINANT	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 ($atm\text{-}m^3/mol$)	Henry's Law constant H' (unitless)	Skin Absorption Factor ABS (unitless)	Cancer Slope Factor Oral CSFo $(mg/kg\text{-}d)^{-1}$	Cancer Slope Factor Inhaled CSFi $(mg/kg\text{-}d)^{-1}$	Reference Dose Oral RfDo (mg/kg-d)	Reference Dose Inhaled RfDi (mg/kg-d)
DICHLOROBENZENE, 1,4-	V	S	147	6.17E+02	6.90E-02	7.90E-06	7.38E+01	2.43E-03	9.96E-02		2.4E-02	2.2E-02	3.0E-02	3.0E-02
DICHLOROBENZIDINE, 3,3-	NV	S	253	1.60E+03			3.11E+00	8.33E-07	3.42E-05	0.10	4.5E-01	4.5E-01		
DICHLORODIPHENYLDICHLOROETHANE (DDD)	NV	S	331	7.80E+05			1.60E-01	7.96E-06	3.26E-04	0.03	2.4E-01	2.4E-01		
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	NV	S	329	4.40E+06			4.00E-02	6.80E-05	2.79E-03	0.03	2.4E-01	2.4E-01		
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	NV	S	355	2.40E+05			3.00E-03	3.89E-05	1.59E-03	0.03	3.4E-01	3.4E-01	5.0E-04	5.0E-04
DICHLOROETHANE, 1,1-	V	L	99	3.16E+01	7.42E-02	1.05E-05	5.06E+03	5.62E-03	2.30E-01				1.0E-01	1.4E-01
DICHLOROETHANE, 1,2-	V	L	99	1.74E+01	1.04E-01	9.90E-06	8.52E+03	9.79E-04	4.01E-02		9.1E-02	9.1E-02	3.0E-02	1.4E-03
DICHLOROETHYLENE, 1,1-	V	L	97	5.89E+01	9.00E-02	1.04E-05	2.25E+03	2.61E-02	1.07E+00				5.0E-02	5.7E-02
DICHLOROETHYLENE, Cis 1,2-	V	L	97	3.55E+01	7.36E-02	1.13E-05	3.50E+03	4.08E-03	1.67E-01				1.0E-02	1.0E-02
DICHLOROETHYLENE, Trans 1,2-	V	L	97	5.25E+01	7.07E-02	1.19E-05	6.30E+03	9.38E-03	3.85E-01				2.0E-02	2.0E-02
DICHLOROPHENOL, 2,4-	NV	S	163	6.00E+03			4.50E+03	2.80E-06	1.15E-04	0.10			3.0E-03	3.0E-03
DICHLOROPROPANE, 1,2-	V	L	113	4.37E+01	7.82E-02	8.73E-06	2.80E+03	2.80E-03	1.15E-01		6.8E-02	6.8E-02	1.1E-03	1.1E-03
DICHLOROPROPENE, 1,3-	V	L	111	4.57E+01	6.26E-02	1.00E-05	2.80E+03	1.77E-02	7.26E-01		1.0E-01	1.4E-02	3.0E-02	5.7E-03
DIELDRIN	NV	S	381	7.40E+03			1.86E-01	5.84E-05	2.39E-03	0.10	1.6E+01	1.6E+01	5.0E-05	5.0E-05
DIETHYLPHTHALATE	NV	S	222	1.40E+02			8.96E+02	1.14E-06	4.67E-05	0.10			8.0E-01	8.0E-01
DIMETHYLPHENOL, 2,4-	NV	S	122	4.00E+01			7.87E+03	2.00E-06	8.20E-05	0.10			2.0E-02	2.0E-02
DIMETHYLPHTHALATE	NV	S	194	1.40E+02			5.00E+03	1.05E-07	4.31E-06	0.10			1.0E+01	1.0E+01
DINITROPHENOL, 2,4-	NV	S	184	1.70E+01			5.60E+03	6.45E-10	2.64E-08	0.10			2.0E-03	2.0E-03
DINITROTOLUENE, 2,4-	NV	S	182	4.50E+01			2.70E+02	4.50E-06	1.85E-04	0.10	2.0E-03	2.0E-03	2.0E-03	2.0E-03
DIOXANE, 1,4-	NV	L	88	3.50E+00			1.00E+06	3.00E-06	1.23E-04	0.10	1.1E-02	1.1E-02		
DIOXIN (2,3,7,8-TCDD)	NV	S	322	1.30E+07			1.40E+01	8.10E-05	3.32E-03	0.03	1.5E+05	1.5E+05		
ENDOSULFAN	NV	S	407	3.20E+03			1.50E-01	1.00E-05	4.10E-04	0.10			6.0E-03	6.0E-03
ENDRIN	NV	S	381	1.70E+03			2.60E-01	7.51E-06	3.08E-04	0.10			3.0E-04	3.0E-04
ETHYLBENZENE	V	L	106	3.63E+02	7.50E-02	7.80E-06	1.69E+02	7.88E-03	3.23E-01				1.0E-01	2.9E-01
FLUORANTHENE	NV	S	202	3.80E+04			2.65E-01	6.50E-06	2.67E-04	0.13			4.0E-02	4.0E-02
FLUORENE	V	S	166	1.38E+04	6.08E-02	7.88E-06	1.90E+00	7.70E-05	3.16E-03				4.0E-02	4.0E-02
HEPTACHLOR	NV	S	373	2.20E+04			5.60E-02	1.48E-03	6.07E-02	0.10	4.5E+00	4.6E+00	5.0E-04	5.0E-04
HEPTACHLOR EPOXIDE	NV	S	389	2.30E+04			3.50E-01	3.16E-05	1.30E-03	0.10	9.1E+00	9.1E+00	1.3E-05	1.3E-05
HEXACHLOROBENZENE	NV	S	285	1.20E+06			1.10E-01	1.70E-03	6.97E-02	0.10	1.6E+00	1.6E+00	8.0E-04	8.0E-04
HEXACHLOROBUTADIENE	NV	S	261	2.90E+04			2.00E+00	2.56E-02	1.05E+00	0.10	7.8E-02	7.8E-02	3.0E-04	3.0E-04
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	NV	S	291	3.70E+03			7.00E+00	4.93E-07	2.02E-05	0.04	1.3E+00	1.3E+00	3.0E-04	3.0E-04
HEXACHLOROETHANE	NV	S	237	2.00E+04			5.00E+01	9.85E-03	4.04E-01	0.10	1.4E-02	1.4E-02	1.0E-03	1.0E-03
INDENO(1,2,3-cd)PYRENE	NV	S	276	1.60E+06			5.30E-04	6.95E-08	2.85E-06	0.13	7.3E-01	7.3E-01		
LEAD	NV	S	207											
MERCURY	NV	S	201										1.6E-04	8.5E-05
METHOXYCHLOR	NV	S	347	7.90E+04			4.00E-02	1.58E-05	6.48E-04	0.10			5.0E-03	5.0E-03
METHYL ETHYL KETONE	V	L	72	4.50E+00	8.95E-02	9.80E-06	2.68E+05	2.74E-05	1.12E-03				6.0E-01	1.4E+00
METHYL ISOBUTYL KETONE	V	L	100	1.34E+02	7.50E-02	7.80E-06	1.90E+04	1.40E-04	5.74E-03				8.0E-02	8.6E-01
METHYL MERCURY	NV	S	216							0.10			1.0E-04	
METHYL TERT BUTYL ETHER	V	L	98	6.00E+00	8.00E-02	1.00E-05	1.50E+05	5.87E-04	2.41E-02		1.8E-03	9.1E-04	8.6E-01	8.6E-01
METHYLENE CHLORIDE	V	L	85	1.11E+01	1.01E-01	1.17E-05	1.32E+04	2.19E-03	8.98E-02		7.5E-03	1.6E-03	6.0E-02	8.6E-01
METHYLNAPHTHALENE (total 1- & 2-)	V	S	142	7.20E+02	5.90E-02	7.50E-06	2.60E+01	2.90E-04	1.19E-02				4.0E-02	4.0E-2
MOLYBDENUM	NV	S	96										5.0E-03	
NAPHTHALENE	V	S	128	1.19E+03	5.90E-02	7.50E-06	3.10E+01	4.83E-04	1.98E-02				2.0E-02	8.6E-04
NICKEL	NV	S	59										2.0E-02	

