REVISION 1

Programmatic Environmental Hazard Evaluation and Environmental Hazard Management Plan

Honolulu Rail Transit Project
Oahu, Hawaii

July 2014

Honolulu Authority for Rapid Transportation

HONOLULU AUTHORITY for RAPID TRANSPORTATION

Document Approval

Programmatic Environmental Hazard Evaluation and Environmental Hazard Management Plan (EHE-EHMP) for Honolulu Rail Transit Project (HRTP), Honolulu Authority for Rapid Transportation (HART)

Revision 1

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Abbreviations and Acronyms

AAI	All Appropriate Inquiry
AST	aboveground storage tank
ASTM	ASTM International (formerly American Society for Testing and Materials)
ATSDR	Agency for Toxic Substances and Disease Registry
BMP	best management practice
CFR	*Code of Federal Regulations*
COPC	contaminants of potential concern
CWB	Clean Water Branch
CY	cubic yards
DPP	Department of Planning and Permitting
DU	decision unit
EAL	Environmental Action Level
EDB	ethylene dibromide
EDR	Environmental Database Resources, Inc.
EHE	Environmental Hazard Evaluation
EHMP	Environmental Hazard Management Plan
EIS	Environmental Impact Statement
EJFDF	Ewa Junction Fuel Drumming Facility
ESA	environmental site assessment
FAQ	frequently asked question
GPS	Global Positioning System
HAR	Hawaii Administrative Rules
HART	Honolulu Authority for Rapid Transportation
HAZWOPER	Hazardous Waste Operations and Emergency Response
HDOH	Hawaii Department of Health
HECO	Hawaiian Electric Company
HEER	Hazard Evaluation and Emergency Response
HEPCRA	Hawaii Emergency Planning and Community Right-to-Know Act
HERL	Hawaii Environmental Response Law
HRS	Hawaii Revised Statutes
HRTP	Honolulu Rail Transit Project
HSP	Health and Safety Plan
IDW	investigation-derived waste
KHG	Kamehameha Highway Guideway
LEL	lower explosive limit

LEPC	Local Emergency Planning Committee
LUC	land-use control
LUST	Leaking Underground Storage Tank
mg/kg	milligrams per kilogram
mph	miles per hour
MSF	Maintenance and Storage Facility
MSDS	material safety data sheet
NAVFAC	Naval Facilities Engineering Command
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
OSHA	Occupational Safety and Health Administration
PCB	polychlorinated biphenyls
PEL	permissible exposure limit
PID	photoionization detector
POC	Point of Contact
PPE	personal protective equipment
ppm	parts per million
ROD	record of decision
ROH	Revised Ordinances of Honolulu
RQ	reportable quantity
SAP	Satellite Accumulation Point
SCP	State Contingency Plan
SDAR	Site Discovery and Remediation
SDWB	Safe Drinking Water Branch
SHWB	Solid and Hazardous Waste Branch
TCLP	Toxicity Characteristic Leaching Procedure
TGM	Technical Guidance Manual
TMK	tax map key
ToxFAQ	toxicity summary fact sheets
UIC	Underground Injection Control
UECA	Uniform Environmental Covenants Act
USEPA	Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compound
WOFH	West Oahu-Farrington Highway
XRF	x-ray fluorescence

1. Introduction

This programmatic Environmental Hazard Evaluation and Environmental Hazard Management Plan (EHE-EHMP) was prepared for Honolulu Authority for Rapid Transportation (HART) contractors performing construction activities on the Honolulu Rail Transit Project (HRTP).

1.1 Document Purpose

This plan provides guidance to contractors for managing contamination when it is encountered along the HRTP corridor during preconstruction and construction activities. Implementation of the EHE-EHMP is intended to identify releases and contamination encountered during work activities, control contaminant migration and dispersion, and prevent worker contact with contaminated media encountered during construction. This document does not provide guidance for thorough characterization or remediation of contaminated sites.

HART and their contractors will use the information presented in this document to:

- Understand the roles and responsibilities of all HRTP contractors and subcontractors in managing contaminated media.
- Identify contamination and potential immediate risk to human and/or ecological health (Section 4, EHE).
- Understand how to appropriately manage contaminated soil and groundwater, free-phase fuel products (free product), and/or other media, if encountered (Section 5, EHMP).
- Understand how to identify and report a release (Section 6, Release Reporting).
- Appropriately manage site activities to prevent worker exposure to contaminated media when controls fail to function as planned (Section 7, Exposure Contingency Plan).

The objectives of the EHE, Section 4 of this document, are as follows:

- Identify known or suspected contaminants of potential concern (COPCs) and their chemical properties.
- Identify possible sources of COPCs.
- Identify environmental hazards associated with the different types of COPCs.
- Identify activities that could cause COPCs to migrate from their source locations.
- Identify pathways COPCs could follow in reaching human or ecological receptors, and sensitive environmental resources.
- Estimate the lateral and horizontal extent of contamination within the HRTP.

The objectives of the EHMP, Section 5 of this document, are as follows:

- Identify methods to prevent COPCs from migrating from their source locations.
- Identify methods to capture and manage COPCs that migrate from their source locations.
- Identify methods to prevent workers and the public from coming into contact with COPCs.
- Identify methods to protect ecological receptors from COPCs that could potentially migrate from their source locations.

- Identify methods to monitor the effectiveness of COPC exposure controls.
- Document the proper handling of contaminated media during subsurface construction activities.
- Provide procedures for proper notification and reporting of contamination.

1.2 Regulatory Framework

Under state laws and regulations, HART is ultimately responsible for proper handling of contaminated materials and environmental media, reporting releases where encountered, preventing migration of existing contamination, and ensuring compliance with the law. HART is also responsible for training of contractors and subcontractors on the requirements presented in this EHE-EHMP. This EHE-EHMP is not intended to address chemicals and hazards introduced by contractors during the course of their work. Additional environmental hazards not identified in this plan may exist. During construction, each contractor remains responsible for protecting the environment and the health and safety of its employees, workers, and the general public. Before construction, the contractors should review applicable Occupational Safety and Health Administration (OSHA), U.S. Environmental Protection Agency (USEPA), and State of Hawaii Department of Health (HDOH) regulations and guidance.

The HRTP work is governed under various local, state, and federal regulations as described in the Final Environmental Impact Statement (EIS). This EHE-EHMP is not intended to identify all agencies and environmental statutes and regulations that may be required during construction but instead focuses on the relevant requirements for managing contamination encountered in the field.

Statutory requirements for identification, reporting, and responding to releases are described in Hawaii laws and regulations that are administered by the HDOH Hazard Evaluation and Emergency Response (HEER) Office, and include the following:

- Hawaii Revised Statutes – (HRS)
  - HRS 128-D, Hawaii Environmental Response Law (HERL)
  - HRS 128-E, Hawaii Emergency Planning and Community Right-to-Know Act (HEPCRA)
  - HRS 508-C, Uniform Environmental Covenants Act (UECA)
- Hawaii Administrative Rules – (HAR)
  - HAR 11-451, Hawaii State Contingency Plan (Hawaii SCP)
  - HAR 11-453, HEPCRA

Statutory requirements for managing waste are described in Hawaii laws and regulations administered by the HDOH, Solid and Hazardous Waste Branch (SHWB), and include the following:

- HRS 342-G, Integrated Solid Waste Management
- HRS 342-H, Solid Waste Pollution
- HRS 342-I, Special Waste Management
- HRS 342-J, Hazardous Waste
- HRS 342-L, Underground Storage Tanks
- HAR 11-58.1, Solid Waste Management Control
- HAR 11-104.1, Infectious Waste Management
- HAR 11-260 through 280, Hazardous Waste Management
- HAR 11-281, Underground Storage Tanks

Statutory requirements for managing waters and reporting releases are described in Hawaii laws and regulations administered by the HDOH, Clean Water Branch (CWB), and include the following:

- HRS 342D, Water Pollution
- HRS 342E, Nonpoint Source Pollution Management and Control
- HAR 11-55, Water Pollution Control
- HAR 11-62, Wastewater Systems

1.3 Definitions

Rail Corridor – The entire HRTP area, which includes guideway sections, the Maintenance and Storage Facility, stations, park-and-ride lots, transit centers, and contractor yards located directly adjacent to the guideway and related appurtenances. Movement of waste within, along, adjacent and/or parallel to the Rail Corridor is also considered movement that does not trigger offsite transportation and storage requirements.

Work Area – When discussing soil or groundwater removal and reuse, Work Area means the general vicinity where soil was excavated or groundwater was extracted (that is, within approximately 200 feet of the original excavation, within the same park and ride lot, or within the same plume of contamination). The Work Area is generally a small contiguous portion of the Rail Corridor.

Clean Soil – Soil containing concentrations of contaminants below HDOH Tier 1 Environmental Action Levels (EALs) for unrestricted land use at sites that are less than 150 meters (approximately 500 feet) from a surface water body and that are overlying a drinking water source (refer to Table A of the HDOH HEER guidance Screening For Environmental Hazards at Sites With Contaminated Soil and Groundwater (Fall 2011). Clean soil does not present significant odor, or general pollution concerns, (for example, explosive vapors). This determination may be made based on analytical data, field observations, and/or site knowledge.

Contaminated Soil – Soil containing concentrations of contaminants above HDOH Tier 1 EALs for unrestricted use at sites that are within 150 meters (approximately 500 feet) from surface water and overlying a drinking water source. Soil will also be assumed to be contaminated if it presents significant odor, or general pollution concerns (for example, explosive vapors).

Grossly Contaminated Soil – Soil that contains free product, concentrations of TPH greater than 5,000 milligrams per kilogram (mg/kg) or general pollution concerns (for example, explosive vapors). This determination may be made based on analytical data, field observations, and/or site knowledge.

Clean Groundwater – Water containing concentrations of contaminants below HDOH Tier 1 EALs for unrestricted land use at sites that are less than 150 meters (approximately 500 feet) from a surface water body and groundwater is current or potential source of a drinking water (refer to Table A of the HDOH HEER guidance Screening For Environmental Hazards at Sites With Contaminated Soil and Groundwater (Fall 2011). Clean water does not present significant odor or general pollution concerns, (for example, explosive vapors). This determination may be made based on analytical data, field observations, and/or site knowledge.

Contaminated Groundwater – Water containing concentrations of contaminants above HDOH Tier 1 EALs for unrestricted land use at sites that are less than 150 meters (approximately 500 feet) from a surface water body and groundwater is a current or potential source of drinking water. Water will be assumed to be contaminated if it presents free-phase petroleum product (free product), a sheen, significant odor, or general pollution concerns (for example, explosive vapors). This determination may be made based on analytical data, field observations, and/or site knowledge.

Grossly Contaminated Groundwater/Surface Water – Water that contains free product, a sheen, or general pollution concerns (for example, explosive vapors), or is readily detectable without laboratory analysis. This determination may be made based on analytical data, field observations, and/or site knowledge.

1.4 Document Organization

Following Section 1, this EHE-EHMP is organized as follows:

- **Section 2, Project Background,** includes the project location and setting, and briefly describes the construction approach.
- **Section 3, Environmental Setting,** includes a general discussion of the climate, geology, hydrogeology, historic land uses, previously identified sites that have contributed significant contamination to areas along the HRTP, and a brief description of contaminant fate and transport in soil and groundwater.
- **Section 4, Environmental Hazard Evaluation,** includes specific COPCs, and a general conceptual site model that describes the potential for exposure to COPCs.
- **Section 5, Environmental Hazard Management Plan,** describes the strategies for managing potentially contaminated media and outlines the responsibilities of all HRTP contractors and subcontractors managing contaminated media.
- **Section 6, Release Identification, Response, and Reporting,** describes requirements related to release response planning, release identification, and release reporting.
- **Section 7, Exposure Contingency Plan,** includes contingency plans should planned and anticipated actions fail to adequately protect workers or mitigate the migration or spreading of contaminated media.
- **Section 8, References**, lists the references cited throughout this EHE-EHMP.
- **Figures and Tables** accompanying the main text follow Section 8.
- **Appendix A, Known or Suspected Contaminated Sites,** provides the current listing of sites within a 150-meter buffer on either side of the proposed rail corridor.
- **Appendix B, ATSDR ToxFAQs,** are fact sheets prepared by the Agency for Toxic Substances and Disease Reporting that provides answers to the most frequently asked questions (FAQs) about exposure to each hazardous substance and the effects of exposure on human health.
- **Appendix C, HDOH Tier 1 Environmental Action Levels (EALs),** provides the current action levels for various affected media based on different exposure scenarios.
- **Appendix D, Contractor Guidelines,** provides general guidance and coordination requirements for contractors before and during construction.

1.5 How to Use This Document

This document is meant to be used before and after breaking ground.

1.5.1 Before Breaking Ground

Before breaking ground, the contractor will do the following:

- Read and sign the acknowledgement form to document their understanding of the document and the requirements.
- Complete EHE-EHMP training to reinforce their understanding of the EHMP requirements.
- Complete the contractor section of Appendix D-2, Pre-Construction Environmental Screening Form and submit it to HART for review.
- Review the completed Appendix D-2, Pre-Construction Environmental Screening Form to identify potentially contaminated sites and COPCs in Work Areas they will be working in.
- Identify the environmental hazards associated with contaminated areas and whether there are site restrictions, land use controls (LUCs), and/or existing EHMPs to mitigate potential exposure.
- Ensure that proper spill kits, soil and groundwater management equipment, and worker safety precautions are in place.

Before breaking ground, HART will do the following:

- Review the contractor section of Appendix D-2, Pre-Construction Environmental Screening Form and identify potentially contaminated areas, LUCs, and/or existing EHMPs in Work Areas.
- Perform additional public records searches and/or coordinate with HDOH HEER and SHWB Remedial Project Managers for sites with existing LUCs/EHMPs, significant and/or unusual (e.g., other than fuel-related) contamination.
- Communicate information on environmental hazards to the contractor by providing the completed Appendix D-2, Pre-Construction Environmental Screening Form and any site-specific requirements such as LUCs or site-specific EHE-EHMPs.

1.5.2 After Breaking Ground

After breaking ground, the contractor and HART will do the following:

- Monitor for, and take necessary precautions to prevent, worker exposure to known or suspected hazards in accordance with the EHMP.
- Stop work and notify HART if one or more of the following conditions are encountered:
  - If there is a release of a chemical or hazard not covered by the plan
  - If a larger than anticipated release is encountered
  - If there is a release encountered in a location where contamination was not expected

The purpose of stopping work is to ensure workers are safe, to develop an appropriate response plan, and to notify appropriate parties.

After breaking ground, HART will do the following:

- Provide support to the contractor to identify potential contaminants.
- Notify HDOH and the LEPC and complete release reports in accordance with the release reporting requirements identified in Section 6.

1.5.3 Upon Completion of Work

Upon completion of work activities in a given Work Area, the contractor will submit Appendix D-10, Post-Construction Environmental Reporting Form. In addition, if a release is identified, the contractor portion of Appendix D-12, Release Report Form will be completed and submitted to HART.

Upon receiving Appendix D-10, HART will review the document for completeness and submit to HDOH. HART will also review contractor portion of Appendix D-12, complete the remaining portions of these forms and submit to HDOH.

1.6 Deviations from this EHE-EHMP

Any deviations from this EHMP will be identified in writing and coordinated with HDOH. Ideally, HDOH will be notified at least 30 days before implementation of the proposed change. Deviations that are identified following implementation will be reported in writing to HART. Upon receipt of reported deviation, HART will notify HDOH within 24 hours. Section 5 of this document details the requirements for coordinating and reporting deviations. Major deviations and/or other deviations that may improve the requirements herein and that are deemed acceptable by HART and HDOH may be incorporated in updates/revisions to this EHMP.

1.7 Updates/Revisions to this EHE-EHMP

This EHE-EHMP is a living document. HART will review the EHE-EHMP annually and update it as needed to reflect changes that have occurred in the last year. Should major changes occur, the EHE-EHMP will be revised earlier (that is, within three months of the change). Revisions to the EHE-EHMP will require HDOH approval. Appropriate personnel shall be notified of the revisions made to the EHE-EHMP and required to acknowledge their review by signing an acknowledgement form. A list of personnel who were notified of the revisions will be maintained in the project file.

1.8 Site/Task-Specific EHE-EHMPs or LUCs

Some of the sites where work is anticipated to occur may have existing EHE-EHMPs. This Programmatic EHE-EHMP does not supersede or replace those site-specific EHE-EHMPs. Task-specific EHE-EHMPs were prepared before preparation this Programmatic EHE-EHMP. This programmatic EHE-EHMP is intended to replace the Task-specific EHE-EHMPs in the future. In addition, if a site has existing LUCs but has no existing EHE-EHMP in place, HART may prepare an area-specific EHE-EHMP before modifying institutional control conditions or implementing engineering controls.

1.8.1 Existing Site-Specific EHE-EHMPs or LUCs

Table 1-1 provides information on sites with existing EHE-EHMPs. HDOH records have been maintained for each of these sites, including the EHE-EHMP document. HART will notify HDOH at least 30 days before breaking ground at any site with LUCs or existing EHMPs. Close coordination with a HDOH remedial project manager will most likely be required during construction. Before leaving such a site, any required controls at the site must be fully restored to protect future uses. If there are changes to environmental conditions at the site, a site-specific post-construction EHMP will be required.

1.8.2 New Site-Specific EHE-EHMPs

New site-specific EHE-EHMPs may be required in addition to this EHE-EHMP. If the contractor encounters (1) a release of contaminants or hazards not covered by this document, (2) a larger than anticipated release, and/or (3) a release in a location where contamination was not identified, a new EHE-EHMP will be prepared to address these conditions. HART will contact HDOH if such conditions are encountered near major construction, or extremely hazardous contamination is encountered. These

plans should identify the known nature and extent of contamination, methods to avoid working in contaminated areas, how the dispersion of contaminants into the environment can be prevented, and what will be done to protect workers, the public, and the environment from released contaminants.

1.9 Post-Construction EHE-EHMP

If contamination remains along the guideway route or on properties owned or controlled by HART after construction of the HRTP, a post-construction EHE-EHMP will be prepared. This EHE-EHMP will include the following information:

- Identity of contaminants remaining on property owned or controlled by HART
- Distribution of contaminant concentrations in each medium
- Potential migration pathways
- Exposure pathways
- Exposure mitigation methods
- Post-construction monitoring requirements
- Post-construction notice requirements

A key element of the post-construction EHMP is to ensure individuals most likely to encounter contaminated media are aware that contamination may be present, such as utility or landscape maintenance workers who dig into subsurface soils. When contaminated media is left in place and buried below clean backfill material, the interface between these two media should be clearly identified using either contaminated ground warning mesh or geotextile. Conspicuous maps and other information identifying nearby contamination should also be posted in the maintenance rooms at each station, and comprehensive information about all contaminated areas should be maintained.

1.10 Uncertainties and Limitations

The information on known or suspected contamination near Work Areas was obtained from public records. Additional research may be necessary to identify detailed information to protect workers and prevent the movement of contaminants outside the Rail Corridor.

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2. HRTP Project Background

The detailed history of the HRTP route and nearby areas is found in the June 2010 Final Environmental Impact Statement / Section 4(f) Evaluation and in the Phase I Environmental Site Assessment (ESA) reports for individual properties. Section 8 of this EHE-EHMP lists these references, which are available upon request. The following subsections provide a summary of background information.

2.1 Project Location and Setting

The HRTP runs from the East Kapolei Station to the Ala Moana Center Station. As shown on Figure 2-1, the 20-mile-long HRTP consists of four sections, 21 stations, and a maintenance storage facility with work being conducted under multiple contracts. The southern/western end of the HRTP will be largely constructed in open farmland, and most of the remainder of the system will be constructed along existing streets and within urban areas. Where the route is not within farmland or an existing street, it passes over former or current light industrial properties. Table 2-1 lists the selected contractors for the HRTP sections.

The HRTP includes the following:

- **West Oahu Farrington Highway (WOFH)** – Guideway section runs from East Kapolei to the intersection of Farrington Highway and Kamehameha Highway and includes 6 stations: East Kapolei (park-and-ride), UH West Oahu (park-and-ride), Hoopili, West Loch, Waipahu Transit Center, Leeward Community College.
- **Maintenance Storage Facility (MSF)** – Construction of the system will include building a MSF near the eastern end and immediately south of the WOFH Section.
- **Kamehameha Highway Guideway (KHG) –** Guideway section extends from WOFH to ¼ mile east of Aloha Stadium and includes 3 stations: Pearl Highlands (park-and-ride), Pearlridge, and Aloha Stadium (park-and-ride).
- **Airport –**Guideway section extends from KHG to just east of Middle Street Transit Center Station and includes 4 stations: Pearl Harbor Naval Base, Honolulu International Airport, Lagoon Drive, and Middle Street Transit Center.
- **City Center -** Guideway section extends from Airport section to end at Ala Moana Station and includes 8 stations: Kalihi, Kapalama, Iwilei, Chinatown, Downtown, Civic Center, Kakaako, and Ala Moana Center.

During construction of the HRTP system, multiple open areas along the Rail Corridor will be used to store construction equipment and building materials, and if necessary to stockpile soils or other waste materials before disposal. The locations of these contractor yards and arrangements for their use will be made by the selected contractor(s) after the construction contracts are awarded.

As construction proceeds, the use of each contractor yard is expected to change. Initially, the yards may be used to store drilling equipment and stockpiled soil or other waste generated during the drilling of boreholes in which column foundations are constructed. After the stockpiled soils or other waste are removed, the same yard may be used to mix concrete, store structural steel, or repair equipment.

The contractor yards for the WOFH and KHG sections of the system are shown in Figure 2-2. Table 2-2 lists the section, contractor yard, tax map key (TMK) number, address, and area of the staging areas.

Staging areas for the remaining two sections will be identified after the construction contracts have been awarded.

The pollution control systems installed at each contractor yard (often referred to as Best Management Practices [BMPs]) will protect the environment from possible contaminant releases associated with handling and storage of impacted materials. Locations that receive solid waste, including soil, water, slurry, concrete, asphalt, pipelines, cables, and any other waste generated from the construction and/or operations, may require a solid waste management permit. If required, a solid waste management permit application will be submitted 180 days before operation of the contractor yard.

2.2 Construction Approach

The construction approach includes numerous activities to be completed during preconstruction and preparation and construction. Preconstruction and preparation activities may include the following:

- Archeological inventory survey (AIS) trenching
- Geotechnical/resistivity work
- Clearing/grubbing
- Grading
- Tree relocation
- Utility relocation
- Sewer casing/jacketing
- Potholing
- Test and method shaft construction
- Production shafts/borings for column shafts
- Building Demolition
- Traction power substation construction
- Station touchdowns or at-grade construction
- Footings
- Construction of rail at grade

The typical sequence for overall construction is as follows:

1. Utilities in conflict with support piers are relocated.
2. Shafts for column foundations are drilled, filled with reinforced concrete, and completed with pier capitals.
3. Columns are constructed above and integrated with the pier capitals.
4. Superstructure bearings are placed upon the pier capitals.
5. Underslung erection trusses are placed between adjacent piers.
6. Precast superstructure elements are assembled upon the erection trusses.
7. Superstructure elements are joined by stressing post-tensioning strands.
8. Sound walls are constructed on the superstructure elements.
9. Rail is placed on the superstructure.

Further details related to these construction activities are included in project and contractor work plans and specifications.

3. Environmental Setting

This section presents the physical description of the HRTP area setting, including the climate, geology and hydrogeology, sensitive natural environments, historical land uses that may have contributed to contamination along the HRTP route, and briefly describes contaminant movement (that is, fate and transport) through soil and groundwater.

3.1 Climate

The HRTP route is on the south central coastal plain of Oahu. The average annual precipitation in Honolulu is about 22 inches, which occurs mainly between October and April (Western Regional Climate Center, 2013). The average annual pan evaporation is approximately 91 inches. Light rain that lasts for a short time is common most days of the year.

3.2 Geology and Hydrogeology

Oahu is formed from the remnants of two shield volcanoes, consisting of the Waianae Range on the west side and the Koolau Range on the northeast side (Macdonald, 1983 Nichols, 1996). An alluvial valley (Schofield Plain) separates these mountain ranges. Deposition of lava flows and ash associated with the formation of the island, erosion of the exposed land surfaces, and more recent of post-erosional volcanics and marine and terrigenous sediments comprise the current sequence of materials where the principal aquifers exist beneath the Honolulu region. Groundwater on Oahu and in the Honolulu area that the HRTP passes through exists in two principal types of aquifers: shallow aquifers residing in sedimentary layers commonly referred to as caprock, and the deeper basal aquifers residing in underlying basalt lavas. Shallow caprock aquifers are unconfined or semi-confined, and not commonly used as drinking water sources because of their moderate salinity and vulnerability to contamination. In some areas, the caprock aquifers are unconfined, and are recharged through precipitation or movement of groundwater upward from the basal aquifer due to hydrostatic pressure. Most drinking water supplies on Oahu come from the basal aquifers, which exist as lenses of fresh water floating on and displacing seawater within the pore spaces and fractures within the deeper basalt lavas. In the Honolulu area, the basal aquifers provide all of the drinking water and nearly all of the irrigation water that is used.

In coastal areas, the basal aquifers become confined by overlying sedimentary deposits of the caprock. In the area along the HRTP route, groundwater in the basal aquifer is fully confined by the overlying caprock which are relatively impermeable. The relatively impermeable sedimentary layers within the caprock combined with artesian conditions in the basal aquifer impede the downward migration of groundwater from the upper caprock aquifer to the basal aquifers.

The boundary between basal aquifer recharge areas and non-recharge areas has been established and mapped by HDOH as part of its Underground Injection Control (UIC) program. Figure 3-1, which depicts the UIC boundary along with the HRTP route, shows that most of the HRTP route lies *mauka* (towards the mountains) of the UIC boundary and is within aquifer recharge areas. Major geohydrologic systems of Oahu are shown on Figure 3-2.

Drilling to install column foundations along the HRTP route will be done exclusively above or within the caprock; no borings will be deep enough to reach the basal aquifers within underlying basalt formations. Because of the thickness of the caprock, and the shallow nature of the borings and excavations required to complete the project, impacts to the basal aquifer from construction activities are not anticipated.

3.3 Sensitive Natural Resource Areas

Sensitive natural resource areas along the HRTP route are identified in Figure 3-3. The guideway or other project structures will cross 20 streams or conveyance channels. While undertaking construction activities within these streams or conveyance channels, the potential impacts to aquatic organisms may be greater than in other areas along the route because of the close proximity of sensitive ecosystems, and the short time it might take released COPCs to reach surface water bodies. Additional requirements not covered under this EHE-EHMP may be required for work in or near sensitive natural resource areas. Contractors working in or near sensitive natural resource areas should consult with the appropriate governing authorities and stakeholders at least six months in advance of fieldwork.

3.4 Environmental Conditions along the HRTP Route

Although contamination is most likely present in the historically more industrial neighborhoods and near individual sites with known activities that involved the sale or use of chemicals, the ground beneath any portion of the HRTP could be contaminated. Because of their widespread use, the most likely contaminants are petroleum products.

The long history of industrial activities in the airport industrial area, Mapunapuna, Kapalama-Iwilei, and Kakaako areas increases the chance that soils or groundwater on individual properties will contain residual COPCs. The larger areas or sites along the HRTP route are depicted on Figures 3-4a thru 3-4d. A comprehensive list of sites that were identified as part of the EHE-EHMP effort are tabulated and depicted on figures in Appendix A.

Based on the HRTP Environmental Database Resources, Inc. (EDR) report (November 2, 2007) that was included in the Hazardous Materials Technical Report (August 2008), and on a review of the HDOH public records, several properties were identified with a high likelihood that they may contain significant contaminated media (soil or groundwater) that could be encountered during construction activities.

3.4.1 Property Assessments for Acquisitions

Most of the HRTP will be constructed along publicly owned streets and highways. Construction of the HRTP, however, will require the full acquisition of 40 properties and partial acquisition of 159 properties. A number of properties within the HRTP route were identified as potential hazardous materials sites. In a few cases, properties on which hazardous materials were used or stored will be wholly or partially acquired. These include businesses with underground and aboveground storage tanks (USTs/ASTs), fuel islands, and hazardous materials storage facilities. On properties that will only be partially acquired, utilities and possibly other items (for example, gas station fuel islands and tanks) may be relocated from the acquired part of the property to an area that the property owner is retaining. As properties are acquired, additional environmental site assessments will be conducted and remediation will be completed where needed. The information from these studies and remediation projects will provide information on expected contaminants that may be encountered by construction workers during and after construction. Environmental site assessment reports or relevant contaminant information contained within these reports will be provided to contractors and incorporated into construction contracts after they have been finalized.

3.4.2 Additional Analysis of Existing and Future Data

Throughout the project, additional information will continue to be gathered regarding the historic uses of areas, subsurface soil and groundwater conditions, the presence of contamination, and conditions that will likely be encountered during construction.

Areas evaluated in relation to the rail corridor include a 150-meter buffer zone on either side of the proposed alignment. The following primary reference sources will be reviewed to identify known and suspected areas of contamination and supplemented with public records obtained from HDOH, landowners, documentation of releases reported by the HRTP to date, and additional information provided by HDOH and other agencies:

- *HEER Emergency Response Lookup Spreadsheet* (HDOH, as updated) http://hawaii.gov/health/environmental/hazard/publicrecorddetails.html
- *HEER Sites of Interest Lookup Spreadsheet (*HDOH, as updated) http://hawaii.gov/health/environmental/hazard/publicrecorddetails.html
- *Hawaii Underground Storage Tank/Leaking Underground Storage Tank (UST/LUST) Data Files* (HDOH, June 8, 2012) http://hawaii.gov/health/environmental/waste/ust/data.html
- *Hazardous Materials Technical Report, Honolulu High-Capacity Transit Corridor Project* (Honolulu Authority for Rapid Transportation [HART], August 15, 2008) http://www.honolulutransit.org/media/11993/20110702-haz-waste-and-mat-tech-report.pdf
- *EDR DataMap Environmental Atlas, Honolulu Transit Project, Honolulu, Hawaii* (EDR, November 2, 2007) http://www.honolulutransit.org/media/11990/20110702-haz-waste-and-mat-tech-report-appendix-a.pdf
- *Honolulu High-Capacity Transit Corridor Project, Final Environmental Impact Statement* (United States Department of Transportation, Federal Transit Authority and City and County of Honolulu, Department of Transportation Services, June 2010) http://www.honolulutransit.org/document-library/eis.aspx

3.5 Historical Land Uses and Associated COPCs

Most of the sites that are likely to have existing contamination can be grouped based on the historical uses of the properties. The potential for existing contamination and associated potential impacts on the construction of the HRTP are discussed in this section. The larger areas or sites along the HRTP route are depicted on Figures 3-4a thru 3-4d. A comprehensive list of sites that were identified as part of the EHE-EHMP effort are tabulated and depicted on figures in Appendix A.

3.5.1 Agricultural Uses

Much of the HRTP route was historically used to grow sugar cane and, in some areas, rice. Most of the Ewa Plateau area was occupied by the Ewa Sugar Company, the area between Ewa and Aiea was farmed by the Honolulu Sugar Company, and the Aiea area housed the Oahu Sugar Company. Historical maps show that rice was grown in the lower elevations adjacent to West Loch on the Ewa Plateau.

The agricultural use of the area did not just include the cultivation of crops. Each commercial sugar company operated a mill, mixed and applied pesticides and herbicides to the fields, and likely had fueling operations and areas where pesticide containers and other refuse were disposed of. In addition, multiple railroad lines crossed the fields and areas surrounding Pearl Harbor to transport supplies, agricultural products, and people.

The COPCs associated with agricultural operation consist of organochlorine pesticides and herbicides, as well as some heavy metals, which were used historically in agriculture as pesticide components (HDOH Technical Guidance Manual [TGM], Table 9-1) (HDOH, June 2009). These COPCs, when present in soils, typically cannot be seen or smelled by excavation workers.

Because it could be difficult for excavation workers to detect these types of chemicals, if the potential for encountering COPCs is high, pre-characterization sampling, field screening, and/or taking appropriate precautions (e.g., good hygiene, personal protective equipment [PPE], and managing as potentially contaminated) may be required.

Although much of the contamination associated with historic agricultural production in the Honolulu area has been remediated, residual contamination exists in some areas. Former sugar production operations along the HRTP route are described in the following subsections.

3.5.1.1 Former Ewa Sugar Mill and Pesticide Mixing Area - WOFH Section

The Ewa Plantation Company formerly farmed most of the Ewa Plateau from the base of the Waianae Range to West Loch and the Pacific Ocean. As reflected in Figure 3-4a, the former sugar mill was approximately 1 mile east-southeast of the planned East Kapolei station. Because of the distance between the Kapolei Station and the former sugar mill and mixing area, the likely direction of groundwater flow in the area to the south or west, and the relative immobility of the likely contaminants, a low risk exists that construction workers along the HRTP route might be exposed to contamination from the mill.

Historical maps show that multiple railroad lines crossed the Ewa Plain to carry supplies such as fuel, pesticides, and other chemicals to the mill and fields; sugar cane from the fields to the mill; and refined sugar to the port for shipping. Several passenger stations were also situated on the Ewa Plain. While the railroad was being used, it was common for railroad companies to spray herbicides along the rail line to prevent weed growth and associated grass fires. Residual herbicides and other pesticides are commonly found in soils alongside the rail lines. The HRTP route crosses the path of several of these historical rail lines.

The pesticide mixing area for the Ewa Sugar Company (listed in the EDR report as “East Kapolei Pesticide Mixing and Loading”) was approximately 600 feet *makai* (oceanward) of the HRTP route southeast of the UH West Oahu Station. This area remains contaminated with residual pesticides. Although relatively close to the HRTP route, construction activities are unlikely to encroach on this area.

3.5.1.2 Former Oahu Sugar Mill

The former Oahu Sugar Company was initially at the north end of the Waipio Peninsula between West Loch and Middle Loch (Figure 3-4a). It grew significantly, and by the 1930s covered more than 20 square miles. The risk of direct contact by construction workers to COPCs because of the historical operations at the mill are very low; however, contaminated groundwater from the mill could be found in the area. The company mixed pesticides in an area on the west side of Waipio Peninsula near a small cove. Because of its distance from the rail route, contaminants in the former pesticide mixing area do not pose a risk during construction of the HRTP.

3.5.1.3 Former Honolulu Plantation Company Aiea Sugar Mill

The former Honolulu Plantation Company Aiea Sugar Mill was at the northeast end of Aiea Heights Drive, and approximately one-half mile northeast and upgradient of the HRTP route. The location of the company’s pesticide mixing area is unknown. Reported contamination on the mill site, which includes benzo[a]pyrene and lead, is primarily related to fuel releases. The risk of direct contact to COPCs for construction workers is low; however, contaminated groundwater from the mill may be present.

3.5.2 Industrial and Commercial Uses

Current or former industrial land use has been more prevalent in some areas along the HRTP route than in other areas. Past and present industrial activities along the study corridor mostly relate to agricultural production, and food processing and warehousing. COPCs found in the industrial areas commonly

include petroleum compounds related to gasoline, diesel, and oil releases; solvents related to releases during equipment cleaning and maintenance activities; and heavy metals.

Large industrial and commercial activities have been concentrated in four areas along the HRTP corridor, as follows:

- Waipahu (West Loch) — The neighborhood contains multiple gas stations and car dealerships along Farrington Highway and warehouses and automobile repair businesses *makai* of Farrington Highway.
- Airport Industrial Area — The neighborhood is dominated by airport/airline support activities (tank farms and maintenance facilities), car dealerships, rental car agencies, warehouses, and light industrial activities.
- Kapalama-Iwilei — The area was previously occupied by the Dole Cannery and supporting businesses, but it has increasingly become commercial. The former Kapalama Incinerator and a number of warehouses and light manufacturing businesses were in the area. Warehousing remains along the Kapalama Canal.
- Kakaako — The neighborhood formerly contained automobile dealerships and repair shops, warehouses, and light industry; however, it is becoming increasingly commercial and residential. Many of the capital improvements in this neighborhood are scheduled to be underway during the construction of the City Center Guideway and stations.

3.5.3 Dry Cleaning Facilities

Solvents associated with dry cleaning operations have historically been poorly managed, and at some former dry cleaner locations have contaminated underlying groundwater. Solvent contaminant plumes often extend 3,000 or more feet from the source area. Solvents historically used in dry cleaning include petroleum-based solvents and chlorinated solvents such as tetrachloroethylene, which cannot be seen or smelled.

Because it could be difficult for excavation workers to detect these types of chemicals, if the potential for encountering COPCs is high, pre-characterization sampling and/or field screening may be required.

Information about the historical uses of properties along the HRTP route as dry cleaning facilities has been obtained from the EDR report and HDOH records. Dry cleaners identified within the vicinity of the HRTP that were additionally evaluated based on previously identified contamination and their distance and location relative to the rail route include the former Aiea Laundry Facility, Waipahu Dry Cleaners, Al Phillips the Cleaner, Inc. Hakuyosha Hawaii, Inc., and Marie Louise Fine Garment Care. The Former Aiea Laundry Facility is anticipated to pose the greatest risk for soil and groundwater contamination.

The Former Aiea Laundry Facility was operated by the US Navy from the early to mid-1940s through approximately 1998. The site covers approximately four acres at the northeast corner of Moanalua Road and Kaimakani Street in Aiea. The site is approximately 0.3 mile east of the shoreline of Aiea Bay (northeast shore of Pearl Harbor) and is bordered on the northwest by the Saint Elizabeth Church and School, on the north and northeast by the H-1 Freeway, on the far southeast by Aiea Elementary School and Kaimakani Street, and on the southwest by Moanalua Road and Aloha Stadium. A large dissolved-phase groundwater plume extends from the site to the coast. The site is included as a National Priorities List site within the Pearl Harbor Naval Complex Superfund site. Construction is planned within the boundary of the dissolved-phase plume.

3.5.4 Military Uses

Military bases operate as small cities, with a similar mix of industrial and commercial uses. Several Pearl Harbor Naval Complex Superfund Record of Decision (RODs) have been issued. COPCs listed in these RODs include petroleum, solvents (perchloroethylene and others), polychlorinated biphenyls, heavy metals (in mercury and chromium), and pesticides. If the potential for encountering COPCs is high, then pre-characterization sampling and/or field screening may be required.

Military bases and activities near the project include the following:

- Former Naval Air Station Barbers Point — Portions of the station remain under the jurisdiction of the Navy, while other portions have been transferred to the Hawaii Community Development Authority. This station is approximately 2.5 miles *makai* of the HRTP route.
- Pearl Harbor Naval Complex — An active Navy base on the National Priority List (Superfund), the complex includes the Former Aiea Laundry and formerly included the Navy Drum Site. All of the complex is *makai* of the HRTP route.
- Joint Base Pearl Harbor-Hickam — An active military base, with the portions of the base that are closest to the HRTP are primarily used for housing. The base is approximately 1 mile *makai* of the HRTP route.
- Fort Shafter Flats — An active military base where the area near the HRTP has been and remains a relatively undeveloped floodplain. Active areas of the base are approximately 1 mile *mauka* of the HRTP route.

The Ewa Junction Fuel Drumming Facility (EJFDF), inactive since the early 1970s, has been selected as the location for construction of the MSF for the HRTP. If contaminated soil and groundwater remain, they could be uncovered during the construction activities.

The EJFDF was constructed in 1943 as a fuel drumming and transportation terminal. Fuel stored in large USTs was pumped into steel drums, loaded onto trucks, and transported to ships for further transport. The facility originally contained 24 structures and associated appurtenances related to the drumming activities. These included the former drumming plant, a truck loading facility, valve pits, two 585,000-gallon USTs, and an additional tank with unknown contents.

In a 1998 Memorandum of Agreement pursuant to the Hawaiian Home Lands Recovery Act of 1995, the Navy agreed to transfer ownership of the EJFDF to the Department of Hawaiian Home Lands for housing construction. An environmental assessment did not reveal any significant impacts on human health or the environment, based on the EALs at the time.

The remaining USTs were removed at the end of 2005, and the HDOH SHWB issued a “No Further Action” letter on August 27, 2007, for the storage tanks. In March 2009, Naval Facilities Engineering Command (NAVFAC) concluded that no LUCs or restrictions were needed before the Navy transferred ownership of the site.

3.5.5 Petroleum Facilities

Petroleum handling and transportation facilities are frequently associated with releases of petroleum products or hazardous materials to the environment through leaks, spills, maintenance and other activities. These facilities include gas stations, tank farms, large maintenance yards, and pipelines. They are considered potential sites of COPCs wherever they appear along the project right-of-way.

If the potential for encountering COPCs is high (for example, in an area with known fuel releases and impacted soil and groundwater), pre-characterization sampling, field screening, and taking precautions

(e.g., good hygiene, PPE, and managing as potentially contaminated) may be required. During construction, environmental monitoring, including searching for visual and olfactory (that is, by smell) indication of petroleum contamination, will be conducted. Field screening equipment such as a photo-ionization detector (PID) may also be used to screen for petroleum contamination.

3.5.5.1 Petroleum Pipelines

A recent utility survey identified a number of active and abandoned petroleum pipelines in the study corridor. These pipelines are owned by a variety of organizations and firms, including the U.S. military, Hawaiian Electric Company (HECO), Chevron, and Tesoro. The pipeline locations include the following:

- Under Kapolei Parkway
- Along the Oahu Railway & Land Company right-of-way in Kapolei, Pearl City, Waimalu, and Aiea
- On the *mauka* side of Farrington Highway within Waipahu
- Under Kamehameha Highway between Leeward Community College and the airport
- Throughout the airport area, primarily on the *makai* side of Aolele Street
- Under Nimitz Highway, along easements to bulk petroleum storage facilities and to HECO's downtown power plant

The fixed guideway will cross or run parallel to these pipelines in many areas of the study corridor. These pipelines have been in place for many years, and releases from them could have contaminated soil or groundwater. Initial monitoring and field screening (visual observation, the presence of unusual odors, and/or PID screening) for jet fuel, diesel, or other higher molecular weight hydrocarbons should be done if an active or out-of-service buried fuel pipeline is identified within 150 meters (approximately 500 feet) of the HRTP route, unless the environmental data review reveals that a given release has been delineated and/or remediated and, both the existing data and field evidence during excavation indicate there is no need to conduct monitoring.

3.5.5.2 Underground Storage Tank Sites

Numerous UST sites were identified along the route. UST sites are listed in the HDOH UST and LUST databases. Because of the large number of UST sites along the pipeline route, known or suspected contaminated sites were limited to LUST sites. The LUST sites are listed and depicted in Appendix A.

3.6 Movement of Contaminants in Soil

The direction of contaminant movement in soil may not correlate well with the surface topography. As atmospheric pressure changes, air moves in and out of soil to compensate for changes in the gas pressure in the subsurface. Air is drawn into and exits the soil where surficial soil permeabilities are the greatest and no barrier, such as pavement, exists. This movement of air into and out of soil facilitates both the transport of contaminants and oxygen flux needed for aerobic biodegradation of contaminants. The degree to which ambient air moves into and out of the vadose zone (unsaturated) soils depends on the soil permeability.

The transport and dispersion of contaminants in unsaturated soil depends significantly on the physical and chemical properties of the contaminants, in particular their volatility and ability to chemically adsorb and absorb onto the soil matrix within the unsaturated zone. Although the patterns of contaminant movement within the unsaturated zone are less predictable, the distances these contaminants migrate in the soil are typically much less than the distances contaminants are carried by groundwater. Volatile contaminants can migrate away from the source area in the liquid state as free

product, or as dissolved contaminants in the groundwater, and then move into the overlying unsaturated zone via diffusion and dispersion. Contaminants that are not volatile are typically absent from the vadose zone outside of the contaminant source area.

Along the HRTP route, volatile contaminants might be found in unsaturated soils within the immediate vicinity of the contaminant source area, or directly above a plume of volatile contaminants. At distances more than 150 meters (500 feet) for petroleum products or chlorinated compound releases, the risk that volatile contaminants will be found in the vadose zone soil at levels that could pose a risk to construction workers is low.

3.7 Movement of Contaminants in Groundwater

The physical movement of contaminants away from their sources occurs because of several key factors: mechanical dispersion, which happens as water flows through voids in the soil matrix, chemical diffusion, which occurs at the molecular level, and advection, which is the transport of contaminants in the water. As contaminants move through an aquifer, they are also subject to adsorption onto the surface of the aquifer materials, absorption into aquifer materials, and chemical reactions including oxidation, reduction, and biodegradation.

With few exceptions, contaminants in groundwater move in the same direction as the groundwater. As they migrate from the source area, a contaminant plume will widen because of dispersion and diffusion. The distance of contaminant migration is also impacted by the volume of the contaminant released.

Some contaminants will be found short distances upgradient of a source area, having been transported through dispersion as the contaminants percolate through the soil, the “pancake” effect that occurs when an immiscible contaminant reaches the water table, or diffusion within the groundwater. The distance contaminants will be found upgradient depends on the physical and chemical properties of the contaminant, velocity of the groundwater moving past the contaminant source, where the contaminants have been dispersed within the overlying unsaturated zone, and the soil types. Upgradient dispersion is typically smaller in extent than downgradient dispersion; thus, the potential for aquifers upgradient of a spill area to be impacted is low.

In the Honolulu area, with few exceptions, the direction of groundwater (and dissolved COPC) movement is generally expected to be from *mauka* to *makai* areas. Accordingly, only sites with contamination relatively close and *mauka* of the HRTP route (within 150 meters [500 feet] for petroleum products and 920 meters [3,000 feet] for chlorinated compounds) are likely to affect the construction activities. Unless they are relatively close (within 150 meters) to the HRTP, potential contaminant sources *makai* of the route are unlikely to affect construction.

4. Environmental Hazard Evaluation

The EHE summarizes COPCs, potential exposure points, potential exposure pathways, and potential receptors.

4.1 Contaminants of Potential Concern

The general groups of COPCs that may be encountered during these construction activities include the following:

- Petroleum substances
- Dry cleaning solvents
- Polychlorinated biphenyls (PCBs)
- Chlorinated dioxins and furans
- Pesticides
- Heavy metals

Toxicological summary fact sheets for representative chemicals from these groups of COPCs that may be encountered during HRTP construction activities are provided in Appendix B for the following COPCs:

- Petroleum substances
  - Total petroleum hydrocarbons
  - Automotive gasoline
  - Fuel oils
  - Polycyclic aromatic hydrocarbons
  - Total petroleum hydrocarbons
  - Benzene
  - Ethylbenzene
  - Toluene
  - Xylenes
  - Naphthalenes
  - Methyl tert-butyl ether
- Dry cleaning solvents
  - 1,2-dichloroethylene
  - Tetrachloroethylene
  - Trichloroethylene
  - Vinyl chloride
  - Stoddard solvent
- PCBs
- Chlorinated dioxins and furans
- Pesticides
  - Aldrin/dieldrin
  - Chlordane
- Heavy metals
  - Arsenic

- Cadmium
- Chromium
- Lead
- Mercury

These toxicity summary fact sheets (referred to as ToxFAQs) have been developed by the US Agency for Toxic Substances and Disease Registry (ATSDR) Division of Toxicology and are included for access by users as quick and easy to understand guides. Answers are provided to FAQs about exposure to each hazardous substance and the effects of exposure on human health.

Additional ToxFAQs fact sheets and updated information may be viewed and downloaded at http://www.atsdr.cdc.gov/toxfaqs/index.asp#C

4.2 Environmental Action Levels

Decisions for management of contaminated soil and groundwater will be based on regulatory action levels. HDOH has developed health-conservative Tier 1 EALs to quickly screen soil and groundwater data for potential environmental hazards. These Tier 1 EALs for unrestricted use are not to be considered required, regulatory cleanup standards, but rather represent the concentration of a contaminant in the respective medium where the threat to human health or the environment is considered insignificant under any site condition. Tier 1 EALs for unrestricted use assume that there are no restrictions on current or future use of the property, including potential use as residential housing, schools, day care, and health care. As a result, exceeding the Tier 1 EAL for unrestricted use for a specific chemical does not necessarily indicate that the contamination poses a significant threat to human health or the environment, but only that additional evaluation may be warranted. Thus, contaminant concentrations could be significantly higher than the Tier 1 EALs for unrestricted use and still be protective of human health and the environment. For example, alternative action levels may be most appropriate for sites that will be restricted to commercial/industrial use only area, or for soil that is deep or otherwise isolated such that human exposure is unlikely.

The Tier 1 EALs for unrestricted use will be used as an initial screening for all COPCs that may be encountered in soil and groundwater during the HRTP construction activities. All soil or groundwater with COPCs present at concentrations below the Tier 1 EALs for unrestricted use will be eliminated from further concern. Site media with COPCs present at concentrations exceeding the Tier 1 EALs for unrestricted use will be further evaluated by HART and/or the contractors and adjustments made to the action levels on a site-specific basis, based on the anticipated management options for that medium, and considering available site information on current and reasonably anticipated future land uses, available ecological habitat, and potential beneficial uses of groundwater and surface water in the vicinity of the site. Action levels will be tailored for each site depending on the anticipated management options (for example, Work Area, Rail Corridor soil reuse or offsite disposal, groundwater discharge to surface water, or underground injection). The EHMP will describe the applicability of the EALs to soil management (Table 5-2a) and groundwater management (Table 5-2b).

Separate EALs are provided by HDOH to address the following environmental concerns for soil and groundwater:

4.2.1 Soil

- Protection of human health (Direct Exposure)
- Protection against vapor intrusion into buildings (Vapor Intrusion)
- Protection against leaching and subsequent impacts to groundwater (Groundwater Protection)
- Protection against gross contamination or nuisance conditions (Ceiling Value)

4.2.2 Groundwater

- Protection of drinking water resources (Drinking Water)
- Protection of aquatic habitats (Aquatic Habitat Goal)
- Protection against vapor intrusion into buildings (Vapor Intrusion)
- Protection against gross contamination or nuisance conditions (Ceiling Value)

The HDOH has developed EAL lookup tables that are organized to reflect four default types of contaminated sites in Hawai'i, based on groundwater utility and proximity to a surface water body. If groundwater beneath a site is not considered a current or potential source of drinking water because it is saline and is located *makai* from the UIC line (aquifers *makai* from the UIC line are not a drinking water source in accordance with HAR §11-23-05), the groundwater analytical results will be compared to EALs where no drinking water source is threatened. Moreover, if a site is within 150 meters of a surface water body, groundwater concentrations will be screened with EALs that account for aquatic toxicity considerations.

The most current HDOH EAL tables are located on the HDOH HEER website at http://eha-web.doh.hawaii.gov/eha-cma/Leaders/HEER/environmental-hazard-evaluation-and-environmental-action-levels. The USEPA and HDOH have created additional action levels for substances and potential exposure scenarios that might need to be considered if unanticipated contamination is discovered, or if additional pathways for exposure (other than the EAL defaults) or potential effects to the environment are identified.

4.3 Sources, Receptors and Pathways for Contaminants of Potential Concern

For COPCs to have an effect on human health or the environment, all of the following components must be present:

- A source of COPCs above harmful concentrations (Section 4.3.1)
- A mechanism of chemical release and transport (Section 4.3.2)
- An environmental transport medium (Section 4.3.2)
- An exposure point (Section 4.3.2)
- An exposure route (Section 4.3.3)
- A receptor or exposed population (Section 4.3.4)

4.3.1 Sources of Contaminants of Potential Concern

The source of contamination within the HRTP is existing contamination from historical releases. This contamination may be a delineated plume in soil or groundwater, dissolved-phase contamination, vapors, or free-phase petroleum products. Contaminated surface and subsurface soil, groundwater, and soil vapor are the most common current sources of COPCs along the HRTP route. If not properly managed, pumped groundwater and excavated soils could encounter potential human and/or ecological receptors. If soil is moved offsite before historical research or sampling is conducted, potential receptors may include human and/or ecological receptors in offsite locations.

4.3.2 Potential Pathways of Exposure

Information about the history of properties along the HRTP route was obtained and summarized in the Final EIS. Further information has also been obtained from HDOH and other sources. These prior reports suggest that soil contamination is likely to be encountered during construction at multiple locations along the HRTP route. If the excavated soils are contaminated, these actions could change the

environmental conditions of not only the excavated area, but also where the soils are stockpiled or ultimately placed. Careful planning of construction activities is necessary to prevent release or spreading of COPCs in soil or groundwater and potential effects on site workers, the public, and the environment. This planning is particularly important because, although some contaminants may be identifiable by sight, smell, or field screening instruments, others such as pesticides or metals in soil may not be readily identified in the field. The conceptual exposure flow chart in Figure 4-1 illustrates pathways and routes by which human and ecological receptors may be exposed to COPCs in soil, groundwater, and air during construction activities. The following construction activities may lead to potential receptor exposure to contaminated soil, groundwater, and air:

- Tree relocation
- Geotechnical/resistivity work
- Utility relocation
- Sewer casing/jacketing
- Potholing
- Archeological inventory survey trenching
- Test and method shaft construction
- Clearing/grubbing
- Grading
- Production shafts/borings for column shafts
- Traction power substation construction
- Station touchdowns or at-grade construction
- Footings
- Construction of rail at grade

Given these anticipated activities, the following potential pathways of migration and exposure are identified:

- **Direct Contact Onsite.** Workers, visitors, and trespassers could have direct contact with contaminated soil during excavation activities and removal and installation of utilities. Utility maintenance workers could encounter buried contaminated soil or groundwater. Landscape workers could disturb or encounter contaminated soil remaining after construction or brought to the surface by utility workers. Workers preparing landscaped areas for planting and installing plants both during the initial construction and throughout the life of the facilities could come in direct contact with soils containing COPCs. Workers installing and maintaining irrigation systems could come in direct contact with soils containing COPCs.

- **Runoff.** Contaminated soil could be washed from newly exposed ground surfaces or stockpiled soil piles during storm events and enter storm sewers and waterways as particulate matter, thereby affecting aquatic organisms.

- **Infiltration**. Stormwater could infiltrate stockpiled soils, leach from the stockpiles and flow to surface water and onto adjacent surfaces and properties. Stormwater infiltrating uncontained stockpiled soil could leach COPCs and transport them into underlying soils and groundwater. Irrigation of planted areas could increase the transport of COPCs from soil into underlying groundwater.

- **Volatilization.** Volatile COPCs could become airborne and be inhaled by workers, visitors, and local residents or accumulate in sealed structures constructed above areas with contaminated

soil or groundwater where free product is present. Volatile COPCs in drill cuttings could become airborne and be inhaled by workers, visitors and local residents.

- **Dust Emission.** Dry contaminated soil or dry cuttings could become airborne and inhaled as particulate matter by workers, visitors, and local residents. Soil preparation before landscaping or soil stockpiling could generate dust-containing COPCs.
- **Offsite Transport.** Excess contaminated soils generated while digging could be stockpiled or transported to a new location thereby creating new environmental risks at the storage and disposal locations. Stockpiled contaminated soil could be transported and create new environmental risks at storage and disposal facilities. Visitors in the area could be exposed to COPCs while walking, sitting, or laying on surface soils.

In addition to the above pathways, construction activities may inadvertently spread contamination if contaminated groundwater is discharged to storm drains or surface water or reinfiltrated in a clean area, or if contaminated soil is reused inappropriately. Moreover, if excavated soils are contaminated, construction actions could change the environmental conditions of not only the excavated area, but also areas where the soils are stockpiled or ultimately placed. Utility maintenance workers could disturb shallow or deep contaminated soil or groundwater remaining after construction, and bring these materials to the surface for further movement via other pathways to workers, visitors, local residents, or terrestrial or aquatic organisms.

4.3.3 Potential Exposure Routes

An exposure route is the avenue by which a receptor may contact a COPC such that it may become absorbed into the body. The potential routes through which humans or other organisms could be exposed to hazardous substances include ingestion, inhalation, and dermal contact. These are described briefly in the following subsections.

4.3.3.1 Ingestion

Ingestion is the oral intake of a solid or liquid material. The ingestion of contaminated soil or groundwater is a direct exposure hazard. Accidental ingestion of contaminated soil or groundwater could occur during construction in portions of the HRTP where contaminated soil and groundwater are exposed. Ingestion of COPCs is most likely to occur when workers fail to clean their hands before eating and smoking.

4.3.3.2 Inhalation

Inhalation is the act of drawing air, other gases, vapors, fumes, smoke, dust, or mists into the lungs. Some chemicals in contaminated soil and groundwater could volatilize when the soil and or groundwater is exposed. During excavation and construction activities, contaminated subsurface soils may be disturbed, thus increasing the potential release of dust and volatile compounds into the Work Area, and the risk that COPCs could be inhaled.

4.3.3.3 Dermal Contact

Dermal contact is the direct exposure of skin to solids, liquids, or gases with contaminated soil, groundwater, or vapor. Upon contact, some substances have the potential to absorb directly into the body through the skin. During drilling, excavation and other construction activities, contaminated soils and groundwater are likely to be encountered, thus increasing the potential for dermal contact.

4.3.4 Potential Receptors

The potentially exposed receptors include individuals in the following capacities, and organisms in the immediate vicinity and downstream of the Work Areas. The following potential receptors have been identified:

- HRTP construction workers
- Landscapers
- Future site users and occupants
- Authorized visitors to construction areas
- Trespassers to construction areas
- General public
- Terrestrial organisms
- Freshwater organisms
- Saltwater organisms

5. Environmental Hazard Management Plan

5.1 Elements of the EHMP

This EHMP has been developed to (1) reduce the potential exposure of workers to COPCs during construction, (2) decrease the likelihood of COPC releases to the environment, and (3) identify how contaminated environmental media such as soil, groundwater and soil vapor will be managed during construction activities. It consists of several individual, but interrelated plans, each addressing a potential COPC source and pathway. The specific elements of the EHMP include the following:

- Employee Training, Acknowledgement and Sign-off (Section 5.1.2, and Appendix D-1)
- Pre-Construction Environmental Screening (Section 5.2 and Appendix D-2)
- Inactive Pipeline and Underground Storage Tank Removal Plan (Section 5.3 and Appendix D-3)
- Soil Management Planning (Section 5.4 and Appendix D-4)
- Groundwater Management Planning (Section 5.5 and Appendix D-5)
- Stormwater Management Planning (Section 5.6 and Appendix D-5)
- Decontamination Water Management Planning (Section 5.7 and Appendix D-5)
- Free Product Management Planning (Section 5.8 and Appendix D-6)
- Vapor Management Planning (Section 5.9 and Appendix D-7)
- Debris Management Planning (Section 5.10 and Appendix D-8)
- Unanticipated or Unknown Materials Planning (Section 5.11 and Appendix D-9)
- Post-Construction Environmental Reporting (Section 5.12 and Appendix D-10)
- Release Response Planning (Section 6.1 and Appendix D-11)
- Release Reporting (Section 6.2, 6.3, 6.4 and Appendix D-12)
- Deviation Reporting (Section 1.6, 5.1, 7.0 and Appendix D-13)

Figure 5-1 depicts the construction schedule flow chart that allows for adequate time to pre-screen locations for known or suspected contamination.

Appendix D provides guidelines for workers to implement the requirements of this EHMP and forms that must be completed to comply with internal and regulatory notification processes. Appendix D-10, Post-Construction Environmental Reporting Form, shall be completed after work is finished in a given Work Area. Planned or reported deviations from this EHMP will be identified in writing and coordinated with HDOH. Ideally, HDOH will be notified in writing at least 30 days before implementation of the proposed change. Deviations that are identified following implementation will be reported in writing to HART. Upon receipt of reported deviations, HART will notify HDOH within 24 hours. Deviations will be documented using Appendix D-13, Deviation Form.

The methods and procedures to mitigate or avoid exposure to such hazards will be detailed in contractor Health and Safety Plans (HSPs). Although this EHE-EHMP focuses on the technical work needed to protect human health and the environment, these plans also depend on the implementation of protocols and procedures for reporting a release (Section 6). The release reporting section identifies which individuals should be notified about changes in site conditions, how to report evidence of contamination, and what efforts are being taken to protect workers, the public, and the environment from possible exposure to COPCs. The plan also identifies the roles, responsibilities, and authority each individual has in making decisions regarding how the health and safety of the worksite is monitored, the requirements for worker protection, and what additional efforts need to be taken to protect the general public and the environment.

Proper characterization of environmental media such as soil and extracted groundwater before removal for offsite reuse or disposal includes using existing historical data and, as may be required by the receiving facility or by HEER standards, collecting representative samples to be analyzed for additional criteria. Waste management options in order of preference are reuse, recycling, and treatment and disposal. Target analytes for common contaminants is provided in Table 5-1. Tables 5-2a and 5-2b summarizes the applicable EALs used to guide environmental management decisions. Because of the complexity of waste regulations, it is strongly recommended that contractors seek guidance from solid and hazardous waste regulatory specialists.

5.2 Pre-Construction Environmental Screening

Before beginning construction work, contractors will partially complete Appendix D-2, Pre-Construction Environmental Screening Form to identify key project information including the contractor point of contacts (POCs), the types of intrusive work activities being performed, the specific location of Work Areas, and whether excess media is anticipated to be generated from the proposed work activities. Following receipt of the form, HART will screen the information provided by the contractor and pre-screen the Work Area locations against known or suspected contaminated sites. HART completes the screening portion of the form to: (1) identify environmental sites and associated COPCs and/or existing site-specific EHE-EHMPs that need to be followed, and (2) identify media management plans that should be reviewed/implemented by the contractor. HART will return the completed form to the contractor to inform them of the potential hazards posed by contamination they may encounter.

5.2.1 Hazard Communication

Prior to beginning field work, the Contractor and Subcontractor staff will be provided with a copy of the Programmatic EHE-EHMP and will sign-off on Appendix D-1 to document they have read and understood the document and agree to abide by its provisions.

An environmental professional, industrial hygienist, or other properly trained personnel with experience in managing the remediation of contaminated media should be consulted and/or present while working in areas where contaminated media is known to exist, or when evidence of contamination is detected by construction workers. HART will notify HDOH HEER Office at least 30-days before construction activities in areas where contaminated media is suspected or anticipated.

The environmental professional will do the following:

- Review Appendix D-2, Pre-Construction Environmental Screening Form, and communicate hazards to the field crews at a preconstruction and/or tailgate safety meeting before beginning work.
- Monitor excavated soil for visible evidence of contamination, unusual odors, or elevated measurements from field instruments or test kits.
- Monitor groundwater in excavations for visible evidence of contamination, unusual odors, or elevated measurements from field instruments or test kits.
- Monitor the concentrations of volatile contaminants in air.
- Collect samples for laboratory analysis.
- Direct the placement of excavated soil in appropriate waste disposal containers or stockpiles within the Work Area or onsite within the rail corridor at contractor yards.

- Direct the pumping of contaminated water to containment vessels; pumping and reinfiltration of non-contaminated water should be done in a manner that will not draw or drive contamination away from the Work Areas. (Contractors will evaluate the dimensions of exposed areas and flow rates to determine the need for additional permits [e.g., a UIC permit] 6 to 9 months before the start of field work.)
- Direct the appropriate use of excavated soils as backfill.
- Provide health and safety guidance related to the potential exposure of workers to COPCs.
- Monitor the work activities to ensure compliance with this EHMP.

Once contamination is identified, construction activities that pose a potential risk of exposure to contaminated soil or dust (such as excavation of soil), or exposure to contaminated groundwater or vapors, must be supervised by personnel who have current 40-hour hazardous waste operations and emergency response (HAZWOPER) certification and 8-hour hazardous waste operations supervisor certification (29 *Code of Federal Regulation* [CFR] 1910.120), and who are able to identify potential needs for upgrading the level of health and safety protection. All personnel working in areas where there is potential for direct contact with contaminated media shall have current 40-hour HAZWOPER certification and annual 8-hour HAZWOPER refresher training. The contractor's written HSPs will also be required to identify HAZWOPER-regulated tasks, associated hazards, monitoring and control measures, and emergency response requirements. Contractors will need to determine whether the implementation of the management plans are included within the scope of their work and if the procedures specified are adequate for their use.

5.2.2 Recordkeeping and Reporting

Refer to Appendix D-2, Pre-Construction Environmental Screening Form, to understand potential environmental hazards. The contractor shall maintain detailed records of environmental monitoring of potential hazards in accordance with their HSP and this EHMP, and complete Appendix D-10, Post-Construction Environmental Reporting Form.

5.3 Inactive Pipeline and Underground Storage Tank Removal Plan

This plan provides general guidance on how to prepare for and manage belowground inactive petroleum pipelines and USTs located or exposed during excavation or other subsurface work.

5.3.1 Planning

Before performing any subsurface work, contractors should:

- Review Appendix D-2, Pre-Construction Environmental Screening Form completed by HART

If the results of Appendix D-2, Pre-Construction Environmental Screening Form, reveal known inactive pipelines or USTs, the contractor shall:

- Complete, review and sign Appendix D-3, Inactive Pipeline and Underground Storage Tank Removal Plan
- Complete and review Appendix D-11, Release Response Plan

Any unexpected, inactive pipelines and/or USTs encountered during excavation will be reported to HART. The Contractor shall provide all records to HART and HART will report this information to HDOH-

HEER in accordance with Section 6.0 of this document. HART will notify HDOH in accordance with Section 6.0 and complete Appendix D-12, Release Report Form.

5.3.2 General Guidelines

To the extent possible, all pipelines and USTs will be identified and a determination will be made whether a pipeline and/or UST is active or inactive. Whether it is active or inactive, these tasks should be done in close coordination with HDOH and should be done at the time of discovery. If the pipeline or UST is active, then HART will work closely with the owner and/or operator. If inactive, a determination will be made as to what it contains. If a pipeline contains oil, HART will mobilize special equipment to remove the oil within the excavation area, clean the pipe, then either cap after filling with inert material or cut the pipeline. If a pipeline is active and it contains oil, HART is only required to work within the Rail Corridor, unless pipeline closure activities cause a release to the adjacent property.

Certain types of USTs (for example, heating-fuel USTs) are specifically exempt from UST regulations (Hawaii Revised Statutes 342L-1 and Hawaii Administrative Rules, Title 11, Chapter 281-03). Potential releases from non-regulated USTs, including heating-fuel USTs, are governed under Hawaii Revised Statutes, Chapter 128D, Hawaii Environmental Response Law; and Hawaii Administrative Rules, Title 11, Chapter 451, State Contingency Plan. The HDOH HEER Office provides regulatory oversight for release response actions taken under the State Contingency Plan. In most cases where unknown or unregistered USTs are encountered in excavations and there is no other information available related to the prior use of the UST, it will most likely be managed as an unregulated UST.

As a general guide and to maintain consistency with managing the unregulated USTs, the investigation and management of any unregulated USTs should be coordinated with both the HDOH SHWB UST Section and HDOH HEER Office to determine the status and regulatory authority and requirements to manage the UST. Additional guidance is provided in the following:

- UST TGM (HDOH, March 2000)
- TGM for the Implementation of the Hawaii State Contingency Plan (HDOH, November 21, 2008, updated June 21, 2009)
- Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater (HDOH, summer 2008, updated March 2009)

All UST removals shall be coordinated in advance with the HDOH SHWB UST section and the Honolulu Fire Department. When possible, coordination should occur at least 30 days in advance. In limited circumstances such as when pipelines or USTs are inadvertently discovered during construction, pipelines and USTs may be removed sooner than 30 days with notification, coordination with, and approval from HDOH.

5.3.3 Field Screening and Exposure Monitoring

The worksite will be inspected by qualified environmental personnel retained by the contractor. The qualified individual will have the obligation to do the following:

- Visually screen soils for staining, debris, slag, discoloration, or other evidence of contamination as the soils are removed from the excavation.
- Check for petroleum or other unusual chemical odors emanating from the soil.
- Collect soil samples in inert sealable containers and test the headspace within these containers for volatile organic carbon compounds (VOCs) using a PID.

- Conduct other gross contamination field screening including water, glove, and paper towel tests as described in Section 5.4.1.
- Inspect soil stockpiles to verify effectiveness of control measures to prevent release.

The exposure limits are based on OSHA permissible exposure limits (PELs) or other more stringent published government agency exposure limits adopted by the contractor.

The exposure monitoring plan is included in contractor HSPs. Contractors will monitor vapor concentrations using a PID or similar instrument, and respond to elevated concentrations based on the readings.

5.3.4 Inactive Pipeline Removal Management

To the extent possible, leave inactive pipelines in the ground if they extend beyond the required excavation. Handle soil, water, vapor, debris, or other media in accordance with the applicable management plans. In the event segments of these pipelines are discovered and need to be removed, the following guidelines will apply.

5.3.4.1 Pipeline Tapping, Draining, and Removal

If a pipeline is discovered, attempt to identify the nature of the pipeline and confirm that it is not active. Contact the HEER office or others, including the appropriate utility and petroleum refining and distribution companies, before any excavation work to confirm that any pipeline segments to be removed are inactive. Prepare a site-specific plan that incorporates the procedures described in this section.

Do not attempt to remove pipeline segments without first draining the pipeline segment or determining that it is empty. To the extent practicable, any drainable fluids need to be removed before cutting the pipeline. Petroleum fluids recovered from the pipelines must be representatively sampled and tested to determine how they can be recycled or disposed of in full accordance with HAR Title 11, 58.1, and Chapters 260-279, and any other state and federal regulation governing this activity. Tapping to remove fluids should be conducted using a wet saw or other non-sparking tool. If the pipelines are asbestos covered, appropriate PPE (including breathing apparatus) may be required. Ensure that the area below and adjacent to the cutting location is covered with plastic sheeting and absorbent material. In addition, a catch basin should be placed directly beneath the cutting location. Pipelines may be under pressure; therefore, a vacuum truck or other means to remove liquid should be in the Work Area during cutting to recover any released fluids. Pipeline fluids collected in the catch basin should be pumped out.

Remove the required pipeline segments by cutting. If there is a potential explosion hazard, cutting should be done with a wet saw or other non-sparking tool. If the pipelines are asbestos covered, appropriate PPE (including breathing apparatus) may be required. Ensure that the area below and adjacent to the cutting location is covered with plastic sheeting and absorbent material. In addition, a catch basin should be placed directly beneath the cutting location. Pipelines may be under pressure; therefore, a vacuum truck or other means to remove liquid should be within the Work Area during cutting to recover any released fluids. Pipeline fluids collected in the catch basin should be pumped out.

Cut-off ends of remaining pipeline segments need to be appropriately sealed or otherwise closed, to prevent any potential leakage. Suitable seals include cement plugs, blind flanges, or other methods not involving hot welding. Welding is not appropriate because of the potentially explosive nature of fuel and its associated vapors.

5.3.4.2 Removed Pipe Handling

In many cases, sections of removed pipeline contain heavy, viscous petroleum products that appear to be immobile. However, once the pipes and product heat up, the product can liquefy and cause a release. If sections of waste pipe are stored in the Work Area or Rail Corridor before disposal, the area should be lined with plastic and bermed to contain any fuel that may have mobilized because of atmospheric heating.

5.3.5 UST Removal Management

All UST removals shall be coordinated in advance with the HDOH Solid and Hazardous Waste Branch UST Section, HEER Section and the Honolulu Fire Department.

The following are general guidelines for UST removal but are not intended to provide detailed requirements. The contractor shall consult with HART, appropriate regulatory agencies, and as necessary, professional consultants to develop an independent approach for managing USTs.

5.3.5.1 Mechanical and Electrical Isolation of the Tank and Pipelines

Mechanical isolation of the tank and its fuel lines from adjacent buildings and ancillary equipment will be performed and confirmed by the contractor before beginning removal activities. The equipment served by the tank will be inspected to determine if liquids are present and could drain to the tank or connecting pipelines upon breakage or removal. Before demolition, electrical lines associated with the UST system will be de-energized and removed from conduit.

5.3.5.2 Product Removal and Pipeline Cleaning

To the extent feasible, pipeline contents will be drained back to the UST before removal. Residual fuel will be pumped out of the UST with hand-operated pumps or explosion-proof mechanical pumps. The fuel will be stored appropriately onsite pending approval for disposal. Any residual liquids or other materials remaining in the tank bottom (water, residual fuel or oil, dirt and scale) will be classified as waste, and will require characterization and disposal. If the UST contains water, this will likely be considered evidence that the tank has a leak and extracting the water while the tank is in place may not be feasible. In all cases, the contractor will implement procedures to ensure containment of waste and waste minimization. In accordance with HDOH recommendations, the UST will be considered empty when the tank contains no more than 2.5 centimeters (one inch) or 0.3 percent by weight of the UST's total capacity.

Piping contents that cannot be drained back to the UST will be drained using proper containment measures at isolated locations along the pipeline, as identified in the field. Existing drains and valves will be used if operational. Pipes will be disconnected where possible at flanges or joints, immediately downstream of closed valves. Where joints or valves are not available, the pipes will be cut using cold-cutting techniques (such as air reciprocating saws or hydraulic nibblers). During these activities, containment trays or liners will be placed beneath the piping being cut and a transfer pump (or vacuum truck) will be provided to ensure residual fluids can be captured and contained. If the pipelines are suspected to be full of product because of piping layout, the pipes will be cold-tapped and drained before cutting activities. Pipeline cutting (which will be conducted using only cold-cutting techniques) will not be performed until tanks and connecting lines have been properly purged or inerted as described in Section 5.3.5.4. All piping associated with the UST fuel system will be removed and properly disposed of.

5.3.5.3 Preliminary Excavation of Tank and Pipelines

Excavation will be advanced along the sides of the UST until the top of the tank is exposed. Excavation will not be advanced beyond the top of the tank until the tank has been purged of all flammable and toxic vapors, or otherwise made inert.

5.3.5.4 Purging/Inerting and Air Monitoring

Before advancing excavation beyond the top of the UST, and before any pipeline cutting, tank removal, or tank cutting activities, care must be taken to reduce explosion hazards. The subcontractors shall implement the provisions of the American Petroleum Institute Recommended Practice 1604, Closure of Underground Petroleum Storage Tanks. This can be achieved by either purging or inerting techniques as follows:

- Purging—The removal of flammable vapors from tank interiors and pipelines may be done with an eductor-type (venturi) air displacement system, which can be used for small and large tanks. The eductor is normally installed on the fill pipe of small tanks, with incoming air entering from the vent line or manhole. Larger tanks can be purged by vent lines and access manways. The negative-pressure gradient created by the eductor results in continuous introduction of fresh air into the tank to keep volatile concentrations below the lower explosive limit (LEL). Where purging is employed, the surrounding area will be well ventilated to protect personnel. The eductor must be grounded to prevent the buildup and discharge of static electricity.
- Inerting—Rendering a tank inert involves the physical displacement of oxygen from the tank or line (with incidental removal of flammable vapors), which reduces explosion hazards by removing the oxygen source required for a fire. Inerting can be done by using compressed gases (carbon dioxide or nitrogen) or dry ice. Inerting results in oxygen-deficient conditions within the tank. When compressed gases are used, the gas is typically introduced through a single opening at the opposite end of the tank from the vent point to ensure displacement throughout the interior of the tank. The gases are added at low pressure to avoid creating static electricity, and pressures within the tank should not exceed five pounds per square inch gauge. When dry ice is used, at least 15 pounds of dry ice is typically required for every 1,000 gallons of tank capacity. Dry ice requires special handling to avoid skin injuries. The tank must be sealed after inerting to maintain the oxygen-free atmosphere. Where inerting is employed, the surrounding area will be well ventilated to protect personnel. Inerting cannot be used where the integrity of the tank is suspect because the gases could accumulate in areas occupied by site personnel.
- Air Monitoring—The tank atmosphere will be continuously monitored by the subcontractor for combustible vapors if the tank is purged, or for oxygen if the tank is inerted. Field instrumentation (a PID and combustible gas indicator) will be used to monitor the tanks and the immediate Work Area for the presence of organic vapors, combustible gases, and oxygen-deficient conditions. The tank interior will be considered stable when readings are below 10 percent of the LEL (purging) or oxygen levels are below 8 percent. (Note that combustible gas meters may give false readings when oxygen levels are below 14 percent.) If area readings for oxygen are less than 20.8 percent or greater than 22 percent, or combustible gas readings exceed 10 percent of the LEL, personnel will evacuate the area. The area will not be re-entered until the site manager provides clearance. If testing indicates vapor concentrations to be in or above the explosive range, the tanks will be de-gassed until concentrations reach safe levels. Monitoring of the tank for explosive vapors shall continue until the tank is cleaned and degassing performed as required.

5.3.5.5 UST Removal

Fill, gauge, product, and vent lines and drop tubes will be removed, if present. All removal activities will be conducted by disconnecting joints or implementing cold-cutting techniques. Caps or plugs will be installed in openings not required for reduction of explosion hazards. Piping connecting the UST to the fill ports and dispensers will be excavated and removed. The operations for piping removal and capping will be conducted in a manner that does not contaminate or further contaminate the surrounding soil or water.

After the UST has been properly purged or inerted and ancillary piping removed, excavation will be advanced to the total required depth in compliance with 29 CFR 1926.652. Shoring will be installed where sidewall sloping is not practical because of site constraints such as buildings, walkways, or adjacent utilities. No entry will be allowed into areas of excavation unless the excavation is adequately sloped, or shoring is installed. If sampling is required in unshored/unsloped areas, then sampling will be conducted using mechanical equipment (such as grab samples from excavator bucket or sampling cores attached to the bucket).

5.3.6 Engineering and Administrative Controls

Dust and vapor control methods may be necessary during construction-related work in which inactive pipelines are encountered and investigated. Other controls may also include the use of plastic sheeting for stockpiling and covering, rolloff boxes, or other storage containers to segregate or store soil (Section 5.4), groundwater (Section 5.5), stormwater (Section 5.6), decontamination water (Section 5.7), free product (Section 5.8), debris (Section 5.9) (such as asphalt, concrete, pipeline segments), or unanticipated or unknown materials (Section 5.10) removed during the course of construction.

5.3.7 Periodic Inspections and Preventive Maintenance

A key component of the plan is routine inspections. Accordingly, all locations, and particularly those locations where a greater possibility exists to encounter inactive pipelines, will be inspected continuously by the contractor during intrusive activities. Inactive pipelines should be inspected by the contractor before any intrusive activity to expose, tap, or remove inactive pipelines and/or potentially contaminated soil, groundwater, or free product. In addition, stockpiles generated because of pipeline or UST removal activities shall be inspected for contamination after the intrusive activities are completed.

5.3.8 Recordkeeping and Reporting

Appendix D-3, Inactive Pipeline and UST Removal Management Plan, provides guidelines for the contractor. All records related to inactive pipeline and UST removal shall be documented by the contractor on Appendix D-10, Post-Construction Environmental Reporting Form, upon completion of work in a given Work Area. The contractor shall maintain detailed records of field observations that include the location of the pipeline or UST relative to fixed landmarks (including Global Position System [GPS] coordinates), the depth, diameter, pipeline or UST type, and any other distinguishing features, type of fuel, beginning and ending fluid levels, volumes of each type of fluid removed (for example, water and fuel), flow rates, direction of flow, photographs, and any other information pertinent to the pipeline contents.

Any unexpected, inactive pipelines and/or USTs encountered during excavation will be reported to HART. The contractor shall provide all records to HART and HART will report this information to HDOH-HEER in accordance with Section 6.0 of this document. Appendix D-11, Release Response Plan, provides guidelines for reporting releases, information on releases shall be documented in Appendix D-12, Release Report Form. Additional follow-up reporting may be completed as necessary in accordance with

the HDOH TGM for Underground Storage Tank Closure and Release Response (HDOH, March 2000) and/or the TGM for the Implementation of the Hawaii State Contingency Plan (HDOH, November 2009).

5.4 Soil Management Plan

The purpose of the soil management plan is to help ensure that areas with contaminated soil encountered during construction are identified, the risks associated with working in these areas are understood and addressed, and contaminated soil is properly managed. The main hazards created by contaminated soil are direct exposure, ingestion of COPCs, inhalation of vapors or dust containing COPCs, and releases of COPCs to the environment.

Based on observations and analytical results from previous environmental investigations, some subsurface soil along the HRTP is expected to be contaminated with petroleum substances, chlorinated solvents, heavy metals, pesticides, and other contaminating substances. Although some soil contamination can be identified through visual observations or by smell, other COPCs, such as heavy metals, polychlorinated biphenyls or pesticides, may not be detected visually or by smell.

5.4.1 Planning

Before performing any subsurface work, parties should:

- Review Appendix D-2, Pre-Construction Environmental Screening Form completed by HART

If the results of Pre-Construction Environmental Screening Form identify the potential for contaminated soil, the contractor shall:

- Complete, review and sign Appendix D-4, Soil Management Plan
- Complete and review Appendix D-11, Release Response Plan

If contaminated soil is encountered, notify HART and HDOH in accordance with Section 6.0.

5.4.2 General Guidelines

Where possible, soil will be returned to the excavations within the Work Area or reused elsewhere within the Rail Corridor, provided that reuse will not spread contamination to previously uncontaminated areas. Soil that is not suitable for backfill, contains free product, or is grossly contaminated (contains TPH concentrations greater than 5,000 mg/kg) will be disposed of offsite at a permitted facility.

Onsite storage or treatment of contaminated soil within the Work Area or at other contractor yards within the Rail Corridor will not require a solid waste management permit but may require additional permits (for example, City and County of Honolulu soil stockpile permit). If free product or grossly contaminated soil is encountered at depths shallower than 1 meter (2 to 3 feet) deep, shallow soil will be replaced with an impervious cap and managed long-term via the post-construction EHMP. See the City of Honolulu Stormwater Management Manual Best Management Practice (BMP) WM-03 for additional requirements (http://www.cleanwaterhonolulu.com/storm/learning_center/BMP_manual_2011-11.pdf). All soil removed from a Work Area for reuse or disposal will be tracked to its final location.

Because storage areas have not yet been identified for the Airport and City Center stations areas of the guideway, HART shall ensure that their contractors do not use any unpermitted offsite storage/treatment locations. Any site that is not located directly adjacent to the guideway is considered offsite for the purpose of this project. Contractors shall coordinate their plans with HART. The contractor and HART shall notify the HDOH of their plans, and submit any required solid waste management permit

applications at least 180 days before proposed use. Soil that is taken directly from the site to a permitted solid waste disposal facility allowed to accept such soil will not require a solid waste permit.

If soil is removed from the site and temporarily stored at an offsite location, the contractor shall consult with the City and County of Honolulu Department of Planning and Permitting (DPP) (Grading, Grubbing, and Stockpiling Permit) and HDOH SHWB (Solid Waste Permit) for additional required permits. HART will ensure that their contractors act in accordance with this plan and do not take solid waste to a facility that does not have a permit to receive such waste. Because storage areas have not been identified for the Airport and City Center Station areas, the relevant contractors will coordinate their activities with HART for compliance with this plan. Subsequently, the contractor(s) and HART will notify the HDOH HEER office and SHWB of their proposed plans before implementation. The contractors/HART will submit any required solid waste management permit applications at least 180 days before proposed use. The contractor(s) and HART will also contact and coordinate their efforts with the City and County of Honolulu, DPP, HDOH CWB, and other affected agencies as appropriate.

Contaminated soil is defined as soil containing concentrations of contaminants above HDOH Tier 1 EALs for unrestricted use within 150 meters (approximately 500 feet) from surface water and over a drinking water source.

Where contaminated soil was previously identified during the planning phase or was found during excavation activities, the soil should be removed, stockpiled, characterized, and either reused, treated, or disposed of following safe work practices and in conformity with HDOH and USEPA regulations and guidelines.

Work should proceed only when the contractor has ensured that the following preparation, precautions, and notifications have occurred:

- The HDOH HEER office will be notified at least 30 days before construction activities in areas where contaminated soil is suspected or anticipated. If unknown and unsuspected contamination is found while building the HRTP, HDOH HEER will be notified immediately.
- Workers have been equipped with the appropriate level of PPE.

5.4.3 Field Screening and Exposure Monitoring

5.4.3.1 General Field Screening

The worksite and soils excavated from construction areas will be inspected by qualified environmental personnel retained by the contractor. The qualified individual will have the obligation to do the following:

- Visually screen soils for staining, debris, slag, discoloration, or other evidence of contamination as the soils are removed from the excavation.
- Check for petroleum or other unusual chemical odors emanating from the soil.
- Collect soil samples in inert sealable containers and test the headspace within these containers for volatile organic carbon compounds (VOCs) using a PID.
- Conduct other gross contamination field screening including water, glove, and paper towel tests as described in Section 5.4.3.2.
- Inspect soil stockpiles to verify effectiveness of control measures to prevent release.
- Advise the contractor on the designation of decision units. “A decision unit is an area where a decision is to be made regarding the extent and magnitude of COPCs with respect to potential

environmental hazards posed by existing or anticipated future exposure to the COPCs. (Strictly speaking, a decision unit is really a volume rather than area of soil, because the thickness of the decision unit is often a key factor.) A decision unit can be an identified spill area or 'hot spot,' a residential yard, a playground or schoolyard, a garden, a commercial/industrial property or other specific area of interest. Average COPC levels are determined in the selection decision units." [HDOH, "Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater, Volume 1: Users Guide," Fall 2011, page 1-7].

Many COPCs such as heavy metals and PCBs cannot be identified by sight, smell, or PID measurements**.** While other field screening techniques may be available (for example, x-ray fluorescence [XRF] to test for metals), the cost, time, reliability, and acceptance of the associated field-screening technique should be evaluated on a case-by-case basis**.** Testing of soils for the presence of most types contaminants can typically be done in a laboratory.

5.4.3.2 Gross Contamination Screening

Qualitative field screening techniques that may be helpful in determining the presence of free product and/or grossly contaminated soil (TPH > 5,000 mg/kg) include water, glove, and paper towel field screening techniques.

- Water testing for gross contamination consists of placing a handful of soil into a small container with water and observing for the presence of a sheen or separate phase product on the surface of the water, or on the edges or bottom of the container.
- Glove testing for gross contamination of TPH consists of squeezing a handful of soil in a gloved hand. If oil droplets remain on the glove after releasing the soil, assume that TPH > 5,000 mg/kg.
- Paper towel testing for gross contamination of TPH consists of squeezing a handful of soil in a paper towel. If oil droplets appear on the paper towel, assume that TPH > 5,000 mg/kg.

5.4.3.3 Exposure Monitoring

The exposure limits are based on OSHA-PELs or other more stringent published government agency exposure limits adopted by the contractor.

The exposure monitoring plan is included in construction contractor HSPs. Contractors will monitor vapor concentrations using a PID or other quantitative methods, and respond to elevated concentrations based on the readings.

5.4.4 Excavation and Stockpiling

An environmental professional, industrial hygienist, or other trained personnel will use field observations and measurements to assess the excavated soil for the presence of contamination. When contamination has been confirmed, the process for managing excavated soil is summarized below.

- Contaminated soil will be segregated from uncontaminated soil.
- Water contained within the soils will be captured while removing the soil from the excavation.
- Water that leaches from the soil will be reinfiltrated within the Work Area or properly contained and removed for treatment and disposal (see Section 5.5, Groundwater Management Plan and Appendix D-5).
- Contaminated soil will be properly transported to a location where it can be stockpiled and tested.
- Contaminated soil will be properly disposed of.

- At each worksite, contaminated soil will be segregated from clean soil in separate waste removal units (waste transporter dump containers or roll-off boxes) lined with chemically-resistant liners as necessary; minimum 15- to 20-mil liner thickness (for example, 2 layers of 10-mil polyethylene plastic sheeting), or in separate stockpiles. Segregated contaminated soil shall be labeled or marked to identify that it is contaminated to avoid exposure and mixing with other non-contaminated soil. Common methods to demarcate contaminated soils include signage and marking/flagging portions of stockpiles. Actual methods for demarcation will be the responsibility of contractors.
- Ensure the ground surface on which the stockpile will be placed is relatively free of rocks and other objects that could damage the liner.
- Limit stockpile size to 100 cubic yards (CY) per pile.
- Cover stockpiles with waterproof material and extend the cover beyond the perimeter so that precipitation runs outside the stockpile footprint.
- Periodically inspect soil stockpiles to ensure effectiveness of the control measures to prevent release or misuse
- Leave stockpiles uncovered only when they are actively being worked.
- Contaminated soil stored in dump containers or roll-off boxes that will not be immediately transported for disposal will be covered with plastic sheeting as soon as the box has been filled. The plastic sheeting must be mechanically anchored to the roll-off box.
- The anchoring of plastic covers over stockpiles or roll-off boxes must be able to withstand strong winds at all times.

5.4.4.1 Management of Soil Shown to be Uncontaminated

Because of the historic sugar cane production and commercial and industrial activities along the HRTP route, surficial soils should be considered as potentially contaminated. A lack of knowledge of contamination without underlying research into the historic property uses and potential for contamination cannot substantiate a presumption that soil is not contaminated.

Site history, field observation, field screening, and/or existing analytical results may be used to determine that soil is not contaminated. HART is responsible for assumptions regarding the designation of soil as clean, whether the assumptions are anticipated based on historic knowledge or based on analytical results. Concentrations of contaminants in soil are known (for example, based on analytical data) or anticipated (based on site knowledge) to be below HDOH Tier 1 EAL for unrestricted land use and sites less than 150 meters (approximately 500 feet) from a surface water body overlying a drinking water source. The initial presumption that soil is contaminated can be rebutted if one of three conditions is met:

- Condition 1: An environmental due diligence review of the soil source property concludes that no evidence of past releases exists. The due diligence review should conform to American Society for Testing and Material (ASTM) Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process (ASTM Standard E 1527-05) (ASTM, 2005) and the USEPA's Final Rule on Standards for Conducting All Appropriate Inquiry (AAI) (USEPA, 2005). The ESA should include consideration of past legal use of pesticides on agricultural properties, or termiticide applications.

- Condition 2: A qualified environmental professional has evaluated the potential for COPCs on the site, sampled and tested soils on the site, prepared a fill material characterization report in accordance with the requirements of HDOH HEER's "Guidance for the Evaluation of Imported and Exported Fill Material, Including Contaminant Characterization of Stockpiles," submitted the report to HDOH-HEER for approval, and received approval from HDOH-HEER. These guidelines require that the following information be provided in the characterization report:
  - Intended use of the fill material and land use/zoning or planned future land use at the site where it will be used
  - Quantity of fill material to be imported, exported, or relocated on-site
  - Description of the fill material's original nature (i.e., undisturbed native condition) including the source property address, tax map key (TMK) number, and owner contact information
  - Fill material source property historic usage (i.e., industrial, residential, agricultural, etc.), and citation to Phase I ESA report, if applicable
  - Previous fill material use(s) when the material is other than undisturbed native material
  - Summary of sampling methodology and analytical results from the sampling of the fill material, including:
    - Identification of decision units (DUs) (for example, horizontal and vertical dimensions)
    - Number of DUs per volume of fill material
    - Number of sampling increments in DUs
    - Number and location of replicate samples
    - Summary of laboratory analytical results and copy of laboratory data reports
    - Chain of custody documentation
    - Any additional information that may be necessary to assess the fill material contamination status
  - Evaluation of sample data with respect to potential environmental hazards (for example, comparison to HDOH
  - Tier I EALs using the HDOH EAL Surfer Excel File (HDOH HEER Office, 2008)
  - Identity/signature by party responsible for evaluation of each source of fill material
- Condition 3: A qualified environmental professional has evaluated analytical data generated during preconstruction activities such as test and method shafts, potholing, geotechnical borings, and pre-construction characterization borings intended to identify potential contamination within the Work Areas have not shown evidence of contamination. The data evaluated must be representative of the soil being considered for reuse.

5.4.4.2 Management of Soils from Areas with Evidence of Limited Potential Impact

In some areas, surficial soils could be contaminated, but because of the physical properties of the suspected COPCs, contaminants are unlikely to have migrated deeper than 10 feet below the ground surface. In those cases, surficial soils can be removed with the presumption that they are impacted and require disposal, and soils removed from depths deeper than 10 feet bgs can be presumed

uncontaminated. In determining whether the presumptions can be made for a site or area, the following criteria must be met:

- The environmental consultant performing the due diligence review of the soil source concludes that no evidence of past releases exists other than potential surficial soil contamination. The due diligence review must conform to ASTM Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process (Standard E 1527-05) (ASTM, 2005) and the USEPA Innocent Landowners, Standards for Conducting All Appropriate Inquiry (AAI) (USEPA, 2005).
- A qualified environmental professional has evaluated analytical data generated during previous phases of the project. The data evaluated must be representative of the soil being considered.

Examples of sites with potential surficial contamination but for which it can be presumed that soil below 10 feet is not contaminated include the following:

- Former sugar cane fields (excluding potential pesticide storage or mixing areas)
- Residential or commercial properties, including those constructed before 1990 where termiticides were applied

5.4.4.3 Management of Soils Known or Suspected to be Contaminated

Regardless of the source of the soils, if the soils exhibit one or more of the following characteristics, they will be presumed contaminated and further testing will be needed to demonstrate these soils are suitable for unrestricted use as fill material.

- Suspected or known COPCs exist in the soil or groundwater because the historic use of the property.
- Suspected or known COPCs exist in the soil or groundwater because the historic use of the property included the following activities or conditions:
  - Hazardous materials or hazardous waste use, storage, generation, or release
  - Environmental cleanup activities have not achieved HDOH Tier 1 EALs for unrestricted use within 150 meters (approximately 500 feet) from surface water and over a drinking water source
  - Former or existing buildings painted with lead-based paints
  - Soils treated with termiticides
  - Military operations
  - Pesticide storage or mixing
  - Pesticide container disposal
  - Seed dipping
  - Settling ponds
  - Bagasse piles
  - Former plantation housing
  - Former rail lines
  - Former landing strips

  - Pipelines (active and abandoned)
  - Disposal of fill material
  - Disposal of dredged sediments from heavily developed areas (for example, canals, harbors)
- The soils exhibit visible evidence of possible contamination or unusual odors.
- Field screening of the soils yields elevated conventional PID or PID-benzene readings.
- The soils contain anthropogenic materials (for example, bricks, concrete asphalt, construction debris, and lumber).
- The color or texture of the soil suggests that it is fill material.
- Evidence of contamination is discovered by HART during subsurface activities in the area.