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

CONTAMINANT	Physical State		Molecular Weight	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Pure component water solubility, S (mg/L)	Henry's Law constant H (atm-m^3/mol)	Henry's Law constant H' (unitless)	Skin Absorption Factor ABS (unitless)	Cancer Slope Factor Oral CSFo $(mg/kg\text{-}d)^{-1}$	Cancer Slope Factor Inhaled CSFi $(mg/kg\text{-}d)^{-1}$	Reference Dose Oral RfDo (mg/kg-d)	Reference Dose Inhaled RfDi (mg/kg-d)
PENTACHLOROPHENOL	NV	S	266	3.20E+04			1.40E+04	2.80E-06	1.15E-04	0.25	1.2E-01	1.2E-01	3.0E-02	3.0E-02
PERCHLORATE	NV	S	100				2.00E+05						1.0E-04	
PHENANTHRENE	V	S	178	1.40E+04	6.08E-02	7.88E-06	8.16E-01	3.93E-05	1.61E-03				4.0E-02	4.0E-02
PHENOL	NV	S	94	9.10E+01			8.00E+04	1.30E-06	5.33E-05	0.10			3.0E-01	3.0E-01
POLYCHLORINATED BIPHENYLS (PCBs)	NV	S	327 (ave)	3.30E+04			3.20E-02	5.20E-04	2.13E-02	0.14	2.0E+00	2.0E+00	2.0E-05	2.0E-05
PYRENE	V	S	202	1.05E+05	2.72E-02	7.24E-06	1.35E-01	1.10E-05	4.51E-04				3.0E-02	3.0E-02
SELENIUM	NV	S	79										5.0E-03	
SILVER	NV	S	47										5.0E-03	
STYRENE	V	L	104	7.76E+02	7.10E-02	8.00E-06	3.10E+02	2.75E-03	1.13E-01				2.0E-01	2.9E-01
tert-BUTYL ALCOHOL	V	L	74	3.70E+01	9.00E-02	9.10E-06	1.00E+06	1.17E-05	4.80E-04		3.0E-03	3.0E-03		
TETRACHLOROETHANE, 1,1,1,2-	V	L	168	9.37E+01	7.10E-02	7.90E-06	2.97E+03	3.45E-04	1.41E-02		2.6E-02	2.6E-02	3.0E-02	3.0E-02
TETRACHLOROETHANE, 1,1,2,2-	V	L	168	9.37E+01	7.10E-02	7.90E-06	2.97E+03	3.45E-04	1.41E-02		2.0E-01	2.0E-01	6.0E-02	6.0E-02
TETRACHLOROETHYLENE	V	L	166	1.55E+02	7.20E-02	8.20E-06	2.00E+02	1.84E-02	7.54E-01		5.4E-01	2.1E-02	1.0E-02	1.0E-02
THALLIUM	NV	S	204										6.6E-05	
TOLUENE	V	L	92	1.82E+02	8.70E-02	8.60E-06	5.26E+02	6.64E-03	2.72E-01				2.0E-01	1.1E-01
TOXAPHENE	NV	S	414	4.90E+03			3.00E+00	2.10E-01	8.61E+00	0.10	1.2E+00	1.2E+00		
TPH (gasolines)	V	L	108	5.00E+03	7.00E-02	7.80E-06	1.50E+02	7.20E-04	2.95E-02	0.10			3.0E-02	1.4E-02
TPH (middle distillates)	V	L	170	5.00E+03	7.00E-02	7.80E-06	5.00E+00	7.20E-04	2.95E-02	0.10			3.0E-02	1.4E-02
TPH (residual fuels)	NV	L/S					5.00E+00						3.0E-02	1.4E-02
TRICHLOROBENZENE, 1,2,4-	V	S	180	1.78E+03	3.00E-02	8.23E-06	3.00E+02	1.42E-03	5.82E-02				1.0E-02	1.0E-03
TRICHLOROETHANE, 1,1,1-	V	L	133	1.10E+02	7.80E-02	8.80E-06	1.33E+03	1.72E-02	7.05E-01				2.8E-01	6.3E-01
TRICHLOROETHANE, 1,1,2-	V	L	133	5.01E+01	7.80E-02	8.80E-06	4.42E+03	9.13E-04	3.74E-02		5.7E-02	5.6E-02	4.0E-03	4.0E-03
TRICHLOROETHYLENE	V	L	131	1.66E+02	7.90E-02	9.10E-06	1.10E+03	1.03E-02	4.22E-01		4.00E-01	4.0E-01	3.0E-04	1.0E-02
TRICHLOROPHENOL, 2,4,5-	V	S	198	8.90E+01	2.9E-02	7.0E-06	1.19E+03	2.18E-04	8.94E-03	0.10			1.0E-01	1.0E-01
TRICHLOROPHENOL, 2,4,6-	NV	S	198	2.00E+03			8.00E+02	4.00E-06	1.64E-04	0.10	1.1E-02	1.1E-02	1.0E-04	1.0E-04
VANADIUM	NV	S	51										1.0E-03	

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

CONTAMINANT	Physical State		Molecular Weight	Organic carbon partition coefficient, K_{oc}	Diffusivity in air, D_a	Diffusivity in water, D_w	Pure component water solubility, S	Henry's Law constant H	Henry's Law constant H'	Skin Absorption Factor ABS	Cancer Slope Factor Oral CSFo	Cancer Slope Factor Inhaled CSFi	Reference Dose Oral RfDo	Reference Dose Inhaled RfDi
				(cm^3/g)	(cm^2/s)	(cm^2/s)	(mg/L)	(atm-m^3/mol)	(unitless)	(unitless)	$(mg/kg\text{-}d)^{-1}$	$(mg/kg\text{-}d)^{-1}$	(mg/kg-d)	(mg/kg-d)
VINYL CHLORIDE (nonresidential exposure)	V	G	63	1.86E+01	1.06E-01	1.23E-06	2.76E+03	2.70E-02	1.11E+00		7.5E-01	1.6E-02	3.0E-03	2.9E-02
VINYL CHLORIDE (residential exposure)	V	G	63	1.86E+01	1.06E-01	1.23E-06	2.76E+03	2.70E-02	1.11E+00		1.5E+00	3.1E-02	3.0E-03	2.9E-02
XYLENES	V	L	106	4.07E+02	7.00E-02	7.80E-06	1.61E+02	7.34E-03	3.01E-01				2.0E-01	2.9E-02
ZINC	NV	S	65										3.0E-01	

Notes:

Physical state of chemical at ambient conditions (V - volatile, NV - nonvolatile, S - solid, L - liquid, G - gas).

Chemical considered to be "volatile" if Henry's number (atm m3/mole) >0.00001 and molecular weight <200.

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.)

TPH -Total Petroleum Hydrocarbons. RfD values from MADEP 2002. Molecular weights form ATSDR (gasolines) and NIOSH (middle distillates). See text for discussion of different TPH categories.

TPH as gasolines and middle distillates diffusivity constants based on xylenes. (Required for direct exposure models. Does not significantly affect action levels. See Section 5.3)

Physio-chemical constants and ABS values from USEPA Region IX (USEPA 2002) or Ontario MOEE (MOEE 1996) when not available, except as noted.

Physio-chemical constants for dioxin, polychlorinated biphenyls and toxaphene from ATSDR 2001a. PCB solubility from MOEE (1996).

Henry's constant for 2,4 dimethylphenol from Syracuse Research Corporation (SRC 2005).

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

USEPA Cancer Slope Factors and References Doses as presented in Region IX PRGs (USEPA 2004), unless otherwise noted.

Physio-chemical for TBA from *Assessment and Management of MtBE Impacted Sites* (RWQCB 2001). Oral cancer slope factor from California EPA (CalEPA 1999b).