If adequate analytical data are not available, these soils should be sampled and analyzed for appropriate COPCs and/or designated for transport and disposal offsite at a permitted disposal facility after appropriate waste characterization testing has been completed.

Much of the land through which the HRTP will be constructed formerly contained sugarcane fields. The past use of pesticides on sugarcane fields makes these areas suspect for potential contamination. HDOH recommends that soils within sugar cane fields, and along the pathways of former railroad lines used by the sugar companies be tested for dioxins/furans, arsenic, and organochlorine pesticides (HDOH, June 2009).

Before 1990, soil adjacent to and under the foundations and slabs of buildings or building sites along the HRTP route were commonly treated for termites with chlordane, aldrin, dieldrin, and other persistent pesticides (HDOH HEER Office Fact Sheet Past Use of Chlordane, Dieldrin, and other Organochlorine Pesticides for Termite Control in Hawai‘i: Safe Management Practices around Treated Foundations or during Building Demolition, 2011). Soil under and adjacent to these buildings or at these former building sites should be considered suspect unless otherwise demonstrated to be “clean” through sampling and analytical testing. HDOH recommends soil testing of properties with wooden structures built before 1989 if the structure will be demolished and the soil underneath the structure or foundation perimeter will be reused within the Work Area, Rail Corridor, or offsite.

5.4.5 Soil Sample Collection for Reuse or Disposal

If no contamination is suspected to be present, a multi-increment sampling approach should be followed to confirm this and ensure that the average contaminant concentrations in the soil being considered for re-use are acceptable. Sample collection procedures should follow HDOH HEER’s June 2009 “Interim Final Technical Guidance Manual for the Implementation of the Hawaii State Contingency Plan,” and HDOH HEER’s October 2011 “Guidance for the Evaluation of Imported and Exported Fill Material, Including Contaminant Characterization of Stockpiles.” For unrestricted relocation, the general sample collection procedures are as follows:

- Collect one multi-increment sample for every 500 CY of affected soil (staged in stockpiles of 100 CY or less).
- Each multi-increment sample should consist of 50-100 soil increments collected in a random, stratified manner from the entire volume of soil (500 CY) for which the sample will represent.
- Collect soil increments of the same relative volume/weight (for example, each increment consisting of a 5-gram soil aliquot or similar).

- Use appropriate sample collection methodology to preserve the COPCs to be tested.
- Label samples, place in designated sample container, and preserve in accordance with USEPA procedures.
- Complete chain-of-custody documentation.

If a soil is presumed to be contaminated, the testing of that soil will be depend on the suspected contaminants. HDOH has guided the selection of appropriate testing for many potential contaminants (HDOH HEER TGM, 2009).

Before relocation or disposal, soils must undergo a hazardous waste determination in accordance with HAR 11-261-2. A description of Hazardous Waste Determination can be found in Section 2, Definition of Acceptable Fill Material, of the HDOH HEER Office fill material guidance (HDOH, October 2011).

The proper relocation or disposal of the soil depends on the category in which the soils fall. Soils for the HRTP may fall into one of the following three categories:

- Non-Regulated Soil
- Regulated, Non-Hazardous Soil
- Hazardous Waste

Non-Regulated Soil

Non-regulated soils are soils that do not contain COPCs above the HDOH Tier 1 EALs for unrestricted use within 150 meters (approximately 500 feet) from surface water and over a drinking water source. After background information has been gathered regarding the potential for contamination in an area and testing has demonstrated that soil do not contain detectible COPCs, non-regulated soil can be reused within the Work Area or Rail Corridor or offsite. Sampling will be required before reuse in sensitive areas. Further guidance on the use of non-regulated soil as fill is provided in “Guidance for the Evaluation of Imported and Exported Fill Material, Including Contaminant Characterization of Stockpiles” (HDOH, October 2011).

Regulated, Non-Hazardous Soil

If the soil contains any contaminants above the Tier 1 EALs for unrestricted use within 150 meters (approximately 500 feet) from surface water and over a drinking water source or the Tier 1 EALs for commercial/industrial use, it will most likely be considered regulated, non-hazardous waste. If the soil only exceeds the unrestricted EALs, and not the commercial/industrial EALs, it can be used within the Work Area and in some instances with prior approval, within the Rail Corridor, treated until the contaminant concentrations are below the Tier 1 EALs for unrestricted use within 150 meters (approximately 500 feet) from surface water and over a drinking water source, or disposed at a permitted landfill. If the contaminant concentrations exceed both unrestricted and commercial/industrial EALs, the soil can be used within the Work Area (if not grossly contaminated), treated to reduce concentrations to below Tier 1 EALs, or disposed at a permitted landfill. Mixing soils containing COPCs with soils that do not contain COPCs to reduce concentrations violates state and federal law.

Treatment of soil will require additional coordination with HDOH to identify permitting requirements, treatment methods and locations, best management practices at treatment locations, follow up testing, and other pertinent requirements.

Hazardous Waste

Hazardous wastes are defined in the Hawaii Hazardous Waste regulations of HAR 11- 261 under two major categories: characteristic wastes and listed wastes. As defined in HAR 11-261 Subchapter C, characteristic hazardous wastes are materials that exceed one or more of the following four hazardous traits as defined by the USEPA:

- Ignitability (that is, flammability)
- Reactivity
- Corrosivity
- Toxicity

"Listed hazardous wastes" are materials specifically identified by the HDOH in HAR 11-261 Subchapter D. The waste can come from non-specific sources, specific sources, or discarded chemical products. If soil has become contaminated by a listed waste, the soil must be managed as a listed waste.

In some areas along the HRTP route, soils that are excavated might be tested and determined to be hazardous waste. Examples of soils that may be determined to be hazardous waste include soil generated from spill or release sites associated with former dry cleaning facilities (contaminated with F-listed, spent solvents) or PCB releases. Note that PCB spills fall under the PCB regulations in 40 CFR 761 (not the hazardous waste regulations discussed here); however, requirements are similar.

Soils that are deemed hazardous waste must either be (1) treated to remove hazardous constituents until they no longer exhibit hazardous waste characteristics and no longer contain the listed hazardous waste or (2) be transported, treated, and disposed of at a permitted hazardous waste landfill on the continental U.S. Mixing hazardous waste soils with other soils to reduce contaminant concentrations violates state and federal law (HAR 11-268-3).

Soil with contaminant concentrations (based on laboratory analytical results using Toxicity Characteristic Leaching Procedure [TCLP] Method 1311) that exceed USEPA Toxicity Characteristic levels will carry a hazardous waste code under HAR 11-261-24, D04 through D052. This waste will require special handling and disposal.

A hazardous waste profile will be generated by the designated disposal facility that details the characteristic chemical composition of the investigation-derived waste (IDW) and determines the appropriate disposal procedures. This profile will be reviewed and signed by HART or its designee. The disposal facility will then create a hazardous waste manifest form and arrangements will be made to transport and dispose of the waste. The generator of the waste will need to sign off on the shipping manifest forms.

5.4.6 Engineering and Administrative Controls

If stations, the MSF, or other buildings or areas are underlain by soil containing volatile COPCs that pose a vapor intrusion concern, they will require a site-specific EHMP and may need to be equipped with either passive or active methods to prevent infiltration and accumulation of vapors in confined spaces.

Dust and vapor control methods may be needed during open-trench excavation work. These controls include minimizing the size of excavations, installing utilities and backfilling excavations on an expedited schedule, covering soil stockpiles with plastic sheeting, controlling vapor emissions with ventilation, and spraying water to suppress dust.

In most areas, Level D PPE will be appropriate for workers during construction and while loading, transporting, disposing, and managing soils. If COPCs exceed threshold concentrations, the PPE will be

upgraded to Level C. The criteria for doing so are identified in the project HSP, and in the Vapor Management Plan (Section 5.9).

5.4.7 Periodic Inspections and Preventive Maintenance

Regular and routine inspections of contaminated soil management practices are needed to ensure compliance and to make adjustments in work procedures. Where workers could be exposed to contaminated soil (for example, open excavations, drilling, and soil stockpiles), an inspection should occur daily. Documentation shall include a waste tracking log that includes unique identification number for each separate stockpiled material, approximate volumes, maintenance of any signage/marking, and the status of waste characterization and disposal.

Waste soil containment areas should be inspected daily. When weather reports indicate that wind velocities might exceed 20 miles per hour (mph) within the next 24 hours, the condition of covers and anchors over stockpiled soil must be inspected before the wind event, and at 12-hour increments as long as wind velocities are greater than 20 mph. When damage or defects to any component of the controls needed to prevent exposure to or release of contaminated soil are detected, repairs must take place immediately.

PPE must be inspected for damage and defects before use. If a defect or damage is identified, it must be replaced.

5.4.8 Recordkeeping and Reporting

Appendix D-4, Soil Management Plan, provides guidelines for managing soil. All records related to soil management shall be documented in Appendix D-10, Post-Construction Environmental Reporting Form. Detailed records of workspace monitoring, excavation conditions, the approximate dimensions and contents of soil stockpiles, and response activities must be maintained. If changes in the contaminated soil handling procedures are needed, the conditions warranting the change must be reported to supervisors, and adjustments must be made after approval is received from the responsible person identified in Section 6.All soil removed from an excavation and reused onsite (within the Work Area or Rail Corridor) or offsite must be tracked and reported. Contaminated soil must be tracked even if it is replaced into the excavation where it was generated. The tracking information will be provided to the HEER office periodically throughout the project in accordance with reporting requirements in Section 6 of this document and will be included in the final project EHMP. HART will track the movement of soil and groundwater within the Work Area and Rail Corridor, and offsite. All contamination within the HRTP will be managed long term via a post-construction EHMP.

When evidence of soil contamination is found while constructing the HRTP the results of any testing, a description of the depth at which the contaminated soil was found, and other observations by field crews and the onsite environmental manager shall be reported to HDOH Contaminated soil will also be reported to HDOH-HEER as a release in accordance with Section 6 of this document. Appendix D-11, Release Response Plan, provides guidelines for reporting releases and information on releases shall be documented in Appendix D-12, Release Report Form.

5.5 Groundwater Management Plan

This groundwater environmental hazard management plan is intended to help ensure that contaminated groundwater encountered during construction is properly managed. Potential hazards created by contaminated water include direct exposure, ingestion of water containing COPCs, inhalation of volatile COPCs released from water, aquatic hazards caused by a release to a surface water body, and releases of COPCs to the environment through contact of water with contaminated soil.

Contaminated groundwater has been discovered while drilling geotechnical test borings, and through prior environmental studies for properties along the HRTP route. The known COPCs include petroleum substances, chlorinated solvents, and heavy metals. Other contaminating substances are also expected to be encountered while drilling boreholes to install column foundations. Some groundwater contamination can be detected through visual observation or by smell, but the presence of other COPCs, such as elevated concentrations of heavy metals, may be less apparent.

5.5.1 Planning

Before performing any subsurface work, parties should:

- Review Appendix D-2, Pre-Construction Environmental Screening Form completed by HART

If the results of Pre-Construction Environmental Screening Form identify the potential for contaminated soil, the contractor shall:

- Complete, review and sign Appendix D-5, Groundwater, Storm Water and Decontamination Water Management Plan
- Complete and review Appendix D-11, Release Response Plan

If contaminated groundwater is encountered, notify HART and HDOH in accordance with Section 6.0.

5.5.2 General Guidelines

In areas where contaminated groundwater is encountered and must be removed as part of the construction process, safe work practices and HDOH and USEPA regulations and guidelines will control how the water is managed. Further work should proceed only when the contractor has ensured that the following precautions and preparations are in place:

- Advanced planning and coordination for obtaining permits, such as the UIC permit and Notice of Intent (NOI) under the National Pollutant Discharge Elimination System (NPDES) General Permit program, have been conducted.
- The HDOH HEER office will be notified at least 30 days before construction activities in areas where contaminated groundwater is suspected or anticipated. If unknown and unsuspected contamination is found while building the HRTP, HDOH HEER will be notified immediately.
- Field oversight is provided to identify contaminated groundwater, manage the disposal of groundwater, and provide health and safety guidance related to the potential exposure of workers to COPCs.
- Workers have the appropriate level of PPE.
- Water encountered during excavation, used in construction activities, or leached from soil stockpiles can be contained and returned to the aquifer if contaminant concentrations are acceptably low, treated at the site until contaminant concentrations are reduced to acceptable levels and then reinfiltrated, or removed for offsite treatment and disposal.

Water generated during dewatering or other activities should be either immediately reinfiltrated/reinjected into the aquifer or stored in appropriate containers pending sampling, analysis, treatment, and discharge in compliance with City and County of Honolulu, HDOH, or USEPA regulations and permits. It is important to note that an existing dewatering permit may not include sampling and analytical requirements for contaminants encountered. Additional coordination should be conducted with an environmental professional and the regulatory agency to ensure that water is properly characterized before reinfiltration/reinjection at the site or disposal.

5.5.3 Field Screening and Exposure Monitoring

Exposure limits are based on OSHA PELs or other more stringent published government agency exposure limits adopted by the contractor.

The exposure monitoring plan is included in contractor HSPs. Contractors will monitor vapor concentrations using a PID, and respond to elevated concentrations based on the readings.

5.5.4 Groundwater Handling, Treatment and Disposal

Contaminated water removed during dewatering or when drilling boreholes for column foundations should be captured and contained for subsequent treatment and disposal. Containment areas for contaminated water must be protected by secondary containment systems.

Groundwater and drilling fluid pumped from boreholes and trenches during construction work along the HRTP route should be handled in one of five ways:

1. Reinfiltration within Work Area
2. Reinjection into the same aquifer within Work Area under UIC permit
3. Treatment and release to the sanitary sewer system under discharge permit
4. Discharge to storm drains or surface water (if proposed, additional coordination with HDOH Clean Water Branch and a NPDES General Permit will be required)
5. Offsite Disposal

5.5.4.1 Reinfiltration of Water within Work Area

Under many circumstances, contaminated groundwater can be reinfiltrated within the Work Area as long as it will not result in contamination of previously unaffected areas. However, methods must be evaluated to determine if a UIC permit is necessary. Advanced coordination with the City and County of Honolulu and the HDOH Safe Drinking Water Branch (SDWB) must occur before reinfiltration or reinjection. Subject to approval from SDWB, the use of existing UIC injection wells may also be considered as long as use of existing UIC injection wells will not spread contamination away from the site and contiguous aquifer.

The reinfiltration of groundwater into the aquifer within the Work Area where it was removed can be done pursuant to HDOH regulations (TGM, Section 5.8). These processes require coordination with jurisdictional agencies such as the CWB and SDWB of HDOH and the City and County of Honolulu. Several conditions must be met before this is done, as follows:

- The wastewater may not be classified as hazardous waste pursuant to federal or state law. Hazardous waste, regardless of its source, must be either managed offsite at an appropriately permitted facility or stored securely onsite until removal or disposal options are identified.
- Any free product or other gross contaminants are removed before reinfiltration.
- The selected location to reinfiltrate is within 100 feet of the excavation, well, or borehole where the water was generated (this includes wash water from decontamination activities).
- Advanced clearance from the SDWB if any portion of a reinfiltration trench is deeper than 10 feet.

If construction of UIC wells is needed, SDWB permit requirements must be met for well construction, placement, use, and closure:

- The water will be reinfiltrated into the Work Area where it was generated.

After water has been reinfiltrated, the site must be restored. If the water has been injected via a cased well, the well casing must be removed after the injection process. If the water is returned to the aquifer via a reinfiltration trench, pit, or hole deeper than 10 feet and/or considered to be a UIC well (deeper than it is wide), this cavity must be filled using approved cementitious backfill material.

5.5.4.2 Reinjection of Water within Work Area or Contiguous Area and Aquifer

Reinjection within the Work Area may be possible as long as it will not result in contamination of previously unaffected areas. Reinjection refers to the placement of water into a trench, hole, or cased well that is deeper than it is wide but may also apply if a trench is deeper than 10 feet and where a UIC permit is necessary. Advanced coordination with the City and County of Honolulu and the HDOH Safe Drinking Water Branch (SDWB) must occur before reinfiltration or reinjection. Subject to approval from SDWB, the use of existing UIC injection wells may also be considered as long as use of existing UIC injection wells will not spread contamination away from the site and contiguous aquifer.

The reinfiltration of groundwater into the aquifer within the Work Area where it was removed can be done pursuant to HDOH regulations (TGM, Section 5.8). These processes require coordination with jurisdictional agencies such as the CWB and SDWB of HDOH and the City and County of Honolulu. Several conditions must be met before this is done, as follows:

- The wastewater may not be classified as hazardous waste pursuant to federal or state law. Hazardous waste, regardless of its source, must be either managed offsite at an appropriately permitted facility or stored securely onsite until removal or disposal options are identified.
- Any free product or other gross contaminants are removed before reinfiltration.
- The selected location to reinfiltrate is within 100 feet of the excavation, well, or borehole where the water was generated (this includes wash water from decontamination activities).
- Advanced clearance from the SDWB if any portion of a reinfiltration trench is deeper than 10 feet.

The water will be reinfiltrated into the Work Area where it was generated. After water has been reinfiltrated, the site must be restored. If the water has been injected via a cased well, the well casing must be removed after the injection process. If the water is returned to the aquifer via a reinfiltration trench, pit, or hole deeper than 10 feet and/or considered to be a UIC well (deeper than it is wide), this cavity must be filled using approved cementitious backfill material. If construction of UIC wells is needed, SDWB permit requirements must be met for well construction, placement, use, and closure. UIC wells may be used, but advance planning and approval are required. SDWB permit requirements must be met for well construction, placement, use, and closure.

5.5.4.3 Discharge to Sanitary Sewer

If treated water is to be discharged to the sanitary sewer system, prior approval must be obtained from the City and County of Honolulu Department of Environmental Services and the sanitary sewer discharge criteria limits specified under the Revised Ordinance of Honolulu (ROH) Section 14-1.9 must be met. Analytical requirements for the groundwater to be discharged may be based on knowledge of contamination within the vicinity of the Work Area. At a minimum, all water discharged to sanitary sewers must be analyzed for constituents related to petroleum and solvents.

5.5.4.4 Discharge to Storm Drains

If discharge to a storm drain or surface water is proposed, additional coordination with HART and HDOH Clean Water Branch (CWB) will be required, and an NOI for NPDES coverage must be submitted to and approved by HDOH before discharge. The NOI must include a dewatering plan. Before discharge into an

aquatic habitat, the water will be tested and, if necessary, treated to address contamination. If discharge water was generated within regulated contaminated areas, additional coordination with HDOH HEER is required and Aquatic Habitat Goals (Chronic Toxicity) will apply to discharge within these areas, in addition to any criteria applicable to the NPDES General Permit.

NPDES General Permit requirements are not covered in this plan and must be coordinated separately through the CWB. Treatment and disposal under an NPDES permit must meet the following requirements:

- The water must be analyzed for known or suspected contaminants based on knowledge of contamination within the vicinity of the Work Area. The results must be screened against the Aquatic Habitat Goal (Chronic Toxicity) for Surface Water Bodies, in Table D of Volume 1 of HDOH "Screening for Environmental Hazards at Sites with Contaminated Soil and Groundwater" (Fall 2011 updates, revised January 2012).
- Treatment must reduce the concentrations of all COPCs below limits specified by the NPDES permit. Other requirements of the NPDES permit may include meeting criteria for pH, turbidity, temperature, dissolved oxygen, and total suspended solids.

5.5.4.5 Offsite Disposal

Water generated during project activities must be treated and disposed of if reinjection or reinfiltration into the aquifer at the Work Area from which it was generated is impracticable. Reasons for impracticability may include the depth of the water table, time requirements, or other logistical difficulties.

Should disposal become necessary, the groundwater will be stored onsite in appropriate containers (for example, 55-gallon drums, Baker tanks), characterized (e.g., using generator knowledge, field screening, or laboratory analysis) to determine the disposal options, and disposed of properly at approved offsite facilities. Waste characterization, profiles, and manifests will be coordinated with HART before transport and disposal.

5.5.5 Engineering and Administrative Controls

Volatile COPCs in water discharged from excavations could emit vapors at unsafe concentrations. The emission of vapors into the workplace should be monitored by an onsite environmental professional or industrial hygienist. Vapor control methods (for example, vapor suppressants) to control the emissions of volatile COPCs from water are unlikely to be needed during construction. However, if elevated concentrations of volatile chemicals are observed, workers should leave the area and the area should be vented until the COPC concentrations are acceptable.

In most areas, Level D PPE will be appropriate for workers during construction and while loading, transporting, disposing, and managing contaminated soils and groundwater. If COPCs exceed threshold concentrations, the PPE will be upgraded to Level C. The criteria for doing so are identified in the project HSP. Respiratory protection and vapor monitoring are described in the Vapor Management Plan (Section 5.9).

5.5.6 Periodic Inspections and Preventive Maintenance

Regular and routine inspections of the procedures used to capture, store, treat and dispose of water are needed to ensure compliance with this plan and to make any needed adjustments in work procedures. All water treatment processes should occur in secure areas with regular surveillance. Containers, transfer pipes and hoses, and any treatment systems should be inspected for leakage or other

deficiencies. In active construction areas, review of the procedures being followed and inspection of equipment should occur each workday.

PPE must be inspected for damage and defects before use. If defects or damage are identified, it must be replaced.

5.5.7 Recordkeeping and Reporting

This plan, alongside Appendix D-5, Groundwater, Storm Water and Decontamination Water Management Plan, provides guidelines for managing groundwater. All records related to groundwater management shall be documented in Appendix D-10, Post-Construction Environmental Reporting Form. Detailed records of workspace monitoring activities, spill response activities, and water storage, treatment, and disposal processes must be maintained. If changes in the contaminated water handling procedures are needed, they must be reported to supervisors and adjustments must be made in conformance with the project plan.

When evidence of groundwater contamination is found while constructing the HRTP the results of any testing, the depth at which the contaminated groundwater was found, and other observations by field crews and the onsite environmental manager must be submitted to HDOH for their records. Contaminated groundwater shall be reported to HDOH-HEER as a release in accordance with Section 6.0 of this document. Appendix D-11, Release Response Plan, provides guidelines for reporting releases, and information on releases shall be documented in Appendix D-12, Release Report Form.

5.6 Stormwater Management Plan

This plan describes the measures needed to control stormwater in construction areas. Preventing stormwater from coming into contact with contaminated media is the primary objective. The following types of conditions can create this risk:

- Stormwater washing contaminated soil from pavement, unpaved areas, or soil piles and carrying particulate matter to storm sewers and surface waters, thus impacting aquatic species
- Stormwater leaching through stockpiled soils and flowing to surface water
- Stormwater leaching through soil stockpiled on an unsealed surface transmitting COPCs into underlying soils and water-bearing zones
- Stormwater entering soil stored in lined roll-off boxes generating contaminated water that could leach out at storage facilities or final disposal locations

5.6.1 Planning

Before performing any construction work, parties should:

- Review Appendix D-2, Pre-Construction Environmental Screening Form completed by HART

If the results of Pre-Construction Environmental Screening Form identify the potential for contaminated soil, the contractor shall:

- Complete, review and sign Appendix D-5, Groundwater, Storm Water and Decontamination Water Management Plan
- Complete and review Appendix D-11, Release Response Plan

If contaminated stormwater is encountered, notify HART and HDOH in accordance with Section 6.0.

5.6.2 Stormwater Management

If stormwater remains uncontaminated, it is not considered hazardous even if it falls in active Work Areas. Only when stormwater encounters contaminated soil or water is a risk created by its runoff. This plan has been developed to identify how contact of stormwater with contaminated soil or groundwater can be prevented and to provide appropriate response methods if contact does occur.

Contaminated stormwater allowed to leave construction areas could expose downstream individuals and ecological receptors to COPCs and can transport free product to surface waters. Although stormwater runoff carrying large amounts of uncontaminated soil and non-hazardous water from construction areas could create hazards for downgradient receptors, the potential for impacts increases when the soil or groundwater is contaminated. Any water containing free product will be pumped to drums, tanks, or other containers and properly stored, transported and disposed of.

The best methods to prevent environmental impacts from stormwater are to control the release of contaminated soil and groundwater, and to prevent contact of stormwater with contaminated soil or water during rainfall events. The following activities are recommended:

- Contaminated soil stored in dump containers or roll-off boxes that will not be immediately transported for disposal should be covered as soon as the box has been filled and then mechanically anchored.
- Uncontained soil stockpiles should be created by laying down 10-mil polyethylene plastic sheeting in designated soil stockpiling areas. When multiple sections of plastic sheeting are needed to create a stockpile base the sheets should overlap by at least 1 foot, with the uphill sheet on top. The edges of the plastic sheeting must be underlain by bermed soil high enough to contain stormwater runoff. The stockpile must be covered at the end of each day or before a rain event with well-anchored plastic sheeting to reduce the potential for dust generation and to prevent contact with stormwater. Plastic covers should be anchored outside the bermed area and be able to withstand strong winds.
- Work Areas and contractor yards within the Rail Corridor should be continually inspected to identify contaminated media that has been released outside of designated stockpile areas and could be exposed to stormwater. Any released media identified through inspection must be removed completely and placed in appropriate stockpiles. Engineered stormwater controls should be constructed to divert runoff water from active Work Areas. The control measures should be inspected each day to evaluate their adequacy.
- Open excavations should be backfilled as soon as practicable to prevent stormwater and direct precipitation from entering the excavation. When possible, open excavations should be bermed or otherwise protected from stormwater. Inspect excavations daily to ensure their protection from stormwater.
- Regularly monitor weather throughout the day for signs of approaching storms and/or heavy rains.

5.6.3 Field Screening and Exposure Monitoring

Exposure limits are based on OSHA-PELs or other more stringent published government agency exposure limits adopted by the contractor.

The exposure monitoring plan is included in contractor HSPs as well as their NDPES General Permit pollution prevention plans. Contractors will monitor vapor concentrations using a PID and respond to elevated concentrations based on the readings.

5.6.4 Engineering and Administrative Controls

The engineering controls identified in Section 5.8 of the TGM (HDOH, 2009) are recommended to prevent stormwater from entering construction areas and to capture stormwater that has become contaminated. Additional precautions to mitigate contaminated stormwater runoff include the following.

- Availability of moveable booms to contain spills
- Use of absorbent pads or booms if free product is observed in stormwater runoff

5.6.5 Periodic Inspections and Preventive Maintenance

A key component of the plan is routine inspections. Areas where stormwater could encounter contaminated media (for example, open excavations or soil stockpiles) should be inspected daily. During storm events, additional inspections should be conducted to ensure that stormwater runoff and direct precipitation do not encounter soil stockpiles or enter open excavations. If stormwater encounters contaminated material, the captured water should be contained and treated before disposal.

Storage containers, vehicles, and heavy equipment should be cleaned regularly and inspected to identify possible leaks that could release petroleum-based products or other hazardous substances. Defective or leaking equipment must be repaired or replaced.

Although not designed to remove COPCs from water, sediment control filter fabric at all storm drain inlets could help control the release of oils, greases, and other insoluble COPCs. Moveable petroleum-absorbent booms should be maintained and regularly inspected. General site inspections should be periodically performed and documented. During prolonged rainfall, daily or more frequent inspections may be needed.

5.6.6 Recordkeeping and Reporting

This plan, alongside Appendix D-5, Groundwater, Storm Water and Decontamination Water Management Plan, provides guidelines for managing stormwater. All records related to stormwater management shall be documented in Appendix D-10, Post-Construction Environmental Reporting Form. Detailed records of storm events, inspections of engineering controls, repairs, and response activities must be maintained. If changes in stormwater management procedures are needed, they should be reported to site supervisors and adjustments in the management program should be made. Appropriate governmental regulators must be notified if contaminants are released during storm runoff events.

5.7 Decontamination Water Management Plan

During construction of the HRTP, water (referred to as decontamination or wash water) will be used to wash soil and groundwater from equipment used in contaminated areas. Even where soils or groundwater are not contaminated, the unrestrained discharge of wash water containing high particulate loads could damage the environment.

5.7.1 Planning

Before performing any construction work, parties should:

- Review Appendix D-2, Pre-Construction Environmental Screening Form completed by HART

If the results of Pre-Construction Environmental Screening Form identify the potential for contaminated soil, the contractor shall:

- Complete, review and sign Appendix D-5, Groundwater, Storm Water and Decontamination Water Management Plan

- Complete and review Appendix D-11, Release Response Plan

If contaminated water is encountered, notify HART and HDOH in accordance with Section 6.0.

5.7.2 General Guidelines

Decontamination water should be contained and properly disposed of in one of three ways:

- Onsite treatment and reinfiltration or reinjection into the aquifer. Contaminated groundwater cannot be allowed to contaminate clean soil, groundwater, or surface water.
- Offsite treatment or recycling.
- Treatment and release to sanitary sewers. However, no water will be discharged to sanitary sewers without prior coordination and obtaining necessary approvals and permits.

No decontamination water will be discharged to storm drains or surface water.

5.7.3 Injection or Reinfiltration of Decontamination Water

The reinjection or reinfiltration of wash water can be done pursuant to HDOH regulations (TGM, Section 5.8). These processes require coordination with jurisdictional agencies such as the CWB and SDWB of HDOH and the City and County of Honolulu. Several conditions must be met before this is done, as follows:

- The water may not be classified as hazardous waste pursuant to federal or state law. Hazardous waste, regardless of its source, must be either managed offsite at an appropriately permitted facility or stored securely onsite until remedial action completed.
- No grease, oil, other free product, or gross contaminants may be present in the decontamination water. If present, they must be removed before reinjection or reinfiltration.
- The selected location to reinject or reinfiltrate wash water must be within 100 feet of the excavation, well or borehole where the contaminated soil or water being washed from the equipment was generated.
- The water must be returned to the same aquifer from which the contaminants came.
- The water can either be reinfiltrated into the aquifer from which it came or placed in an HDOH-approved reinfiltration hole, trench, or pit.

After water has been reinfiltrated, the site must be restored. If the water has been reinfiltrated via a cased well, the well casing must be removed after the reinfiltration process. If the water is returned to the aquifer via a trench, pit, or hole, the cavity must be filled using approved backfill material.

5.7.4 Field Screening and Exposure Monitoring

Exposure limits are based on OSHA-PELs or other more stringent published government agency exposure limits adopted by the contractor.

The exposure monitoring plan is included in contractor HSPs. Contractors will monitor vapor concentrations using a PID and respond to elevated concentrations based on the readings.

5.7.5 Engineering and Administrative Controls

Volatile COPCs in decontamination water could emit vapors at unsafe concentrations. The emission of vapors into the workplace should be monitored by an onsite environmental professional or industrial hygienist. Vapor control methods (for example, vapor suppressants) to control the emissions of volatile COPCs from water are unlikely to be needed during construction. However, if elevated concentrations of

volatile chemicals are observed, workers should leave the area and the area should be vented until the COPC concentrations are acceptable.

In most areas, Level D PPE will be appropriate for workers during construction and while loading, transporting, disposing, and managing contaminated decontamination water. If COPCs exceed threshold concentrations, the PPE will be upgraded to Level C. The criteria for doing so are identified in the project HSP. Respiratory protection and vapor monitoring are described in the Vapor Management Plan (Section 5.9).

5.7.6 Periodic Inspections and Preventive Maintenance

Regular and routine inspections of the procedures used to capture, store, treat and dispose of water are needed to ensure compliance with this plan and to make any needed adjustments in work procedures. All water treatment processes should occur in secure areas with regular surveillance. Containers, transfer pipes and hoses, and any treatment systems should be inspected for leakage. In active construction areas, review of the procedures being followed and inspection of equipment should occur each workday.

PPE must be inspected for damage and defects before use. If defects or damage are identified, it must be replaced.

5.7.7 Recordkeeping and Reporting

This plan, along with Appendix D-5, Groundwater, Storm Water and Decontamination Water Management Plan, provides guidelines for managing decontamination water. All records related to water management shall be documented in Appendix D-10, Post-Construction Environmental Reporting Form. Detailed records of workspace monitoring activities, spill response activities, and water storage, treatment, and disposal processes must be maintained. If changes in the contaminated water handling procedures are needed, they must be reported to supervisors and adjustments must be made in conformance with the project plan.

5.8 Free Product Management Plan

Free product may be encountered in former petroleum storage areas during construction of the HRTP. It exists when liquids with densities less than or greater than water are present, and may be readily evident by strong odors of hydrocarbon compounds, and visual evidence of (1) flowing free product (for example, black or brown petroleum product), (2) a thin layer of free product (for example, black or brown petroleum product), (3) a discontinuous layer of product (for example, spots or globules of petroleum product), or (4) a petroleum hydrocarbon sheen (for example, spots or a rainbow-colored haze on the surface of water). Vapors emitted from the excavation area may contain benzene, toluene, ethyl benzene, xylene, methane, total petroleum hydrocarbons, or other toxic or potentially explosive substances. The presence of free product increases both the risk of exposure, and the risk of a possible fire or explosion particularly in confined spaces such as trenches or walled structures.

5.8.1 Planning

Before performing any excavation work, parties should:

- Review Appendix D-2, Pre-Construction Environmental Screening Form completed by HART

If the results of Pre-Construction Environmental Screening Form identify the potential for free product, the contractor shall:

- Complete, review, and sign Appendix D-6, Free Product Management Plan
- Complete and review Appendix D-11, Release Response Plan

If free product is encountered, notify HART and HDOH in accordance with Section 6.0.

5.8.2 General Guidelines

An effective method to prevent the accumulation of explosive vapors in open trenches is to capture and either remove the free product or remove the water containing free product before vapors can accumulate and vapor concentrations can rise above explosive levels. This can be accomplished by pumping water containing free product to drums, tanks, or other containers. Absorption pillows or mats can also be used to capture the hydrocarbons, or with supplied ventilation within the trench.

In cased boreholes, free product will most often be present only when excavating soil within one to two feet of the uppermost groundwater surface. Because the outer casing isolates the boring or excavation from the surrounding soil, the free product typically quickly diminishes as further excavation work proceeds. If work progresses without delay, an accumulation of free product is unlikely.

In uncased, open boreholes, free product may continue to flow into the borehole even after the drilling advances past the water table. In these situations, the drilling methods may need to be changed to include cased methods or other means to isolate the borehole from the surrounding areas that contain free product.

The basic procedures needed to handle contaminated soil and groundwater should guide the preparation of Work Areas for addressing free product. In addition to following safe work practices, the Work Area should be monitored using an explosimeter, which measures the concentrations of explosive gases. A Class A-B-C fire extinguisher should be present onsite at all times, and intrinsically safe equipment should be utilized where vapors may be present. Because of the potentially extensive regulatory requirements, and because many fire suppression foams are groundwater and surface water contaminants, contractors that intend to use fire suppression foam in the event of a fire must identify their intent in advance and provide additional details including manufacturer literature and/or safety data sheets at least 30 days before fieldwork. Additionally, the use of fire suppression foam will not be used as a means to suppress vapors. When free product is anticipated or encountered in the field, the contractor will notify HART and HART will notify HDOH in accordance with the Release Reporting requirements (Section 6).

5.8.3 Field Screening and Exposure Monitoring

The exposure limits are based on OSHA-PELs or other more stringent published government agency exposure limits adopted by the contractor.

The exposure monitoring plan is included in contractor HSPs. Contractors will monitor vapor concentrations using a PID, and respond to elevated concentrations based on the readings.

5.8.4 Free Product Management

Free product will be removed to the extent practicable. If free product is found during construction, several additional procedures should be undertaken beyond those identified in the procedures for handling contaminated soil and groundwater. These include the following:

- The ambient air space within the Work Area should be monitored for evidence of an explosive environment.
- Stop work and report the release in accordance with HAR 11-451, as described in Section 6.0 and Appendix D-11, Release Response Plan, of this document. Return to work when advised by the State On-Scene Coordinator.

- All precautions should be taken to prevent release or spread of petroleum hydrocarbon products.
- Methods of free product removal include but are not limited to use of absorbents, skimming, water table depression, vapor extraction/groundwater extraction and dual-phase recovery.
- Following completion of product recovery, absorbent pads, socks or other apparatus should be allowed to dry and be properly disposed of.
- Recovered fuel should be tested and disposed of offsite at approved waste disposal or blending/reuse facilities in accordance with applicable regulations.
- Temporary storage, transport, and disposal of recovered petroleum may require additional labeling, containment, placarding, and permits in accordance with applicable regulations.

A detailed plan for free product removal may need to be developed by the contractor if free product is encountered during construction. Additional information about free product removal can be found in the 1996 USEPA guidance document "How to Effectively Recover Free Product at Leaking Underground Storage Tank Sites: A Guide for State Regulators."

5.8.5 Engineering and Administrative Controls

Although free product might be encountered while installing column foundations and relocating utilities, with normal work progression, explosive vapors associated with free product are unlikely to accumulate in confined spaces. If they do accumulate, vapors increase the risk of fire and explosion. Accordingly, if free product is encountered, the workspace atmosphere must be monitored with an explosimeter to ensure that vapor concentrations do not exceed the LEL.

In most areas, Level D PPE will be appropriate for workers during construction and while loading, transporting, disposing, and managing soils. If COPCs exceed threshold concentrations, the PPE should be upgraded to Level C. The criteria for doing so are identified in the project HSP. Respiratory protection and vapor monitoring are described in the Vapor Management Plan (Section 5.9).

5.8.6 Periodic Inspections and Preventive Maintenance

Regular and routine inspections of the procedures needed to capture, store, treat and dispose of water and soil should be used to detect and address free product if it is found. When free product is identified, the environmental professional or industrial hygienist should complete an initial evaluation of the explosive concentrations within all confined spaces in the area, and they should regularly monitor work spaces until the risk posed by the free product passes.

5.8.7 Recordkeeping and Reporting

This plan, alongside Appendix D-6, Free Product Management Plan, provides guidelines for managing free product. All records related to free product management shall be documented in Appendix D-10, Post-Construction Environmental Reporting Form. Detailed records of workspace monitoring (including LEL measurements), product recovery and response activities must be maintained. If changes in the free product handling procedures are needed, they must be reported to supervisors, and adjustments must be made.

The existence of free product creates risks beyond those related to the construction of the HRTP. Accordingly, upon discovery of free product, HDOH should be notified of the field conditions that are observed so that they may take additional action beyond what is required for the construction work.

Free product shall be reported to HDOH-HEER as a release in accordance with Section 6.0 of this document. Appendix D-11, Release Response Plan, provides guidelines for reporting releases, and information on releases shall be documented in Appendix D-12, Release Report Form.

5.9 Vapor Management Plan

This plan describes the necessary controls to minimize the exposure of workers to hazardous vapors, and reduce the risk of explosions and fires created by COPCs. Included are procedures to detect and mitigate potential fire and explosion hazards posed by explosive vapors.

5.9.1 Planning

Before performing any subsurface work, parties should:

- Review Appendix D-2, Pre-Construction Environmental Screening Form completed by HART

If the results of Pre-Construction Environmental Screening Form identify the potential for contaminated soil, the contractor shall:

- Complete, review and sign Appendix D-7, Vapor Management Plan
- Complete and review Appendix D-11, Release Response Plan

If hazardous vapors are encountered, notify HART and HDOH in accordance with Section 6.0.

5.9.2 General Guidelines

The purpose of the vapor management plan is to identify and address volatile substances that could degrade air quality, or create dangerous conditions during construction activities. The principal hazards posed by volatized COPCs above are direct exposure through inhalation, flammability and explosivity. Although naturally-occurring methane (an explosive gas) could exist, the sections of the HRTP route with increased concern for vapor hazards are in areas where contaminated soil, contaminated groundwater and free product are encountered.

If volatile COPCs are found during excavation activities, the concentrations of these vapors must be controlled pursuant to HDOH and USEPA regulations and guidelines. The goal of response actions is to ensure workers are not exposed to hazardous volatized COPC concentrations, and that the public is not adversely affected. The tasks needed to manage vapor exposure are summarized below.

- The concentrations of the vapors both within the workspace and at the perimeter of the Work Area need to be monitored.
- Before workers enter an excavation, the monitoring of LEL and VOC vapor concentrations (including benzene) inside the excavation must begin. Air monitoring must continue as long as workers remain in the excavation.
- If air monitoring indicates that vapor concentrations exceed safe threshold levels, workers should leave the excavation until it has been properly vented. It is unlikely work will be required in areas requiring Level C or higher respiratory protection.

5.9.3 Field Screening and Exposure Monitoring

The exposure limits are based on OSHA-PELs or other more stringent published government agency exposure limits adopted by the contractor.

The exposure monitoring plan is included in contractor HSPs. Contractors will monitor vapor concentrations using a PID, and respond to elevated concentrations based on the readings.

Normally, air monitoring should be done using a conventional PID to determine VOC vapor concentrations. If standard PID air testing yields readings above 20 parts per million (ppm), a benzene-specific PID meter should be employed to measure benzene concentrations, and frequency of explosimeter measurements should be increased.

If benzene concentrations at the perimeter of the work zone exceed 0.5 ppm or explosimeter measurements exceed 10 percent of the LEL, active vapor control methods should be initiated. These controls include minimizing the size of excavations, backfilling excavations on an expedited schedule if it can be done safely, and covering soil stockpiles with plastic sheeting.

5.9.4 Engineering and Administrative Controls

Vapors in construction areas often will be diluted by prevailing ambient air and trade winds. Vapor control methods, however, may be needed when construction work exposes contaminated soil. The best way to reduce vapors is through source removal, via methods such as those stated in Section 5.8.1, paragraph 1. Other possible vapor emissions controls include minimizing the size of excavations, backfilling excavations in a timely manner, covering soil stockpiles with plastic sheeting, and dust suppression using applied water.

Level D PPE is expected to be appropriate for workers during construction work. As described above, if VOC concentrations rise above threshold limits, the PPE should be upgraded to Level C.

In addition to respiratory protection, the emission and migration of volatile COPCs should be minimized with engineering controls and safe work practices. Engineering controls include barriers that prevent individuals from unnecessarily entering work zones and the use of recycled air conditioning in automobile and equipment cabs. Safe work practices include monitoring wind direction and having workers stand upwind of VOC vapor sources whenever possible, or instituting a modified work schedule.

5.9.5 Periodic Inspections and Preventive Maintenance

Routine inspections and air monitoring should be used at all locations where the hazardous vapors are likely or suspected (for example, open excavations, soil stockpiles). These areas should be inspected daily.

Conventional and benzene-specific PID instruments require daily calibration. The conventional PID should be calibrated using a 100-ppm isobutylene standard. The benzene-specific PID should be calibrated using a 5-ppm benzene standard, and measurements of the standard must be periodically made to confirm that the PID remains accurate. Records of the recalibrations should be maintained. If test equipment is found to be defective or damaged, it must be repaired or replaced.

PPE and monitoring equipment should be inspected for damage and defects before donning. If respiratory protection is required, a daily positive pressure respirator fit test should be performed at the start of each day and filter cartridges should be replaced regularly. If a defect in or damage to PPE is identified, or a positive pressure respiratory fit test fails, the PPE must be replaced.

5.9.6 Recordkeeping and Reporting

This plan, alongside Appendix D-7, Vapor Management Plan, provides guidelines for vapors. All records related to vapor management shall be documented in Appendix D-10, Post-Construction Environmental Reporting Form. Detailed records of workspace monitoring and changes to PPE requirements must be maintained. Daily monitoring results and sampling locations should be documented in field logs and reported to HART. All workers should be informed of and remain apprised of elevated PID and benzene readings.

The existence of elevated airborne contaminant concentrations creates risks beyond those related to the construction of the HRTP. Accordingly, upon discovery of elevated vapor concentrations, HDOH should be notified of the field conditions that are observed so that it may take additional action beyond what is required for the construction work.

5.10 Debris Management Plan

During the course of the project, the contractor may encounter debris. When debris is encountered, the notification and work processes described in Section 6 will be performed.

Debris may be encountered during the course of construction within the Rail Corridor and may be hazardous or not hazardous. Debris may also require management and/or offsite reuse/recycling/disposal. This section describes the management of debris encountered within the Rail Corridor.

The contractor will manage all debris in a manner that will prevent exposure to project personnel and the public, and cross contamination. Debris may include, but is not limited to, the following:

- Wood
- Asphalt
- Concrete
- Metal
- Glass/Pottery
- Miscellaneous building materials that may include asbestos or lead-based paint

5.10.1 Planning

Before performing any subsurface work, parties should:

- Review Appendix D-2, Pre-Construction Environmental Screening Form completed by HART

If the results of Pre-Construction Environmental Screening Form identify the potential for contaminated soil, the contractor shall:

- Complete, review and sign Appendix D-8, Debris Management Plan
- Complete and review Appendix D-11, Release Response Plan

If contaminated debris is encountered, notify HART and HDOH in accordance with Section 6.0.

5.10.2 General Guidelines

If any unknown or unexpected drum, bottle, or other container suspected of containing petroleum or if a potentially hazardous substance is encountered, stop work immediately and notify the HART POC for further consultation on release reporting, removal, containment, and disposition (refer to Section 5.11).

Debris should be recycled whenever possible. General guidelines for debris are as follows:

- Segregate types of debris for storage and disposal (that is, segregate clearing and grubbing debris from excavated debris and segregate types of excavated debris [metal from concrete, for example]).
- Remove excess soil from debris to the extent practical. Manage excess soil in accordance with Appendix D-4, Soil Management Plan. Note that debris-contaminated soil may fail TCLP and be considered a hazardous waste. Any soil or water generated by decontamination must be managed in accordance with the Soil Management Plan (Section 5.4) or Decontamination Water Management Plan (Section 5.7). Workers will complete and submit Appendix D-10, as specified

in the Record Keeping and Reporting Section. Other materials generated during cleaning (for example, grit blasting) must be stored in containers and will be managed as excess material.

- If the contractor determines that the debris is hazardous (in consultation with the HART POC), the contractor will inform the HART POC where they plan to set up hazardous waste Satellite Accumulation Points (SAPs) and additional coordination with the HDOH SHWB will be required.

Any debris excavated should be reused, sent for recycling or disposal to a HDOH-permitted solid waste management facility after decontamination. Examples of debris that can be recycled include asphalt (for example, crushed and reused as road base), concrete that meets the inert fill definition in HRS 342H-1 (for example, reused to construct a berm or fill), or clearing and grubbing and untreated wood debris (for example, ground up and reused as mulch or compost at landscaped sites along the HRTP corridor). If debris is sent offsite, it must first be decontaminated to the extent practical. Any soil or water generated by decontamination must be managed in accordance with the Soil Management or Water Management Plans, Appendix D-4 and D-5, respectively. Other materials generated during cleaning (for example, grit blasting) must be stored in containers and will be managed as excess material.

5.10.3 Field Screening and Exposure Monitoring

The exposure limits are based on OSHA-PELs or other more stringent published government agency exposure limits adopted by the contractor.

The exposure monitoring plan is included in contractor HSPs. Contractors will monitor vapor concentrations using a PID, and respond to elevated concentrations based on the readings.

5.10.4 Engineering and Administrative Controls

Dust and vapor control methods may be needed during movement or handling of debris. These controls include minimizing the size of excavations, covering stockpiled materials with plastic sheeting, controlling vapor emissions with ventilation, and spraying water to suppress dust.

In most areas, Level D PPE will be appropriate for workers during construction and while loading, transporting, disposing, and managing debris. If COPCs exceed threshold concentrations, the PPE will be upgraded to Level C. The criteria for doing so are identified in the project HSP, and in the Vapor Management Plan (Section 5.9).

5.10.5 Periodic Inspections and Preventive Maintenance

Regular and routine inspections of management practices are needed to ensure compliance and to make adjustments in work procedures. Where workers could be exposed to contaminants associated with debris, an inspection should occur daily. Documentation shall include a waste tracking log that includes unique identification number for each separate stockpiled material, approximate volumes, maintenance of any signage/marking, and the status of waste characterization and disposal.

Debris stockpiles or containment areas should be inspected daily. When weather reports indicate that wind velocities might exceed 20 mph within the next 24 hours, the condition of covers and anchors over stockpiled materials must be inspected before the wind event and at 12-hour increments as long as wind velocities are greater than 20 mph. When damage or defects to any component of the controls needed to prevent exposure to or release of contaminated soil are detected, repairs must take place immediately.

5.10.6 Recordkeeping and Reporting

This plan, along with Appendix D-9, Unanticipated or Unknown Materials Management Plan, provides guidelines for managing debris. All records related to debris management shall be documented in

Appendix D-10, Post-Construction Environmental Reporting Form. Detailed records of workspace monitoring, excavation conditions, the approximate dimensions and contents of soil stockpiles, and response activities must be maintained. If changes in handling procedures are needed, the conditions warranting the change must be reported to supervisors, and adjustments must be made after approval is received.

Contractors should record field observations that include the location of the debris relative to fixed landmarks (GPS coordinates), the depth, diameter, materials of construction, appearance of contents, and any other distinguishing features. The field observations will be provided, with detailed photographs, to the HDOH HEER Office and, if requested, the property owner.

When hazards associated with debris are identified while constructing the HRTP the results of any testing, a description of the hazardous materials, and other observations by field crews and the onsite environmental manager shall be reported to HDOH. Debris shall be reported to HDOH-HEER as a release in accordance with Section 6.0 of this document. Appendix D-11, Release Response Plan, provides guidelines for reporting releases, and information on releases shall be documented in Appendix D-12, Release Report Form.

5.11 Unanticipated or Unknown Materials Management Plan

During the course of the project, the contractor may encounter unanticipated or unknown materials. When any such materials are encountered, the notification and work processes described in Section 6 will be performed.

Previously unknown materials may be encountered during the course of construction within the Rail Corridor and may be hazardous or not hazardous, but still regulated. These unknown materials may also require management and/or offsite reuse/recycling/disposal. This section describes the management of these types of unanticipated or unknown materials that may be encountered within the Rail Corridor.

The contractor will manage all unknown materials in a manner that will prevent exposure to project personnel and the public, and cross contamination. Unknown materials may include, but are not limited to, the following:

- Drums
- Unexpected USTs
- Unexpected Pipelines
- Soils or other materials that appear to contain asbestos

5.11.1 Planning

Before performing any subsurface work, parties should:

- Review Appendix D-2, Pre-Construction Environmental Screening Form completed by HART

If the results of Pre-Construction Environmental Screening Form reveal known USTs or inactive pipelines the contractor shall:

- Complete, review and sign Appendix D-9, Unanticipated or Unknown Materials Management Plan
- Complete and review Appendix D-11, Release Response Plan

If any unanticipated or unknown materials are encountered, notify HART and HDOH in accordance with Section 6.0.

5.11.2 General Guidelines

Upon discovery of an unknown material, the contractor and the HART representative will be immediately notified, work will be stopped, and the area secured as necessary to protect workers or prevent the spread of contamination. Protecting worker and public health and safety and preventing the spread of contamination take precedence over construction costs and delays.

Notify HDOH-HEER office and property owners immediately if any unanticipated or unknown materials or contamination are encountered.

Do not attempt to remove unknown materials. Only a subcontractor experienced in handling unknowns shall handle unknown materials. The unknown materials will be representatively sampled and tested to determine how they can be recycled or disposed of in full accordance with HRS Title 11, 58.1 and Chapters 260-279 and any other state and federal regulation governing this activity.

Any soil, water, or vapor associated with the unknown materials will be handled as discussed in the Soil Management Plan (Section 5.4), Groundwater Management Plan (Section 5.5), Free Product Management Plan (Section 5.8), and Vapor Management Plan (Section 5.9).

5.11.3 Field Screening and Exposure Monitoring

The exposure limits are based on OSHA-PELs or other more stringent published government agency exposure limits adopted by the contractor.

The exposure monitoring plan is included in contractor HSPs. Contractors will monitor vapor concentrations using a PID, and respond to elevated concentrations based on the readings.

5.11.4 Engineering and Administrative Controls

Dust and vapor control methods may be needed during movement or handling of unknown materials. These controls include minimizing the size of excavations, covering stockpiled materials with plastic sheeting, controlling vapor emissions with ventilation, and spraying water to suppress dust.

In most areas, Level D PPE will be appropriate for workers during construction and while loading, transporting, disposing, and managing unknown materials. If COPCs exceed threshold concentrations, the PPE will be upgraded to Level C. The criteria for doing so are identified in the project HSP, and in the Vapor Management Plan (Section 5.9).

5.11.5 Periodic Inspections and Preventive Maintenance

Regular and routine inspections of management practices are needed to ensure compliance and to make adjustments in work procedures. Where workers could be exposed to contaminants associated with unknown materials, an inspection should occur daily. Documentation shall include a waste tracking log that includes unique identification number for each separate stockpiled material, approximate volumes, maintenance of any signage/marking, and the status of waste characterization and disposal.

Waste soil containment areas should be inspected daily. When weather reports indicate that wind velocities might exceed 20 miles per hour (mph) within the next 24 hours, the condition of covers and anchors over stockpiled materials must be inspected before the wind event, and at 12-hour increments as long as wind velocities are greater than 20 mph. When damage or defects to any component of the controls needed to prevent exposure to or release of contaminated soil are detected, repairs must take place immediately.

PPE must be inspected for damage and defects before use. If a defect or damage is identified, it must be replaced.

5.11.6 Recordkeeping and Reporting

This plan, and Appendix D-9, Unanticipated or Unknown Materials Management Plan, provides guidelines for managing debris. All records related to debris management shall be documented in Appendix D-10, Post-Construction Environmental Reporting Form. Parties should record field observations that include the location of the unknown material relative to fixed landmarks (GPS coordinates), the depth, diameter, materials of construction, appearance of contents, and any other distinguishing features. The field observations will be provided, with detailed photographs, to the HDOH HEER Office and, if requested, the property owner.

If changes in handling procedures are needed, the conditions warranting the change must be reported to supervisors, and adjustments must be made after approval is received from the responsible person identified in Section 6.

When hazards associated with unknown materials are identified while constructing the HRTP the results of any testing, a description of the hazardous materials, and other observations by field crews and the onsite environmental manager shall be reported to HDOH. Unanticipated and unknown materials shall be reported to HDOH-HEER as a release in accordance with Section 6.0 of this document. Appendix D-11, Release Response Plan, provides guidelines for reporting releases, and information on releases shall be documented in Appendix D-12, Release Report Form.

All unknown materials removed from an excavation must be tracked. The tracking information will be provided to the HEER office periodically throughout the project and will be included in the final project EHMP. HART will track the movement of unknown materials within the Rail Corridor and offsite.

5.12 Post-Construction Environmental Reporting

Following completion of work in a specific Work Area, contractors will complete Appendix D-10, Post-Construction Environmental Reporting Form. The purpose of post-construction environmental reporting is to track work completion, document and summarize implementation of the individual management plans, and track the volume and final disposition of media generated within a Work Area.

5.13 Release Reporting

Contractors shall complete Appendix D-11, Release Response Plan and Appendix D-12, Release Report Form in accordance with Section 6 if any of the following are encountered:

- Unanticipated inactive pipelines or USTs
- Contaminated soil, water, free product, vapor
- Debris or unanticipated or unknown material

5.14 Deviations Reporting

Contractors shall complete Appendix D-13, Deviation Form to document any deviations from the EHMP including those identified during pre-construction, during construction, and post-construction. Reporting deviations is important to document non-compliance with the EHMP and to identify alternative management practices that may be incorporated into subsequent revisions of the EHMP.

5.14.1 Pre-Construction

Ideally, contractors will identify any proposed deviations in advance of work activities during pre-construction planning. Proposed deviations should be reviewed/approved by HART and communicated with HDOH prior to implementation. HDOH will be allowed at least 30 days to review the revision prior to implementation. Examples of deviations include:

- Work activities that improve upon, or are more stringent than EHMP requirements
- Permit-specific requirements such as BMPs incorporated as part of NPDES General Permit
- Work activities/practices that have been negotiated with regulators and/or stakeholders in separate agreements

5.14.2 During Construction

If deviations were not proposed/planned and are required during construction, contractors will identify the deviations and notify HART immediately in advance of the deviation or in limited instances (e.g., when safety or an environmental release is imminent) during implementation of work activities and complete Appendix D-13, Deviation Form. HART will immediately contact HDOH-HEER by phone and will follow-up in writing within 30 days. HART will determine if the deviation is acceptable or requires corrective action. Examples of deviations during construction include:

- Field changes required because of changing or unsafe Work Area conditions that require stop work and abandonment of Work Area because of dangerous conditions that do not allow for removal of gross contamination
- Field changes required where implementation of an EHMP requirement may compromise the integrity of the Work Area or adjacent structures, e.g., removal of free product or gross contamination may compromise or cause damage to adjacent to buildings, utilities, or natural features

5.14.3 Post-Construction

If deviations are identified post-construction, contractors will identify the deviations and notify HART immediately and complete Appendix D-13, Deviation Form. HART will immediately contact HEER by phone and will follow-up in writing within 30 days. Examples of post-construction deviations include:

- Failure to track disposition of media such as soil reused within the Work Area, Rail Corridor, or offsite (outside the Rail Corridor)

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6. Release Identification, Response, and Reporting

The following process will be used to consistently relay environmental information between HDOH, HART, and their contractors.

6.1 General

The following guidelines shall be followed to communicate release identification, planning, and reporting.

If a release occurs, the contractor will notify HART of the release (following the Release Reporting Flow Chart).

- HART shall be the point of contact for all communication with HDOH; this will include the monthly status meeting in which notification of new work scheduled and the status of on-going work will occur.
- HART shall report environmental releases to the HDOH (following the Release Reporting Flow Chart).
- If apparent unsafe conditions related to environmental hazards are observed, the contractor or HART shall inform contractor and HART health and safety.

6.2 Release Identification

Releases, should they occur, will be reported in accordance with HRS 128D and HAR 11-451 and as discussed in the HDOH HEER TGM Section 2 and Appendices 2A, Hazardous Substance Release Notification and Inventory Guideline, and 2B, Hazardous Substance Release Notification Guideline (http://eha-web.doh.hawaii.gov/eha-cma/Leaders/HEER/spill-reporting-and-emergency-response). Contaminated materials will be managed in accordance with applicable regulations including HAR 11-58.1, Solid Waste Management Control, and HAR 11-260 through 280, Hazardous Waste Management. Releases may include contractor releases as well as contractor encounters with pre-existing contamination.

6.2.1 Contractor Releases

During construction, a release could occur if a hazardous substances accidently leaks from heavy equipment, vehicles, or damaged storage containers. Contractors shall follow their work plans, for example, a Spill Prevention Countermeasures and Control Plan if a new release occurs.

If a release occurs, the appropriate jurisdiction must be immediately notified after the release of the following:

- A listed substance designated under HAR 11-451-5(b), in quantities equal to or exceeding the reportable quantity (RQ) criteria in HAR 11-451-6(b) in any 24-hour period
- An unlisted substance designated under HAR 11-451-5(c), in quantities equal to or exceeding the RQ criteria in HAR 11-451-6(c) in any 24-hour period

Notifications for releases of mixtures or solutions containing hazardous substances are required only when a component of the mixture or solution is released in a quantity equal to or greater than its reportable quantity. However, if the exact concentration of all the hazardous substance components in

the mixture or solution is not known, notification is required if the entire amount released equals or exceeds the reportable quantity of any of the hazardous substances it contains.

Oil is considered a hazardous substance in the Hawaii rules, but has some more specific criteria for notification, as follows:

- Any amount of oil causing a sheen to appear on surface water or any navigable water of the State (sheens resulting from discharge of oil from a properly functioning vessel engine are exempt)
- Any free product that appears on groundwater
- Any amount of oil greater than 25 gallons released to the environment
- Any amount of oil less than 25 gallons released to the environment that is not contained and remediated within 72 hours is considered a release and must be reported to HDOH (However, such oil releases do not need to be reported immediately, but must be reported in written form within 30 days of the release.)

6.2.2 Pre-Existing Contamination

In addition to contractor releases, a release may include pre-existing contamination encountered in the field. In some cases, the contamination may be well documented and anticipated; in other cases, the contamination may be undocumented or unanticipated.

- Contamination Observed within Known Contaminated Sites/Areas as Identified in the EHE or sites where HART previously reported a Release: Field observations of contamination and/or analytical results will not be considered new releases. Instead, the contractor will notify HART who will in turn report on the findings in monthly status reports.
- Contamination Observed within Suspected Contaminated Sites/Areas: Field observations of contamination will be considered new releases. However, following initial notification, additional field observations and/or analytical results that indicate the contamination is from the same source and type and within the same property (for example, same TMK) or a contiguous area owned by same property owner (for example, along State or City-owned roadway) will not require separate additional immediate notification. Instead, the contractor will notify HART, who will in turn report on the findings in the associated release report and monthly status reports. Field observations that indicate a potential different source or contaminant type (that is, a different odor or color or are fuel versus ash or debris) will be reported as a new release.
- Contamination Observed within Undocumented/Unanticipated Areas: Field observations and/or analytical results of contamination will be considered new releases and reported as described in Section 6.4.

A release could also occur if the contractor encounters a hazardous substance or a potentially hazardous substance. In addition to the release definitions provided in Section 6.2.1 and per agreement with HDOH, the following observations constitute a release:

- A hydrocarbon sheen on surface or groundwater
- Any amount of free product observed in soil or groundwater
- Any visual evidence of contamination (for example, staining, ash, asphalt, construction debris, or illegal dumping)

- Any evidence of unusual odors or a PID reading greater than 10 ppm

6.3 Release Response

In most cases, work may continue in areas where contamination has been identified in the EHE and through the pre-screening characterization, (1) if covered by the EHMP, (2) if HART demonstrates good compliance with the EHMP, and (3) where adequate response resources are available. The encounters should still be reported in accordance with Section 6.4, but work can continue as notification is made to facilitate appropriate response actions to prevent the spread of contamination and exposure, and minimize construction delays. However, if contamination is mishandled or not reported correctly, the ability to continue with release response and construction as the notification is made may be revoked and require work stoppage whenever contamination is encountered.

If a release occurs, the following actions should be taken:

- Assess the identity, source, quantity, and severity of the spill.
- Stop work if contaminant releases are extremely large and cannot be contained. If an imminent threat to human health or the environment exists, or if human or environmental receptors are impacted (for example, exposed people falling ill or suffering sudden illness), notify the Honolulu Fire Department by calling 911.
- If the spill is of a volatile, flammable, or combustible liquid or vapor (for example, gasoline, diesel fuel), eliminate possible ignition sources and direct workers to remain upwind. In addition, monitor for explosive vapors using an LEL meter. Stop work if an explosion threat exists and notify the Honolulu Fire Department by calling 911.
- Stop work if an unusually large release or contaminated area is encountered unexpectedly or if there is any release of chemicals or hazards not covered by the plan (for example, unexploded ordnance).
- Stop work and take immediate emergency response actions if a worker or member of the public is injured.
- Eliminate the source of the spill to the extent practicable (for example, shutting off a valve, turning off an engine, righting an overturned container).
- Protect sensitive ecological receptors threatened by the spill.
- Conduct response actions and reporting in full conformance with the State Contingency Plan (HAR 11-451).
- Initiate response activities only by trained onsite personnel wearing appropriate PPE. To the extent possible and practicable, contain the spill to a small area, prevent from migrating, and clean up with absorbent materials. Ensure follow-up response actions (for example, assessment, final cleanup, reporting), are done by qualified individuals.
- If contaminated media is removed as part of the response activities, characterize and dispose of the material in accordance with state and federal regulations.
- Complete required reporting according to Section 6.4.

6.4 Release Reporting

HDOH regulations require release notification and reporting when contractors release hazardous substances above their RQs and when contaminated soil or groundwater is encountered during subsurface construction activities. Figure 6-1 outlines the procedures for HART's contractors to report releases to HDOH.

For contractor releases or contamination encountered in the field that poses immediate threat to human health or the environment, the contractor must make immediate notification as follows:

- HDOH HEER office at (808) 586-4249 or (808) 247-2191 (after work hours)
- Local Emergency Planning Committee (LEPC) at (808)723-8960 or 911 (after work hours)
- National Response Center (NRC) at (800) 424-8802 (Note: Oil observed in soil or groundwater is not reportable to NRC. Oil observed on surface water is reportable to NRC. In addition, any other hazardous substance released above the RQ is reportable to NRC.)
- Fire Department at (808) 723-7101 or 911 (after work hours)
- HART will be notified as soon as possible following notification to emergency response agencies
- HART will verify that appropriate agencies have been notified and make notifications where necessary

For pre-existing contamination encountered in the field that does not pose an immediate threat to human health or the environment, the contractor must report the release to HART immediately. Following notification from contractors, HART must report a release/discovery within 24 hours, as follows:

- HDOH HEER office at (808) 586-4249 or (808) 247-2191 (after work hours)
- LEPC at (808)723-8960
- NRC at (800) 424-8802 (Note: Oil observed in soil or groundwater is not reportable to NRC. Oil observed on surface water is reportable to NRC. In addition, any other hazardous substance released above the RQ is reportable to NRC.)
- Fire Department at (808) 723-7101

A new release number shall be assigned. The following information should be provided at the time of the phone call:

- Name and telephone number of the caller
- Name of the hazardous substance spilled
- Approximate quantity spilled
- Location of the spill
- Date and time of the spill
- Description of how it happened
- Immediate danger or threat posed by the release
- Contact information for the responsible party
- Measures taken or proposed to be taken to clean-up the spill
- Any known injuries resulting from exposure
- Other county, state, or federal officials that were also notified

Required written reports include a written report documenting the incident, response, notification, and any potential impacts to human health and/or the environment. Appendix D-12, Release Report Form provides a format for the release notification. This document should be completed by the contractor and submitted to HART within 2 days of the release. HART shall submit this form alongside any supporting analytical data to the HDOH HEER office within 30 days of the release.

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7. Exposure Contingency Plan

This exposure contingency plan is intended to guide what should be done when engineering controls, administrative controls, or PPE fail to function as designed. The activities in this section are intended to supplement the exposure prevention and control procedures identified in Section 5. This exposure contingency plan consists of several individual plans, each addressing a potential COPC source:

- Soil Contingency Plan
- Water Contingency Plan
- Free Product Contingency Plan
- Vapor Contingency Plan
- Debris Contingency Plan
- Unanticipated or Unknown Materials Contingency Plan

Before beginning and regularly during construction, workers should be informed about these contingencies and when they should implement them. The listed items are not intended to preclude the development of other solutions. When elements of this contingency plan are implemented, the implementation should be recorded in the field logbook; reported to field crews, supervisors, oversight personnel, and the HART POC; and their use approved by the site health and safety officer and the environmental professional monitoring the construction work.

If an engineering control, administrative control, or PPE fails, the first priority is to provide health and safety assistance and (if needed) first aid. Personnel should not enter an area with an imminent risk to human health or life. Once safety concerns have been addressed, immediate action should be taken to respond to the release of COPCs. In all instances, common sense, good judgment, training, and experience should prevail.

7.1 Contingency Information and Notification

An emergency notification list should be prepared and maintained. This list should identify the individuals to whom failed engineering controls, administrative controls, or PPE must be reported. A copy should be placed in all contractor vehicles and equipment, and posted at temporary jobsite offices and other designated locations.

As work progresses along the HRTP route, maps and other information showing the layout of the construction areas, the known and anticipated locations of COPCs and hazardous substances, and the locations of emergency medical supplies and spill response equipment should be prepared. This information should be conspicuously posted in a location commonly used by construction workers, and the workers should be briefed on the information. The provided information should include a list of hazardous substances and the location of MSDSs maintained onsite.

7.2 Soil Contingency Plan

This Soil Contingency Plan provides guidelines for the actions to be taken when engineering controls, administrative controls, or PPE fail and there is an imminent risk of exposure to COPCs, or when unanticipated contaminated soil is encountered.

7.2.1 Open Excavations

During construction, COPCs in soil could be exposed when buried pipelines or cables are relocated, new utilities are installed, foundations are dug, or when constructing other subsurface structures. If COPC

concentrations and direct exposure hazards are greater than anticipated, the need for heightened precautions should be assessed, and the following possible actions taken:

- If appropriate, PPE should be upgraded from Level D to Level C.
- Contaminated soil should be segregated from uncontaminated soil, and managed in accordance with the procedures in Section 5.4. If needed, work should stop until preparations to handle the contaminated soil have been completed.
- Stockpiled contaminated soil or groundwater that is the source of exposure should be contained or removed from the site before resuming work.
- If airborne dust generated from COPCs becomes significant, additional dust control measures should be implemented.

7.2.2 Soil Stockpiles

During construction activities, plastic sheeting used to berm and cover soil stockpiles could be damaged by strong winds or punctured by equipment, debris or other sharp objects. This damage could allow site workers to encounter COPC or stormwater to encounter the contaminated soil. The following actions should be taken to prevent potential exposure.

- Damaged sections of plastic sheeting should be promptly replaced.
- Damaged sections of the berm should be promptly repaired.

7.3 Groundwater Contingency Plan

The Groundwater Contingency Plan provides guidelines for what should be done when engineering controls, administrative controls, or PPE fail and an imminent risk of exposure to contaminated water exists.

7.3.1 Open Excavations

During construction activities, contaminated groundwater could be exposed in excavations used to install pipelines, electrical and communication cables, or other subsurface structures. If contaminated groundwater creates a direct exposure hazard, the following actions may need to be taken.

- PPE could be upgraded from Level D to Level C.
- The excavation could be backfilled using sand, gravel, or other approved and appropriate materials to a height above the standing water.
- Contaminated groundwater should be managed in accordance with the procedures in Section 5.5. If needed, work should stop until preparations to handle the contaminated groundwater have been completed.
- If it becomes necessary to remove contaminated groundwater from the excavation, it should be stored in appropriate containers before treatment and disposal.

7.3.2 Temporary Storage Containers

Contaminated groundwater removed from excavations or generated from construction activities may need to be containerized and temporarily stored pending characterization and treatment, reuse, reinfiltration, reinjection, or disposal as appropriate. Temporary storage containers shall be double-walled tanks and/or single-walls tanks/drums/other compatible containers placed within secondary containment. Storage containers shall be accessible to allow inspection, sampling, and handling.

7.4 Stormwater Contingency Plan

The Stormwater Contingency Plan provides guidelines for the actions to be taken when engineering or administrative controls fail and there is an imminent risk of stormwater becoming contaminated by COPCs or of contaminated stormwater discharging offsite.

7.4.1 Open Excavations

During construction, stormwater could encounter contaminated soil or groundwater in utility or other subsurface structures. If a storm event more severe than anticipated threatens an excavation with contaminated water to overflow, the following actions may be taken.

- The height of the berm along the upstream edges of the excavation could be increased to prevent stormwater runoff from entering the excavation.
- Modifications in the stormwater runoff diversion system could be made to carry water away from the excavation or active Work Areas.
- Stormwater in bermed areas or in excavations could be pumped into containers for later treatment and discharge.
- Excavations could be covered with plywood and plastic sheeting to prevent the direct entry of precipitation or stormwater runoff.
- Excavations could be backfilled to prevent the direct entry of precipitation or stormwater runoff.

7.4.2 Soil Stockpiles

During construction activities, stormwater could encounter COPCs stored in stockpiles. If rainwater or runoff begins to wash away stockpiled soil, or winds damage plastic covers over the stockpile, the following actions should be taken.

- Berms surrounding soil stockpiles damaged by a storm should be repaired.
- The height of the berm surrounding the stockpile may be increased.
- Water in the bermed stockpile area could be pumped into containers for subsequent treatment and discharge.
- Diversion structures could be created to divert stormwater away from soil stockpiles.
- Damaged plastic sheeting covering soil stockpiles should be repaired or replaced. Additional plastic sheeting may be necessary.

7.4.3 Offsite Contaminated Stormwater Discharges

During construction activities, stormwater could enter the construction areas and encounter contaminated soil or groundwater. If rainwater or runoff enters a construction area, the following action should be taken.

- Diversion structures could be improved to divert stormwater away from construction areas.
- A runoff water containment area could be created to capture water.
- Moveable petroleum-absorbent booms or pads could be deployed to capture COPCs in in areas where storm water enters or leaves the site.

7.5 Free Product Contingency Plan

The Free Product Contingency Plan provides guidelines for what should be done when engineering controls, administrative controls, or PPE fail and workers, the public or ecological receptors could be exposed to free product, or when an imminent risk of a fire or an explosion is created.

7.5.1 Open Excavations

During construction activities, free product could be encountered in excavations used to install utility corridors or other subsurface structures. If free product poses a direct risk to workers, the following actions may be taken.

- PPE could be upgraded from Level D to Level C.
- If the volume of free product encountered is too great for absorbent pads to manage effectively, a vacuum truck could be used to pump product out of the excavation, and transport it for treatment and disposal.
- If needed, after removing the free product, the excavation could be backfilled using appropriate materials (for example, gravel, select borrow) to a height above any standing water.

7.5.2 Free Product Recovery and Storage

During construction activities, free product being recovered and temporarily contained or stored onsite could leak from recovery equipment and/or storage units and released to surrounding areas. If recovered free product is released from recovery equipment or storage units, the following actions should be taken.

- Use absorbent pads, booms or other means to prevent free product from entering any storm drains, sanitary sewers, or surface waters. If the volume is too great for absorbent pads, booms, or secondary berms to manage effectively, a vacuum truck could be used to pump product out of the excavation, and transport it for treatment and disposal.
- If needed, after removing the free product, the equipment should be repaired or replaced, and any areas contaminated by the free product should be cleaned up.

7.6 Vapor Contingency Plan

The Vapor Contingency Plan provides guidelines for what should be done when engineering controls, administrative controls, or PPE fail and an imminent risk of exposure to hazardous vapors exists.

The Vapor Management Plan (Section 5.9) includes most of the contingencies in the Vapor Contingency Plan. If hazardous vapors are encountered at higher levels than anticipated and they pose a direct exposure hazard to workers, the following actions may be taken.

- Workers should leave the impacted Work Area immediately and not return until vapor concentrations decline to safe levels.
- Access to the construction area should be restricted with additional barriers.
- Activities requiring active excavation should be planned to include methods for minimizing vapor risks (for example excavation could be done at night when air temperatures are lower).

7.7 Debris Contingency Plan

The Debris Contingency Plan provides guidelines for what should be done when engineering controls, administrative controls, or PPE fail and an imminent risk of exposure to hazardous debris exists.

The Debris Management Plan (Section 5.10) includes most of the contingencies in the Debris Contingency Plan. If hazardous debris is encountered and poses a direct exposure hazard to workers, the following actions may be taken.

- Workers should leave the impacted Work Area immediately and notify HART.
- Complete Appendix D-11, Release Response Plan and Appendix D-12, Release Report Form and do not return to the construction area until it has been determined that is safe.
- Access to the construction area should be restricted until it has been determined that it is safe.
- Activities requiring active excavation should be planned to include methods for minimizing disturbance of debris (for example, using alternative means to avoid excavating through hazardous debris such as geophysical clearance or less damaging techniques such as air-knife excavation methods.

7.8 Unanticipated or Unknown Materials Contingency Plan

The Unanticipated or Unknown Materials Contingency Plan provides guidelines for what should be done when engineering controls, administrative controls, or PPE fail and an imminent risk of exposure to unanticipated or unknown materials exists.

The Unanticipated or Unknown Materials Management Plan (Section 5.11) includes most of the contingencies in the Debris Contingency Plan. If unanticipated or unknown hazardous materials are encountered and they pose a direct exposure hazard to workers, the following actions may be taken.

- Workers should leave the impacted Work Area immediately and notify HART and other response personnel (if necessary).
- Complete Appendix D-11, Release Response Plan and Appendix D-12, Release Report Form and do not return to the construction area until it has been determined that is safe.
- Access to the construction area should be restricted until it has been determined that it is safe.
- Methods for minimizing disturbance of unanticipated or unknown materials (for example, using alternative means to avoid excavating through such materials such as geophysical clearance or less damaging techniques such as air-knife excavation methods.

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8. References

8.1 Applicable Regulations and Guidance Documents

The HDOH has established cleanup guidelines for many organic and naturally occurring inorganic compounds in soil and groundwater. The process for evaluating sites with contamination are identified in HDOH several documents, identified below.

These documents have been and continue to be frequently updated, and new guidance documents continue to be developed by HDOH; therefore, changes to the procedures used to evaluate and properly address environmental hazards during the construction of the HRTP may be required.

- ATSDR, ToxFAQsT^{M}. http://www.atsdr.cdc.gov/toxfaqs/index.asp.
- ASTM, *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process* (ASTM Standard E 1527-05), 2005.
- HDOH, "*Update to Soil Action Levels for Inorganic Arsenic and Recommended Soil Management Practices*," November 2011. hawaii.gov/health/environmental/hazard/arsenic_home.html.
- HDOH, "*Guidance for the Evaluation of Imported and Exported Fill Material, Including Contaminant Characterization of Stockpiles*," October 2011. http://www.hawaiidoh.org/tgm-guidance/HEER%20Office%20Fill%20Material%20Guidance%20Oct%202011.pdf.
- HDOH, "*Screening for Environmental Hazards at Sites with Contaminated Soil and Groundwater*," Fall 2011. All volumes and appendices available at: http://hawaii.gov/health/environmental/hazard/eal2005.html.
- HDOH, "*Use of Decision Unit and Multi-Increment Soil Sample Investigation Approaches to Characterize a Subsurface Solvent Plume, Site CG110, Hickam Air Force Base*," March 2011. www.hawaiidoh.org/tgm-guidance/Hickam MIS-VOC (Final March 2011).pdf.
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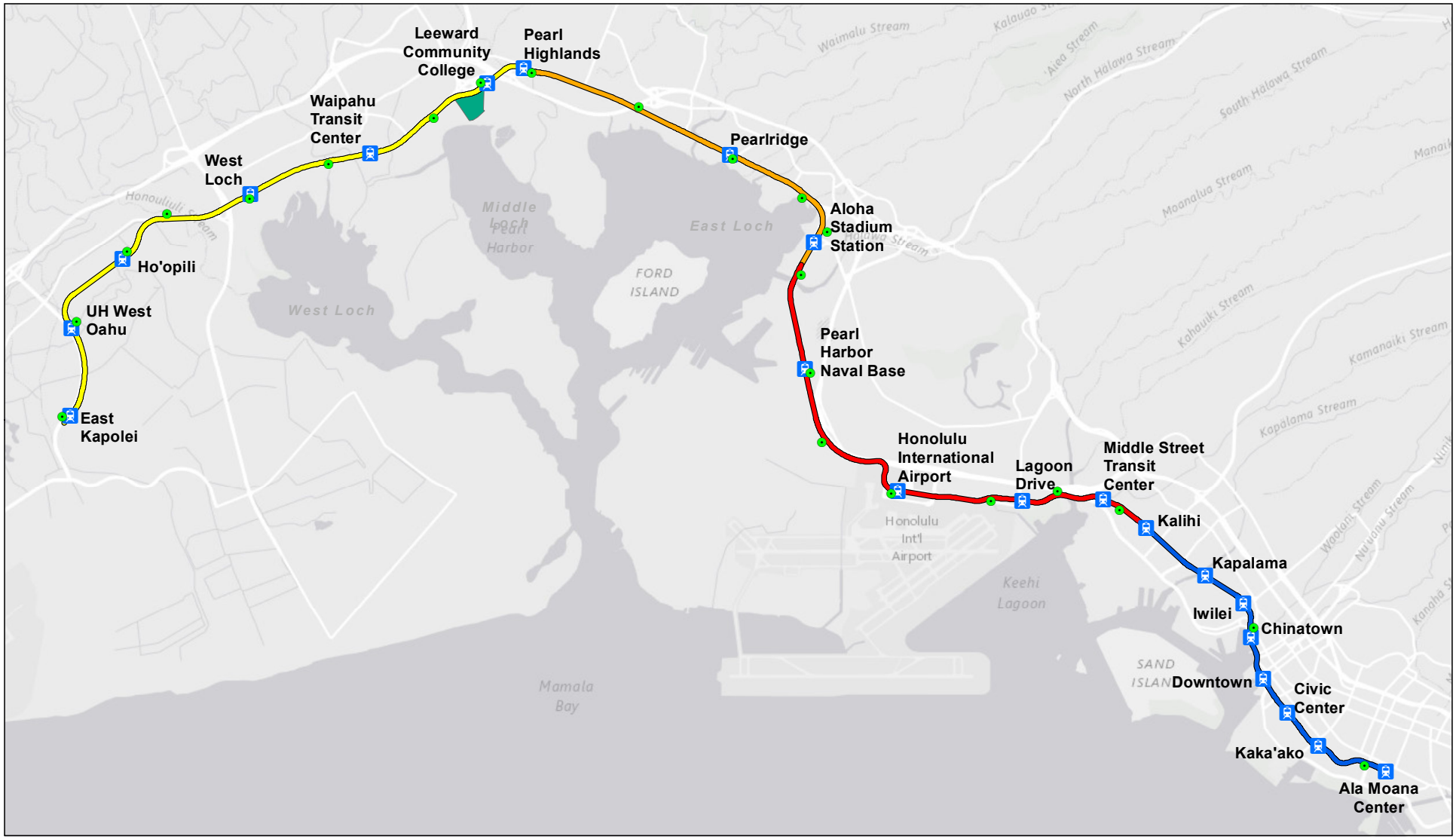

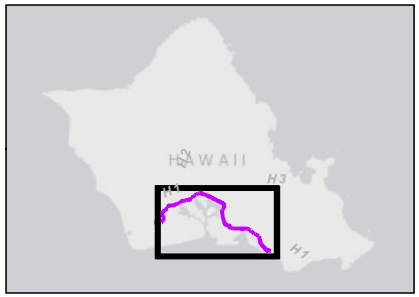

Guideway Segments
- West O'ahu/Farrington Highway Guideway (WOFH)
- Kamehameha Highway Guideway (KHG)
- Airport Guideway
- City Center Guideway
- Maintenance and Storage Facility

- Transit Station
- Traction Power Substations

N

0 0.5 1 2 Miles

FIGURE 2-1
Map of HRTP Route Sections and Maintenance and Storage Facility (MSF)
Programmatic Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

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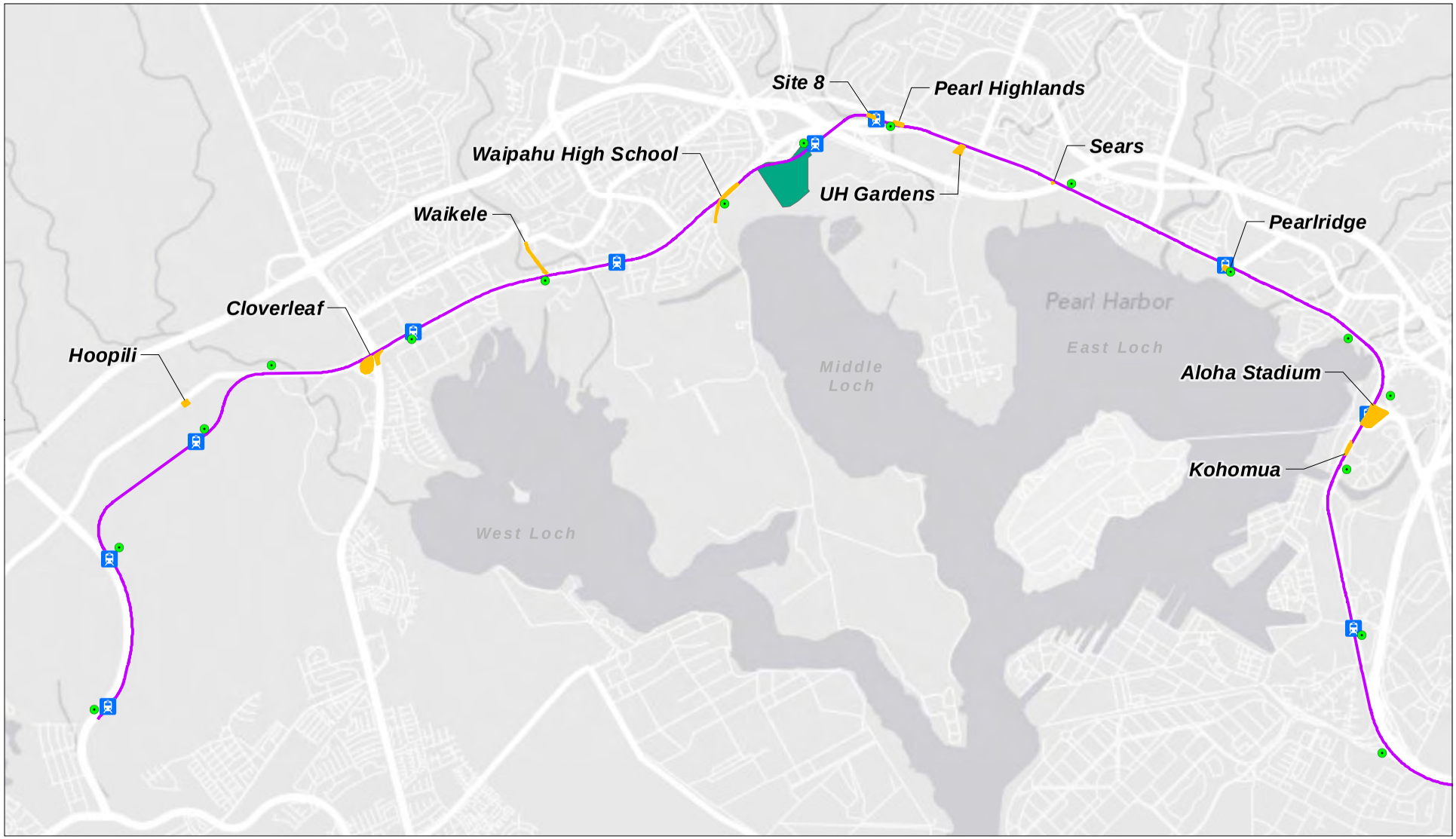

- Traction Power Substations
- Transit Station
- HART Guideway
- Contractor Yards
- Maintenance and Storage Facility

N

0 0.25 0.5 1 Miles

FIGURE 2-2
Contractor Yards along the WOFH and KHG Sections
Programmatic Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

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Transit Station

HART Guideway

Above UIC Line

Below UIC Line

UIC = Underground Injection Control

N

0 0.5 1 2 Miles

FIGURE 3-1
UIC Boundary along HRTP Route
Programmatic Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

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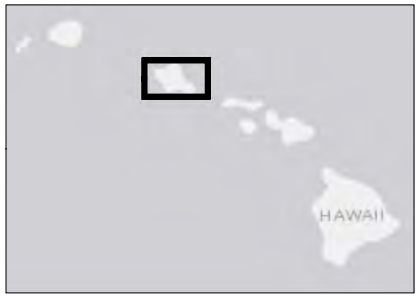

Major Geohydrologic Boundary

N

0 2 4 8 Miles

FIGURE 3-2
Major Geohydrologic Systems of Oahu
Programmatic Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

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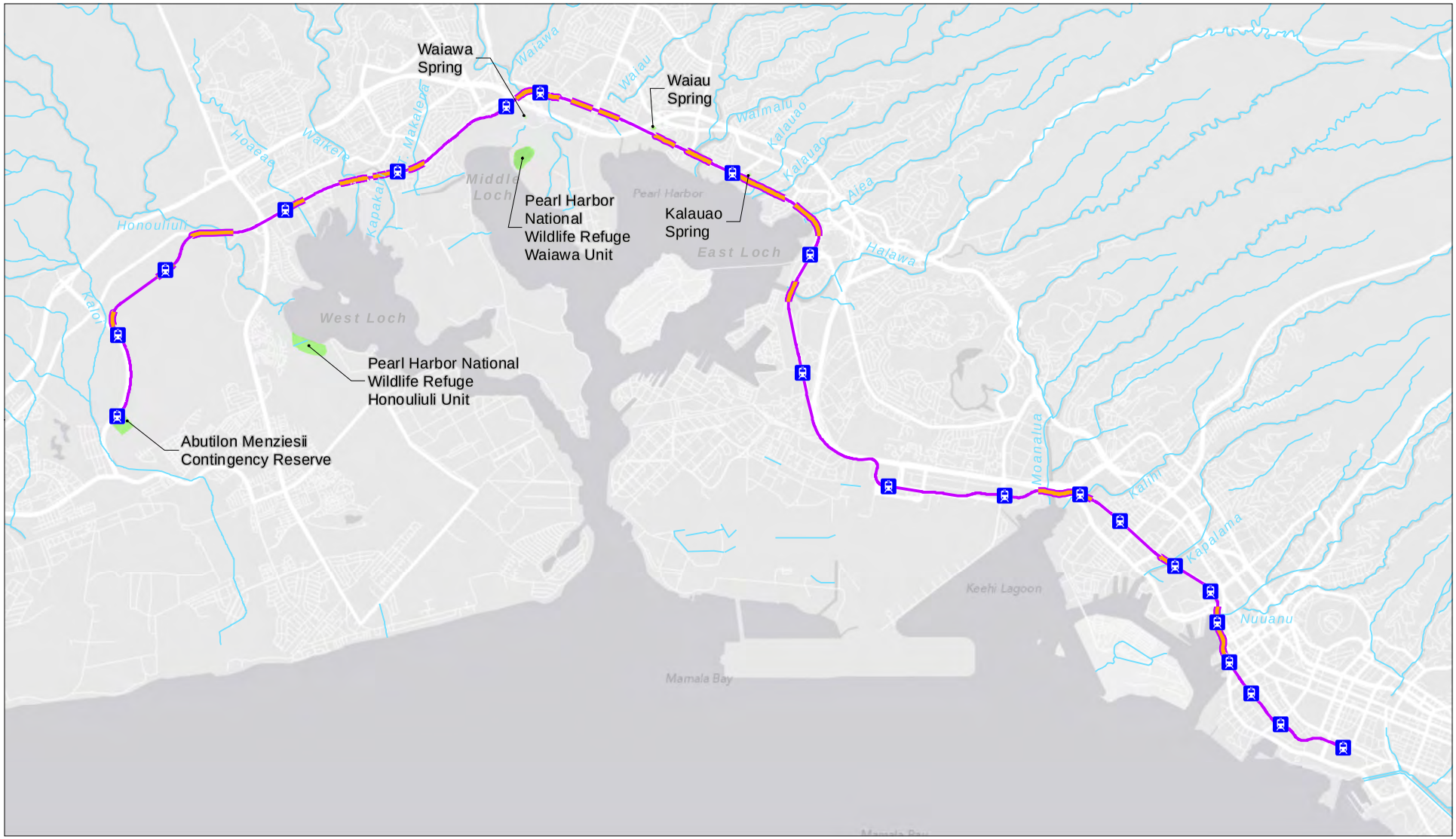

Transit Station

Section of Guidway Within 150m From Surface Water Body

HART Guideway

Stream

Wildlife Refuge or Reserve Area

Honolulu High-Capacity Transit Corridor Project, Final Environmental Impact Statement (United States Department of Transportation, Federal Transit Authority and City and County of Honolulu, Department of Transportation Services, June 2010). http://www.honolulutransit.org/document-library/eis.aspx

N

0 0.5 1 2 Miles

FIGURE 3-3
Sensitive Natural Resource Areas
Programmatic Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

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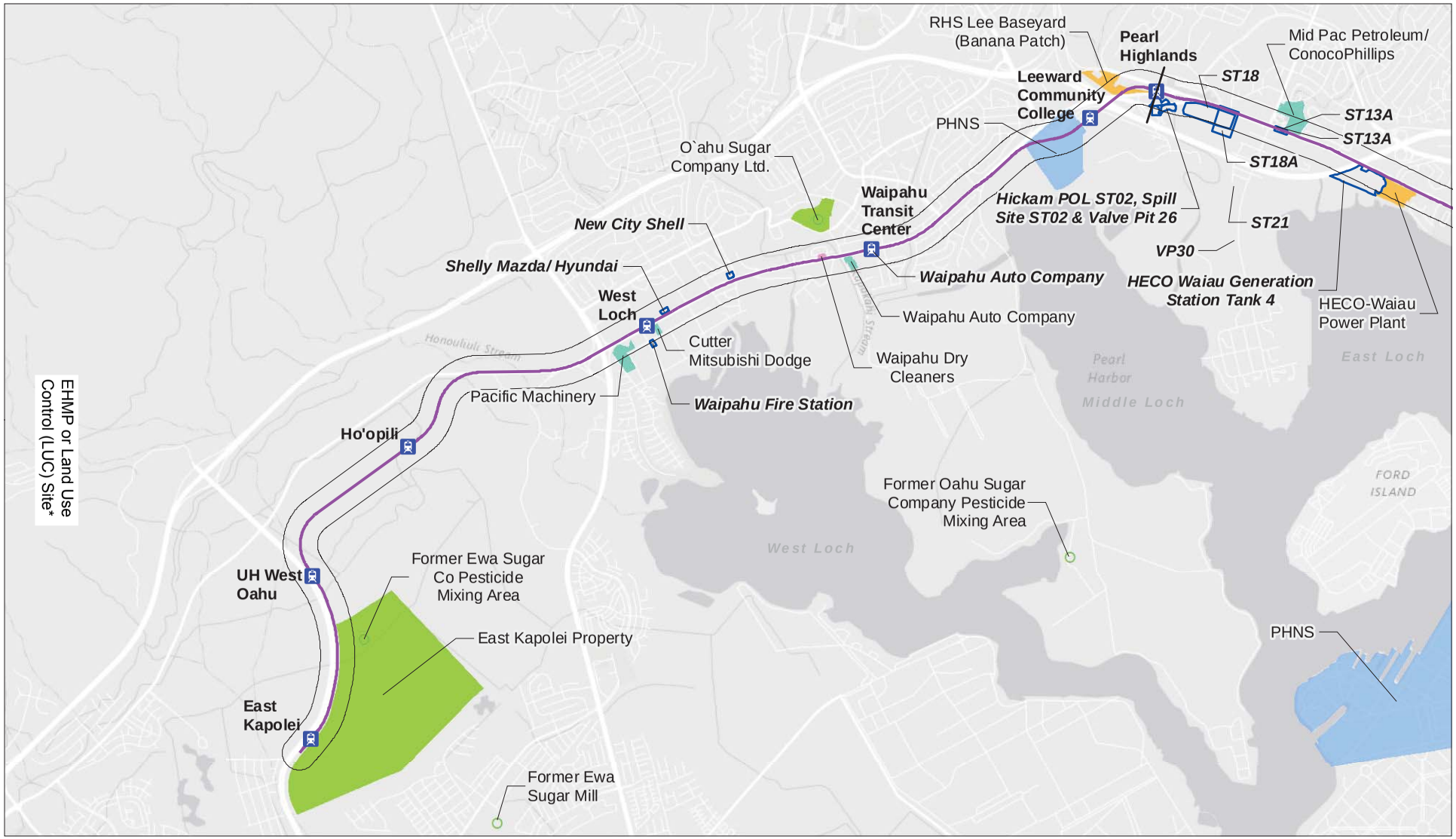