Physio-chemicals and toxicity constants for xylenes based on m-xylene.

Diffusivity constants for methylnaphthalene not available. Constants presented based on naphthalene.

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

Alternative cancer slope factors and exposure models used for residential exposure to vinyl (refer to USEPA 2004).

TABLE I-1. DIRECT-EXPOSURE ACTION LEVELS
[1]RESIDENTIAL EXPOSURE SCENARIO

CONTAMINANT	Final Action Level (mg/kg)	Basis	Carcinogens (mg/kg)	Noncarcinogens (mg/kg)	Saturation (mg/kg)
ACENAPHTHENE	3.7E+03	noncarcinogenic effects	-	3.7E+03	NA
ACENAPHTHYLENE	1.3E+03	noncarcinogenic effects	-	1.3E+03	NA
ACETONE	1.4E+04	noncarcinogenic effects	-	1.4E+04	1.0E+05
ALDRIN	2.9E-02	carcinogenic effects	2.9E-02	1.8E+00	NA
ANTHRACENE	2.2E+04	noncarcinogenic effects	-	2.2E+04	NA
ANTIMONY	3.1E+01	noncarcinogenic effects	-	3.1E+01	NA
ARSENIC	4.2E-01	carcinogenic effects	4.2E-01	2.3E+01	NA
BARIUM	5.4E+03	noncarcinogenic effects	-	5.4E+03	NA
BENZENE	6.4E-01	carcinogenic effects	6.4E-01	3.3E+01	8.7E+02
BENZO(a)ANTHRACENE	6.2E+00	carcinogenic effects	6.2E+00	-	NA
BENZO(a)PYRENE	6.2E-01	carcinogenic effects	6.2E-01	-	NA
BENZO(b)FLUORANTHENE	6.2E+00	carcinogenic effects	6.2E+00	-	NA
BENZO(g,h,i)PERYLENE	2.3E+03	noncarcinogenic effects	-	2.3E+03	NA
BENZO(k)FLUORANTHENE	6.2E+01	carcinogenic effects	6.2E+01	-	NA
BERYLLIUM	1.5E+02	noncarcinogenic effects	1.1E+03	1.5E+02	NA
BIPHENYL, 1,1-	3.0E+03	noncarcinogenic effects	-	3.0E+03	NA
BIS(2-CHLOROETHYL)ETHER	2.0E-01	carcinogenic effects	2.0E-01	-	9.6E+03
BIS(2-CHLOROISOPROPYL)ETHER	2.9E+00	carcinogenic effects	2.9E+00	9.5E+02	7.9E+02
BIS(2-ETHYLHEXYL)PHTHALATE	3.5E+01	carcinogenic effects	3.5E+01	1.2E+03	NA
BORON	1.2E+04	noncarcinogenic effects	-	1.2E+04	NA
BROMODICHLOROMETHANE	8.2E-01	carcinogenic effects	8.2E-01	2.2E+02	3.0E+03
BROMOFORM	6.1E+01	carcinogenic effects	6.1E+01	1.2E+03	NA
BROMOMETHANE	3.8E+00	noncarcinogenic effects	-	3.8E+00	3.1E+03
CADMIUM	3.9E+01	noncarcinogenic effects	1.4E+03	3.9E+01	NA
CARBON TETRACHLORIDE	2.5E-01	carcinogenic effects	2.5E-01	2.2E+00	1.1E+03
CHLORDANE	1.6E+00	carcinogenic effects	1.6E+00	3.5E+01	NA
CHLOROANILINE, p-	2.4E+02	noncarcinogenic effects	-	2.4E+02	NA
CHLOROBENZENE	1.5E+02	noncarcinogenic effects	-	1.5E+02	6.8E+02
CHLOROETHANE	3.0E+00	carcinogenic effects	3.0E+00	5.0E+03	1.6E+03
CHLOROFORM	2.2E-01	carcinogenic effects	2.2E-01	5.4E+01	2.9E+03
CHLOROMETHANE	4.6E+01	noncarcinogenic effects	-	4.6E+01	4.1E+03
CHLOROPHENOL, 2-	6.3E+01	noncarcinogenic effects	-	6.3E+01	5.5E+04
CHROMIUM (Total)	2.1E+02	carcinogenic effects	2.1E+02	-	NA
CHROMIUM III	1.2E+05	noncarcinogenic effects	-	1.2E+05	NA
CHROMIUM VI	3.0E+01	carcinogenic effects	3.0E+01	2.2E+02	NA
CHRYSENE	6.2E+02	carcinogenic effects	6.2E+02	-	NA

TABLE I-1. DIRECT-EXPOSURE ACTION LEVELS
[1]RESIDENTIAL EXPOSURE SCENARIO

CONTAMINANT	Final Action Level (mg/kg)	Basis	Carcinogens (mg/kg)	Noncarcinogens (mg/kg)	Saturation (mg/kg)
COBALT	5.2E+02	trench/construction worker	9.1E+02	1.4E+03	NA
COPPER	3.1E+03	noncarcinogenic effects	-	3.1E+03	NA
CYANIDE (Free)	1.2E+03	noncarcinogenic effects	-	1.2E+03	NA
DIBENZO(a,h)ANTHTRACENE	6.2E-01	carcinogenic effects	6.2E-01	-	NA
DIBROMO-3-CHLOROPROPANE, 1,2-	4.5E-01	carcinogenic effects	4.5E-01	2.1E+00	1.1E+03
DIBROMOCHLOROMETHANE	1.1E+00	carcinogenic effects	1.1E+00	3.8E+02	NA
DIBROMOETHANE, 1,2-	3.2E-02	carcinogenic effects	3.2E-02	4.1E+01	NA
DICHLOROBENZENE, 1,2-	6.0E+02	saturation limit	-	1.1E+03	6.0E+02
DICHLOROBENZENE, 1,3-	5.3E+02	noncarcinogenic effects	-	5.3E+02	6.0E+02
DICHLOROBENZENE, 1,4-	3.4E+00	carcinogenic effects	3.4E+00	4.8E+02	NA
DICHLOROBENZIDINE, 3,3-	1.1E+00	carcinogenic effects	1.1E+00	-	NA
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.4E+00	carcinogenic effects	2.4E+00	-	NA
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.4E+00	carcinogenic effects	2.4E+00	-	NA
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.7E+00	carcinogenic effects	1.7E+00	3.6E+01	NA
DICHLOROETHANE, 1,1-	4.9E+02	noncarcinogenic effects	-	4.9E+02	1.7E+03
DICHLOROETHANE, 1,2-	2.7E-01	carcinogenic effects	2.7E-01	8.4E+00	1.8E+03
DICHLOROETHYLENE, 1,1-	1.2E+02	noncarcinogenic effects	-	1.2E+02	1.5E+03
DICHLOROETHYLENE, Cis 1,2-	4.2E+01	noncarcinogenic effects	-	4.2E+01	1.2E+03
DICHLOROETHYLENE, Trans 1,2-	6.9E+01	noncarcinogenic effects	-	6.9E+01	3.1E+03
DICHLOROPHENOL, 2,4-	1.8E+02	noncarcinogenic effects	-	1.8E+02	NA
DICHLOROPROPANE, 1,2-	3.4E-01	carcinogenic effects	3.4E-01	5.7E+00	1.1E+03
DICHLOROPROPENE, 1,3-	7.7E-01	carcinogenic effects	7.7E-01	1.6E+01	1.4E+03
DIELDRIN	3.0E-02	carcinogenic effects	3.0E-02	3.1E+00	NA
DIETHYLPHTHALATE	4.9E+04	noncarcinogenic effects	-	4.9E+04	NA
DIMETHYLPHENOL, 2,4-	1.2E+03	noncarcinogenic effects	-	1.2E+03	NA
DIMETHYLPHTHALATE	6.1E+05	noncarcinogenic effects	-	6.1E+05	NA
DINITROPHENOL, 2,4-	1.2E+02	noncarcinogenic effects	-	1.2E+02	NA
DINITROTOLUENE, 2,4-	1.2E+02	noncarcinogenic effects	2.4E+02	1.2E+02	NA
DIOXANE, 1,4-	4.4E+01	carcinogenic effects	4.4E+01	-	NA
DIOXIN (2,3,7,8-TCDD)	3.9E-06	carcinogenic effects	3.9E-06	-	NA
ENDOSULFAN	3.7E+02	noncarcinogenic effects	-	3.7E+02	NA
ENDRIN	1.8E+01	noncarcinogenic effects	-	1.8E+01	NA
ETHYLBENZENE	4.0E+02	saturation limit	-	1.8E+03	4.0E+02
FLUORANTHENE	2.3E+03	noncarcinogenic effects	-	2.3E+03	NA
FLUORENE	2.7E+03	noncarcinogenic effects	-	2.7E+03	NA
HEPTACHLOR	1.1E-01	carcinogenic effects	1.1E-01	3.1E+01	NA