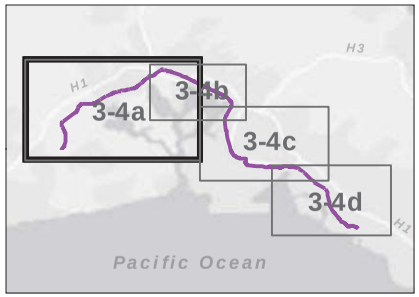

Past or Current Source Of Contamination

- Agricultural
- Military
- Dry Cleaning
- Commercial/Industrial
- Petroleum
- Site with EHE-EHMP or Land Use Control (LUC)

- Transit Station
- HART Guideway
- HART Guideway Contract Division
- Guideway Buffer (150m)

PHNS = Pearl Harbor Naval Station

N

0 1,250 2,500 5,000 Feet

FIGURE 3-4a
Overview of Major Areas of Environmental Contamination
WEST O'AHU FARRINGTON HIGHWAY (WOHF) SECTION
Programmatic Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

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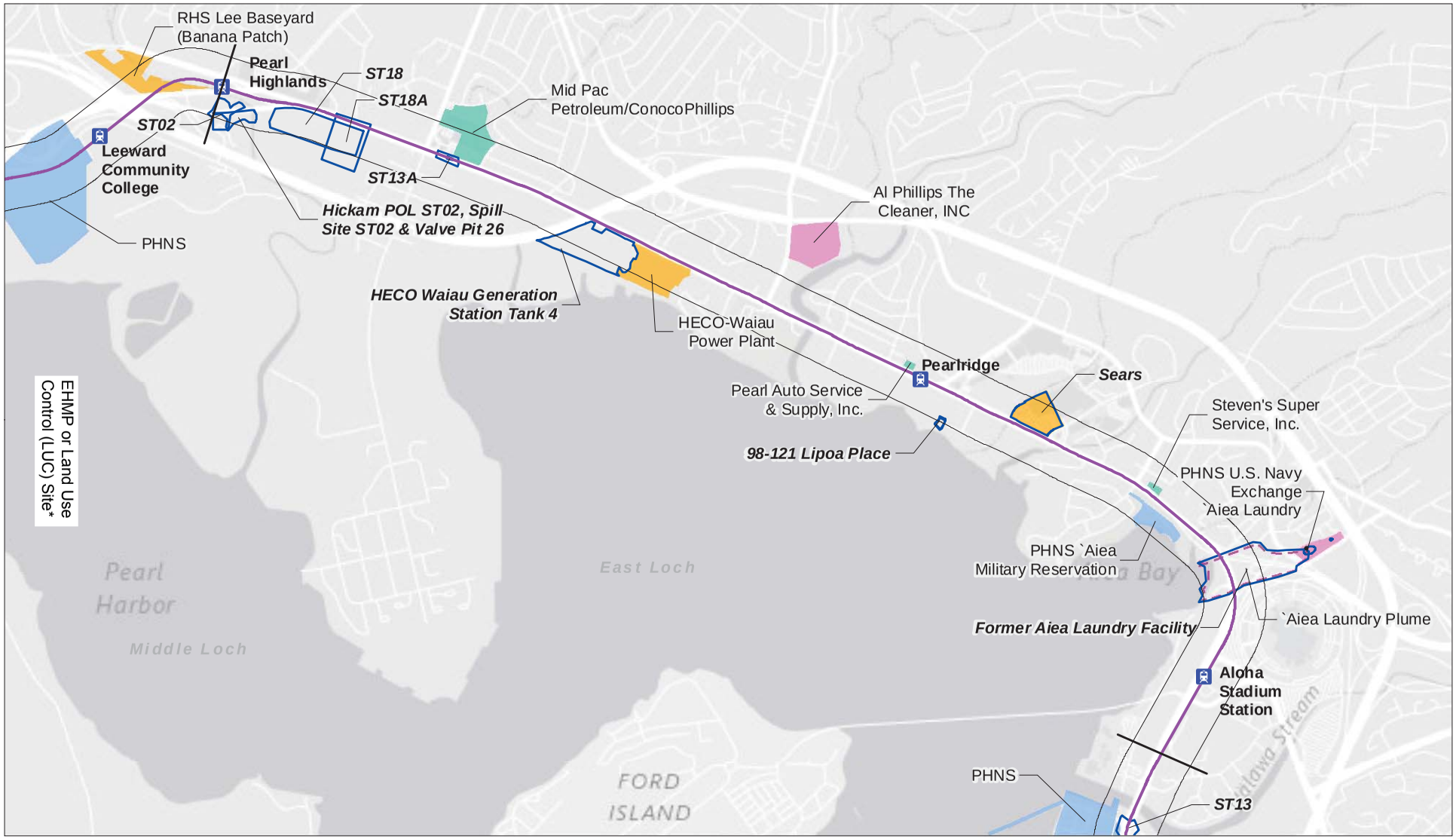

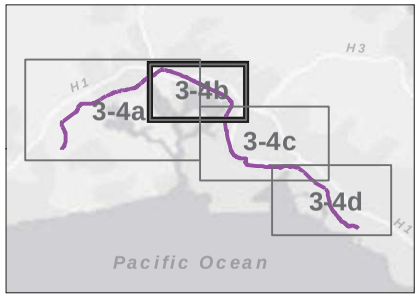

Past or Current Source Of Contamination

- Agricultural
- Military
- Dry Cleaning
- Commercial/Industrial
- Petroleum
- Site with EHE-EHMP or Land Use Control (LUC)

- Transit Station
- HART Guideway
- HART Guideway Contract Division
- Guideway Buffer (150m)

PHNS = Pearl Harbor Naval Station

N

0 750 1,500 3,000 Feet

FIGURE 3-4b
Overview of Major Areas of Environmental Contamination
KAMEHAMEHA HIGHWAY SECTION
Programmatic Environmental Hazard Evaluation and
Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

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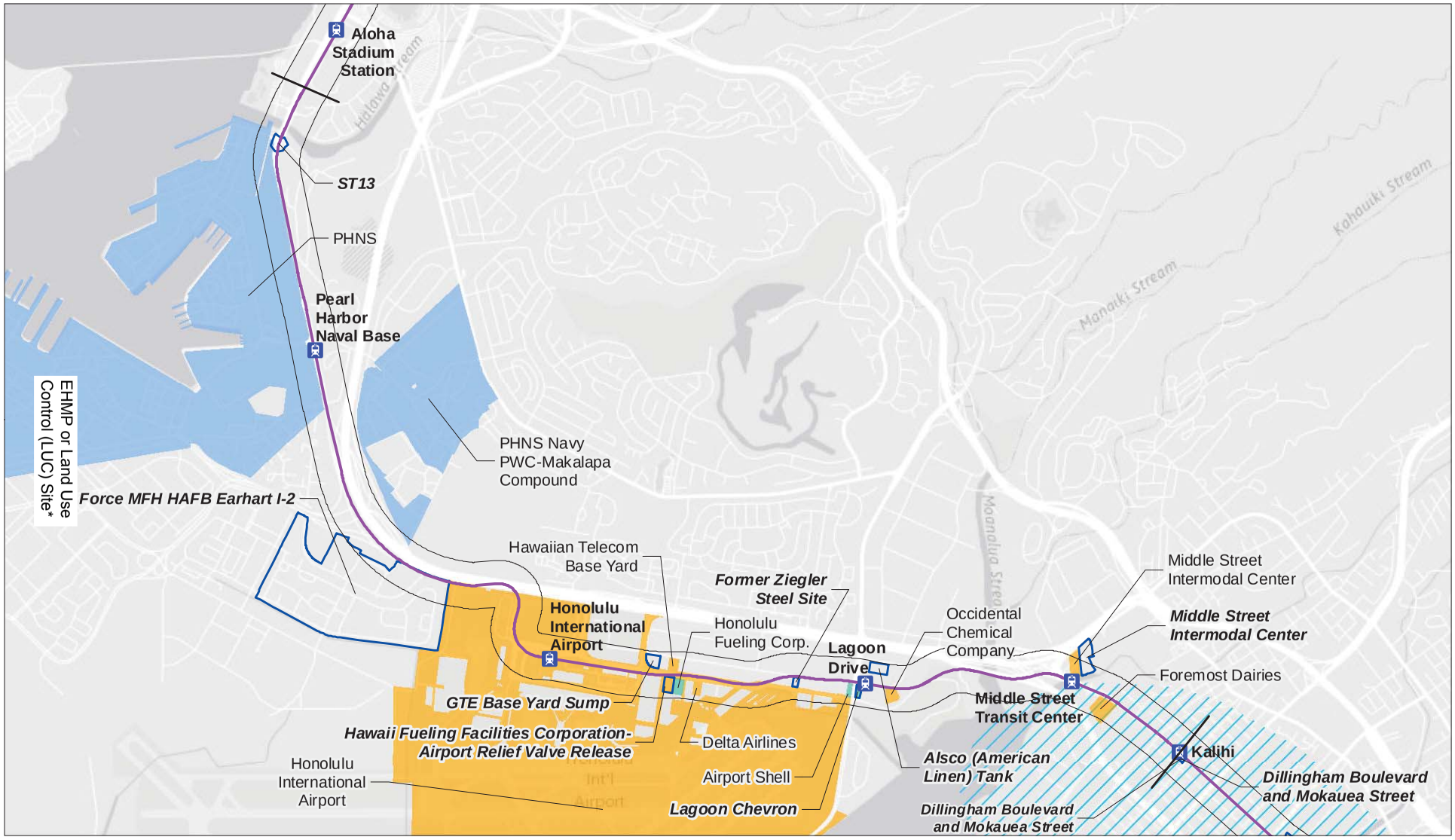

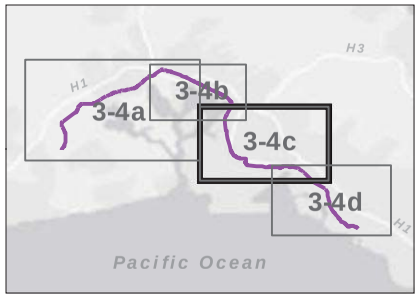

Past or Current Source Of Contamination

- Agricultural
- Military
- Dry Cleaning
- Commercial/Industrial
- Petroleum
- Site with EHE-EHMP or Land Use Control (LUC)

- Transit Station
- HART Guideway
- HART Guideway Contract Division
- Guideway Buffer (150m)
- Honolulu Harbor

PHNS = Pearl Harbor Naval Station

N

0 750 1,500 3,000 Feet

FIGURE 3-4c
Overview of Major Areas of Environmental Contamination
AIRPORT SECTION
Programmatic Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

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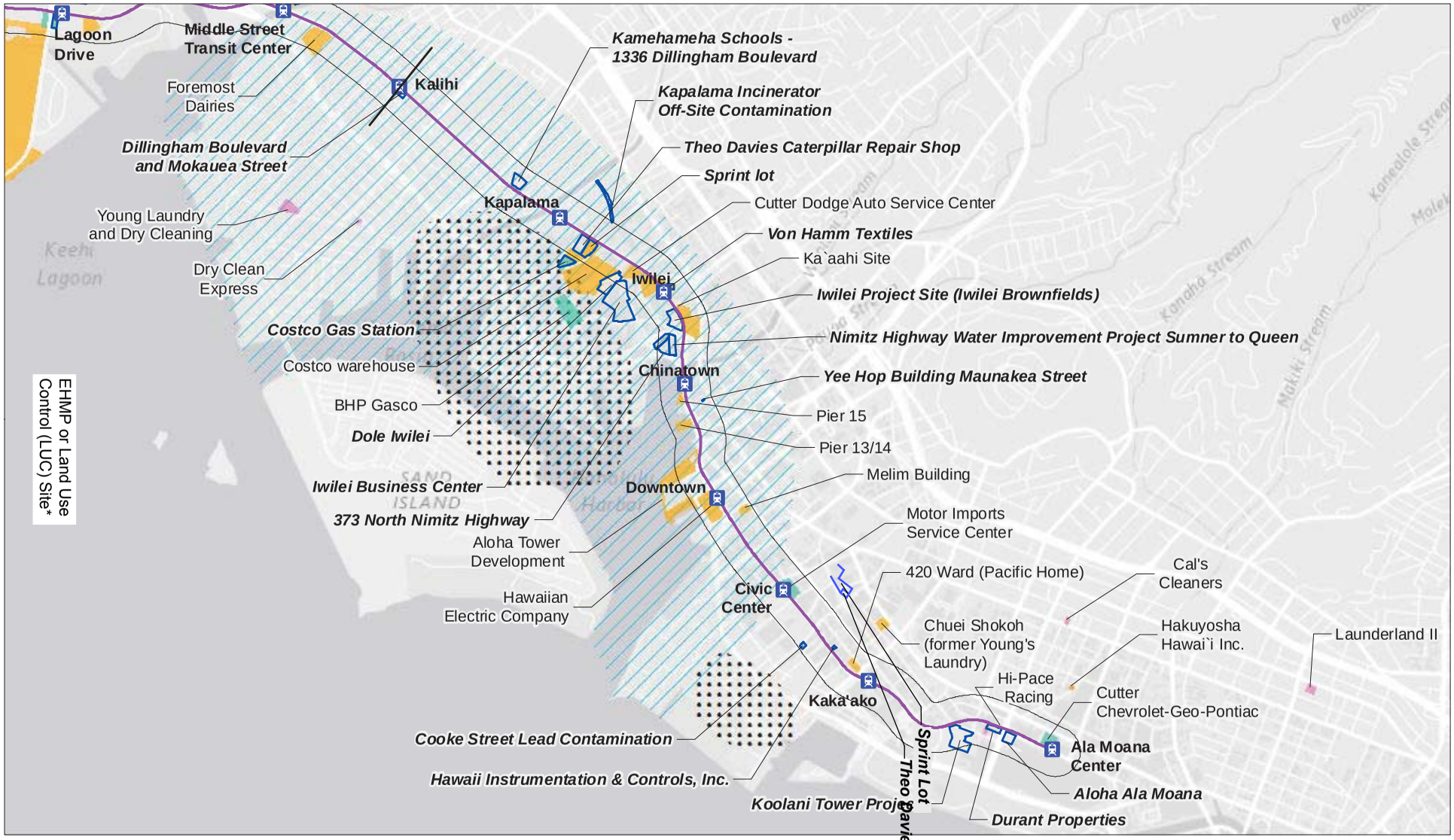

FIGURE 3-4d
Overview of Major Areas of Environmental Contamination
CITY CENTER SECTION
Programmatic Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

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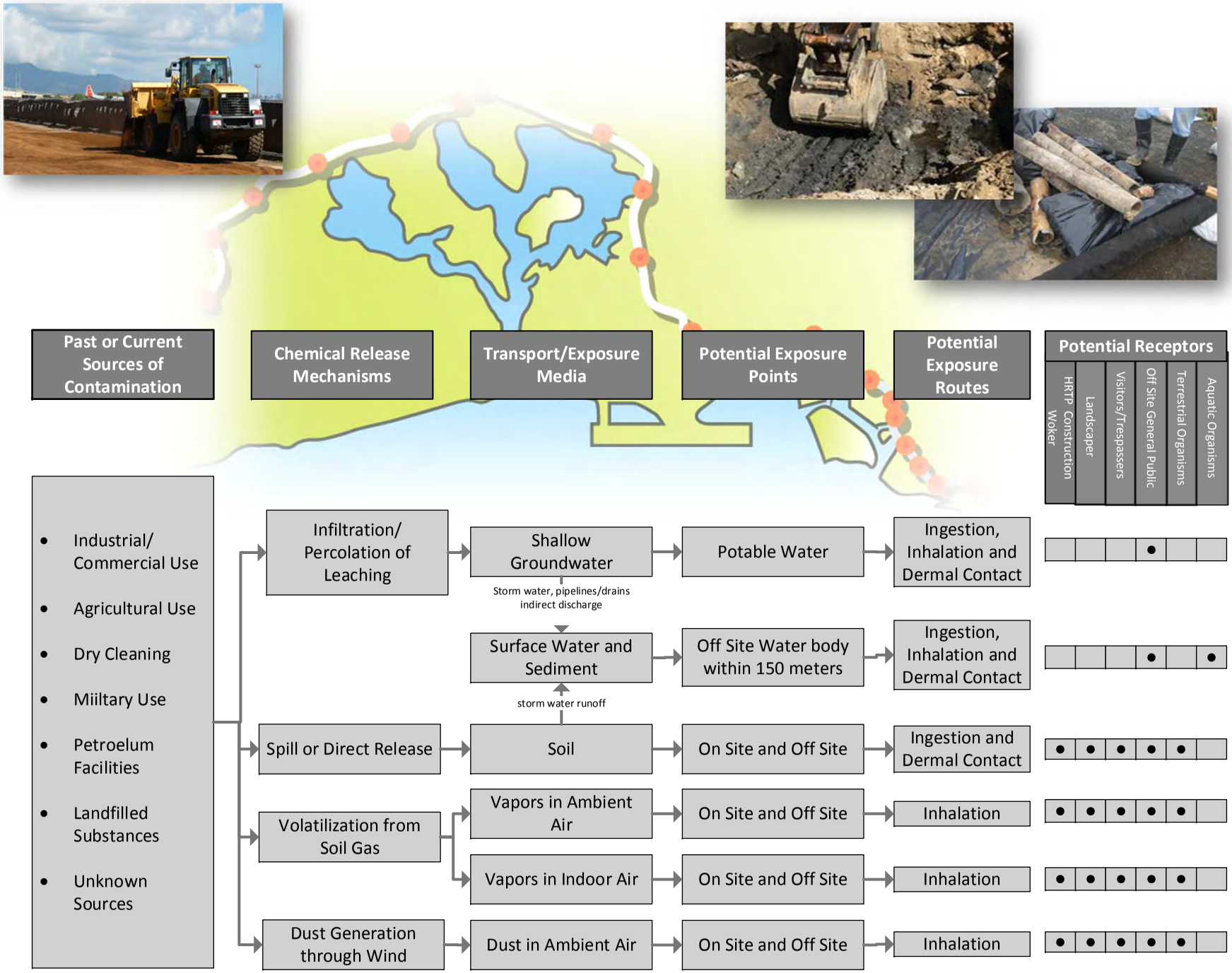

FIGURE 4-1

Conceptual Site Model For Potential Human and Ecological Receptors

Programmatic Environmental Hazard Evaluation and Environmental Hazard Management Plan

Honolulu Rail Transit Project Oahu, Hawaii

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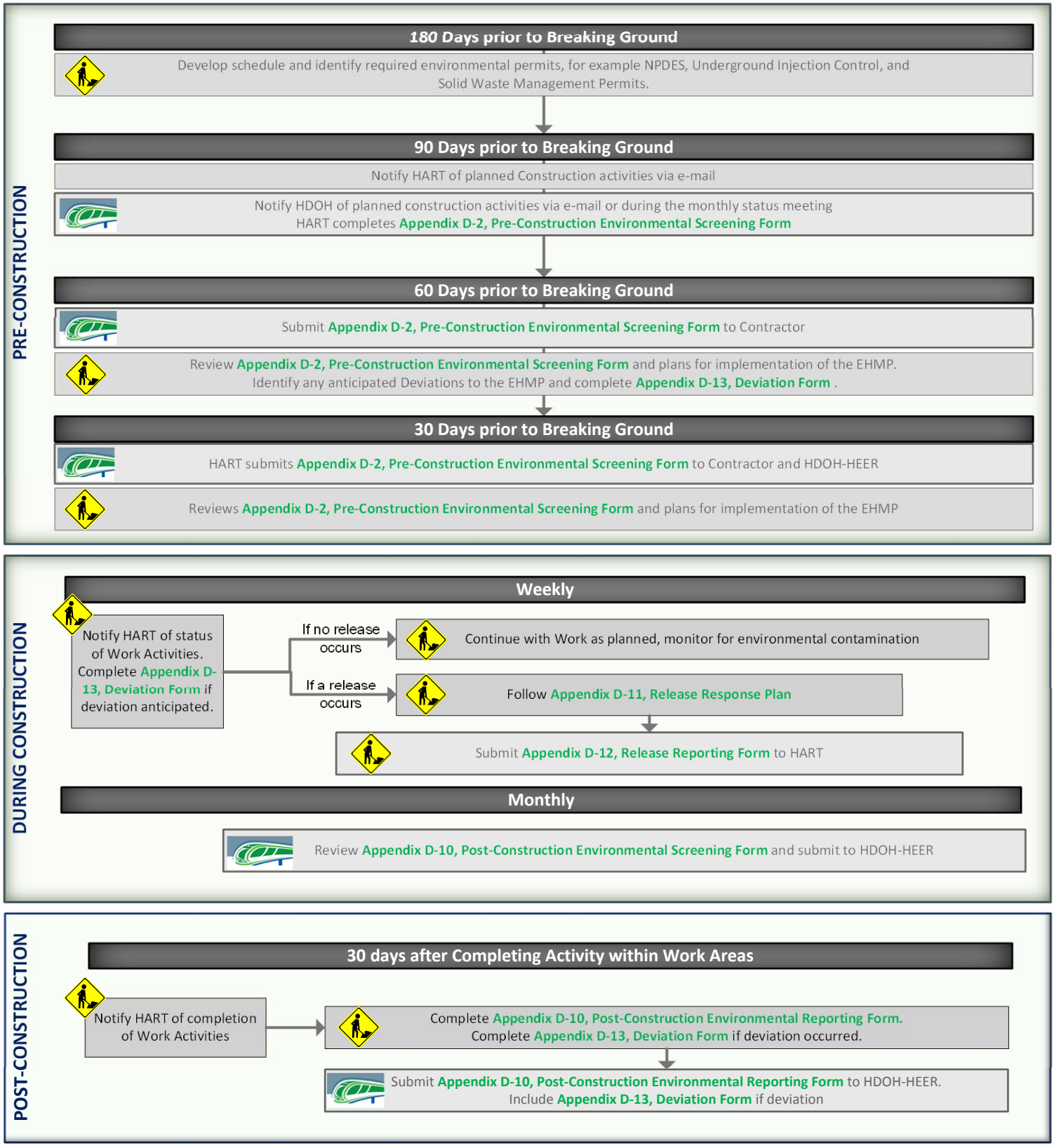

= Contractor

= HART

HART = Honolulu Authority for Rapid Transit

HDOH-HEER = Hawaii Department of Health Hazard Evaluation and Emergency Response

FIGURE 5-1

Construction Schedule Flow Chart

Programmatic Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project Oahu, Hawaii

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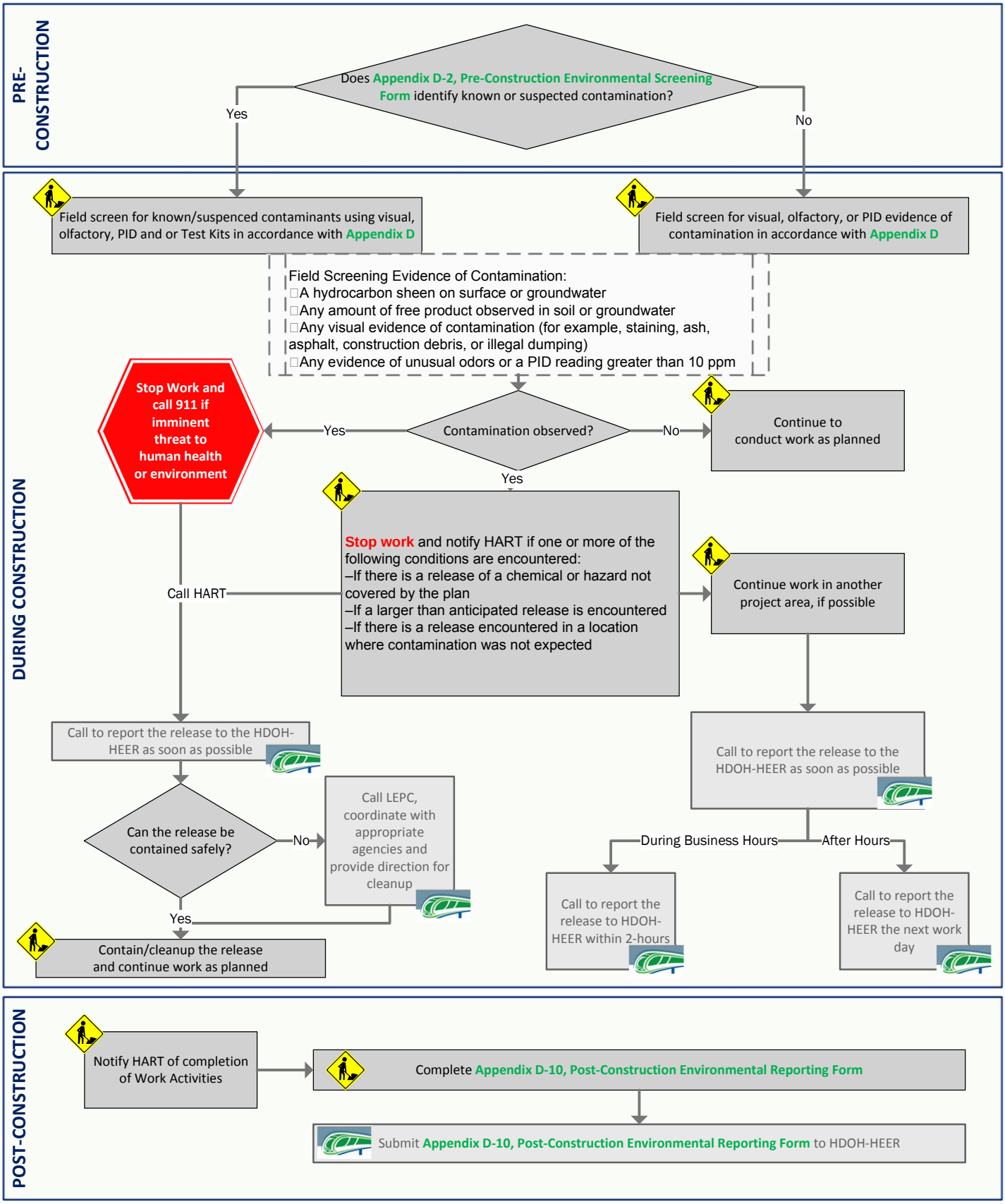

= Contractor

= HART

FIGURE 6-1

Release Reporting Flow Chart for Encountering Pre-Existing Contamination

Programmatic Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project Oahu, Hawaii

HART = Honolulu Authority for Rapid Transit
HDOH-HEER = Hawaii Department of Health Hazard Evaluation and Emergency Response
LEPC = Local Emergency Planning Committee

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Tables

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TABLE 1-1
Sites with EHE-EHMPs or LUCs
Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

Site Type	Facility Registry Identifier	Facility Site Name	HDOH Project Manager	COPCs	Impacted Media	Site Status	Summary of EHMP/LUCs	Potential Site Hazard for HRTP?
Waipahu Old Farrington Highway								
LUST	9-200098	Waipahu Fire Station	Josh Nagashima	TPH, VOC, PAH, metals	Soil, groundwater	MNA	**LUCs:** HDOH commented that an EHE-EHMP could be completed or need to continue groundwater monitoring. No EHE-EHMP in HDOH records.	Unlikely. Site is located downgradient of guideway.
LUST	9-200839	Shelly Mazda/ Hyundai	Roger Brewer	TPH, VOC, PAH, PCE, metals	Soil, groundwater	NFA	**EPMP:** Hawaii International Environmental Services (1994) requires that the asphalt cap remain intact. If an exposure pathway is created, the Exposure Contingency Plan must be implemented. EHE for site states that TPH are localized to site with little migration.	Potential. Site is located upgradient of guideway, in close proximity.
LUST	9-201029	New City Shell	Shunsheng Fu	TPH, VOC, PAH, metals	Soil, groundwater	MNA	**LUCs:** Delta Environmental (2010) prepared an Environmental Hazard Evaluation (EHE) for Waipahu Shell Service Stations. Existing EHE states that contaminants are contained by BMPs and natural barriers mitigate chances of contaminants migrating.	Potential. Site is located upgradient of guideway, in close proximity.
SDAR	NA	Waipahu Auto Company	Not listed	TPH, VOC, PAH, metals	Soil	NFA	**LUCs:** The HDOH NFA letter (2006) states that the residual petroleum contamination in soil must be properly handled if disturbed or excavated.	Likely. Site is located on Waipahu Transit Center footprint and downgradient of guideway.
Kamehameha Highway Guideway								
SDAR	NA	Hickam POL ST-02, Spill Site ST02, ST-18, & Valve Pit 26	Steve Mow	TPH, VOC, PAH, metals	Soil, groundwater, soil vapor	Assessment Ongoing	**EHMP:** Parsons (2013) completed the Final EHMP for Sites Associated with the Hickam POL System. Coordination is required with the Navy Remedial Project Manager and HDOH before any intrusive activities shall be performed.	Unlikely. Site is downgradient of guideway. The Final EHMP for Sites Associated with the Hickam POL System will be implemented.
SDAR	NA	HECO Waiau Generating Station Tank 4	Jordan Nakayama	TPH, VOC, PAH, metals	Soil, groundwater	Response Ongoing	**LUCs:** The SDAR spreadsheet (2014) states "Controls required to manage contamination," details were not found in the HDOH records.	Potential. Site is located downgradient of guideway, in close proximity.
SDAR	NA	98-121 Lipoa Place	Cal Miyahara	TPH-g, VOCs (BTEX, MTBE), PAHs, metals	Soil, groundwater, soil vapor	Response Ongoing	**EHMP:** Bureau Veritas (2012) completed the Revised EHE-EHMP. Residential apartment planned for the property will be built on stilts above the concrete/asphalt cap to mitigate vapor intrusion hazards. Tenants restricted from digging/gardening. During future construction/maintenance activities, precautions must be taken to prevent direct exposure and contaminated media properly handled/disposed of.	Unlikely. Site is located downgradient of guideway.
LUST	9-201836	Sears Facility #1578 at Pearlridge Mall*	Mark Sutterfield	Lead, TPH, BTEX, VOCs, metals, Lead.	Soil, groundwater	Response Ongoing	**EPMP:** Dames and Moore requires that current engineering cap remain in place and that proper EHMP and letter of notification be sent to DOH if potential for worker exposure occurs.	Potential. Site is located upgradient of guideway.

TABLE 1-1
Sites with EHE-EHMPs or LUCs
Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

Site Type	Facility Registry Identifier	Facility Site Name	HDOH Project Manager	COPCs	Impacted Media	Site Status	Summary of EHMP/LUCs	Potential Site Hazard for HRTP?
SDAR	NA	Sears Facility #1578 at Pearlridge Mall Elevator Jack*	Mark Sutterfield	TPH, VOC, PAH, metals	Soil, groundwater	Response Complete	**LUCs:** The SDAR spreadsheet (2014) states "Controls required to manage contamination; must test the groundwater when jack is permanently removed," details were not found in the HDOH records.	Potential. Site is located upgradient of guideway..
SDAR	110014039888	Sears Facility #1578 at Pearlridge Mall Hydraulic Hoist*	Cal Miyahara	TPH, VOC, PAH, metals	Soil, groundwater	Response Ongoing	**LUCs:** The SDAR spreadsheet (2014) states "Controls required to manage contamination; prohibit excavation," details were not found in the HDOH records.	Potential. Site is located upgradient of guideway.
SDAR	110013768226	PHNC Aiea Laundry Building 436	Maria Reyes	Chlorinated solvents	Soil, groundwater, soil vapor	Assessment Ongoing	**LUCs:** HART (2012) prepared the EHE-EHMP, Kamehameha Highway Guideway, Test Shaft 13 and Method Shaft 6 (TS13/MS6) document, which will be implemented when working within the Former Aiea Laundry Plume. This plan includes management of soil, groundwater, soil vapor, free product, and storm water, and includes engineering and administrative controls, requirements for personal protective equipment, and a monitoring program.	Likely. Site is located upgradient of and contaminant plume extends under the guideway. The TS13/MS6 EHE-EHMP will be implemented if below ground work is necessary.
Airport								
SDAR	NA	Hickam POL ST-13	Steve Mow	TPH, VOC, PAH, metals	Soil, groundwater, soil vapor	Assessment Ongoing	**EHMP:** Parsons (2013) completed the Final EHMP for Sites Associated with the Hickam POL System. Coordination is required with the Navy Remedial Project Manager and HDOH before any intrusive activities shall be performed.	Likely. Site is located upgradient of and extends under guideway. The Final EHMP for Sites Associated with the Hickam POL System will be implemented.
SDAR	NA	Air Force MFH HAFB Earhart I-2	Eric Sadoyama	Pesticides	Soil	Response Ongoing	**LUCs:** Engineering controls required to manage contamination.	Potential. Site is located downgradient from guideway, in close proximity.
SDAR	110013789999	GTE Base Yard Sump	Unassigned	TPH-d, VOC, PAH, metals	Soil	NFA	**LUCs:** The HDOH NFA Letter (2009) stated that an EHMP is required if cap is compromised and the zoning must remain Commercial/Industrial.	Potential. Site is located upgradient of guideway.
SDAR	110013789686	Hawaii Fueling Facilities Corporation-Airport Relief Valve Release	Eric Sadoyama	TPH, VOC, PAH, metals	Soil, groundwater	NFA	**LUCs:** The HDOH NFA Letter (2013) stated that the NFA status is contingent upon continued area wide monitoring and implementation of the existing site-wide remediation program.	Potential. Site is located downgradient of guideway, in close proximity.
SDAR	110013781531	Former Ziegler Steel Site	Steve Mow	TPH, VOC, PAH, PCB, metals	Soil, groundwater	NFA	**LUCs:** The HDOH NFA Letter (2005) stated that the asphalt and concrete cap have sufficiently addressed concerns at the site.	Potential. Site is located downgradient of guideway, in close proximity.

TABLE 1-1
Sites with EHE-EHMPs or LUCs
Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

Site Type	Facility Registry Identifier	Facility Site Name	HDOH Project Manager	COPCs	Impacted Media	Site Status	Summary of EHMP/LUCs	Potential Site Hazard for HRTP?
LUST	9-101221	Lagoon Chevron Service Station	Richard Takaba	TPH, VOC, PAH, metals	Soil, groundwater	NFA	**EPMP:** CH2M HILL (2000) requires monitoring of engineered barriers for development of exposure pathways and implementation of the contingency plan if a potential exposure pathway is identified.	Likely. Site is located on the Lagoon Drive Transit Station footprint and downgradient of guideway, in close proximity.
SDAR	110013783138	Alsco (American Linen) Tank	Mark Sutterfield	TPH-d, VOC, PAH, metals	Soil	NFA	**LUCs:** Engineering controls required to manage contamination. If contamination is encountered during excavation, follow "Guidance Fact Sheet for Use when Petroleum Contamination is Encountered During Subsurface Soil Excavation" (December 2003, revised).	Potential. Site is located upgradient of guideway.
SDAR	110013783361	Middle Street Intermodal Center	Cal Miyahara	TPH, VOC, PAH, metals, chlorinated solvents	Soil, groundwater	NFA	**EHMP:** Masa Fujioka & Associates (2008) requires maintenance of the cap over contaminated soil, proper disposal of excavated soil, and appropriate construction worker protections.	Potential. Site is located upgradient of guideway.
City Center								
SDAR	110013781372	Dillingham Boulevard and Mokauea Street	Steve Mow	TPH, VOC, PAH, metals	Soil	NFA	**LUCs:** The HDOH NFA Letter (2005) stated that the asphalt cap has sufficiently addressed concerns at the site. Additional investigation and cleanup action may be required if future information reveals that contaminant exposure may pose a threat to human health or the environment.	Likely. Site is located in the Kalihi Transit Station footprint and downgradient of guideway, in close proximity.
SDAR	NA	Kamehameha Schools - 1336 Dillingham Boulevard	Jordan Nakayama	TPH, VOC, PAH, metals, chlorinated solvents	Soil, groundwater, soil vapor	Response Ongoing	**LUCs:** The SDAR spreadsheet (2014) states "Controls required to manage contamination," details were not found in the HDOH records.	Potential. Site is located upgradient of guideway, in close proximity.
SDAR	NA	Kapalama Incinerator Off-Site Contamination	Eric Sadoyama	PAH, dioxins/furans, lead	Soil	Response Ongoing	**LUCs:** The Corrective Action Report (2009) states that an EHMP should be prepared to address existing issues that my impact commercial construction activities on the property.	Unlikely. Site is located upgradient of the guideway.
SDAR	110013779401	Costco Gas Station	Wendy Ray	TPH, VOC, PAH, metals	Soil, groundwater	NFA	**LUCs:** In 2006, the HDOH-HEER Office requested submittal of a soil management plan before subsurface construction, implementation of a groundwater management plan, and evaluation of soil vapor intrusion concerns for new above ground construction.	Unlikely. Site is located downgradient of guideway.
SDAR	NA	Theo Davies Caterpillar Repair Shop	Kelton Otsuka	TPH, VOC, PAH, metals, methane	Soil, groundwater, soil vapor	Response Ongoing	**EHMP:** Central Planet Repair, LLC (2008) prepared an EHMP for the site that details soil and groundwater management and gas and vapor exposure control.	Potential. Site is located downgradient of guideway, in close proximity.

TABLE 1-1
Sites with EHE-EHMPs or LUCs
Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

Site Type	Facility Registry Identifier	Facility Site Name	HDOH Project Manager	COPCs	Impacted Media	Site Status	Summary of EHMP/LUCs	Potential Site Hazard for HRTP?
SDAR	110013778055	Sprint Lot	Steve Mow	TPH, VOC, PAH, metals	Soil, groundwater, soil vapor	NFA	**LUCs:** The SDAR spreadsheet (2012) states "Controls required to manage contamination; prohibit any activity that may disturb the integrity of the capping or monitoring systems". Requirement to develop an EHMP for future construction at the site.	Potential. Site is located downgradient of guideway, in close proximity.
SDAR	110002148729	Dole Iwilei	Steve Mow	TPH, VOC, PAH, metals	Soil, groundwater, soil vapor	Assessment Ongoing	**LUCs:** The Human Health Risk Assessment (Latham & Watkins, 1997) recommended PPE and air-monitoring during excavations, and vapor control/ ventilation system for buildings.	Potential. Site is located downgradient of guideway.
SDAR	110013773309	Von Hamm Textiles	Eric Sadoyama	TPH, VOC, PAH, metals (lead)	Soil	NFA	**LUCs:** The HDOH NFA letter (2006) states that due to the lead-contaminated soil present beneath the existing building, if the floor of the building is disturbed and the underlying soil is exposed, a potential exposure hazard may exist and must be addressed at that time.	Potential. Site is located upgradient of guideway.
SDAR	NA	Iwilei Business Center	Steve Mow	TPH, VOC, PAH, metals	Soil, groundwater	NFA	**LUCs:** A letter from HDOH (2005) states that the site is to be fully characterized and remediated if the site is developed, and recommended that a Phase I site assessment be performed at that time.	Unlikely. Site is located downgradient of guideway.
SDAR	110013788516	Iwilei Project Site (Iwilei Brownfields)	Melody Calisay	TPH, VOC, PAH, metals	Soil, groundwater	Response Ongoing	**LUCs:** An EHMP was recommended for implementation for activities associated with excavating soil at the site.	Potential. Site is downgradient of guideway, in close proximity.
SDAR	NA	Nimitz Highway Water Improvement Project Sumner to Queen	Steve Mow	TPH, VOC, PAH, metals	Soil, groundwater	Response Ongoing	**LUCs:** The SDAR spreadsheet (2012) states "Controls required to manage contamination," details were not found in the HDOH records.	Unlikely. Site is located downgradient of guideway.
SDAR	110014030903	373 North Nimitz Highway	Anna Fernandez	TPH, VOC, PAH, metals	Soil, groundwater	Response Ongoing	**LUCs:** The SDAR spreadsheet (2012) states "Controls required to manage contamination," details were not found in the HDOH records.	Unlikely. Site is downgradient of guideway.
SDAR	NA	Yee Hop Building Maunakea Street	Mark Sutterfield	TPH, VOC, PAH, metals	Soil, groundwater	Response Ongoing	**LUCs:** The SDAR spreadsheet (2012) states "Controls required to manage contamination."	Potential. Site is located upgradient of guideway.
SDAR	110013789604	Hawaii Instrumentation & Controls, Inc.	Richard Palmer	Solvents	Soil vapor	Response Ongoing	**LUCs:** Memo to File (2011) from HDOH states that the site is "Closed with Restrictions". If the cap is disturbed, additional sampling must occur to determine if new remedial action is necessary.	Potential. Site is located upgradient of guideway, in close proximity.
SDAR	110013780051	Cooke Street Lead Contamination	Steve Mow	Lead	Soil	NFA	**EHMP:** Cotton and Frazier Consultants, Inc. (1996) completed an Exposure Management Plan, which is similar to an EHMP. This plan prohibits any activity that may disturb the integrity of the capping system (i.e. concrete flooring and asphalt pavement).	Unlikely. Site is located downgradient of guideway.

TABLE 1-1
Sites with EHE-EHMPs or LUCs
Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

Site Type	Facility Registry Identifier	Facility Site Name	HDOH Project Manager	COPCs	Impacted Media	Site Status	Summary of EHMP/LUCs	Potential Site Hazard for HRTP?
							EHE states that lead contamination will likely stay contained within the soils, and groundwater transport is a non-issue due to well-graded sandy coralline gravel medium. However, no data in EHE regarding extent of lead contamination.	
SDAR	NA	Koolani Tower Project	Mark Sutterfield	TPH, VOC, PAH, metals (lead)	Soil	NFA	**EHMP:** Clayton Group Services, Inc. (2006) Phase II Environmental Investigation (App F & D, Soil Management Plan and Exposure Prevention Management Plan) prohibits any activity that may disturb the integrity of the capping system.	Potential. Site is located downgradient of guideway, in close proximity.
SDAR	NA	Durant Properties	Cal Miyahara	Nickel, Cadmium	Soil, groundwater	NFA	**EHMP:** EnviroServices & Training Center (2011) completed the EHE-EHMP to address untreated effluent migrating off-site during dewatering or infrastructure installation activities. Groundwater destined for off-site disposal must be tested for contaminants and appropriate disposal permits obtained. Dewatering is allowed as long as it doesn't cause untreated effluent to migrate offsite.	Potential. Site is located downgradient of guideway, in close proximity.
LUST	9-100322	Aloha Petroleum	Not Stated	TPH-g, BTEX, MtBE	Soil, groundwater.	Not Stated	**EHAR:** Central Planet Repair concluded that engineering controls contain the contamination and only a change in the construction of the area will warrant an EHMP. Existing EHE states that contaminated soil exists within the first 3 meters of soil but below Tier 1 EALs for TPH, and above Tier 1 but below Tier 2 EALs for xylene. Depth to groundwater is greater than 5 meters, which may mitigate the need for any dewatering activities.	Likely. Site is located makai and extends under guideway.

Notes:
BTEX = benzene, toluene, ethylbenzene, xylenes
COPC = constituent of potential concern
EHMP = Environmental Hazard Management Plan
EPMP = Exposure Prevention Management Plan
EHAR = Environmental Hazard Assessment Report
HDOH = State of Hawaii Department of Health
LUC = land use control
LUST = Leaking Underground Storage Tank
MNA = monitored natural attenuation
MtBE = methyl tert butyl ether
*Two SDAR sites and one LUST site located on the same TMK parcel.

NA = not available
NFA = No Further Action
PAH = polycyclic aromatic hydrocarbons
PCB = polychlorinated biphynels
PCE = tetrachloroethylene
SDAR = Site Discovery and Remediation
TPH = total petroleum hydrocarbons
TPH-d = total petroleum hydrocarbons, diesel-range
TPH-g = total petroleum hydrocarbons, gasoline-range
VOC = volatile organic compounds

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TABLE 2-1
HRTP Sections and Selected Contractors
Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

Section Name	Design/Construction Work	Contractor
West Oahu-Farrington Highway (WOFH) Section	West Oahu Guideway – from East Kapolei to the intersection of Farrington Highway and Kamehameha Highway	Kiewit Infrastructure West Co. (KIWC)
	West Oahu Station Group (East Kapolei, UH West Oahu, Hoopili)	Design: URS Construction contractor not selected
	Farrington Highway Station Group– (West Loch, Waipahu Transit Center, Leeward Community College)	Design: AVA Construction contractor not selected
Maintenance & Storage Facility (MSF)	Maintenance & storage facility	KIWC/Kobayashi Joint Venture
Kamehameha Highway Guideway (KHG) Section	Kamehameha Highway Guideway – from WOFH to ¼ mile east of Aloha Stadium	KIWC
	Kamehameha Station Group – (Pearl Highlands, Pearlridge, Aloha Stadium)	Design: AVA Construction contractor not selected
Airport Section	Airport Guideway – from KHG to just east of Middle Street Transit Center Station	Design: AECOM Construction contractor not selected
	Airport Stations – (Pearl Harbor Station, Honolulu Airport, and Lagoon Drive, Middle Street)	Design: AECOM Construction contractor not selected
City Center Section	City Center Guideway – from Airport section to end at Ala Moana Station	Design: AECOM Construction contractor not selected
	City Center Stations – (Kalihi, Kapalama, Iwilei, Chinatown, Downtown, Civic Center, Kakaako, Ala Moana)	Design: AECOM Construction contractor not selected

Notes:

Park and Ride lots are located only at the stations indicated.

HRTP = Honolulu Rail Transit Project

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TABLE 2-2
Contractor Yards along the WOFH and KHG Sections
Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

Section	Contractor Yards	TMK Number	Approximate Address	Property Area m^2 (ft^2)
WOFH	Hoopili	91017070	91 Farrington Highway (approximately)	2,600 m^2 (27,983 ft^2)
WOFH	Cloverleaf	HDOT ROW	SW Quadrant of Interchange at Farrington Highway and Fort Weaver Road	17,997 m^2 (193,721 ft^2)
WOFH	Waikele	94010008	EB Farrington Highway at Waikele Stream Bridge	4,665 m^2 (50,214 ft^2)
WOFH	Waipahu High School	HDOT ROW	Waipio Point Access Road; adjacent to Waipahu High School	7,578 m^2 (81,565 ft^2)
KHG	Site 8	HDOT ROW	Kamehameha Highway at Kuala Street	1,536 m^2 (16,532 ft^2)
KHG	Pearl Highlands	HDOT ROW	Kamehameha Highway/ Farrington Highway Interchange	2,875 m^2 (30,945 ft^2)
KHG	UH Gardens	97023008	941 Kamehameha Highway	4,898 m^2 (52,727 ft^2)
KHG	Sears	97019045	near 655 Kamehameha Highway at H-1 Freeway; Triangle lot under Freeway RoW	213 m^2 (2.296 ft^2)
KHG	Pearl Ridge	98009017	98-77 Kamehameha Highway	2,239 m^2 (24,101 ft^2)
KHG	Aloha Stadium	99003071	parking lot SE of Kamehameha Highway / Salt Lake Boulevard intersection	29,081 m^2 (313,026 ft^2)
KHG	Kohomua	99003068	Kamehameha Highway at Kohomua Street	2,729 m^2 (29,377 ft^2)

Notes:

EB = eastbound
ft^2 = square feet
HDOT = State of Hawaii Department of Transportation Health
KHG = Kamehameha Highway Guideway
m^2 = square meters
ROW = right-of-way
SE = southeast
SW = southwest
TMK = Tax Map Key
UH = University of Hawaii
WOFH = West Oahu/ Farrington Highway

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Table 3-1
COPCs Potentially Encountered during Construction Activities
Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

Past or Current Source of Contamination	Historic Property Use	Suspected COPC[1]
Industrial Commercial Releases	Facilities with underground storage tanks	Petroleum-related contaminants: TPH, VOCs, PAHs, PCBs (if waste oil), metals[2]
	Wooden structures built before 1990	Pesticides (Termiticides)
Agricultural Use Releases	Sugar cane fields and railroad beds for former sugar cane transport	Pesticides, Herbicides, Arsenic Dioxins/furans[3]
	Pesticide mixing areas, seed dipping areas, pesticide container disposal area	Pesticides, TPH, PAHs, heavy metals, semivolatile organic compounds, dioxin/furans[3]
	Settling ponds and Bagasse piles	Dioxins/furans, heavy metals (arsenic and lead), organochlorine pesticides[3]
Dry Cleaning Releases	Dry cleaning facilities	Chlorinated dry cleaning or parts cleaning solvents, Stoddard Solvent
Military Use Release	Areas with transformers, facilities that used cutting oils	PCBs
	Facilities with underground storage tanks	Petroleum-related contaminants: TPH, VOCs, PAHs, PCBs (if waste oil), metals[2]
Petroleum Releases	Areas with transformers, facilities that used cutting oils	PCBs
	Service station, petroleum depots, facilities with underground storage tanks	Petroleum-related contaminants: TPH, VOCs, PAHs, PCBs (if waste oil), metals[2]
	Machine shops, automotive repair shops	Chlorinated solvents, Petroleum-related contaminants: TPH, VOCs, PAHs, PCBs (if waste oil), metals[2]
Landfilled Substances	Asphalt, construction debris	TBD

[1] See also Section 9 of the HEER TGM (HDOH, 2009) for additional COPCs, analytes, and methods.
[2] See also Table 9-5 of the HEER TGM (HDOH, 2009) for fuel types and COPCs.
[3] See also Tables 9-1 thru 9-4 of the HEER TGM (HDOH, 2009) for agricultural and pesticide-related COPCs.

Notes:
COPC = chemical of potential concern
HDOH = Hawaii Department of Health
HEER = Hazard Evaluation and Emergency Response
PAH = polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyls
TBD = to be determined
TGM = Technical Guidance Manual
TPH = total petroleum hydrocarbons
VOC = volatile organic compounds

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TABLE 5-1
Target Analytes for Common Contaminants
Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

		Analytical Parameters/Laboratory Method[1]													
Common Contaminant Types	**Matrix**	**Soil and Groundater VOC SW8260**	**Vapor VOC TO15/TO17[2]**	**Vapor Methane ASTM 1946D[3]**	**PAH SW8270**	**GRO SW8015**	**TPH-DRO SW8015**	**TPH-RRO SW8015**	**Metals (SW6010/ SW6020/ SW7471/ SW7470 (GW))**	**PCBs SW8082**	**Pesticides SW8081**	**Herbicides SW8151**	**Dioxins/ Furans SW8280 or SW8290**	**Additional Analyses[4]**	**Comments/ Notes**
Petroleum															
Leaded Gasoline (mogas, avgas)	SOIL	x				x			x						
Leaded Gasoline (mogas, avgas)	GW	x				x			x						
Leaded Gasoline (mogas, avgas)	SG		x	x											
Unleaded Gasoline	SOIL	x				x									
Unleaded Gasoline	GW	x				x									
Unleaded Gasoline	SG		x	x											
Middle Distillates (diesel, kerosene, jet fuel, heating fuels, etc.)	SOIL	x		x		x	x								
Middle Distillates (diesel, kerosene, jet fuel, heating fuels, etc.)	GW	x		x		x	x								
Middle Distillates (diesel, kerosene, jet fuel, heating fuels, etc.)	SG		x	x											
Residual Fuels (lube oils, hydraulic oils, transformer oils, fuel oil, bunker c, waste oil, etc.)	SOIL	x		x	x	x	x	x	x	x					
Residual Fuels (lube oils, hydraulic oils, transformer oils, fuel oil, bunker c, waste oil, etc.)	GW	x		x	x	x	x	x	x	x					
Residual Fuels (lube oils, hydraulic oils, transformer oils, fuel oil, bunker c, waste oil, etc.)	SG														soil gas not applicable
Unidentified Petroleum	SOIL	x		x	x	x	x	x	x	x					
Unidentified Petroleum	GW	x		x	x	x	x	x	x	x					
Unidentified Petroleum	SG		x	x											
Dry Cleaning Solvents	SOIL	x													
Dry Cleaning Solvents	GW	x													
	SG														
Polychlorinated Biphenyls (PCBs)	SOIL									x					
Polychlorinated Biphenyls (PCBs)	GW									x					
Polychlorinated Biphenyls (PCBs)	SG														soil gas not applicable
Pesticides/Herbicides[5]	SOIL	x			x				x		x	x			
Pesticides/Herbicides[5]	GW	x			x				x		x	x			
Pesticides/Herbicides[5]	SG														soil gas not applicable
Heavy Metals	SOIL								x						
Heavy Metals	GW								x						
Heavy Metals	SG														soil gas not applicable
Ash/Burn/Debris Layer[6]	SOIL				x	x	x	x	x	x	x		x	(potential)	
Ash/Burn/Debris Layer[6]	GW				x	x	x	x	x	x	x		x	(potential)	
Ash/Burn/Debris Layer[6]	SG		x	x											

Notes:
[1] Contractor may use similar, comparable analytical methods.
[2] See TGM Sectopm 9 for target vapor-phase COPC's at petroleum release sites. TPH-G should be reported as the sum of C5 to C12 hydrocarbon compounds. TPH-D should be reported as the sum of C5 to C18 hydrocarbon compounds.
[3] Field instruments may often be used to detect methane and helium (leak testing).
[4] The need for additional analyses will be determined on a site-by-site basis after reviewing contaminant/release information.
[5] The analyte list and laboratory analytical methods will be reviewed on a site-by-site basis. Some analyses/methods may be eliminated based on review and identification of the type of pesticide/herbicide.
[6] Ash/Burn/Debris Layers may require additional analyses based on the type of materials burned/deposited and will be evaluated on a site-by-site basis after review of contaminant/release information and field observations.
PAHs = polynuclear aromatic hydrocarbons
SVOCs = semi-volatile organic compounds
GRO = gasoline range organics
DRO = diesel range organics
RRO = residual range organics
VOCs = volatile organic compounds will be analyzed for variety of analytes (e.g., BTEX, naphthalenes, MTBE, and other volatile additives, solvents, etc) based on target contaminants

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TABLE 5-2a
Applicability of EALs to Soil Reuse or Disposal Options
Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

Management Action	To be Considered Under the Following Conditions
Reuse within Immediate Work Area (including areas with known contamination)	If the work area is a known contaminated site, it may be possible to place contaminated soil back into the excavation if contaminants are: ➢ < or > Tier 1 EALs for unrestricted use within approximately 150 meters (500 feet) from surface water and over a drinking water source ➢ > or < Tier 1 EALs for commercial/industrial use ➢ < hazardous waste criteria ➢ < Tier 1 EALs for gross contamination. TPH concentrations up to 5,000 mg/kg can often be placed as backfill in portions of an excavation that are above the underlying water table ➢ < site-specific Tier 2 EALs *See EALs[a] Tables F-2, I-1, and I-2.*
On Site Reuse (within the Rail Corridor)	Onsite reuse (that is, reuse within the rail corridor) is allowed if soil contaminants are: ➢ < Tier 1 EALs for unrestricted use within approximately 150 meters (500 feet) from surface water and over a drinking water source ➢ < Tier 1 EALs for commercial/industrial (on a site by site basis with prior coordination) Soil that contains contaminants at concentrations > Tier 1EALs for unrestricted use, but < commercial/industrial EALs, can (in most cases) be used onsite within the Rail Corridor. However, prior approval must be obtained. *See EALs[a] Tables I-1, and I-2.*
Off Site Reuse	Offsite reuse is allowed if soil contaminants are: ➢ < Tier 1 EALs for unrestricted use within approximately 150 meters (500 feet) from surface water and over a drinking water source Further guidance on the use of non-regulated soil as fill is provided in "Guidance for the Evaluation of Imported and Exported Fill Material, Including Contaminant Characterization of Stockpiles" (HDOH, October 2011).

TABLE 5-2a
Applicability of EALs to Soil Reuse or Disposal Options
Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

Management Action	To be Considered Under the Following Conditions
	See EALs[a] Table I-1.
Disposal	Soil should be disposed at a permitted landfill if it: ➢ is not suitable for backfill or reuse due to issues other than contamination, ➢ > Tier 1 or 2 EALs for commercial or industrial use ➢ contains free product ➢ is grossly contaminated (contains TPH concentrations greater than 5,000 mg/kg) ➢ is determined to be a hazardous waste *See EALs[a] Table F-2.*

Notes:

Whenever soil is reused in a sensitive area (even within the Work Area), HDOH recommends it is sampled to confirm that concentrations of contaminants do not exceed Tier 1 EALs for unrestricted use.

HDOH Tier 1 EALs are based on unrestricted land use, potentially impacted groundwater being a current or potential drinking water resource, and a distance of <150 meters to the nearest surface water body (HDOH 2011, updated January 2012).

EAL = Environmental Action Level
HDOH = State of Hawaii Department of Health
mg/kg = milligrams per kilogram

TABLE 5-2b
Applicability of EALs to Groundwater, Stormwater, and Decontamination Water Management Plan
Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

Management Action	To be Considered Under the Following Conditions
Reinfiltration or reinjection within Immediate Work Area (including areas with known contamination)	Under many circumstances, contaminated groundwater can be reinfiltrated or reinjected within the Work Area (within 200 feet of the point of generation) as long as it will not result in contamination of previously unaffected areas. However, reinfiltration/reinjection methods must be evaluated to determine if a UIC permit is necessary. Advanced coordination with the City and County of Honolulu and the HDOH SDWB must occur before reinfiltration or reinjection. The reinfiltration of groundwater into the aquifer within the Work Area where it was removed can be done pursuant to HDOH regulations (TGM, Section 5.8). Water to be reinfiltrated/reinjected should meet the following criteria: ➢ Water is not considered a hazardous waste pursuant to federal or state law. ➢ Water does not contain any free product or other gross contaminants. ➢ Water can be reinfiltrated in an HDOH-approved reinfiltration hole, trench, or pit ➢ Advance dewatering permits are obtained as necessary from the HDOH CWB ➢ Advanced clearance from the HDOH SDWB if any portion of a reinfiltration trench is deeper than 10 feet. If construction of UIC wells is needed, SDWB permit requirements must be met for well construction, placement, use, and closure. Water that is considered hazardous waste, regardless of its source, must be either managed offsite at an appropriately permitted facility or stored securely onsite until remedial action is completed.
On Site or Off Site Reinfiltration or Reinjection	Under limited circumstances, groundwater can be reinfiltrated through the surface at other designated areas onsite within the Rail Corridor if all of the following conditions are met: ➢ Contaminant concentrations < HDOH Tier 1 EALs for unrestricted use within approximately 150 meters (500 feet) from surface water and over a drinking water source. ➢ Returned to the same aquifer. ➢ Reinfiltration will be done at a slow enough rate so that it does not flow past the designated reinfiltration area, enter storm drains, or impact surface water in the area. Off Site reinfiltration or reinjection is not anticipated though if any reuse were proposed, water would need to meet the strictest Tier 1 EALs.
Discharge to Sanitary Sewers Disposal at Permitted Facility	Water that cannot be reinfiltrated, reinjected, or discharged will require disposal. Options currently include: ➢ Discharge to the City and County of Honolulu sanitary sewer system (requires appropriate permits). If discharge water was generated within contaminated areas, additional coordination with HDOH HEER is required and Aquatic Habitat Criteria (Chronic Toxicity) will apply to discharge within these areas, in addition to any criteria applicable to permit. ➢ Transport for treatment and disposal at an HDOH-permitted facility. *See EALs[a] Tables G-1 and G-2.*

[a] Appendix C contains the HDOH Environmental Action Level Tables (Fall 2011, rev January 2012).

Notes:
HDOH Tier 1 EALs are based on unrestricted land use, potentially impacted groundwater being a current or potential drinking water resource, and a distance of <150 meters to the nearest surface water body (HDOH 2011, updated January 2012).

COPC = constituent of potential concern
CWB = Clean Water Branch
EAL = Environmental Action Level
HDOH = State of Hawaii Department of Health
mg/kg = milligrams per kilogram
NOI = Notice of Intent
NPDES = National Pollution Discharge Elimination System
SDWB = Safe Drinking Water Branch
TGM = Technical Guidance Manual
UIC = Underground Injection Line

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Appendix A
Known or Suspected Contaminated Sites

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INDEX

NUMBER	TITLE
A.1	Mapbook of Known or Suspected Contaminated Sites
A.2	List of Known or Suspected Contaminated Sites

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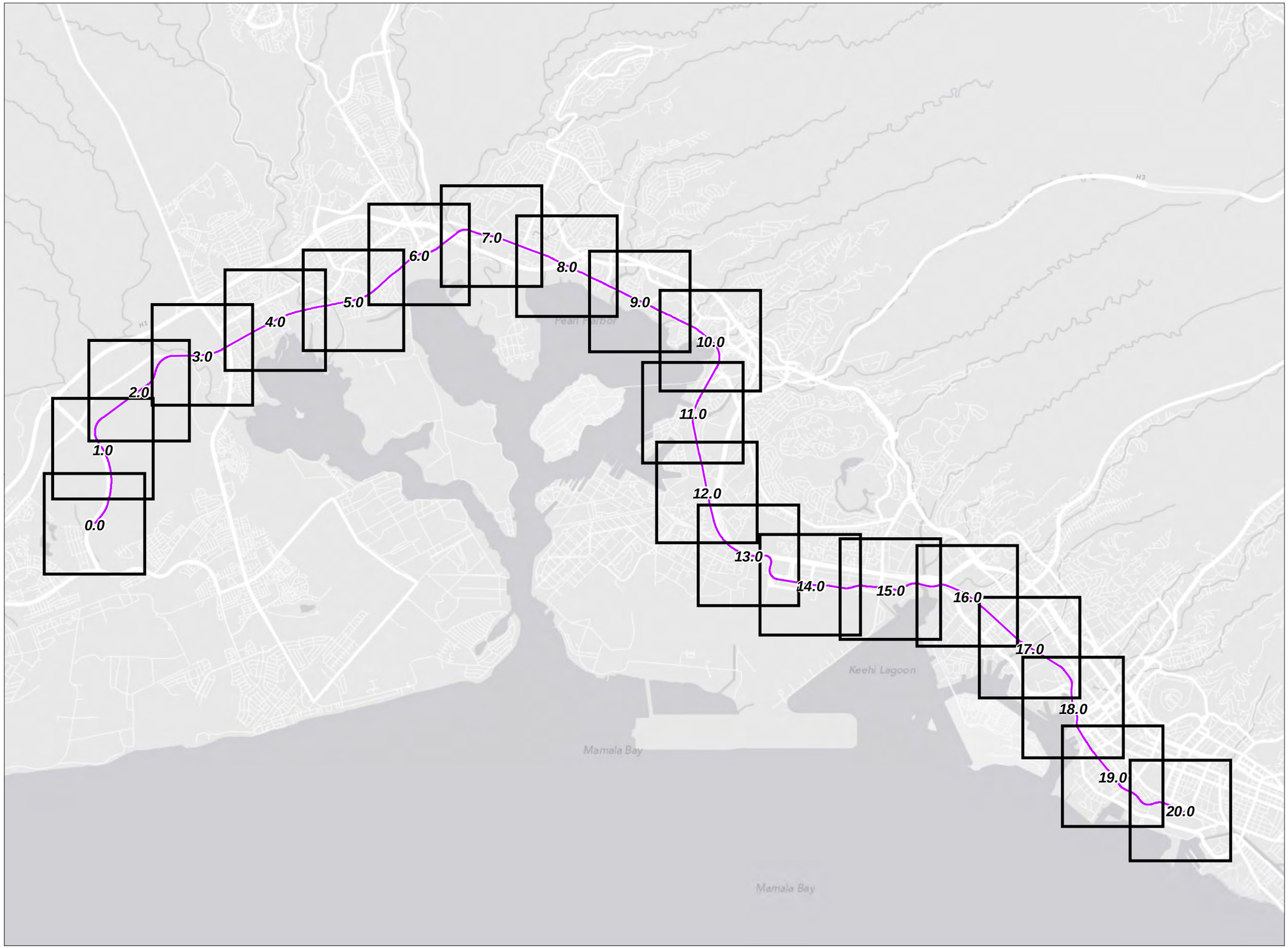

HART Guideway

Map Extent Indicator

N

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FIGURE A-1
Areas of Known and Suspected Contamination - Mile Indicator
Programmatic Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

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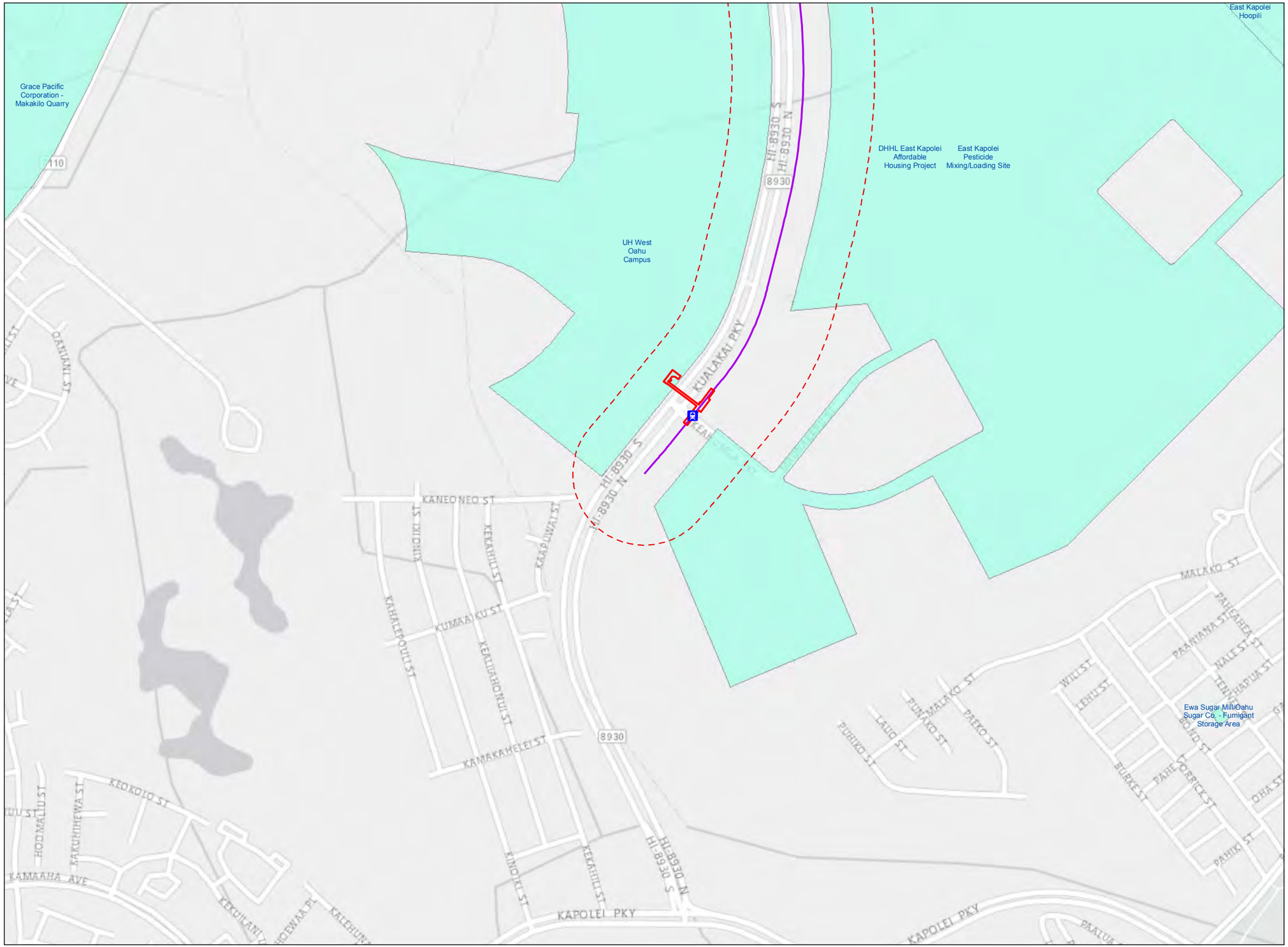

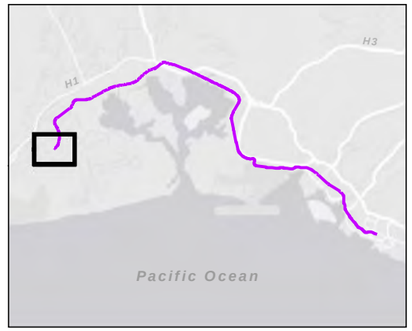

- HEER Release Site
- LUST Site
- HART Release Sites
- HPOL Site Boring
- Hickam POL Pipeline
- HPOL Site
- EHMP/Land Use Control Boundary
- Site with Hazards/Controls TMK Boundary
- Site of Interest (SDAR)
- Trench Location
- Transit Station
- HART Guideway
- Transit Station Footprint
- Guideway Buffer (150m)

HEER Release Sites – HDOH database updated January 4, 2014
LUST Site – HDOH database updated January 4, 2014
SDAR – HDOH database updated January 4, 2014

N

0 250 500 1,000 Feet

FIGURE A-1
Areas of Known and Suspected Contamination - Mile 0.0
Programmatic Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

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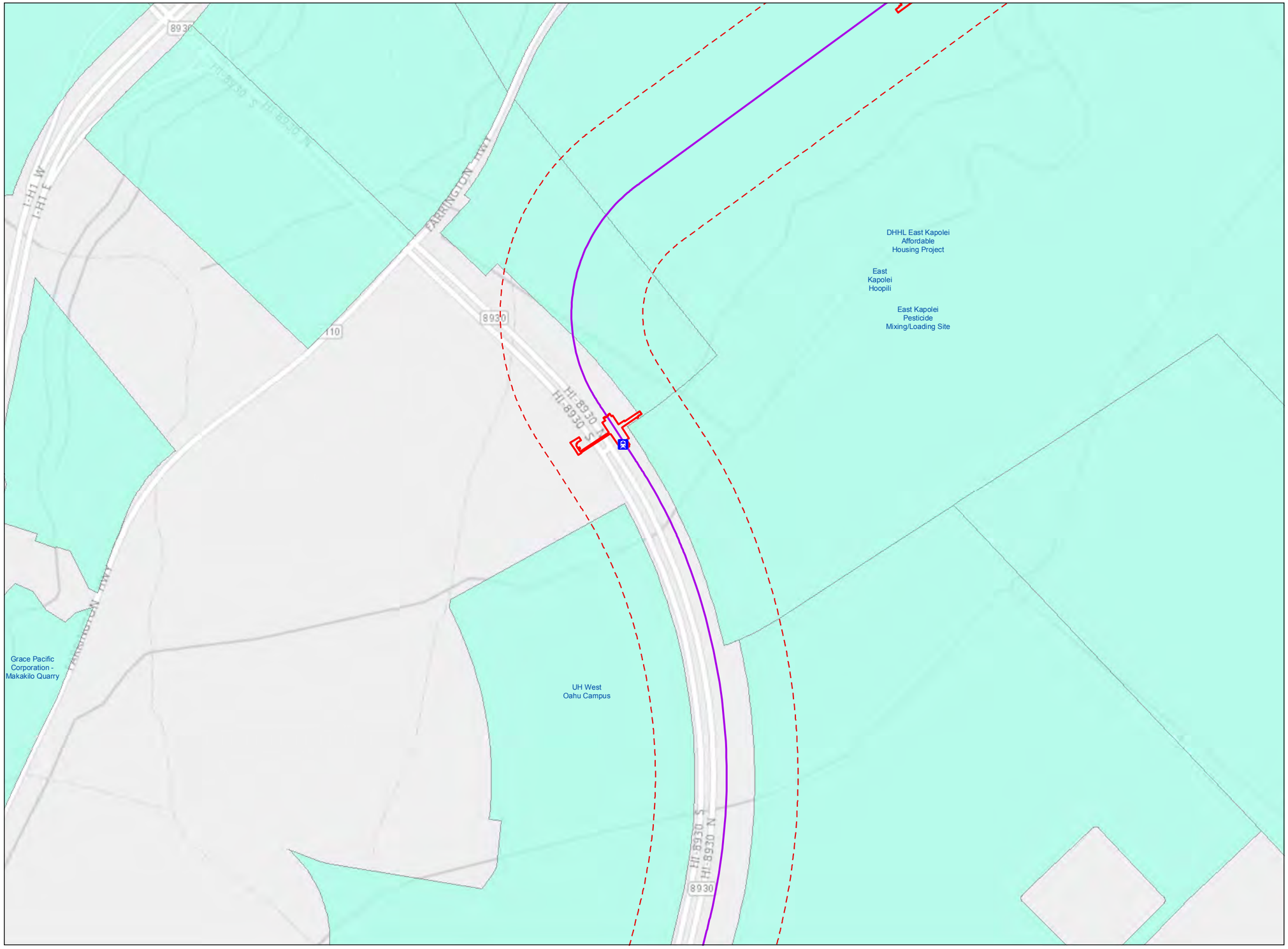

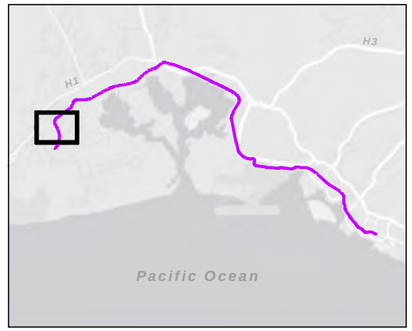

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HEER Release Sites – HDOH database updated January 4, 2014
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FIGURE A-1
Areas of Known and
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Programmatic Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

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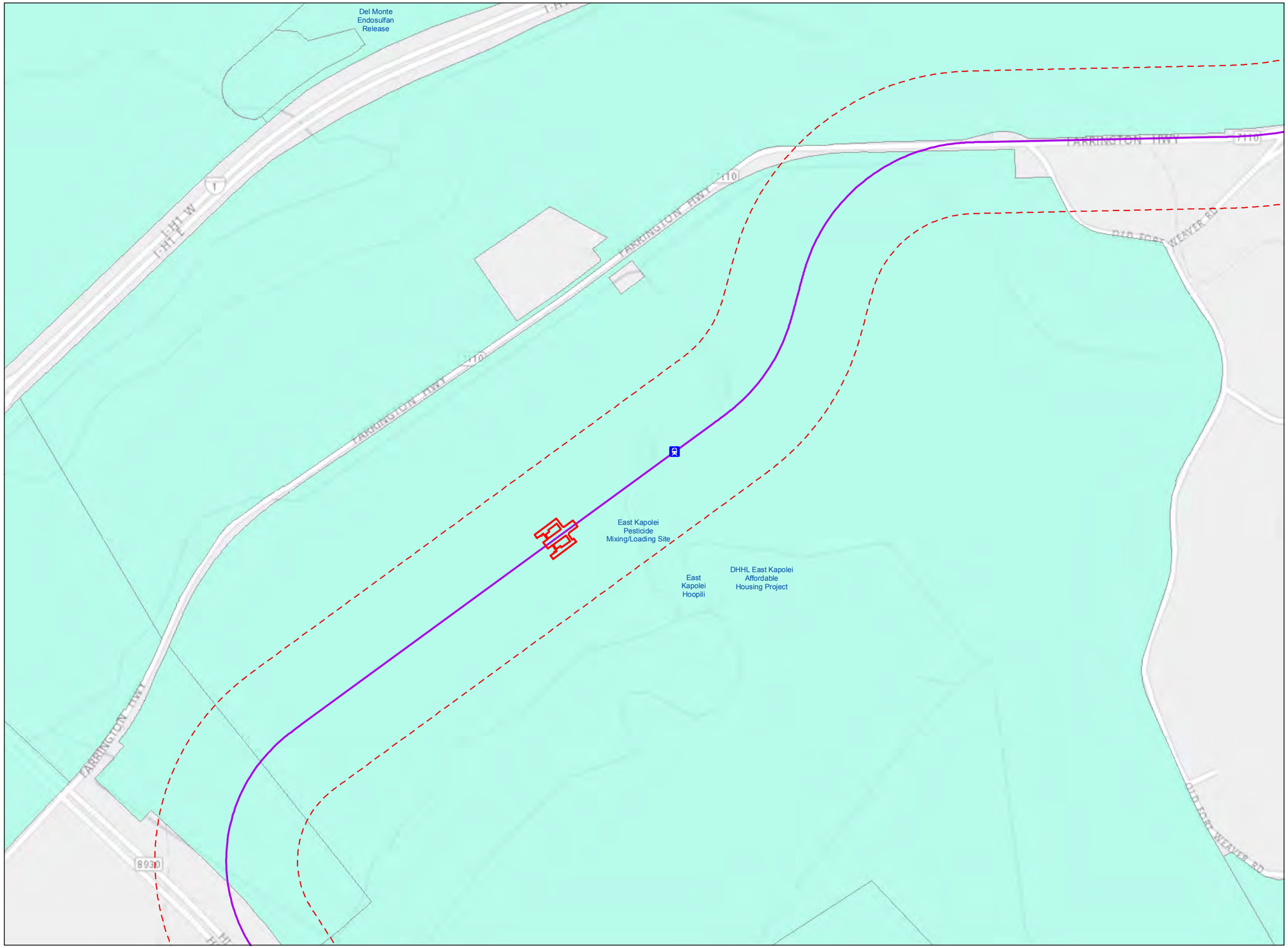

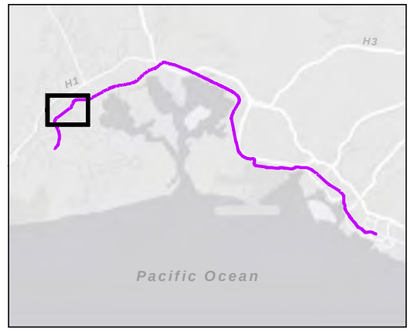

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HEER Release Sites – HDOH database updated January 4, 2014
LUST Site – HDOH database updated January 4, 2014
SDAR – HDOH database updated January 4, 2014

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FIGURE A-1
Areas of Known and Suspected Contamination - Mile 2.0
Programmatic Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

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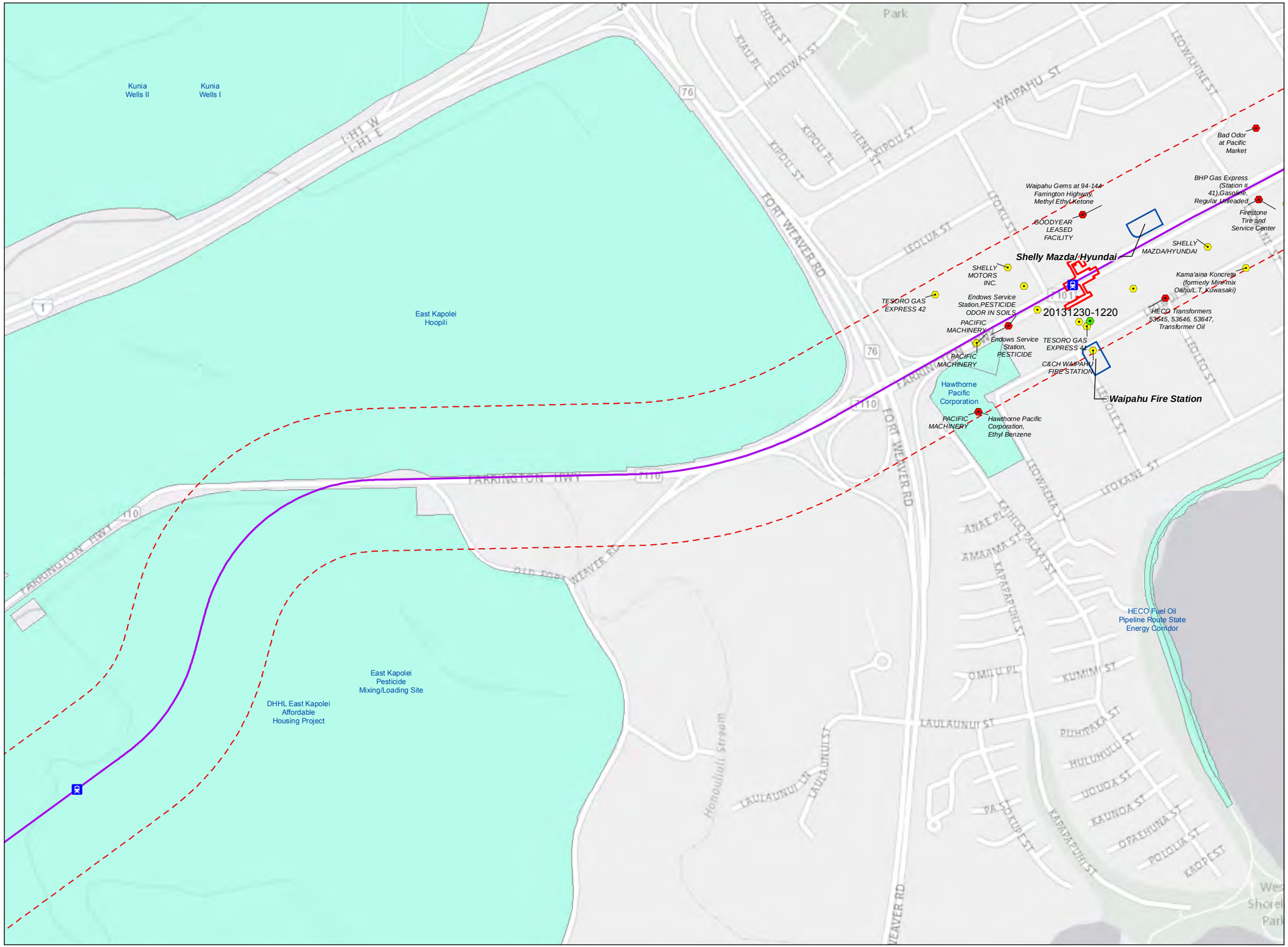

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HEER Release Sites – HDOH database updated January 4, 2014
LUST Site – HDOH database updated January 4, 2014
SDAR – HDOH database updated January 4, 2014

N

0 250 500 1,000 Feet

FIGURE A-1
Areas of Known and Suspected Contamination - Mile 3.0
Programmatic Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

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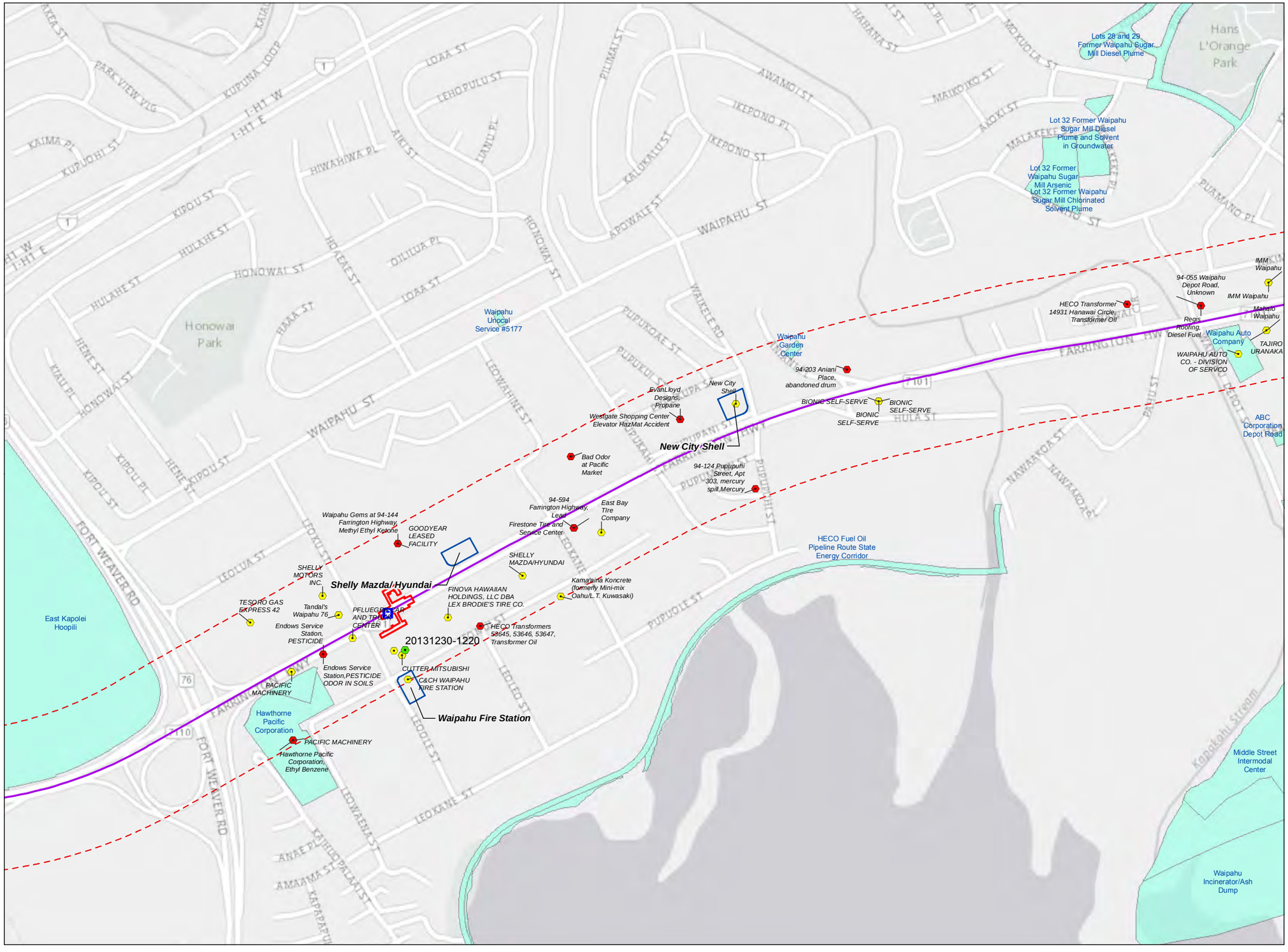

FIGURE A-1
Areas of Known and Suspected Contamination - Mile 4.0
Programmatic Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

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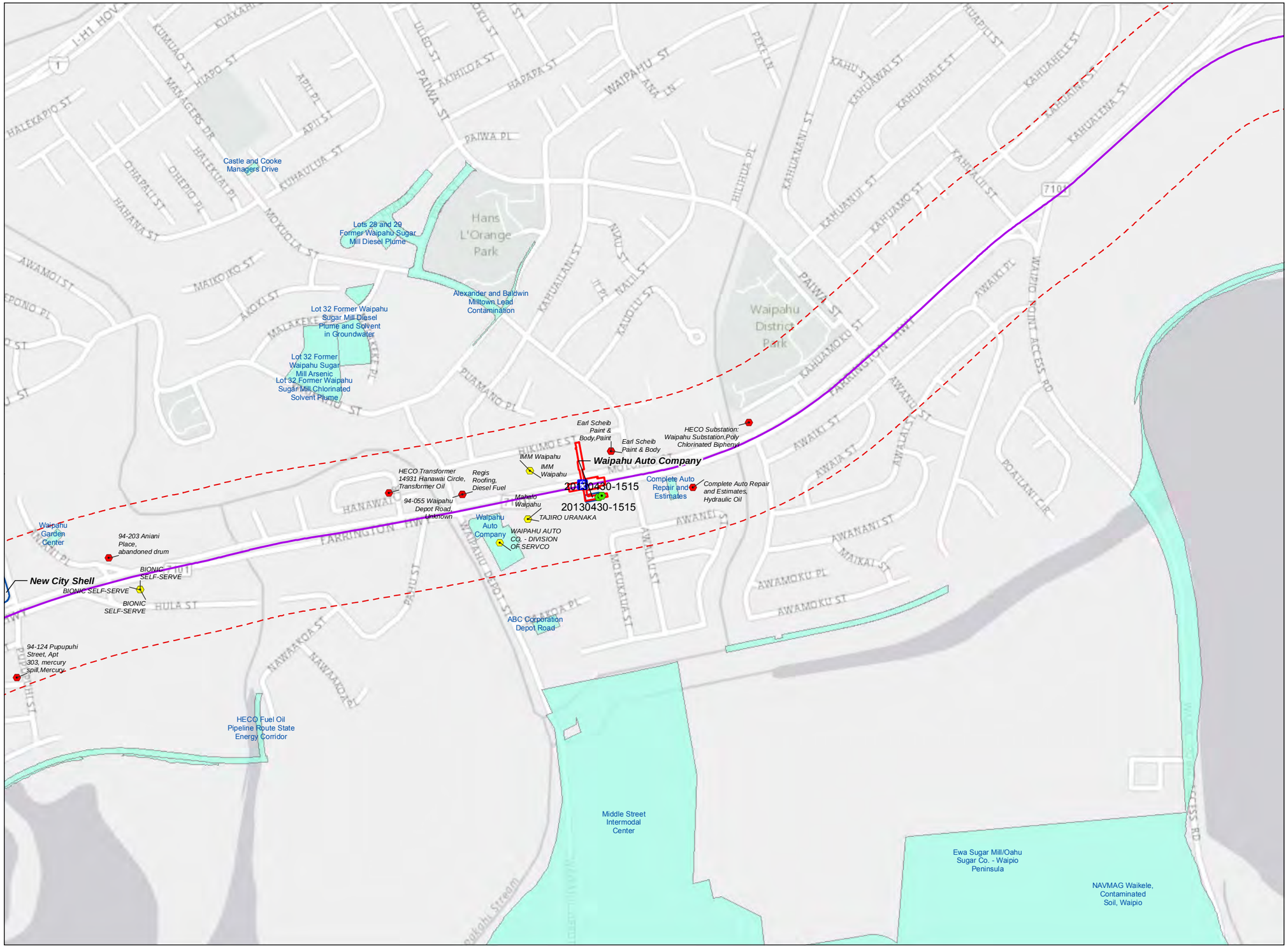

FIGURE A-1
Areas of Known and Suspected Contamination - Mile 5.0
Programmatic Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

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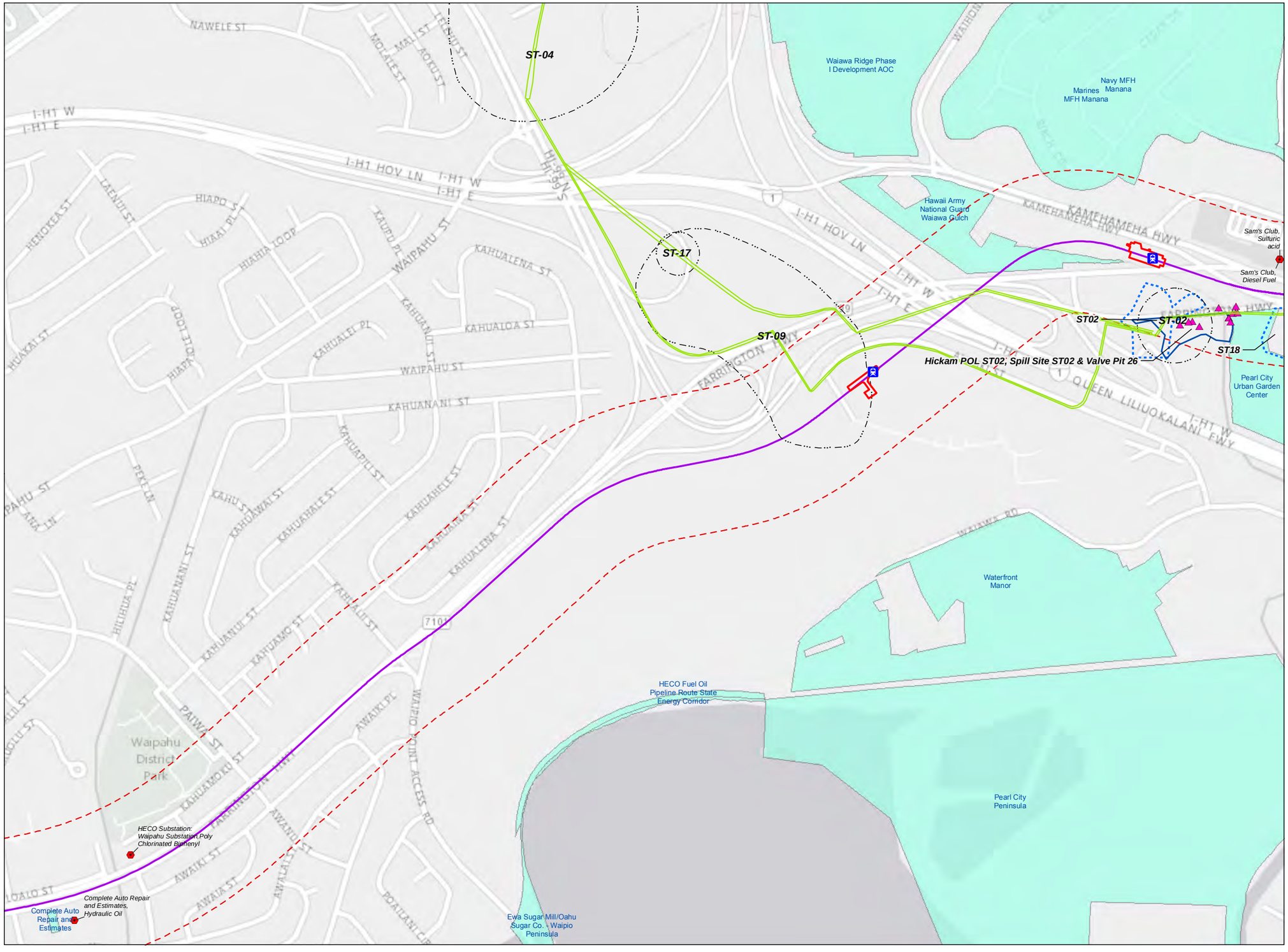