TABLE I-1. DIRECT-EXPOSURE ACTION LEVELS
[1]RESIDENTIAL EXPOSURE SCENARIO

CONTAMINANT	Final Action Level (mg/kg)	Basis	Carcinogens (mg/kg)	Noncarcinogens (mg/kg)	Saturation (mg/kg)
HEPTACHLOR EPOXIDE	5.3E-02	carcinogenic effects	5.3E-02	7.9E-01	NA
HEXACHLOROBENZENE	3.0E-01	carcinogenic effects	3.0E-01	4.9E+01	NA
HEXACHLOROBUTADIENE	6.2E+00	carcinogenic effects	6.2E+00	1.8E+01	NA
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	4.4E-01	carcinogenic effects	4.4E-01	2.1E+01	NA
HEXACHLOROETHANE	3.5E+01	carcinogenic effects	3.5E+01	6.1E+01	NA
INDENO(1,2,3-cd)PYRENE	6.2E+00	carcinogenic effects	6.2E+00	-	NA
LEAD	4.0E+02	USEPA Region IX PRG	-	4.0E+02	NA
MERCURY	1.3E+01	noncarcinogenic effects	-	1.3E+01	NA
METHOXYCHLOR	3.1E+02	noncarcinogenic effects	-	3.1E+02	NA
METHYL ETHYL KETONE	2.2E+04	noncarcinogenic effects	-	2.2E+04	3.4E+04
METHYL ISOBUTYL KETONE	5.3E+03	noncarcinogenic effects	-	5.3E+03	1.7E+04
METHYL MERCURY	6.1E+00	noncarcinogenic effects	-	6.1E+00	NA
METHYL TERT BUTYL ETHER	3.1E+01	carcinogenic effects	3.1E+01	5.7E+03	2.1E+04
METHYLENE CHLORIDE	9.2E+00	carcinogenic effects	9.2E+00	1.9E+03	2.4E+03
METHYLNAPHTHALENE (total 1- & 2-)	1.4E+03	noncarcinogenic effects	-	1.4E+03	NA
MOLYBDENUM	3.9E+02	noncarcinogenic effects	-	3.9E+02	NA
NAPHTHALENE	5.5E+01	noncarcinogenic effects	-	5.5E+01	NA
NICKEL	1.6E+03	noncarcinogenic effects	-	1.6E+03	NA
PENTACHLOROPHENOL	3.0E+00	carcinogenic effects	3.0E+00	1.4E+03	NA
PERCHLORATE	7.8E+00	noncarcinogenic effects	-	7.8E+00	NA
PHENANTHRENE	2.8E+03	noncarcinogenic effects	-	2.8E+03	NA
PHENOL	1.8E+04	noncarcinogenic effects	-	1.8E+04	NA
POLYCHLORINATED BIPHENYLS (PCBs)	1.1E+00	noncarcinogenic effects	2.2E+00	1.1E+00	NA
PYRENE	2.3E+03	noncarcinogenic effects	-	2.3E+03	NA
SELENIUM	3.9E+02	noncarcinogenic effects	-	3.9E+02	NA
SILVER	3.9E+02	noncarcinogenic effects	-	3.9E+02	NA
STYRENE	1.5E+03	saturation limit	-	4.3E+03	1.5E+03
tert-BUTYL ALCOHOL	7.0E+01	carcinogenic effects	7.0E+01	-	3.2E+05
TETRACHLOROETHANE, 1,1,1,2-	3.1E+00	carcinogenic effects	3.1E+00	5.1E+02	2.0E+03
TETRACHLOROETHANE, 1,1,2,2-	4.1E-01	carcinogenic effects	4.1E-01	1.0E+03	2.0E+03
TETRACHLOROETHYLENE	4.8E-01	carcinogenic effects	4.8E-01	3.8E+01	2.3E+02
THALLIUM	5.2E+00	noncarcinogenic effects	-	5.2E+00	NA
TOLUENE	6.5E+02	noncarcinogenic effects	-	6.5E+02	6.5E+02
TOXAPHENE	4.0E-01	carcinogenic effects	4.0E-01	-	NA
TPH (gasolines)	8.0E+02	noncarcinogenic effects	-	8.0E+02	NA
TPH (middle distillates)	8.0E+02	noncarcinogenic effects	-	8.0E+02	NA

TABLE I-1. DIRECT-EXPOSURE ACTION LEVELS
[1]RESIDENTIAL EXPOSURE SCENARIO

CONTAMINANT	Final Action Level (mg/kg)	Basis	Carcinogens (mg/kg)	Noncarcinogens (mg/kg)	Saturation (mg/kg)
TPH (residual fuels)	2.3E+03	noncarcinogenic effects	-	2.3E+03	NA
TRICHLOROBENZENE, 1,2,4-	6.1E+01	noncarcinogenic effects	-	6.1E+01	NA
TRICHLOROETHANE, 1,1,1-	1.2E+03	saturation limit	-	2.0E+03	1.2E+03
TRICHLOROETHANE, 1,1,2-	7.2E-01	carcinogenic effects	7.2E-01	3.6E+01	1.8E+03
TRICHLOROETHYLENE	5.2E-01	carcinogenic effects	5.2E-01	1.6E+01	1.3E+03
TRICHLOROPHENOL, 2,4,5-	2.5E+03	noncarcinogenic effects	-	2.5E+03	NA
TRICHLOROPHENOL, 2,4,6-	6.1E+00	noncarcinogenic effects	4.4E+01	6.1E+00	NA
VANADIUM	7.8E+01	noncarcinogenic effects	-	7.8E+01	NA
VINYL CHLORIDE	1.5E-01	carcinogenic effects	1.5E-01	3.8E+01	1.2E+03
XYLENES	2.7E+02	noncarcinogenic effects	-	2.7E+02	4.2E+02
ZINC	2.3E+04	noncarcinogenic effects	-	2.3E+04	NA

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

Notes:

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

See text for equations and assumptions used in models.
Final action level is lowest of individual action 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).
Carcinogens: Based on target cancer risk of 10^{-6} unless otherwise noted.
Noncarcinogens: Based on target hazard quotient of 1.0. Maximum value 1,000,000 mg/kg.
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).
Direct-exposure action levels for carcinogenic PAHs, PCBs and TCE based on target excess cancer risk of 10^{-5} (see section 3.2.2 in text).
TPH:Total Petroleum Hydrocarbons. See text for discussion of different TPH categories. Direct exposure action levels after Massachusetts Department of Environmental Protection (see Section 5.3).
Vinyl Chloride final action level for carcinogenic effects based on alternative model presented in USEPA Region IX PRGs (USEPA 2004).

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

CONTAMINANT	Final Action Level (mg/kg)	Basis	Carcinogens (mg/kg)	Noncarcinogens (mg/kg)	Saturation (mg/kg)
ACENAPHTHENE	2.9E+04	noncarcinogenic effects	-	2.9E+04	NA
ACENAPHTHYLENE	6.1E+03	noncarcinogenic effects	-	6.1E+03	NA
ACETONE	5.4E+04	noncarcinogenic effects	-	5.4E+04	1.0E+05
ALDRIN	1.0E-01	carcinogenic effects	1.0E-01	1.8E+01	NA
ANTHRACENE	2.4E+05	noncarcinogenic effects	-	2.4E+05	NA
ANTIMONY	4.1E+02	noncarcinogenic effects	-	4.1E+02	NA
ARSENIC	1.9E+00	carcinogenic effects	1.9E+00	3.1E+02	NA
BARIUM	1.2E+04	trench/construction worker	-	6.7E+04	NA
BENZENE	1.4E+00	carcinogenic effects	1.4E+00	1.2E+02	8.7E+02
BENZO(a)ANTHRACENE	2.1E+01	carcinogenic effects	2.1E+01	-	NA
BENZO(a)PYRENE	2.1E+00	carcinogenic effects	2.1E+00	-	NA
BENZO(b)FLUORANTHENE	2.1E+01	carcinogenic effects	2.1E+01	-	NA
BENZO(g,h,i)PERYLENE	2.2E+04	noncarcinogenic effects	-	2.2E+04	NA
BENZO(k)FLUORANTHENE	2.1E+02	carcinogenic effects	2.1E+02	-	NA
BERYLLIUM	4.9E+02	trench/construction worker	2.2E+03	1.9E+03	NA
BIPHENYL, 1,1-	2.3E+04	noncarcinogenic effects	-	2.3E+04	NA
BIS(2-CHLOROETHYL)ETHER	5.3E-01	carcinogenic effects	5.3E-01	-	9.6E+03
BIS(2-CHLOROISOPROPYL)ETHER	7.3E+00	carcinogenic effects	7.3E+00	4.0E+03	7.9E+02
BIS(2-ETHYLHEXYL)PHTHALATE	1.2E+02	carcinogenic effects	1.2E+02	1.2E+04	NA
BORON	1.2E+05	noncarcinogenic effects	-	1.2E+05	NA
BROMODICHLOROMETHANE	1.8E+00	carcinogenic effects	1.8E+00	8.0E+02	3.0E+03
BROMOFORM	2.2E+02	carcinogenic effects	2.2E+02	1.2E+04	NA
BROMOMETHANE	1.3E+01	noncarcinogenic effects	-	1.3E+01	3.1E+03
CADMIUM	5.1E+02	noncarcinogenic effects	3.0E+03	5.1E+02	NA
CARBON TETRACHLORIDE	5.4E-01	carcinogenic effects	5.4E-01	7.2E+00	1.1E+03
CHLORDANE	6.5E+00	carcinogenic effects	6.5E+00	4.0E+02	NA
CHLOROANILINE, p-	2.5E+03	noncarcinogenic effects	-	2.5E+03	NA
CHLOROBENZENE	5.2E+02	noncarcinogenic effects	-	5.2E+02	6.8E+02
CHLOROETHANE	6.4E+00	carcinogenic effects	6.4E+00	1.9E+04	1.6E+03
CHLOROFORM	4.6E-01	carcinogenic effects	4.6E-01	1.8E+02	2.9E+03
CHLOROMETHANE	1.5E+02	noncarcinogenic effects	-	1.5E+02	4.1E+03
CHLOROPHENOL, 2-	2.3E+02	noncarcinogenic effects	-	2.3E+02	5.5E+04
CHROMIUM (Total)	2.2E+02	trench/construction worker	4.5E+02	-	NA
CHROMIUM III	1.0E+06	maximum	-	1.0E+06	NA
CHROMIUM VI	3.1E+01	trench/construction worker	6.4E+01	2.5E+03	NA
CHRYSENE	2.1E+03	carcinogenic effects	2.1E+03	-	NA

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

CONTAMINANT	Final Action Level (mg/kg)	Basis	Carcinogens (mg/kg)	Noncarcinogens (mg/kg)	Saturation (mg/kg)
COBALT	5.2E+02	trench/construction worker	1.9E+03	1.3E+04	NA
COPPER	4.1E+04	noncarcinogenic effects	-	4.1E+04	NA
CYANIDE (Free)	1.2E+04	noncarcinogenic effects	-	1.2E+04	NA
DIBENZO(a,h)ANTHTRACENE	2.1E+00	carcinogenic effects	2.1E+00	-	NA
DIBROMO-3-CHLOROPROPANE, 1,2-	2.0E+00	carcinogenic effects	2.0E+00	1.1E+01	1.1E+03
DIBROMOCHLOROMETHANE	2.5E+00	carcinogenic effects	2.5E+00	1.5E+03	NA
DIBROMOETHANE, 1,2-	7.2E-02	carcinogenic effects	7.2E-02	1.4E+02	NA
DICHLOROBENZENE, 1,2-	6.0E+02	saturation limit	-	4.0E+03	6.0E+02
DICHLOROBENZENE, 1,3-	6.0E+02	saturation limit	-	2.1E+03	6.0E+02
DICHLOROBENZENE, 1,4-	7.8E+00	carcinogenic effects	7.8E+00	1.8E+03	NA
DICHLOROBENZIDINE, 3,3-	3.8E+00	carcinogenic effects	3.8E+00	-	NA
DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.0E+01	carcinogenic effects	1.0E+01	-	NA
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.0E+01	carcinogenic effects	1.0E+01	-	NA
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	7.0E+00	carcinogenic effects	7.0E+00	4.3E+02	NA
DICHLOROETHANE, 1,1-	1.7E+03	noncarcinogenic effects	-	1.7E+03	1.7E+03
DICHLOROETHANE, 1,2-	6.0E-01	carcinogenic effects	6.0E-01	2.8E+01	1.8E+03
DICHLOROETHYLENE, 1,1-	4.1E+02	noncarcinogenic effects	-	4.1E+02	1.5E+03
DICHLOROETHYLENE, Cis 1,2-	1.4E+02	noncarcinogenic effects	-	1.4E+02	1.2E+03
DICHLOROETHYLENE, Trans 1,2-	2.3E+02	noncarcinogenic effects	-	2.3E+02	3.1E+03
DICHLOROPHENOL, 2,4-	1.8E+03	noncarcinogenic effects	-	1.8E+03	NA
DICHLOROPROPANE, 1,2-	7.3E-01	carcinogenic effects	7.3E-01	2.0E+01	1.1E+03
DICHLOROPROPENE, 1,3-	1.7E+00	carcinogenic effects	1.7E+00	5.3E+01	1.4E+03
DIELDRIN	1.1E-01	carcinogenic effects	1.1E-01	3.1E+01	NA
DIETHYLPHTHALATE	4.9E+05	noncarcinogenic effects	-	4.9E+05	NA
DIMETHYLPHENOL, 2,4-	1.2E+04	noncarcinogenic effects	-	1.2E+04	NA
DIMETHYLPHTHALATE	1.0E+06	maximum	-	1.0E+06	NA
DINITROPHENOL, 2,4-	1.2E+03	noncarcinogenic effects	-	1.2E+03	NA
DINITROTOLUENE, 2,4-	8.6E+02	carcinogenic effects	8.6E+02	1.2E+03	NA
DIOXANE, 1,4-	1.6E+02	carcinogenic effects	1.6E+02	-	NA
DIOXIN (2,3,7,8-TCDD)	1.6E-05	carcinogenic effects	1.6E-05	-	NA
ENDOSULFAN	3.7E+03	noncarcinogenic effects	-	3.7E+03	NA
ENDRIN	1.8E+02	noncarcinogenic effects	-	1.8E+02	NA
ETHYLBENZENE	4.0E+02	saturation limit	-	7.3E+03	4.0E+02
FLUORANTHENE	2.2E+04	noncarcinogenic effects	-	2.2E+04	NA
FLUORENE	2.6E+04	noncarcinogenic effects	-	2.6E+04	NA
HEPTACHLOR	3.8E-01	carcinogenic effects	3.8E-01	3.1E+02	NA