FIGURE A-1
Areas of Known and Suspected Contamination - Mile 6.0
Programmatic Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

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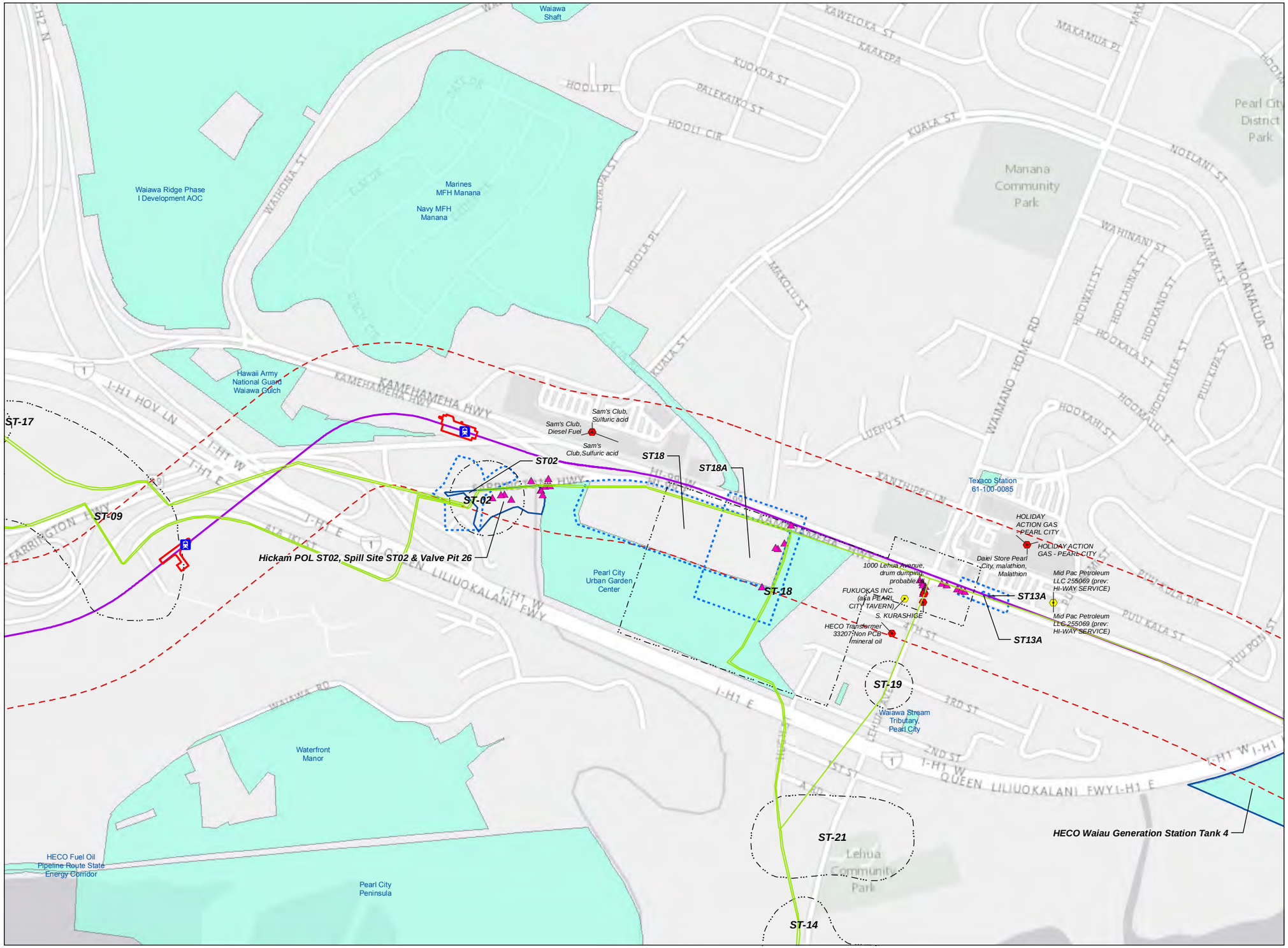

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HEER Release Sites – HDOH database updated January 4, 2014
LUST Site – HDOH database updated January 4, 2014
SDAR – HDOH database updated January 4, 2014

N

0 250 500 1,000 Feet

FIGURE A-1
Areas of Known and Suspected Contamination - Mile 7.0
Programmatic Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

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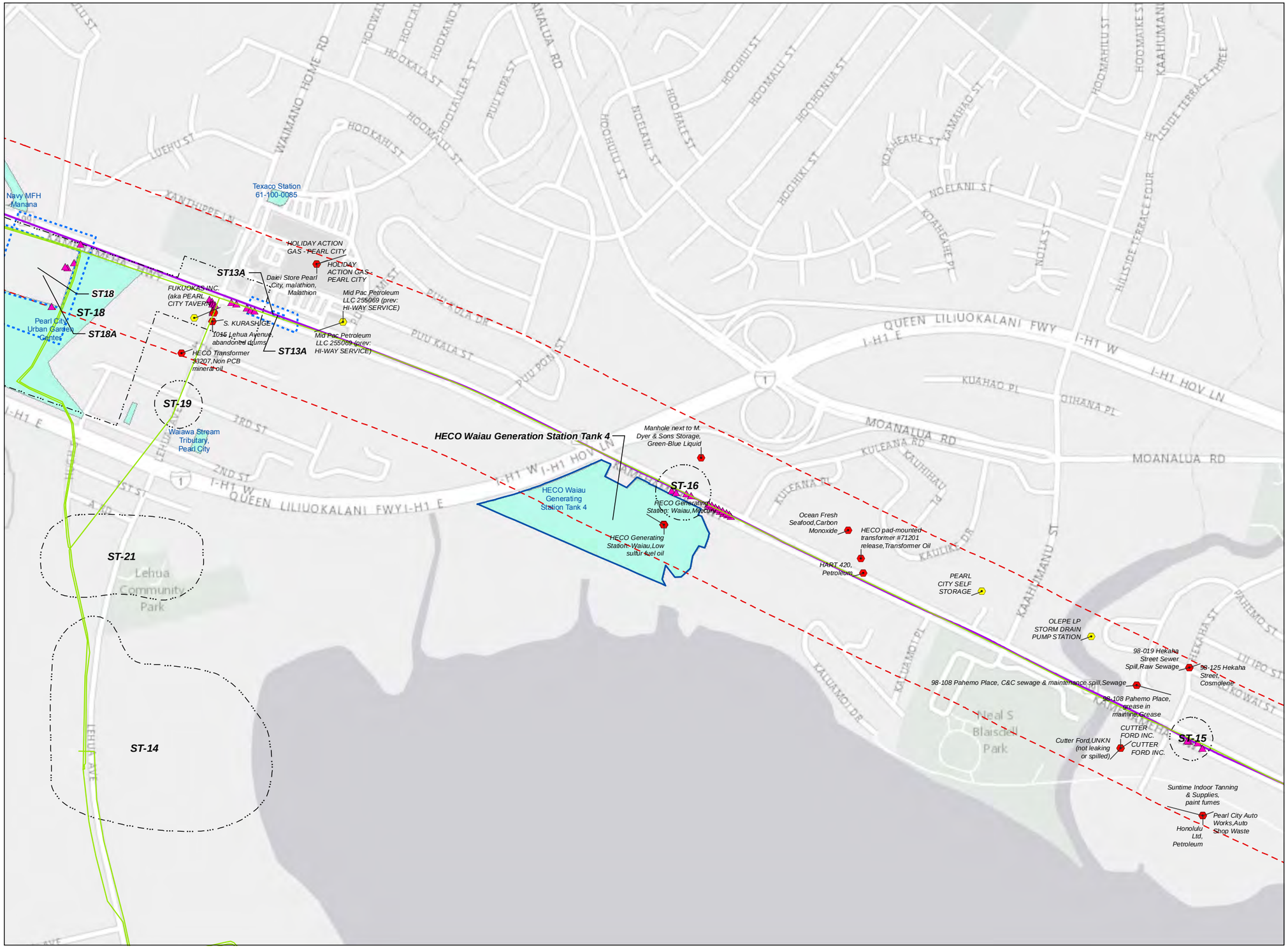
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ST13A
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FUKUOKAS INC. (aka PEARL CITY TAVERN)
S. KURASHIGE
1015 Lehua Avenue, abandoned drums
ST13A
Mid Pac Petroleum LLC 255069 (prev: HI-WAY SERVICE)
Mid Pac Petroleum LLC 255069 (prev: HI-WAY SERVICE)
HECO Transformer 39207,Non PCB mineral oil
ST18
ST-18
ST18A
Pearl City Urban Garden Center
ST-19
Waiawa Stream Tributary, Pearl City
HECO Waiau Generation Station Tank 4
Manhole next to M. Dyer & Sons Storage, Green-Blue Liquid
ST-16
HECO Waiau Generating Station Tank 4
HECO Generating Station: Waiau,Mercury
HECO Generating Station: Waiau,Low sulfur fuel oil
Ocean Fresh Seafood,Carbon Monoxide
HECO pad-mounted transformer #71201, release,Transformer Oil
HART 420, Petroleum
PEARL CITY SELF STORAGE
OLEPE LP STORM DRAIN PUMP STATION
98-019 Hekaha Street Sewer Spill,Raw Sewage
98-125 Hekaha Street, Cosmolene
98-108 Pahemo Place, C&C sewage & maintenance spill,Sewage
98-108 Pahemo Place, grease in mainline,Grease
CUTTER FORD INC.
Cutter Ford,UNKN (not leaking or spilled)
CUTTER FORD INC.
ST-15
Suntime Indoor Tanning & Supplies, paint fumes
Pearl City Auto Works,Auto Shop Waste
Honolulu Ltd, Petroleum
ST-21
ST-14
Lehua Community Park
Neal S Blaisdell Park
QUEEN LILIUOKALANI FWY
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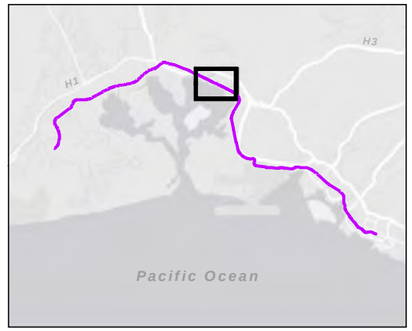

- HEER Release Site
- LUST Site
- HART Release Sites
- HPOL Site Boring
- Hickam POL Pipeline
- HPOL Site
- EHMP/Land Use Control Boundary
- Site with Hazards/Controls TMK Boundary
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- Trench Location
- Transit Station
- HART Guideway
- Transit Station Footprint
- Guideway Buffer (150m)

HEER Release Sites – HDOH database updated January 4, 2014
LUST Site – HDOH database updated January 4, 2014
SDAR – HDOH database updated January 4, 2014

FIGURE A-1
Areas of Known and Suspected Contamination - Mile 9.0
Programmatic Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

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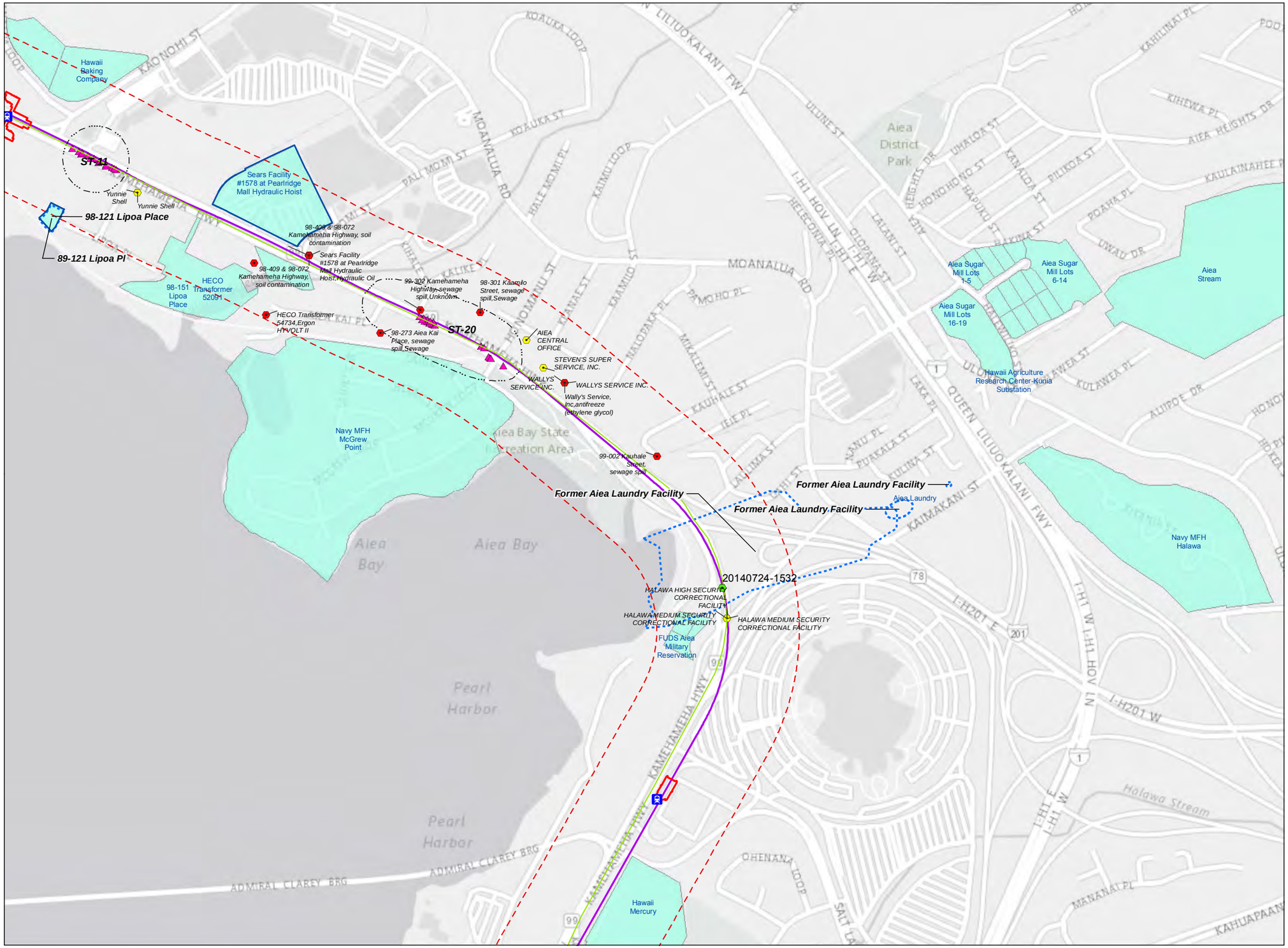

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HEER Release Sites – HDOH database updated January 4, 2014
LUST Site – HDOH database updated January 4, 2014
SDAR – HDOH database updated January 4, 2014

N

0 250 500 1,000 Feet

FIGURE A-1
Areas of Known and Suspected Contamination - Mile 10.0
Programmatic Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

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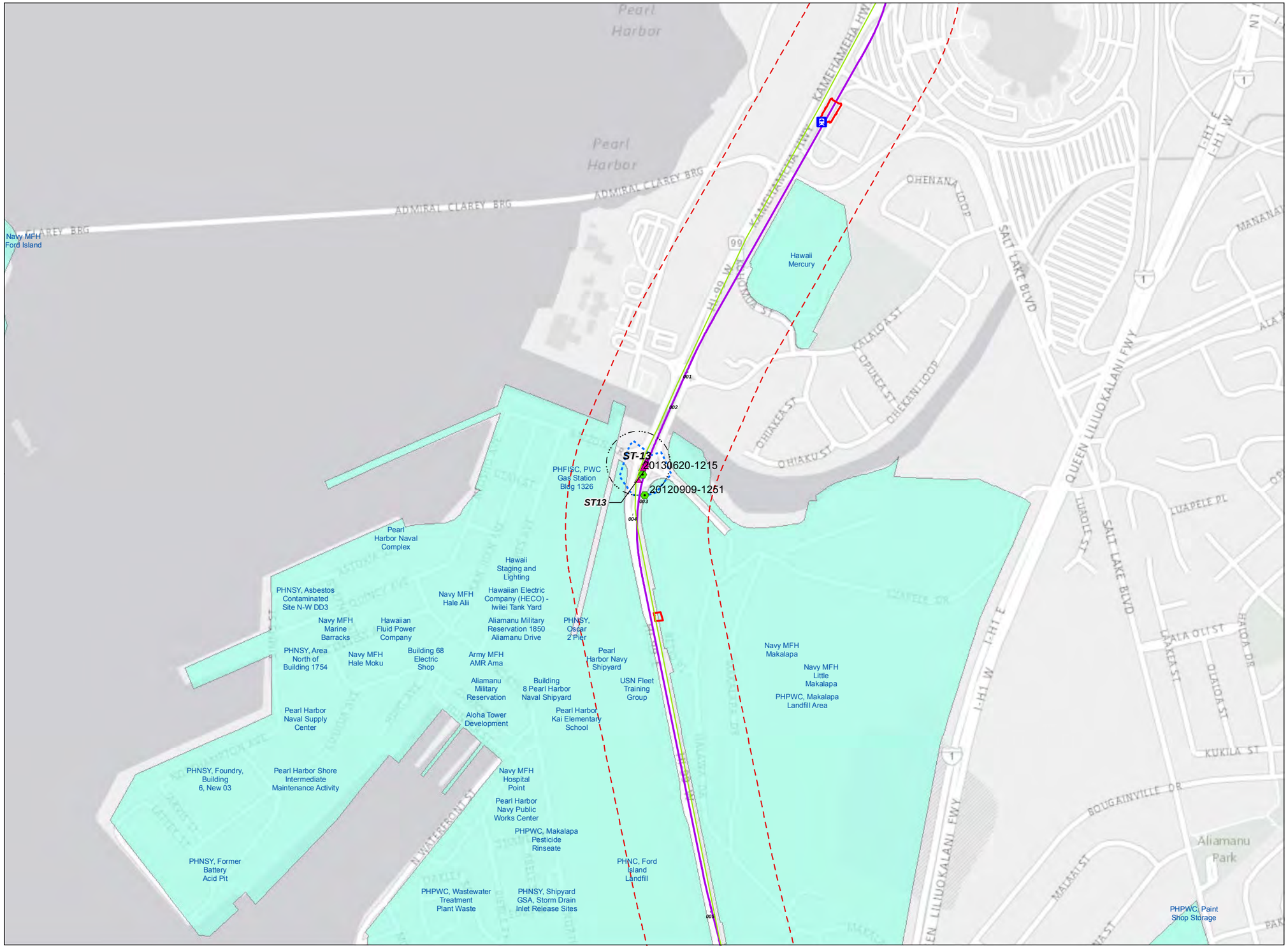

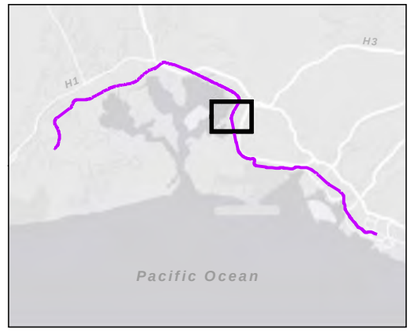

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- Transit Station Footprint
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HEER Release Sites – HDOH database updated January 4, 2014
LUST Site – HDOH database updated January 4, 2014
SDAR – HDOH database updated January 4, 2014

N

0 250 500 1,000 Feet

FIGURE A-1
Areas of Known and Suspected Contamination - Mile 11.0
Programmatic Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

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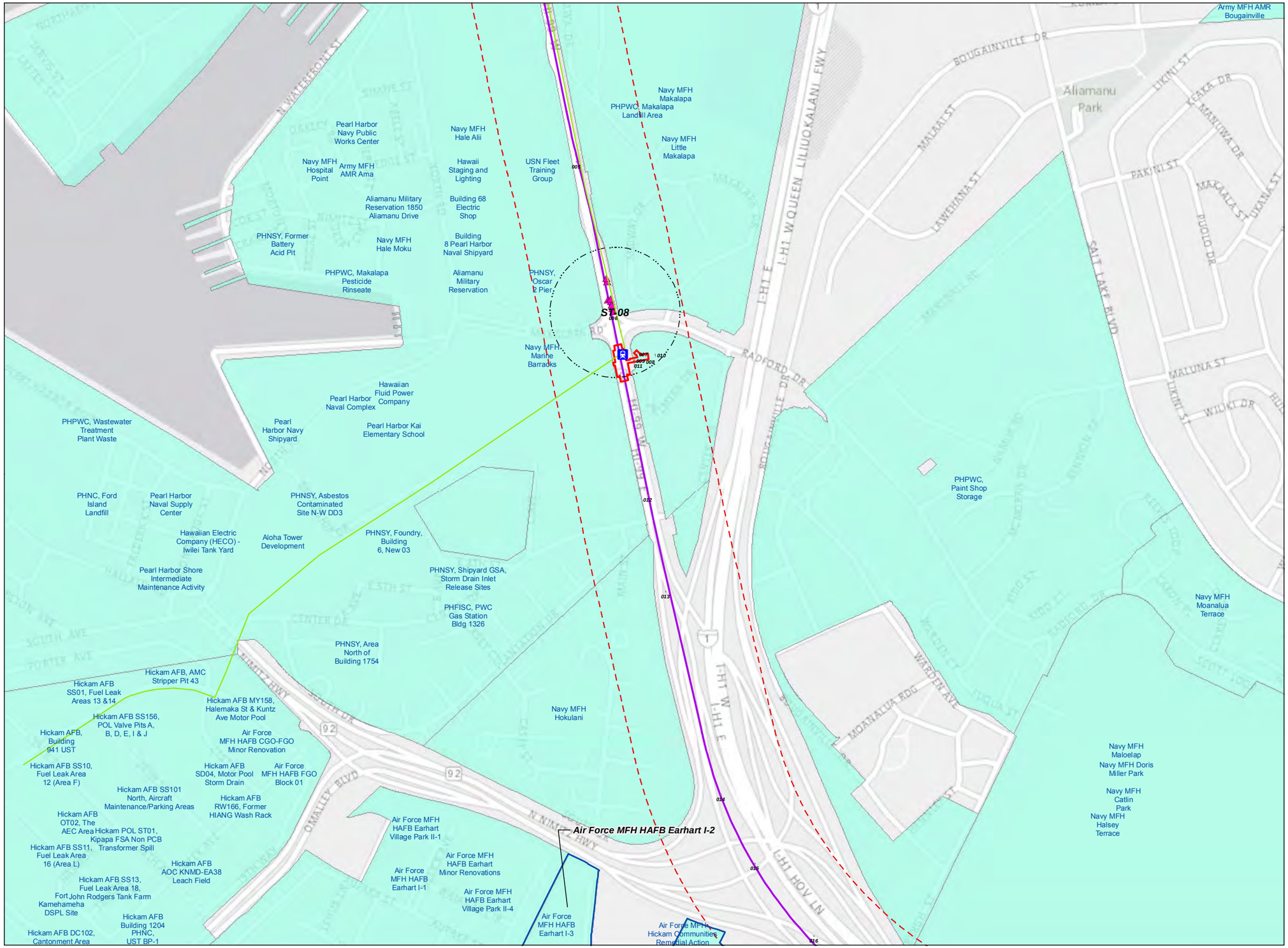

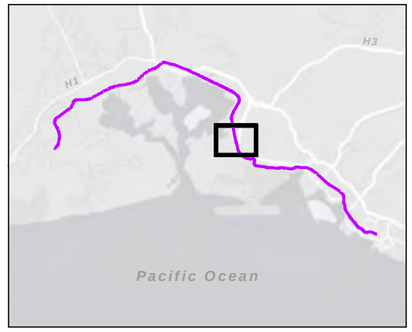

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- Guideway Buffer (150m)

HEER Release Sites – HDOH database updated January 4, 2014
LUST Site – HDOH database updated January 4, 2014
SDAR – HDOH database updated January 4, 2014

N

0 250 500 1,000 Feet

FIGURE A-1
Areas of Known and Suspected Contamination - Mile 12.0
Programmatic Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

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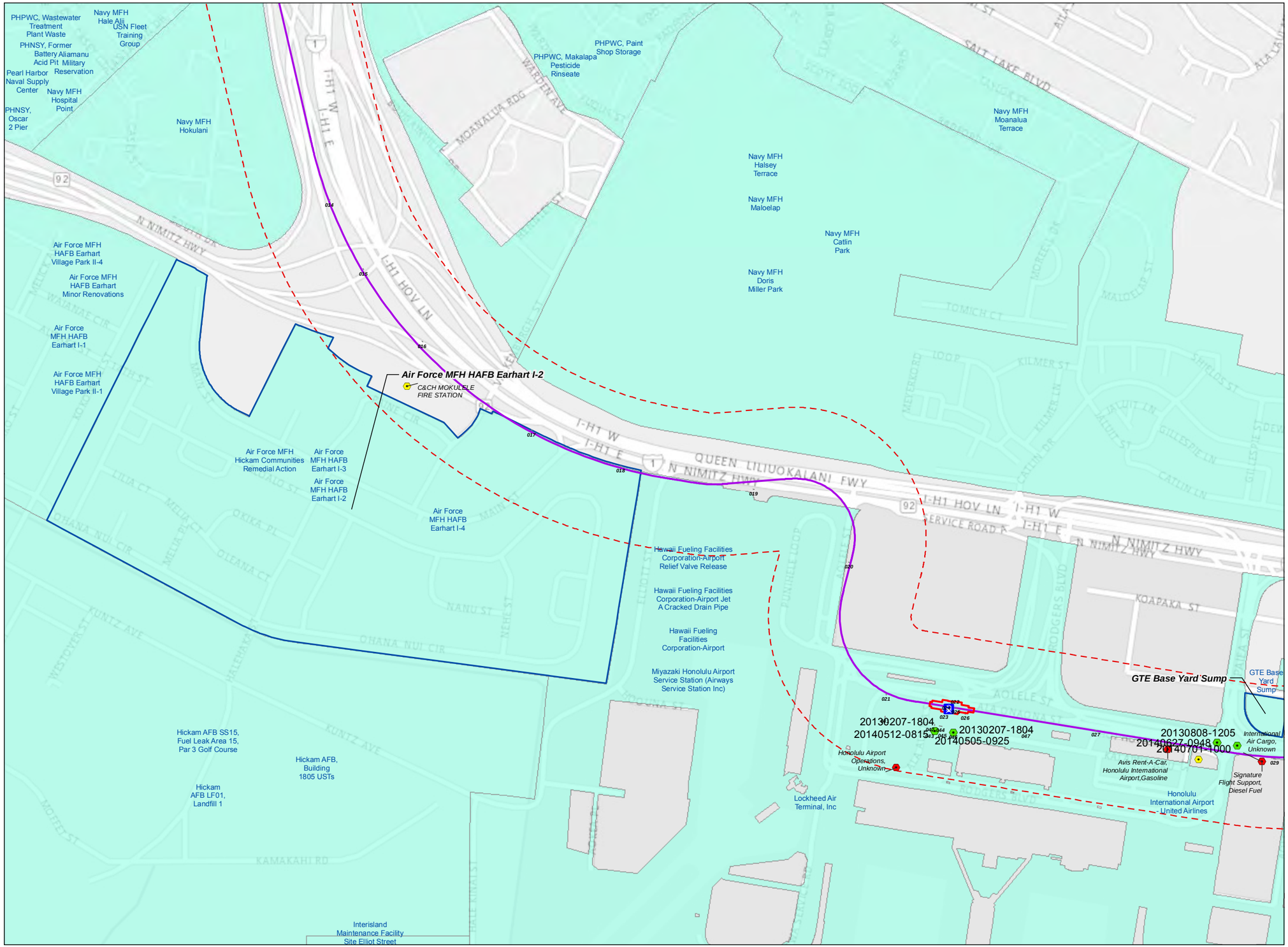

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HEER Release Sites – HDOH database updated January 4, 2014
LUST Site – HDOH database updated January 4, 2014
SDAR – HDOH database updated January 4, 2014

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0 250 500 1,000 Feet

FIGURE A-1
Areas of Known and Suspected Contamination - Mile 13.0
Programmatic Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

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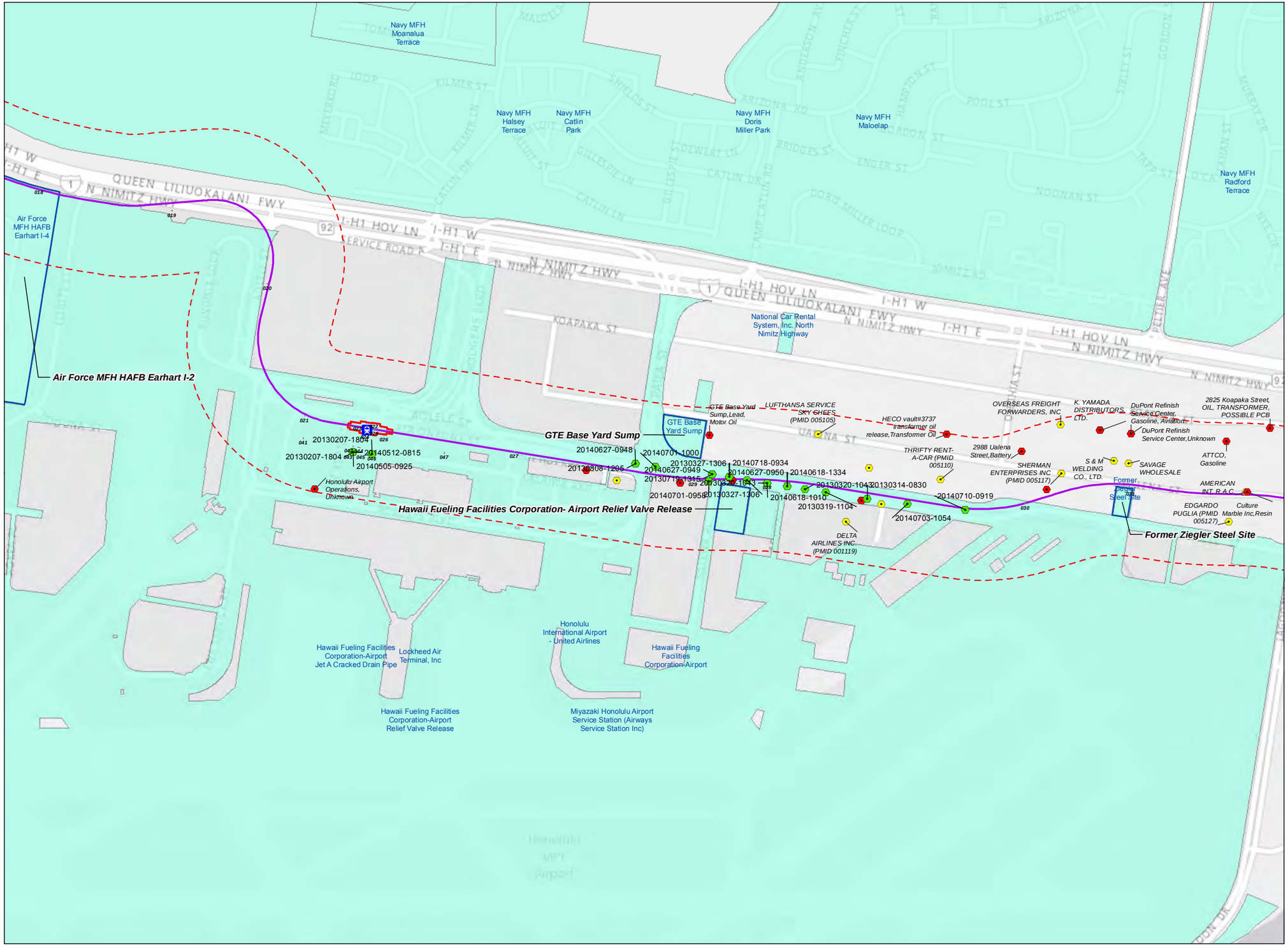

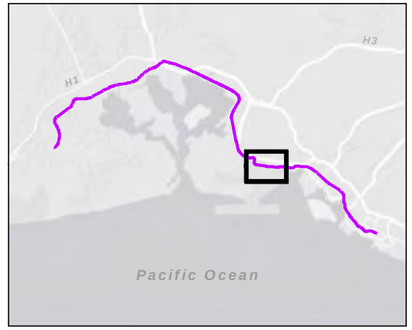

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- HART Guideway
- Transit Station Footprint
- Guideway Buffer (150m)

HEER Release Sites – HDOH database updated January 4, 2014
LUST Site – HDOH database updated January 4, 2014
SDAR – HDOH database updated January 4, 2014

N

0 250 500 1,000 Feet

FIGURE A-1
Areas of Known and Suspected Contamination - Mile 14.0
Programmatic Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

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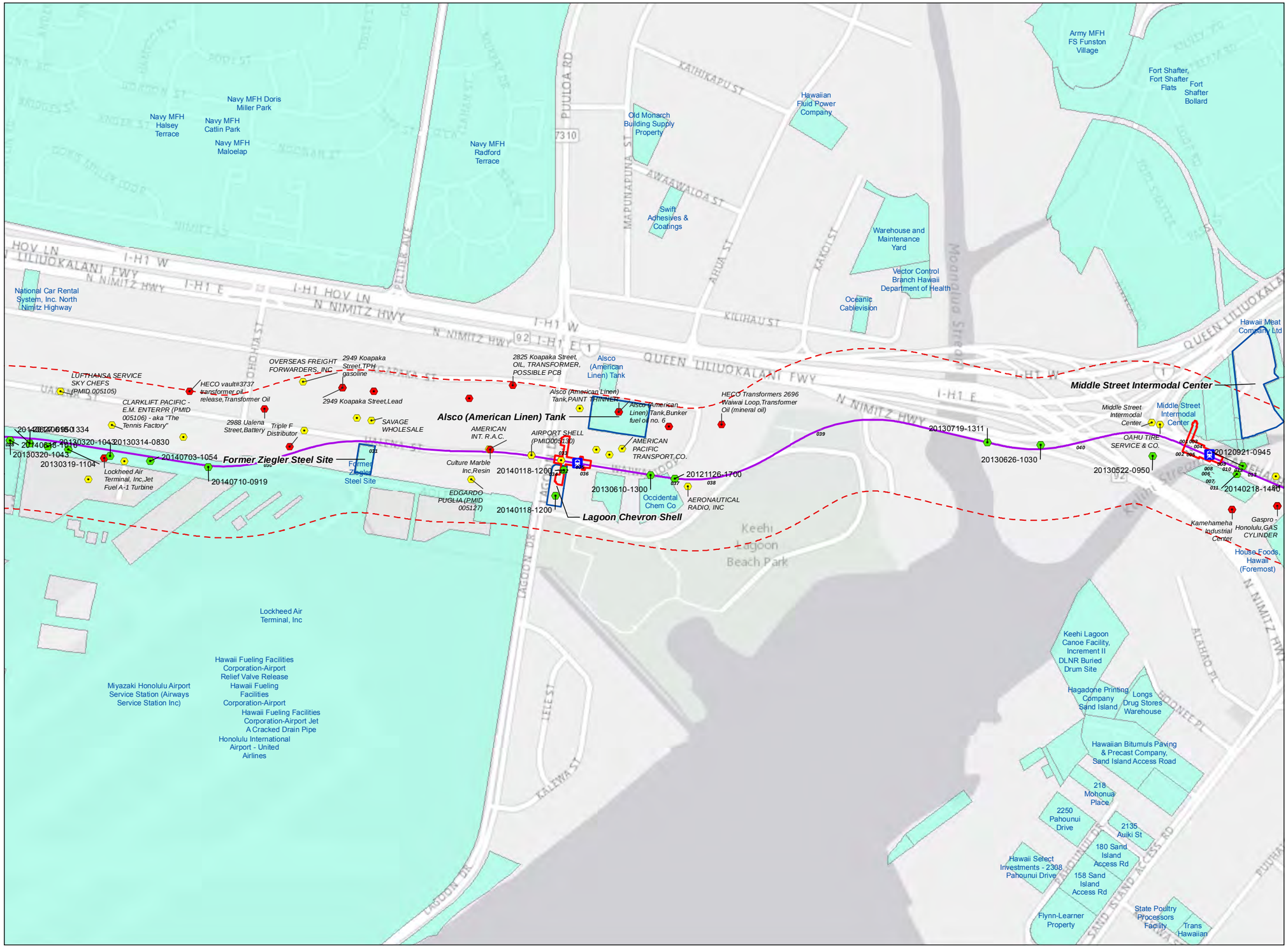

- HEER Release Site
- LUST Site
- HART Release Sites
- HPOL Site Boring
- Hickam POL Pipeline
- HPOL Site
- EHMP/Land Use Control Boundary
- Site with Hazards/Controls TMK Boundary
- Site of Interest (SDAR)
- Trench Location
- Transit Station
- HART Guideway
- Transit Station Footprint
- Guideway Buffer (150m)

HEER Release Sites – HDOH database updated January 4, 2014
LUST Site – HDOH database updated January 4, 2014
SDAR – HDOH database updated January 4, 2014

N

0 250 500 1,000 Feet

FIGURE A-1
Areas of Known and Suspected Contamination - Mile 15.0
Programmatic Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

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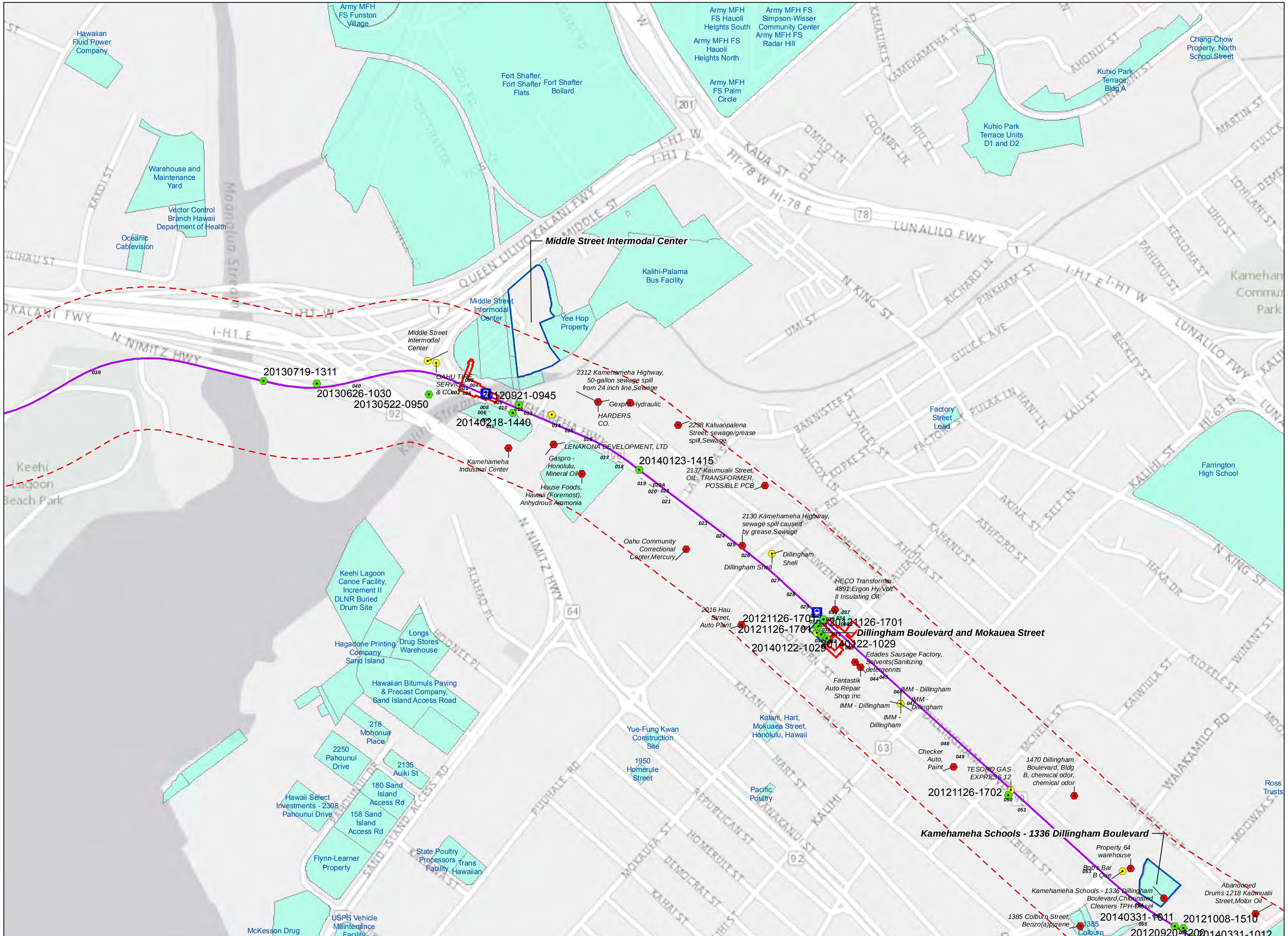

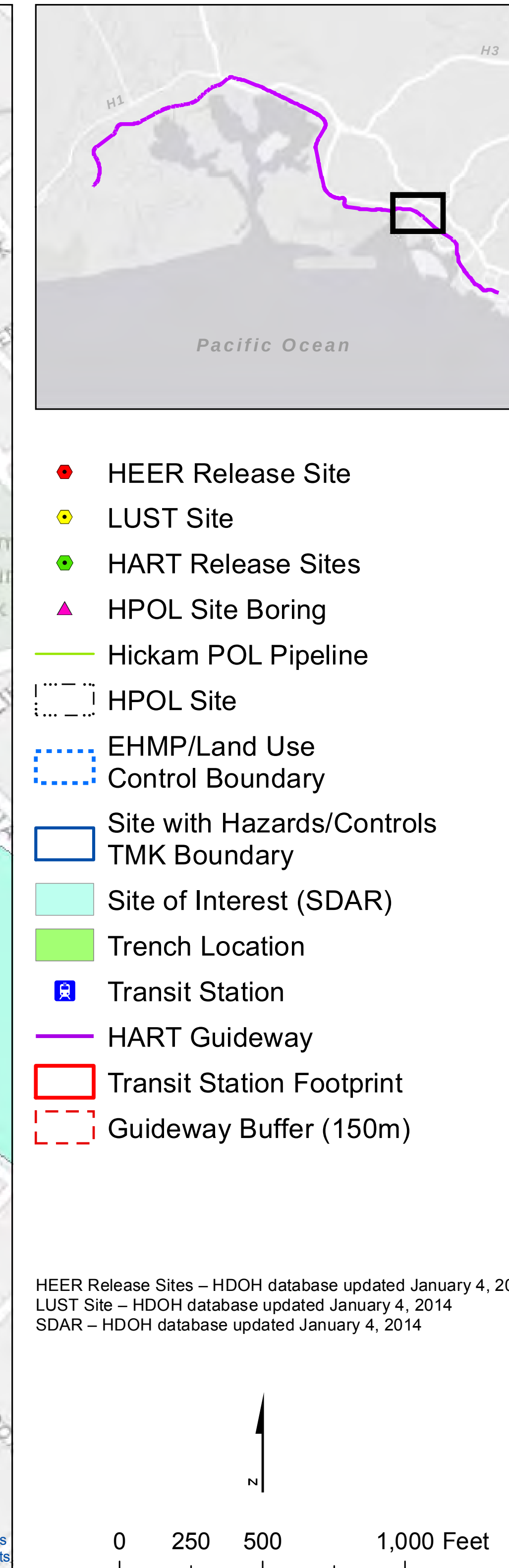

FIGURE A-1
Areas of Known and
Suspected Contamination - Mile 16.0
Programmatic Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

UNK R:\HART_ 20001307\MAPFILES\EHE_EHMP\FIGUREA-1_KNOWNSUSPECTED_CONTAMINATION.MXD ACOSS 10/2/2014 1:24:14 PM

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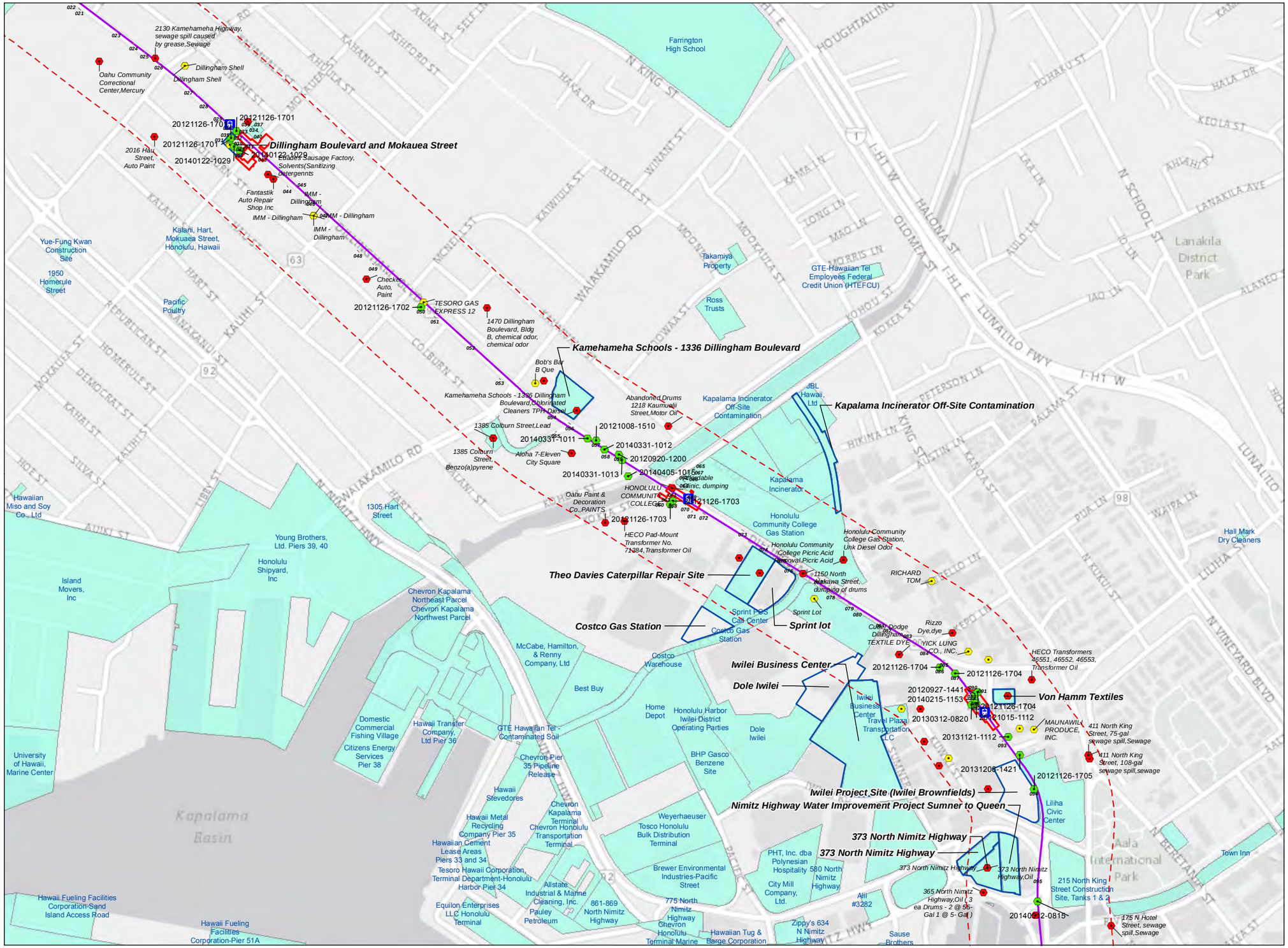