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

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

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

CONTAMINANT	Final Action Level (mg/kg)	Basis	Carcinogens (mg/kg)	Noncarcinogens (mg/kg)	Saturation (mg/kg)
TPH (residual fuels)	3.1E+04	noncarcinogenic effects	-	3.1E+04	NA
TRICHLOROBENZENE, 1,2,4-	2.1E+02	noncarcinogenic effects	-	2.1E+02	NA
TRICHLOROETHANE, 1,1,1-	1.2E+03	saturation limit	-	6.9E+03	1.2E+03
TRICHLOROETHANE, 1,1,2-	1.6E+00	carcinogenic effects	1.6E+00	1.3E+02	1.8E+03
TRICHLOROETHYLENE	1.1E+00	carcinogenic effects	1.1E+00	1.1E+02	1.3E+03
TRICHLOROPHENOL, 2,4,5-	1.1E+04	noncarcinogenic effects	-	1.1E+04	NA
TRICHLOROPHENOL, 2,4,6-	6.2E+01	noncarcinogenic effects	1.6E+02	6.2E+01	NA
VANADIUM	1.0E+03	noncarcinogenic effects	-	1.0E+03	NA
VINYL CHLORIDE	7.4E-01	carcinogenic effects	7.4E-01	1.4E+02	1.2E+03
XYLENES	4.2E+02	saturation limit	-	8.9E+02	4.2E+02
ZINC	3.1E+05	noncarcinogenic effects	-	3.1E+05	NA

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

Notes:

See text for equations and assumptions used in models.

Final action level is lowest of individual action 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).

Carcinogens: Based on target cancer risk of 10^{-6} unless otherwise noted.

Noncarcinogens: Based on target hazard quotient of 1.0. Maximum value 1,000,000 mg/kg.

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).

Direct-exposure action levels for carcinogenic PAHs, PCBs and TCE based on target excess cancer risk of 10^{-5} (see section 3.2.2 in text).

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

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

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

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

CONTAMINANT	Final Action Level (mg/kg)	Basis	Carcinogens (mg/kg)	Noncarcinogens (mg/kg)	Saturation (mg/kg)
COBALT	5.2E+02	noncarcinogenic effects	9.4E+02	5.2E+02	NA
COPPER	1.5E+05	noncarcinogenic effects	-	1.5E+05	NA
CYANIDE (Free)	4.1E+04	noncarcinogenic effects	-	4.1E+04	NA
DIBENZO(a,h)ANTHTRACENE	2.4E+01	carcinogenic effects	2.4E+01	-	NA
DIBROMO-3-CHLOROPROPANE, 1,2-	9.4E+01	noncarcinogenic effects	2.8E+02	9.4E+01	1.1E+03
DIBROMOCHLOROMETHANE	9.6E+02	carcinogenic effects	9.6E+02	1.6E+04	NA
DIBROMOETHANE, 1,2-	2.9E+01	carcinogenic effects	2.9E+01	1.7E+03	NA
DICHLOROBENZENE, 1,2-	6.0E+02	saturation limit	-	4.6E+04	6.0E+02
DICHLOROBENZENE, 1,3-	6.0E+02	saturation limit	-	2.2E+04	6.0E+02
DICHLOROBENZENE, 1,4-	3.0E+03	carcinogenic effects	3.0E+03	2.0E+04	NA
DICHLOROBENZIDINE, 3,3-	4.4E+02	carcinogenic effects	4.4E+02	-	NA
DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.2E+03	carcinogenic effects	1.2E+03	-	NA
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.2E+03	carcinogenic effects	1.2E+03	-	NA
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	8.7E+02	carcinogenic effects	8.7E+02	1.5E+03	NA
DICHLOROETHANE, 1,1-	1.7E+03	saturation limit	-	2.0E+04	1.7E+03
DICHLOROETHANE, 1,2-	2.6E+02	carcinogenic effects	2.6E+02	3.4E+02	1.8E+03
DICHLOROETHYLENE, 1,1-	1.5E+03	saturation limit	-	5.0E+03	1.5E+03
DICHLOROETHYLENE, Cis 1,2-	1.2E+03	saturation limit	-	1.8E+03	1.2E+03
DICHLOROETHYLENE, Trans 1,2-	2.8E+03	noncarcinogenic effects	-	2.8E+03	3.1E+03
DICHLOROPHENOL, 2,4-	6.0E+03	noncarcinogenic effects	-	6.0E+03	NA
DICHLOROPROPANE, 1,2-	2.4E+02	noncarcinogenic effects	3.1E+02	2.4E+02	1.1E+03
DICHLOROPROPENE, 1,3-	6.6E+02	noncarcinogenic effects	6.8E+02	6.6E+02	1.4E+03
DIELDRIN	1.2E+01	carcinogenic effects	1.2E+01	1.0E+02	NA
DIETHYLPHTHALATE	1.0E+06	maximum	-	1.0E+06	NA
DIMETHYLPHENOL, 2,4-	4.0E+04	noncarcinogenic effects	-	4.0E+04	NA
DIMETHYLPHTHALATE	1.0E+06	maximum	-	1.0E+06	NA
DINITROPHENOL, 2,4-	4.0E+03	noncarcinogenic effects	-	4.0E+03	NA
DINITROTOLUENE, 2,4-	4.0E+03	noncarcinogenic effects	1.0E+05	4.0E+03	NA
DIOXANE, 1,4-	1.8E+04	carcinogenic effects	1.8E+04	-	NA
DIOXIN (2,3,7,8-TCDD)	2.0E-03	carcinogenic effects	2.0E-03	-	NA
ENDOSULFAN	1.2E+04	noncarcinogenic effects	-	1.2E+04	NA
ENDRIN	6.0E+02	noncarcinogenic effects	-	6.0E+02	NA
ETHYLBENZENE	4.0E+02	saturation limit	-	7.9E+04	4.0E+02
FLUORANTHENE	7.0E+04	noncarcinogenic effects	-	7.0E+04	NA
FLUORENE	1.3E+05	noncarcinogenic effects	-	1.3E+05	NA
HEPTACHLOR	4.4E+01	carcinogenic effects	4.4E+01	1.0E+03	NA

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

CONTAMINANT	Final Action Level (mg/kg)	Basis	Carcinogens (mg/kg)	Noncarcinogens (mg/kg)	Saturation (mg/kg)
HEPTACHLOR EPOXIDE	2.2E+01	carcinogenic effects	2.2E+01	2.6E+01	NA
HEXACHLOROBENZENE	1.2E+02	carcinogenic effects	1.2E+02	1.6E+03	NA
HEXACHLOROBUTADIENE	6.0E+02	noncarcinogenic effects	2.6E+03	6.0E+02	NA
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	2.1E+02	carcinogenic effects	2.1E+02	8.3E+02	NA
HEXACHLOROETHANE	2.0E+03	noncarcinogenic effects	1.4E+04	2.0E+03	NA
INDENO(1,2,3-cd)PYRENE	2.4E+02	carcinogenic effects	2.4E+02	-	NA
LEAD	7.5E+02	USEPA Region IX PRG	-	7.5E+02	NA
MERCURY	5.7E+02	noncarcinogenic effects	-	5.7E+02	NA
METHOXYCHLOR	1.0E+04	noncarcinogenic effects	-	1.0E+04	NA
METHYL ETHYL KETONE	3.4E+04	saturation limit	-	9.9E+05	3.4E+04
METHYL ISOBUTYL KETONE	1.7E+04	saturation limit	-	2.5E+05	1.7E+04
METHYL MERCURY	2.0E+02	noncarcinogenic effects	-	2.0E+02	NA
METHYL TERT BUTYL ETHER	2.1E+04	saturation limit	2.8E+04	2.4E+05	2.1E+04
METHYLENE CHLORIDE	2.4E+03	saturation limit	8.2E+03	8.5E+04	2.4E+03
METHYLNAPHTHALENE (total 1- & 2-)	6.4E+04	noncarcinogenic effects	-	6.4E+04	NA
MOLYBDENUM	1.9E+04	noncarcinogenic effects	-	1.9E+04	NA
NAPHTHALENE	2.3E+03	noncarcinogenic effects	-	2.3E+03	NA
NICKEL	7.7E+04	noncarcinogenic effects	-	7.7E+04	NA
PENTACHLOROPHENOL	9.8E+02	carcinogenic effects	9.8E+02	3.5E+04	NA
PERCHLORATE	3.9E+02	noncarcinogenic effects	-	3.9E+02	NA
PHENANTHRENE	1.4E+05	noncarcinogenic effects	-	1.4E+05	NA
PHENOL	6.0E+05	noncarcinogenic effects	-	6.0E+05	NA
POLYCHLORINATED BIPHENYLS (PCBs)	3.4E+01	noncarcinogenic effects	8.4E+01	3.4E+01	NA
PYRENE	1.1E+05	noncarcinogenic effects	-	1.1E+05	NA
SELENIUM	1.9E+04	noncarcinogenic effects	-	1.9E+04	NA
SILVER	1.9E+04	noncarcinogenic effects	-	1.9E+04	NA
STYRENE	1.5E+03	saturation limit	-	1.9E+05	1.5E+03
tert-BUTYL ALCOHOL	5.6E+04	carcinogenic effects	5.6E+04	-	3.2E+05
TETRACHLOROETHANE, 1,1,1,2-	2.0E+03	saturation limit	2.8E+03	2.2E+04	2.0E+03
TETRACHLOROETHANE, 1,1,2,2-	3.6E+02	carcinogenic effects	3.6E+02	4.3E+04	2.0E+03
TETRACHLOROETHYLENE	2.3E+02	saturation limit	3.7E+02	1.5E+03	2.3E+02
THALLIUM	2.6E+02	noncarcinogenic effects	-	2.6E+02	NA
TOLUENE	6.5E+02	saturation limit	-	2.7E+04	6.5E+02
TOXAPHENE	1.7E+02	carcinogenic effects	1.7E+02	-	NA
TPH (gasolines)	3.0E+04	noncarcinogenic effects	-	3.0E+04	NA
TPH (middle distillates)	3.0E+04	noncarcinogenic effects	-	3.0E+04	NA

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

CONTAMINANT	Final Action Level (mg/kg)	Basis	Carcinogens (mg/kg)	Noncarcinogens (mg/kg)	Saturation (mg/kg)
TPH (residual fuels)	1.1E+05	noncarcinogenic effects	-	1.1E+05	NA
TRICHLOROBENZENE, 1,2,4-	2.5E+03	noncarcinogenic effects	-	2.5E+03	NA
TRICHLOROETHANE, 1,1,1-	1.2E+03	saturation limit	-	8.1E+04	1.2E+03
TRICHLOROETHANE, 1,1,2-	6.6E+02	carcinogenic effects	6.6E+02	1.5E+03	1.8E+03
TRICHLOROETHYLENE	4.9E+01	carcinogenic effects	4.9E+01	7.4E+02	1.3E+03
TRICHLOROPHENOL, 2,4,5-	9.3E+04	noncarcinogenic effects	-	9.3E+04	NA
TRICHLOROPHENOL, 2,4,6-	2.0E+02	noncarcinogenic effects	1.8E+04	2.0E+02	NA
VANADIUM	3.9E+03	noncarcinogenic effects	-	3.9E+03	NA
VINYL CHLORIDE	2.3E+02	carcinogenic effects	2.3E+02	1.6E+03	1.2E+03
XYLENES	4.2E+02	saturation limit	-	1.1E+04	4.2E+02
ZINC	1.0E+06	maximum	-	1.0E+06	NA

Primary source: USEPA Region IX Preliminary Remediation Goals (PRGs, USEPA 2002), modified as noted below. See text for discussion.

Notes:

See text for equations and assumptions used in models.

Final action level is lowest of individual action 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).

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

Noncarcinogens: Based on target hazard quotient of 1.0. Maximum value 1,000,000 mg/kg.

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 text for discussion of different TPH categories. Direct exposure action levels after Massachusetts Department of Environmental Protection (see text).

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.)

CONTAMINANT	Target Organs And Health Effects													
	[a]Carcinogen	[b]Alimentary Tract	Cardiovascular	Developmental	Endocrine	Eye	Hematologic	Immune	Kidney	Nervous	Reproductive	Respiratory	[c]Skin	Other
ACENAPHTHENE	NA	5,6						4					4	
ACENAPHTHYLENE	D						5,6	4					4	= Fluorene
ACETONE	D	5,6					3		5,6					
ALDRIN	B2	6								3				
ANTHRACENE	D							4					4	
ANTIMONY	D		4			3,4	5,7				4	1,3,4		hair loss (4)
ARSENIC	A	3,4,6	1,2,4	1,2,3,4			3,4,6			1,2,3,4			1,3,4,6	
BARIUM	D		4				5		6		5			hypertension (6)
BENZENE	A	3		1,2,4			1,2,3,4	3		1,2				
BENZO(a)ANTHRACENE	B2							4					4	No chronic toxicity factors.
BENZO(a)PYRENE	B2							4			3		4	No chronic toxicity factors.
BENZO(b)FLUORANTHENE	B2							4					4	No chronic toxicity factors.
BENZO(g,h,i)PERYLENE	D	5,6					5,6	4	5,6				4	= Fluoranthene
BENZO(k)FLUORANTHENE	B2							4					4	No chronic toxicity factors.
BERYLLIUM	B1	1,6						2	1			1,2,3,4,6	3	
BIPHENYL, 1,1-	D	3							6	3				
BIS(2-CHLOROETHYL)ETHER	B2									4	4			No chronic toxicity factors.
BIS(2-CHLOROISOPROPYL)ETHER	NA						6							
BIS(2-ETHYLHEXYL)PHTHALATE	NA	7,8									8			No chronic toxicity factors.
BORON	D										4,6	5		
BROMODICHLOROMETHANE	B2	4							4,6					
BROMOFORM	B2	3,4,6							4	3,4				
BROMOMETHANE	D	3,5,6	3	1,2					3,4	1,2,3,4		1,2,3,4,5,6		
CADMIUM	B1/D								1,2,3,4,5,6			1,2,3,4		bone loss (1,4)
CARBON TETRACHLORIDE	B2	1,2,4,6		1,2					4	1,2				
CHLORDANE	B2	3,4,6						3,5		4				
CHLOROANILINE, p-	NA	3,6						5	3				3	
CHLOROBENZENE	D	1,2,3,5,6					3		1,2,3,4,5	3	1,2			
CHLOROETHANE	B	1,2		1,2,4										
CHLOROFORM	B2	1,2,3,4,6		1,2					1,2,3,4					
CHLOROMETHANE	C/D			4						3	3,4			
CHLOROPHENOL, 2-	D	1,4		1							1,5,6			
CHROMIUM (Total)	-													
CHROMIUM III	D												3	
CHROMIUM VI	A						1				2	1,6		
CHRYSENE	B2							4					4	No chronic toxicity factors.
COBALT	NA		3									3	3	hearing (3)
COPPER	D	8										1,4	3	
CYANIDE (Free)	D		1,4		1,4,6		4			1,5,6		4		
DIBENZO(a,h)ANTHTRACENE	B2							4					3,4	
DIBROMO-3-CHLOROPROPANE, 1,2-		1		1					3		1,3,4,5,6	1		
DIBROMOCHLOROMETHANE	C	6												

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.)

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

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.)

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

TABLE 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.)

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

Notes:

a. Carcinogen type as summarized in RWQCBCV 2001 and ORNL 2001 (see classification below).

b. Includes gastro-intestinal tract, liver, spleen, gall bladder, etc.

c. Includes skin sensitization but not general dermatitus or defatting of skin.

Perchlorate: Chronic effects as summarized in California DHS Perchlorate Action Level supporting documernt (CalDHS 2001).

Carcinogen Classification

A: Human carcinogen

B: Probable human carcinogen (B1: limited human evidence; B2 Sufficient evidence in animals and inadequate or no evidence in humans)

C: Possible human carcinogen

D: Not classifiable as to human carcinogenicity

E: Evidence of noncarcinogenicity for humans

NA: Carcinogen classification information not available

References:

1. CalARB, 2001, Consiolidated Table of OEHHA/ARB Approved Risk Assessment Health Values: California Air Resources Board, September, 2001, www.arb.ca.gov/toxics/healthval/healthval.html.

2. CalEPA, 2002, Determination of Noncancer Chronic Exposure Levels, Chronic Toxicity Summaries: Office of Environmental Health Hazard Assessment, September 2002. www.oehha.org/air/chronic_rels/AllChrels.html.

3. USDHHS, 2003, International Chemical Safety Cards: International Programme on Chemical Safety: United Nations Environment Program, International Labour Office and World Health Organization (accessed July 2003); published through US Department of Health and Human Services, Centers for Disease Control and Prevention, www.cdc.gov/niosh/ipcs/ipcscard.html.

4. ATSDR, 2003, ToxFAQs™: Agency for Toxic Substances and Disease Registry (accessed July 2003), http://www.atsdr.cdc.gov/toxfaq.html.

5. Illinois, 2001, Tiered Approach to Corrective Action Objectives (TACO): Illinois Environmental Protection Agency, Title 35, Part 742, Similar Acting Noncarcinogenic Chemicals (Appendix A, Table E), December, 1997, http://www.epa.state.il.us/land/taco/.

6. USEPA, 2003, IRIS: U.S. Environmental Protection Agency, IRIS Database (accessed July 2003); (Critical effect used for derivation of USEPA RfD as presented in IRIS database; may not be inclusive of all potentially significant health effects), http://www.epa.gov/iris/subst/index.html.

7. ORNL, 2003, Risk Assessment Information System (RAIS), Toxocity Profiles: Oak Ridge National Laboratory/U.S. Department of Energy (accessed July 2003), RAGs A Format, especially Critical Effect used for derivation of RfDs, http://risk.lsd.ornl.gov/tox/rap_toxp.shtml.

8. USEPA National Primary Drinking Water Standards (March 2001): U.S. Environmental Protection Agency, Office of Water, EPA 816-F-01-007, www.epa.gov/safewater. (Selectively used.)

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. SOIL ACTION LEVELS FOR TERRESTRIAL ECOTOXICTY CONCERNS.

CONTAMINANT	Urban Area Ecotoxicity Criteria (mg/kg)
ACENAPHTHENE	-
ACENAPHTHYLENE	-
ACETONE	-
ALDRIN	3.5E-01
ANTHRACENE	4.0E+01
ANTIMONY	2.0E+01
ARSENIC	2.0E+01
BARIUM	7.5E+02
BENZENE	2.5E+01
BENZO(a)ANTHRACENE	4.0E+01
BENZO(a)PYRENE	4.0E+01
BENZO(b)FLUORANTHENE	-
BENZO(g,h,i)PERYLENE	4.0E+01
BENZO(k)FLUORANTHENE	4.0E+01
BERYLLIUM	4.0E+00
BIPHENYL, 1,1-	-
BIS(2-CHLOROETHYL)ETHER	-
BIS(2-CHLOROISOPROPYL)ETHER	-
BIS(2-ETHYLHEXYL)PHTHALATE	-
BORON	1.6E+00
BROMODICHLOROMETHANE	-
BROMOFORM	-
BROMOMETHANE	-
CADMIUM	1.2E+01
CARBON TETRACHLORIDE	-
CHLORDANE	-
CHLOROANILINE, p-	-
CHLOROBENZENE	3.0E+01
CHLOROETHANE	-
CHLOROFORM	-
CHLOROMETHANE	-
CHLOROPHENOL, 2-	1.0E+01
CHROMIUM (Total)	-
CHROMIUM III	7.5E+02
CHROMIUM VI	8.0E+00
CHRYSENE	4.0E+01
COBALT	4.0E+01
COPPER	2.3E+02
CYANIDE (Free)	-
DIBENZO(a,h)ANTHTRACENE	-
DIBROMO-3-CHLOROPROPANE, 1,2-	-
DIBROMOCHLOROMETHANE	-
DIBROMOETHANE, 1,2-	-
DICHLOROBENZENE, 1,2-	3.0E+01
DICHLOROBENZENE, 1,3-	3.0E+01
DICHLOROBENZENE, 1,4-	3.0E+01
DICHLOROBENZIDINE, 3,3-	-
DICHLORODIPHENYLDICHLOROETHANE (DDD)	-
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	4.0E+00
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	4.0E+00
DICHLOROETHANE, 1,1-	-
DICHLOROETHANE, 1,2-	6.0E+01

TABLE K. SOIL ACTION LEVELS FOR TERRESTRIAL ECOTOXICTY CONCERNS.

CONTAMINANT	Urban Area Ecotoxicity Criteria (mg/kg)
DICHLOROETHYLENE, 1,1-	-
DICHLOROETHYLENE, Cis 1,2-	-
DICHLOROETHYLENE, Trans 1,2-	-
DICHLOROPHENOL, 2,4-	1.0E+01
DICHLOROPROPANE, 1,2-	-
DICHLOROPROPENE, 1,3-	-
DIELDRIN	4.0E+00
DIETHYLPHTHALATE	-
DIMETHYLPHENOL, 2,4-	-
DIMETHYLPHTHALATE	-
DINITROPHENOL, 2,4-	-
DINITROTOLUENE, 2,4-	-
DIOXANE, 1,4-	-
DIOXIN (2,3,7,8-TCDD)	-
ENDOSULFAN	-
ENDRIN	6.0E-02
ETHYLBENZENE	-
FLUORANTHENE	4.0E+01
FLUORENE	-
HEPTACHLOR	-
HEPTACHLOR EPOXIDE	-
HEXACHLOROBENZENE	3.0E+01
HEXACHLOROBUTADIENE	-
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	2.0E+00
HEXACHLOROETHANE	-
INDENO(1,2,3-cd)PYRENE	4.0E+01
LEAD	2.0E+02
MERCURY	1.0E+01
METHOXYCHLOR	-
METHYL ETHYL KETONE	-
METHYL ISOBUTYL KETONE	-
METHYL MERCURY	1.0E+01
METHYL TERT BUTYL ETHER	-
METHYLENE CHLORIDE	-
METHYLNAPHTHALENE (total 1- & 2-)	-
MOLYBDENUM	4.0E+01
NAPHTHALENE	4.0E+01
NICKEL	1.5E+02
PENTACHLOROPHENOL	5.0E+00
PERCHLORATE	-
PHENANTHRENE	4.0E+01
PHENOL	4.0E+01
POLYCHLORINATED BIPHENYLS (PCBs)	-
PYRENE	-
SELENIUM	1.0E+01
SILVER	2.0E+01
STYRENE	-
tert-BUTYL ALCOHOL	-
TETRACHLOROETHANE, 1,1,1,2-	-
TETRACHLOROETHANE, 1,1,2,2-	-
TETRACHLOROETHYLENE	-
THALLIUM	-

TABLE K. SOIL ACTION LEVELS FOR TERRESTRIAL ECOTOXICTY CONCERNS.

CONTAMINANT	Urban Area Ecotoxicity Criteria (mg/kg)
TOLUENE	-
TOXAPHENE	-
TPH (gasolines)	-
TPH (middle distillates)	-
TPH (residual fuels)	-
TRICHLOROBENZENE, 1,2,4-	3.0E+01
TRICHLOROETHANE, 1,1,1-	-
TRICHLOROETHANE, 1,1,2-	-
TRICHLOROETHYLENE	6.0E+01
TRICHLOROPHENOL, 2,4,5-	1.0E+01
TRICHLOROPHENOL, 2,4,6-	1.0E+01
VANADIUM	2.0E+02
VINYL CHLORIDE	6.0E+01
XYLENES	-
ZINC	6.0E+02

Notes:

1. Based primarily on phytotoxicity. Included in selection of final soil action levels if less than one-half of the residential soil screening level for human-health, direct-exposure concerns (see Tables A-1, A-2, B-1 and B-2).
2. For use in urban areas only. Site-specific studies required for areas where sensitive habitats are present. Refer to Section 3.9.