FIGURE A-1
Areas of Known and Suspected Contamination - Mile 17.0
Programmatic Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

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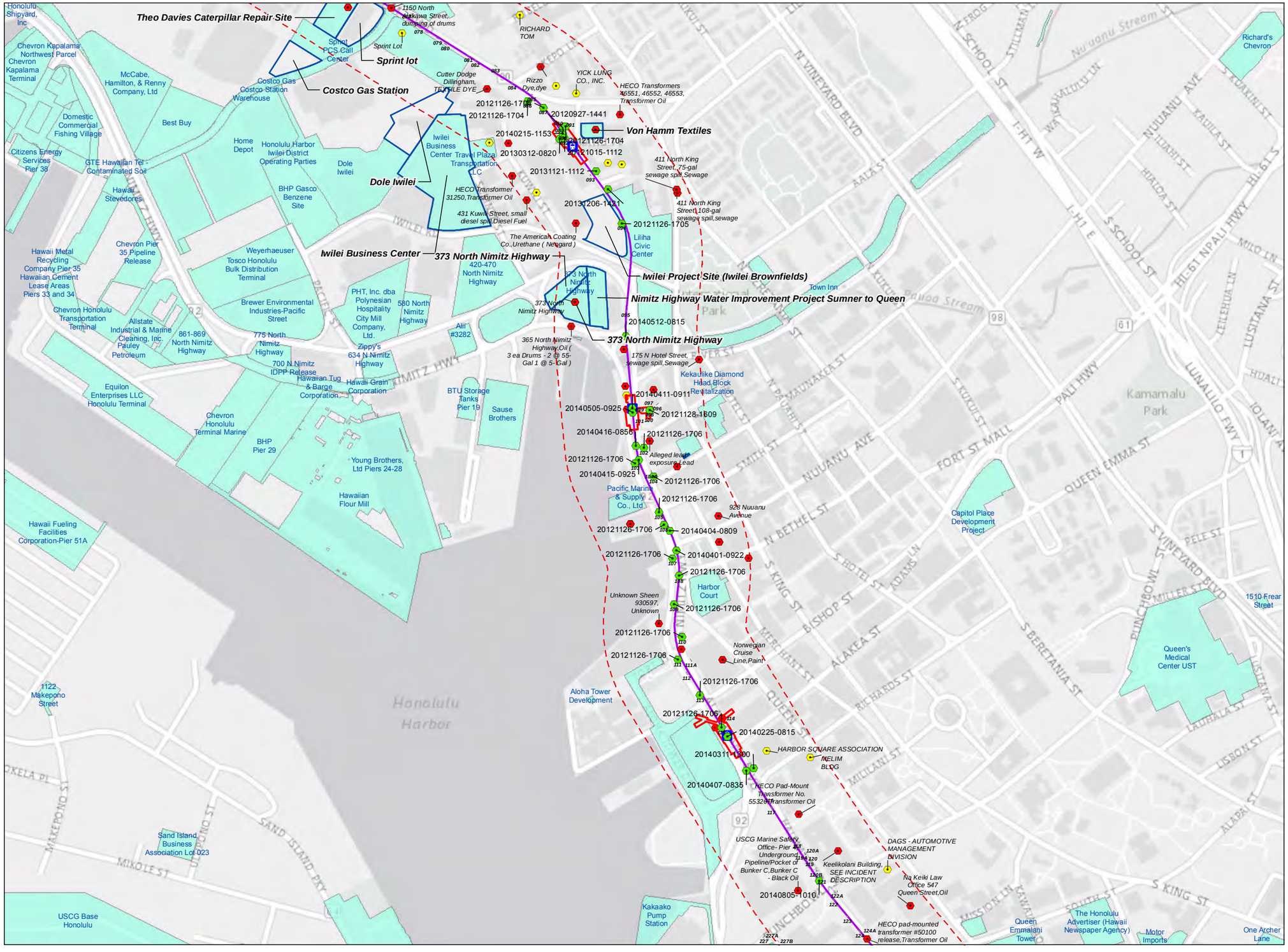

HEER Release Site
LUST Site
HART Release Sites
HPOL Site Boring
Hickam POL Pipeline
HPOL Site
EHMP/Land Use Control Boundary
Site with Hazards/Controls TMK Boundary
Site of Interest (SDAR)
Trench Location
Transit Station
HART Guideway
Transit Station Footprint
Guideway Buffer (150m)

HEER Release Sites – HDOH database updated January 4, 2014
LUST Site – HDOH database updated January 4, 2014
SDAR – HDOH database updated January 4, 2014

N

0 250 500 1,000 Feet

FIGURE A-1
Areas of Known and Suspected Contamination - Mile 18.0
Programmatic Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

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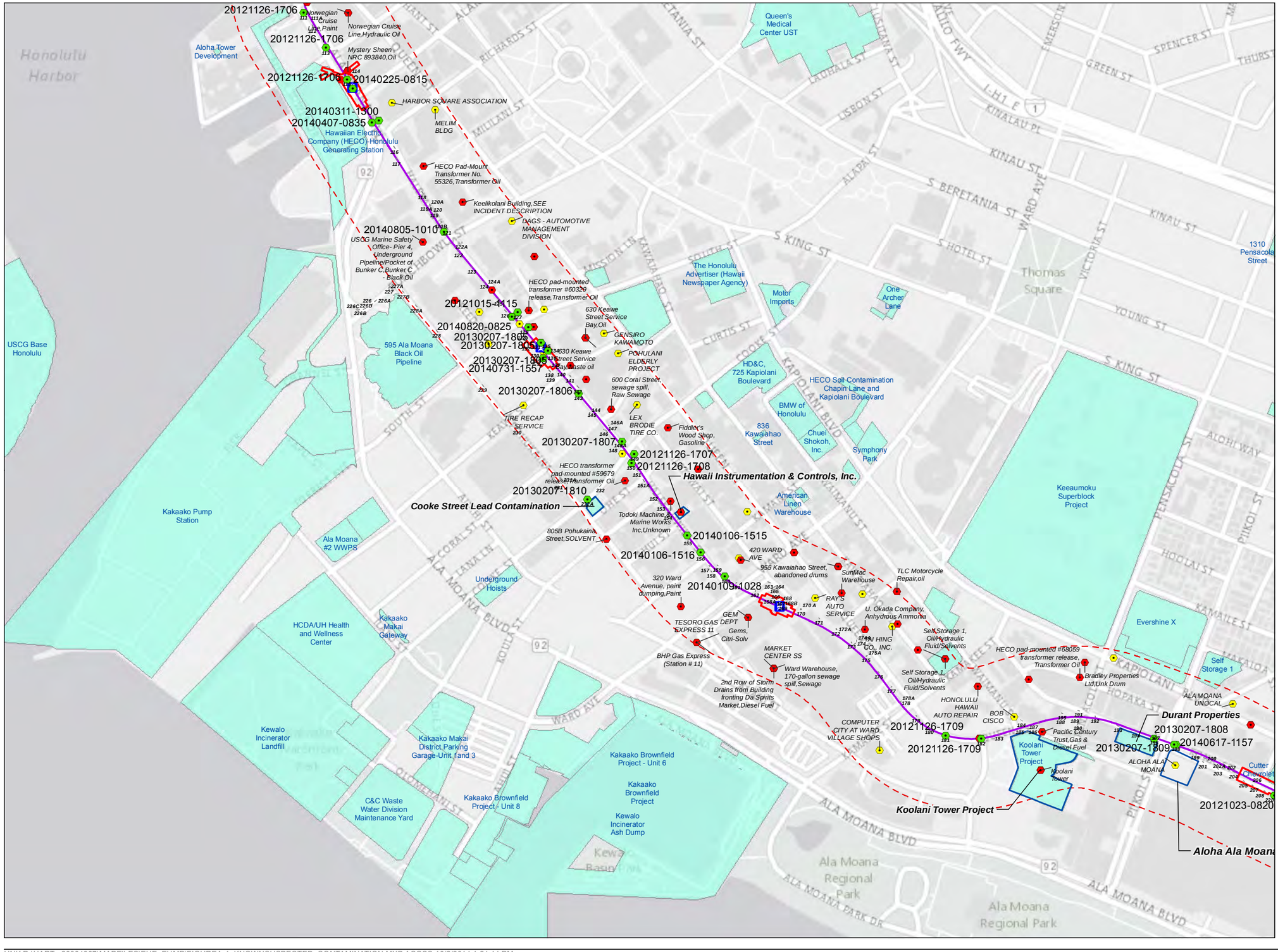

FIGURE A-1
Areas of Known and Suspected Contamination - Mile 19.0
Programmatic Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

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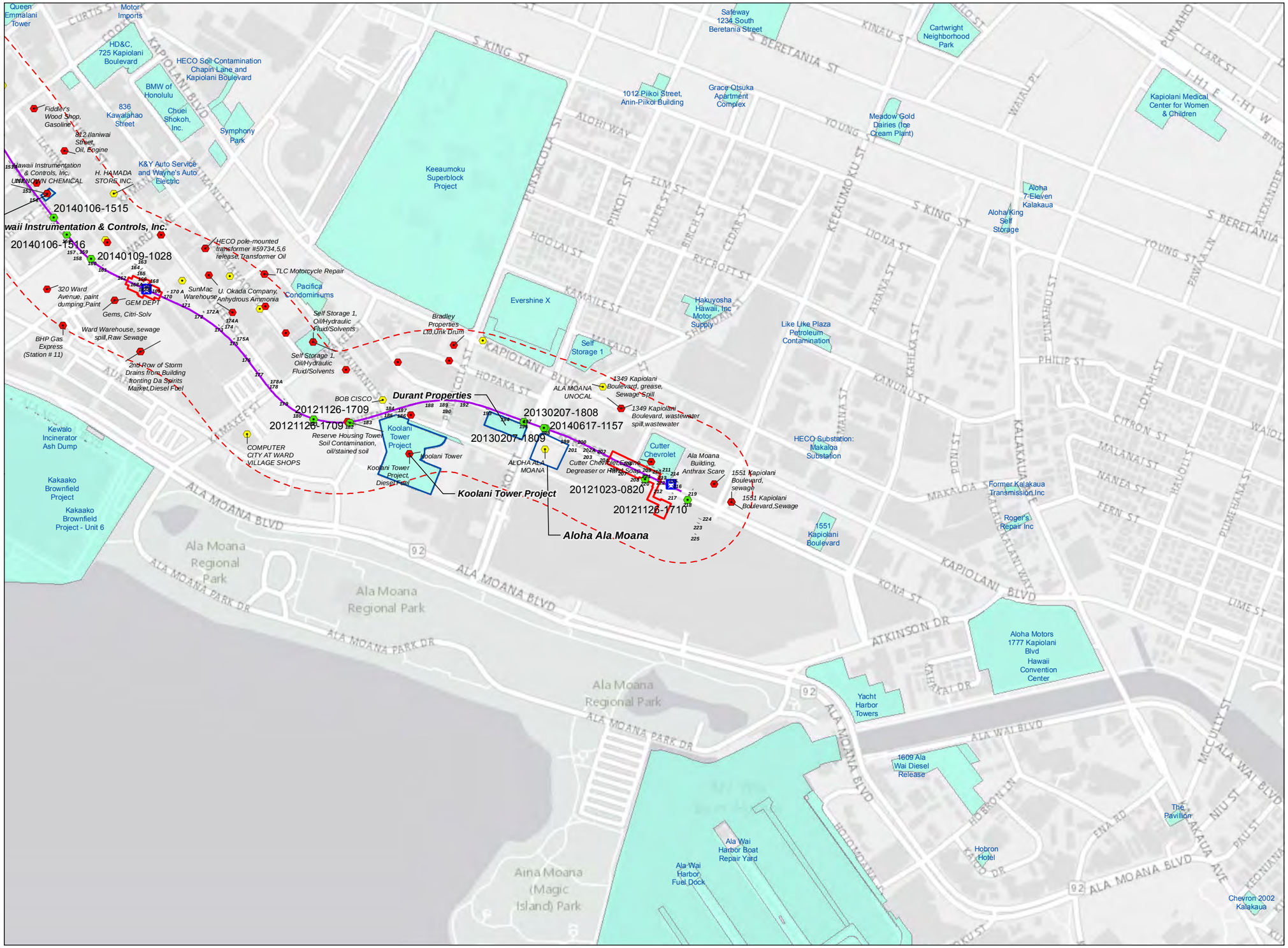

FIGURE A-1
Areas of Known and Suspected Contamination - Mile 20.0
Programmatic Environmental Hazard Evaluation and Environmental Hazard Management Plan
Honolulu Rail Transit Project, Oahu, Hawaii

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TABLE A-2

Known or Suspected Contaminated Sites

Environmental Hazard Evaluation and Environmental Hazard Management Plan

Honolulu Rail Transit Project, Oahu, Hawaii

Site Name	Address	Substance	Source	Easting[1]	Northing[1]	Release ID
UH West Oahu Campus		Presumed: Analytes below HDOH EALS for residential use.	HDOH SDAR - 2014	66,861.47	1,622,558.01	
DHHL East Kapolei Affordable Housing Project		Presumed: The site was a former sugarcane field and was suspected to be contaminated with pesticides and dioxin. Analytical results indicated levels of dioxin/furans below the EAL for residential development.	HDOH SDAR - 2014	70,836.04	1,622,717.46	
DHHL East Kapolei Affordable Housing Project		Presumed: The site was a former sugarcane field and was suspected to be contaminated with pesticides and dioxin. Analytical results indicated levels of dioxin/furans below the EAL for residential development.	HDOH SDAR - 2014	66,287.20	1,625,141.14	
East Kapolei Pesticide Mixing/Loading Site	Farrington Hwy	Found: Dioxins, Arsenic	HDOH SDAR - 2014	66,287.20	1,625,141.14	
East Kapolei Hoopili		Presumed: Analytes below HDOH EALs for residential land use.	HDOH SDAR - 2014	75,722.37	1,626,362.24	
DHHL East Kapolei Affordable Housing Project		Presumed: The site was a former sugarcane field and was suspected to be contaminated with pesticides and dioxin. Analytical results indicated levels of dioxin/furans below the EAL for residential development.	HDOH SDAR - 2014	71,763.53	1,626,521.44	
East Kapolei Hoopili		Presumed: Analytes below HDOH EALs for residential land use.	HDOH SDAR - 2014	71,763.53	1,626,521.44	
East Kapolei Pesticide Mixing/Loading Site	Farrington Hwy	Found: Dioxins, Arsenic	HDOH SDAR - 2014	71,763.53	1,626,521.44	
TESORO GAS EXPRESS 42	94-050 FARRINGTON HWY Waipahu, HI. 96797		HDOH LUST - 2014	76,726.86	1,631,708.39	
PACIFIC MACHINERY	94-031 FARRINGTON HWY Waipahu, HI. 96797		HDOH LUST - 2014	76,390.44	1,631,994.08	
PACIFIC MACHINERY	94-031 FARRINGTON HWY Waipahu, HI. 96797		HDOH LUST - 2014	76,390.44	1,631,994.08	
Hawthorne Pacific Corporation	94-025 Farrington Hwy, Waipahu HI. 96797	Ethyl Benzene	HDOH HEER	75,917.93	1632000.357	19981117-0954
Hawthorne Pacific Corporation	94-025 Farrington Hwy		HDOH SDAR - 2014	75,923.10	1,632,001.39	
PACIFIC MACHINERY	94-025 FARRINGTON HWY Waipahu, HI. 96797		HDOH LUST - 2014	75,916.68	1,632,005.26	
PACIFIC MACHINERY	94-025 FARRINGTON HWY Waipahu, HI. 96797		HDOH LUST - 2014	75,916.68	1,632,005.26	
PACIFIC MACHINERY	94-025 FARRINGTON HWY Waipahu, HI. 96797		HDOH LUST - 2014	75,916.68	1,632,005.26	
SHELLY MOTORS INC.	94-212 LEOKU ST Waipahu, HI. 96797		HDOH LUST - 2014	76,913.42	1,632,208.20	
Endows Service Station	67-016 Farrington Hwy, Waipahu HI. 96797	PESTICIDE	HDOH HEER	76,512.37	1632208.985	19900405
Endows Service Station	67-016 Farrington Hwy, Waipahu HI. 96797	PESTICIDE ODOR IN SOILS	HDOH HEER	76,512.37	1632208.985	19900504
Tandal's Waipahu 76	94-206 LEOKU ST Waipahu, HI. 96797		HDOH LUST - 2014	76,781.47	1,632,320.05	
Tandal's Waipahu 76	94-206 LEOKU ST Waipahu, HI. 96797		HDOH LUST - 2014	76,781.47	1,632,320.05	
PFLUEGER CAR AND TRUCK CENTER	94-097 FARRINGTON HWY Waipahu, HI. 96797		HDOH LUST - 2014	76,621.55	1,632,414.31	
NISSAN OF WAIPAHU - SHOWROOOM	94-119 FARRINGTON HWY Waipahu, HI. 96797		HDOH LUST - 2014	76,536.36	1,632,701.63	
Waipahu Gems at 94-144 Farrington Highway	94-144 Farrington Hwy, Waipahu HI. 96797	Methyl Ethyl Ketone	HDOH HEER	77,275.53	1632721.635	19930323-2
GOODYEAR LEASED FACILITY	94-144 FARRINGTON HWY Waipahu, HI. 96797		HDOH LUST - 2014	77,274.28	1,632,726.54	
TESORO GAS EXPRESS 41	94-120 FARRINGTON HWY Waipahu, HI. 96797		HDOH LUST - 2014	76,503.99	1,632,755.55	
CUTTER MITSUBISHI	94-149 FARRINGTON HWY Waipahu, HI. 96797		HDOH LUST - 2014	76,503.99	1,632,755.55	
CUTTER MITSUBISHI	94-149 FARRINGTON HWY Waipahu, HI. 96797		HDOH LUST - 2014	76,503.99	1,632,755.55	
13-535-01			Geotech Boring	76,547.02	1,632,778.14	20131230-1220
C&CH WAIPAHU FIRE STATION	94-121 LEONUI ST Waipahu, HI. 96797		HDOH LUST - 2014	76,339.72	1,632,796.90	
FINOVA HAWAIIAN HOLDINGS, LLC DBA LEX BRODIE'S TIRE CO.	94-169 FARRINGTON HWY Waipahu, HI. 96797		HDOH LUST - 2014	76,766.00	1,633,074.94	
HECO Transformers 53645, 53646, 53647	94-222 Leonui St, Waipahu HI. 96797	Transformer Oil	HDOH HEER	76,704.23	1633290.604	20010803-0717
SHELLY MAZDA/HYUNDAI	94-223 FARRINGTON HWY Waipahu, HI. 96797		HDOH LUST - 2014	77,054.17	1,633,589.59	
Bad Odor at Pacific Market	94-300 Farrington Hwy, Waipahu HI. 96797		HDOH HEER	77,875.18	1633917.912	19990718-1335
BHP Gas Express (Station # 41)	94-120 Farrington Hwy, Waipahu HI. 96797	Gasoline, Regular Unleaded	HDOH HEER	77,382.78	1633937.552	19970808-0818
Firestone Tire and Service Center	94-267 Farrington Hwy, Waipahu HI. 96744		HDOH HEER	77,382.78	1633937.552	19920413-2

TABLE A-2

Known or Suspected Contaminated Sites

Environmental Hazard Evaluation and Environmental Hazard Management Plan

Honolulu Rail Transit Project, Oahu, Hawaii

Site Name	Address	Substance	Source	Easting[1]	Northing[1]	Release ID
94-594 Farrington Highway	94-594 Farrington Hwy, Waipahu HI. 96797	Lead	HDOH HEER	77,382.78	1633937.552	20090714-1526
East Bay TIre Company	94-299 Farrington Hwy Waipahu, HI. 96797		HDOH LUST - 2014	77,352.34	1,634,133.33	
EvanLloyd Designs	94-366 Pupupani St, Waipahu HI. 96797	Propane	HDOH HEER	78,130.36	1634670.194	19921020-1
Westgate Shopping Center Elevator HazMat Accident	94-366 Pupupani St, Waipahu HI. 96797		HDOH HEER	78,130.36	1634670.194	19970417-1642
New City Shell	94-380 PUPUPANI ST. Waipahu, HI. 96797		HDOH LUST - 2014	78,240.55	1,635,059.98	
94-124 Pupupuhi Street, Apt 303, mercury spill	94-124 Pupupuhi St, Honolulu HI. 96797	Mercury	HDOH HEER	77,653.53	1635191.348	20010329-1750
Waipahu Garden Center	Aniani Pl		HDOH SDAR - 2014	78,622.85	1,635,453.75	
94-203 Aniani Place, abandoned drum	94-203 Aniani Pl, Waipahu HI. 96797		HDOH HEER	78,476.97	1635823.574	19980320-1003
BIONIC SELF-SERVE	94-485 FARRINGTON HWY Waipahu, HI. 96797		HDOH LUST - 2014	78,256.41	1,636,046.85	
BIONIC SELF-SERVE	94-485 FARRINGTON HWY Waipahu, HI. 96797		HDOH LUST - 2014	78,256.41	1,636,046.85	
BIONIC SELF-SERVE	94-485 FARRINGTON HWY Waipahu, HI. 96797		HDOH LUST - 2014	78,256.41	1,636,046.85	
HECO Transformer 14931 Hanawai Circle	94-342 Hanawai Cir, Waipahu HI. 96797	Transformer Oil	HDOH HEER	78,927.64	1637756.812	20050129-1200
94-055 Waipahu Depot Road	94-055 Waipahu Depot Rd, Waipahu HI. 96797	Unknown	HDOH HEER	78,917.16	1638265.62	19910426
Regis Roofing	94-605 Waipahu Depot St, Waipahu HI. 96797	Diesel Fuel	HDOH HEER	78,917.16	1638265.62	19951207
Waipahu Auto Company		Found: Hydraulic fluid	HDOH SDAR - 2014	78,612.09	1,638,512.75	
WAIPAHU AUTO CO. - DIVISION OF SERVCO	94-729 FARRINGTON HWY Waipahu, HI. 96797		HDOH LUST - 2014	78,583.81	1,638,528.47	
TAJIRO URANAKA	94-767 FARRINGTON HWY Waipahu, HI. 96797		HDOH LUST - 2014	78,746.51	1,638,723.19	
Mahalo Waipahu	94-767 FARRINGTON HWY Waipahu, HI. 96797		HDOH LUST - 2014	78,746.51	1,638,723.19	
IMM Waipahu	94-780 FARRINGTON HWY Waipahu, HI. 96797		HDOH LUST - 2014	79,078.09	1,638,736.95	
IMM Waipahu	94-780 FARRINGTON HWY Waipahu, HI. 96797		HDOH LUST - 2014	79,078.09	1,638,736.95	
WC-SO-WAIPAHUTC			AIS Trench	78,901.63	1,639,210.52	20130430-1515
			AIS Trench	78,913.84	1,639,233.12	20130430-1515
Earl Scheib Paint & Body	94-250 Mokuola St, Waipahu HI. 96797		HDOH HEER	79,216.52	1639291.477	19980519-2222
Earl Scheib Paint & Body	94-250 Mokuola St, Waipahu HI. 96797	Paint	HDOH HEER	79,216.52	1639291.477	20051017-0828
Complete Auto Repair and Estimates Hydraulic Lift Removal	94-875 Farrington Hwy		HDOH SDAR - 2014	78,964.26	1,639,717.16	
Complete Auto Repair and Estimates	94-875 Farrington Hwy, Waipahu HI. 96797	Hydraulic Oil	HDOH HEER	78,966.09	1639855.838	20011217-1210
HECO Substation: Waipahu Substation	94-951 Kahuamoku Pl, Waipahu HI. 96797	Poly Chlorinated Biphenyl	HDOH HEER	79,414.34	1640242.132	19930517
Waiawa Gulch	96-1176 Waihona St		HDOH SDAR - 2014	83,754.16	1,645,963.77	
Marines MFH Manana		Found: Organochlorine pesticides in soil	HDOH SDAR - 2014	84,981.43	1,647,269.56	
Navy MFH Manana		Found: Organochlorine pesticides in soil	HDOH SDAR - 2014	84,981.43	1,647,269.56	
Sam's Club	1000 Kamehameha Hwy, Pearl City HI. 96782	Sulfuric acid	HDOH HEER	83,525.31	1648176.491	19941115-2
Sam's Club	1000 Kamehameha Hwy, Pearl City HI. 96782	Sulfuric acid	HDOH HEER	83,525.31	1648176.491	19941115-2
Sam's Club	1000 Kamehameha Hwy, Pearl City HI. 96782	Diesel Fuel	HDOH HEER	83,525.31	1648176.491	20091201-1850
Pearl City Urban Garden Center	962 2nd St	Found: Arsenic, dieldrin, TPH-oil in soil - exceeding residential-use EALs but lower than industrial-use EALs	HDOH SDAR - 2014	82,446.08	1,648,760.78	
HECO Transformer 33207	950 Lehua Ave, Pearl City HI. 96782	Non PCB mineral oil	HDOH HEER	82,134.95	1650247.594	20010330-1444
FUKUOKAS INC. (aka PEARL CITY TAVERN)	905 KAMEHAMEHA HWY Pearl City, HI. 96782		HDOH LUST - 2014	82,374.60	1,650,339.72	
1015 Lehua Avenue, abandoned drums	1015 Lehua Ave, Pearl City HI. 96782		HDOH HEER	82,352.55	1650461.27	19971015-1315
S. KURASHIGE	1015 LEHUA AVE Pearl City, HI. 96782		HDOH LUST - 2014	82,351.30	1,650,466.18	
1000 Lehua Avenue, drum dumping	1000 Lehua Ave, Pearl City HI. 96782	probable oil	HDOH HEER	82,409.54	1650471.262	19971107-1411
Daiei Store Pearl City, malathion	850 Kamehameha Hwy, Pearl City HI. 96782	Malathion	HDOH HEER	82,747.88	1651180.281	19990627-1743
HOLIDAY ACTION GAS - PEARL CITY	850 KAMEHAMEHA HWY Pearl City, HI. 96782		HDOH LUST - 2014	82,746.63	1,651,185.19	
HOLIDAY ACTION GAS - PEARL CITY	850 KAMEHAMEHA HWY Pearl City, HI. 96782		HDOH LUST - 2014	82,746.63	1,651,185.19	
Mid Pac Petroleum LLC 255069 (prev: HI-WAY SERVICE)	826 KAMEHAMEHA HWY Pearl City, HI. 96782		HDOH LUST - 2014	82,346.39	1,651,365.20	
Mid Pac Petroleum LLC 255069 (prev: HI-WAY SERVICE)	826 KAMEHAMEHA HWY Pearl City, HI. 96782		HDOH LUST - 2014	82,346.39	1,651,365.20	
Hawaiian Electric Co.-Waiau Generating Station	475 Kamehameha Hwy	Found: PCBs in soil.	HDOH SDAR - 2014	80,984.55	1,653,228.98	

TABLE A-2

Known or Suspected Contaminated Sites

Environmental Hazard Evaluation and Environmental Hazard Management Plan

Honolulu Rail Transit Project, Oahu, Hawaii

Site Name	Address	Substance	Source	Easting[1]	Northing[1]	Release ID
HECO Waiau Generating Station Tank 4	475 Kamehameha Hwy	Presumed: Low sulfur fuel oil (LFSO) in soil and groundwater.	HDOH SDAR - 2014	80,984.55	1,653,228.98	
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	OIL	HDOH HEER	80,950.29	1653576.358	19900705-1
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Black Oil	HDOH HEER	80,950.29	1653576.358	19901212
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Roofing Tar	HDOH HEER	80,950.29	1653576.358	19960820-1837
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Oil, Waste	HDOH HEER	80,950.29	1653576.358	19970325-0810
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Diesel Fuel	HDOH HEER	80,950.29	1653576.358	19970528-0800
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Diesel Fuel	HDOH HEER	80,950.29	1653576.358	19980716-1540
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Oil	HDOH HEER	80,950.29	1653576.358	19981016-1339
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Diesel Fuel	HDOH HEER	80,950.29	1653576.358	19990216-1648
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Caustic Soda	HDOH HEER	80,950.29	1653576.358	19990427-0800
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Black oil	HDOH HEER	80,950.29	1653576.358	19990518-0900
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Low Sulfur Fuel Oil	HDOH HEER	80,950.29	1653576.358	19990902-1227
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Low Sulfur Fuel Oil	HDOH HEER	80,950.29	1653576.358	19990902-1227
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Diesel Fuel	HDOH HEER	80,950.29	1653576.358	19991017-2121
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Oil	HDOH HEER	80,950.29	1653576.358	20000105-1323
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Low PH wastewater.	HDOH HEER	80,950.29	1653576.358	20000922-1548
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Oil	HDOH HEER	80,950.29	1653576.358	20010131-1617
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Non PCB mineral oil	HDOH HEER	80,950.29	1653576.358	20010211-1040
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Unknown	HDOH HEER	80,950.29	1653576.358	20011203-1647
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Fuel Oil	HDOH HEER	80,950.29	1653576.358	20020109-1423
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Low level PCB	HDOH HEER	80,950.29	1653576.358	20020524-1504
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Low level PCB	HDOH HEER	80,950.29	1653576.358	20020524-1504
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Oil	HDOH HEER	80,950.29	1653576.358	20021118-0845
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Oil	HDOH HEER	80,950.29	1653576.358	20030825-1020
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Oil	HDOH HEER	80,950.29	1653576.358	20031208-0912
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Tar balls	HDOH HEER	80,950.29	1653576.358	20031229-1530
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Diesel Fuel	HDOH HEER	80,950.29	1653576.358	20040209-1425
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Oil, No. 2-D	HDOH HEER	80,950.29	1653576.358	20040323-1104
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Low sulfur fuel oil	HDOH HEER	80,950.29	1653576.358	20040424-0845
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Arsenic Pentoxide	HDOH HEER	80,950.29	1653576.358	20040712-1335
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Tar Balls	HDOH HEER	80,950.29	1653576.358	20040805-1835
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Unknown Oil	HDOH HEER	80,950.29	1653576.358	20041126-0916
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Oil	HDOH HEER	80,950.29	1653576.358	20041222-1242
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Diesel Fuel	HDOH HEER	80,950.29	1653576.358	20050203-1109
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Oil	HDOH HEER	80,950.29	1653576.358	20051023-1157
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Tar Balls	HDOH HEER	80,950.29	1653576.358	20060330-1130
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Sheen	HDOH HEER	80,950.29	1653576.358	20060420-1235
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Sheen	HDOH HEER	80,950.29	1653576.358	20060421-0935
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Unknown	HDOH HEER	80,950.29	1653576.358	20060718-0952
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Fuel Oil 2-D	HDOH HEER	80,950.29	1653576.358	20060920-0723
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Lube Oil	HDOH HEER	80,950.29	1653576.358	20070528-0700
HECO Waiau Generating Station Tank 4	475 Kamehameha Hwy, Pearl City HI. 96782	Fuel Oil	HDOH HEER	80,950.29	1653576.358	20070620-1555
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	sheen	HDOH HEER	80,950.29	1653576.358	20080821-1205
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	sheen	HDOH HEER	80,950.29	1653576.358	20080822-1040
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	sheen	HDOH HEER	80,950.29	1653576.358	20080825-1215
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Oil	HDOH HEER	80,950.29	1653576.358	20080915-0841

TABLE A-2

Known or Suspected Contaminated Sites

Environmental Hazard Evaluation and Environmental Hazard Management Plan

Honolulu Rail Transit Project, Oahu, Hawaii

Site Name	Address	Substance	Source	Easting[1]	Northing[1]	Release ID
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Oil	HDOH HEER	80,950.29	1653576.358	20081023-1021
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Oil	HDOH HEER	80,950.29	1653576.358	20081027-1106
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Oil	HDOH HEER	80,950.29	1653576.358	20081028-1015
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Oil	HDOH HEER	80,950.29	1653576.358	20081112-1232
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Oil	HDOH HEER	80,950.29	1653576.358	20081113-1118
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	sheen	HDOH HEER	80,950.29	1653576.358	20081114-1030
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	oi sheen	HDOH HEER	80,950.29	1653576.358	20090115-1009
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	metallic mercury	HDOH HEER	80,950.29	1653576.358	20091110-1026
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Bunker C/IFO/HFO	HDOH HEER	80,950.29	1653576.358	20100121-0622
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Mercury	HDOH HEER	80,950.29	1653576.358	20100908-1540
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Mercury	HDOH HEER	80,950.29	1653576.358	20100908-1630
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	Low sulfur fuel oil	HDOH HEER	80,950.29	1653576.358	20131001-0840
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	black gooey oil	HDOH HEER	80,950.29	1653576.358	20131121-1350
HECO Generating Station: Waiau	475 Kamehameha Hwy, Pearl City HI. 96782	heavy oil	HDOH HEER	80,950.29	1653576.358	20131223-1454
WAIAU GENERATING STATION	475 KAMEHAMEHA HWY Pearl City, HI. 96782		HDOH LUST - 2014	80,949.04	1,653,581.26	
Manhole next to M. Dyer & Sons Storage	98-054 Kuleana Rd, Pearl City HI. 96782	Green-Blue Liquid	HDOH HEER	81,412.49	1653832.865	19921216
Ocean Fresh Seafood	98-450 Kamehameha Hwy, Pearl City HI. 96782	Carbon Monoxide	HDOH HEER	80,911.82	1654849.072	20070601-1030
HECO pad-mounted transformer #71201 release	98-430 Kamehameha HWY, Pearl City HI. 96782	Transformer Oil	HDOH HEER	80,716.96	1654938.125	20121127-0712
HART 420	420 Kamehameha Hwy, Pearl City HI.	Petroleum	HDOH HEER	80,613.76	1654951.694	20120124-1611
PEARL CITY SELF STORAGE	98-138 HILA PLACE Pearl City, HI. 96782		HDOH LUST - 2014	80,489.09	1,655,777.61	
OLEPE LP STORM DRAIN PUMP STATION	98-152 OLEPE LP Aiea, HI. 96701		HDOH LUST - 2014	80,178.36	1,656,531.93	
Cutter Ford	98-015 Kamehameha Hwy, Aiea HI. 96701	UNKN (not leaking or spilled)	HDOH HEER	79,406.66	1656729.689	19950719
CUTTER FORD INC.	98-015 KAMEHAMEHA HWY Aiea, HI. 96701		HDOH LUST - 2014	79,405.41	1,656,734.60	
CUTTER FORD INC.	98-015 KAMEHAMEHA HWY Aiea, HI. 96701		HDOH LUST - 2014	79,405.41	1,656,734.60	
CUTTER FORD INC.	98-015 KAMEHAMEHA HWY Aiea, HI. 96701		HDOH LUST - 2014	79,405.41	1,656,734.60	
98-108 Pahemo Place, grease in mainline	98-108 Pahemo Pl, Aiea HI. 96701	Grease	HDOH HEER	79,842.17	1656840.604	19991010-2110
98-108 Pahemo Place, C&C sewage & maintenance spill	98-108 Pahemo Pl, Aiea HI. 96701	Sewage	HDOH HEER	79,842.17	1656840.604	20000504-2039
98-019 Hekaha Street Sewer Spill	98-019 Hekaha St, Aiea HI. 96701	Raw Sewage	HDOH HEER	79,964.22	1657203.683	19951004-1
98-125 Hekaha Street	98-125 Hekaha St, Aiea HI. 96701	Cosmolene	HDOH HEER	79,964.22	1657203.683	19920910-1
Pearl City Auto Works	98-025 Hekaha St, Pearl City HI. 96782	Auto Shop Waste	HDOH HEER	78,944.05	1657295.967	19920114-4
Honolulu Ltd	98-025 Hekaha St, Aiea HI. 96701	Petroleum	HDOH HEER	78,944.05	1657295.967	19920629-1
Suntime Indoor Tanning & Supplies	98-025 Hekaha St, Aiea HI. 96701	paint fumes	HDOH HEER	78,944.05	1657295.967	19950327
Aliamanu Military Reservation			HDOH SDAR - 2014	67,166.38	1,657,678.94	
Aliamanu Military Reservation, Freon with Oil Release	1850 Aliamanu Dr		HDOH SDAR - 2014	67,166.38	1,657,678.94	
Aloha Tower Development	Nimitz Hwy	Found: TPH,PAHs,VOCs, metals, PCBs	HDOH SDAR - 2014	67,166.38	1,657,678.94	
Army MFH AMR Ama	Aliamanu Dr & Bougainville Dr	Found: Organochlorine pesticides in soil	HDOH SDAR - 2014	67,166.38	1,657,678.94	
Building 8			HDOH SDAR - 2014	67,166.38	1,657,678.94	
Hawaiian Electric Company (HECO) - Iwilei Tank Yard	855 N Nimitz Hwy	Found: Petroleum in soil and groundwater	HDOH SDAR - 2014	67,166.38	1,657,678.94	
Hawaiian Fluid Power Company	803 Ahua St	Found: Arsenic in soil and groundwater	HDOH SDAR - 2014	67,166.38	1,657,678.94	
Navy MFH Hale Alii		Found: Organochlorine pesticides in soil	HDOH SDAR - 2014	67,166.38	1,657,678.94	
Navy MFH Hale Moku		Found: Organochlorine pesticides in soil	HDOH SDAR - 2014	67,166.38	1,657,678.94	
Navy MFH Hospital Point		Found: Organochlorine pesticides in soil	HDOH SDAR - 2014	67,166.38	1,657,678.94	
Navy MFH Marine Barracks		Found: Organochlorine pesticides in soil	HDOH SDAR - 2014	67,166.38	1,657,678.94	
Pearl Harbor Kai Elementary School UST	1 C Ave	Found: No contamination found. Case was based on possible petroleum contamination.	HDOH SDAR - 2014	67,166.38	1,657,678.94	
Pearl Harbor Naval Complex		Found: multiple COPCs in soil, groundwater, and sediments	HDOH SDAR - 2014	67,166.38	1,657,678.94	
Pearl Harbor Naval Shipyard Building 68			HDOH SDAR - 2014	67,166.38	1,657,678.94	

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Known or Suspected Contaminated Sites

Environmental Hazard Evaluation and Environmental Hazard Management Plan

Honolulu Rail Transit Project, Oahu, Hawaii

Site Name	Address	Substance	Source	Easting[1]	Northing[1]	Release ID
Pearl Harbor Naval Supply Center			HDOH SDAR - 2014	67,166.38	1,657,678.94	
Pearl Harbor Navy Public Works Center			HDOH SDAR - 2014	67,166.38	1,657,678.94	
Pearl Harbor Navy Shipyard		Found: TPH-d, NSF, JP-5	HDOH SDAR - 2014	67,166.38	1,657,678.94	
PHFISC, PWC Gas Station Bldg 1326			HDOH SDAR - 2014	67,166.38	1,657,678.94	
PHNC, Ford Island Landfill		Found: metals, SVOC, and PCB in GW and subsurface soil	HDOH SDAR - 2014	67,166.38	1,657,678.94	
PHNSY, Area North of Building 1754		Found: CVOCs, PAHs in groundwater; TPH -D and BTEX in soil (former UST site)	HDOH SDAR - 2014	67,166.38	1,657,678.94	
PHNSY, Asbestos Contaminated Site N-W DD3		Found: asbestos in soil	HDOH SDAR - 2014	67,166.38	1,657,678.94	
PHNSY, Former Battery Acid Pit		Found: lead and antimony in soil	HDOH SDAR - 2014	67,166.38	1,657,678.94	
PHNSY, Foundry, Building 6, New 03		Found: metals, PAHs, PCBs, TPH in soil	HDOH SDAR - 2014	67,166.38	1,657,678.94	
PHNSY, Oscar 2 Pier		Found: TPH	HDOH SDAR - 2014	67,166.38	1,657,678.94	
PHNSY, Shipyard GSA, Storm Drain Inlet Release Sites		Found: Subsurface soil : TPH-DRO, TPH-RRO, PCBs, metals, VOCs, PAHs. Groundwater: TPH-DRO, TPH-RRO, PCBs, VOCs, metals, PAHs. Soil gas: VOCs.	HDOH SDAR - 2014	67,166.38	1,657,678.94	
PHPWC, Makalapa Pesticide Rinseate		Found: PCBs	HDOH SDAR - 2014	67,166.38	1,657,678.94	
PHPWC, Wastewater Treatment Plant Waste			HDOH SDAR - 2014	67,166.38	1,657,678.94	
Shore Intermediate Maintenance Activity			HDOH SDAR - 2014	67,166.38	1,657,678.94	
USN Fleet Training Group	1430 South Ave		HDOH SDAR - 2014	67,166.38	1,657,678.94	
Vermiculite of Hawaii	842 Mapunapuna St	Found: Asbestos	HDOH SDAR - 2014	67,166.38	1,657,678.94	
98-103 Kanuku Street, oil/grease spill	98-103 Kanuku St, Aiea HI. 96701	Grease/oil	HDOH HEER	79,236.31	1657938.218	20000829-1905
HECO Transformers 77324, 77326, 77327 - 98-059 Kauwa St	98-059 Kauwa St, Aiea HI. 96701	Transformer Oil	HDOH HEER	79,448.60	1657943.898	20101114-1945
HECO transformer pad-mounted #69237 release	98-064 Kamehameha HWY, Aiea HI. 96701	Transformer Oil	HDOH HEER	79,136.71	1658177.429	20121226-1413
AIEA CUE (Formerly Pearl Auto Service & Supply)	98-064 KAMEHAMEHA HWY Aiea, HI. 96701		HDOH LUST - 2014	79,135.46	1,658,182.34	
HART boring 302	98-085 Kamehemeha Highway, HI.	Petroleum	HDOH HEER	78,691.90	1658262.293	20130711-1112
HART boring 306	98-085 Kamehemeha Highway, HI.	petroleum odors	HDOH HEER	78,691.90	1658262.293	20130713-1000
HART boring 305	98-085 Kamehemeha Highway, HI.	petroleum odors	HDOH HEER	78,691.90	1658262.293	20130715-1038
VOLVO HAWAII	98-075 KAMEHAMEHA HWY Aiea, HI. 96701		HDOH LUST - 2014	78,841.04	1,658,267.15	
ASSOCIATED STEEL WORKERS, LTD	98-085 KAMEHAMEHA HWY Aiea, HI. 96701		HDOH LUST - 2014	78,690.65	1,658,267.20	
Hawaii Baking Company	98-736 Moanalua Lp		HDOH SDAR - 2014	79,378.24	1,658,582.97	
98-121 Lipoa Place	98-121 Lipoa Pl	Found: TPH-g and btex at 6.5 ft bgs in soil. TPH-g, benz, mtbe in sv. TPH-g in gw. All COC above Tier 1 EALs.	HDOH SDAR - 2014	78,211.52	1,658,692.34	
Hawaii Baking Company	98-736 Moanalua Lp		HDOH SDAR - 2014	79,211.73	1,658,961.43	
Yunnie Shell	98-135 KAMEHAMEHA HWY Aiea, HI. 96701		HDOH LUST - 2014	78,369.22	1,659,282.21	
Yunnie Shell	98-135 KAMEHAMEHA HWY Aiea, HI. 96701		HDOH LUST - 2014	78,369.22	1,659,282.21	
98-151 Lipoa Place	98-151 Lipoa Pl	Found: TPH-g, benzene, ethylbenzene, xylene, and napthalene in soil above residentail EAL for GC, DE and leaching. TPH-g and d, benz, ethylbenz, xyl, napth, and lead found in gw above residential EALs for AT and GC.	HDOH SDAR - 2014	77,746.35	1,659,676.35	
HECO Transformer 52091	98-199 Kamehameha Hwy	Presumed: Shell Diala Oil	HDOH SDAR - 2014	77,746.35	1,659,676.35	
HECO Transformer 52091	98-199 Kamehameha Hwy, Aiea HI. 96701	Shell Diala Oil	HDOH HEER	77,886.21	1660083.047	20021121-1211
HECO Transformer 54734	98-201 Aiea Kai Pl, Aiea HI. 96701	Ergon HYVOLT II	HDOH HEER	77,529.05	1660164.256	20071016-1057
Sears Facility #1578 at Pearlridge Mall Elevator Jack	98-180 Kamehameha Hwy		HDOH SDAR - 2014	78,341.23	1,660,239.65	
HECO Transformer 52091	98-199 Kamehameha Hwy	Presumed: Shell Diala Oil	HDOH SDAR - 2014	77,836.77	1,660,296.80	
HECO Transformer 5987C	98-119 Kamehameha Hwy, Aiea HI. 96701	Transformer Oil	HDOH HEER	77,936.27	1660461.946	20021121-1210

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Known or Suspected Contaminated Sites

Environmental Hazard Evaluation and Environmental Hazard Management Plan

Honolulu Rail Transit Project, Oahu, Hawaii

Site Name	Address	Substance	Source	Easting[1]	Northing[1]	Release ID
Sears Facility #1578 at Pearlridge Mall Hydraulic Hoist	98-180 Kamehameha Hwy, Aiea HI. 96701	Hydraulic Oil	HDOH HEER	77,936.27	1660461.946	19990830-1348
98-409 & 98-072 Kamehameha Highway, soil contamination	98-409 Kamehameha Hwy, Aiea HI. 96701		HDOH HEER	77,936.27	1660461.946	19980311-1010
98-409 & 98-072 Kamehameha Highway, soil contamination	98-409 Kamehameha Hwy, Aiea HI. 96701		HDOH HEER	77,936.27	1660461.946	19980311-1010
Mahalo Express Pearl Kai 12818	98-189 KAMEHAMEHA HWY Aiea, HI. 96701		HDOH LUST - 2014	77,935.02	1,660,466.85	
SEARS ROEBUCK & CO	98-180 KAMEHAMEHA HWY Aiea, HI. 96701		HDOH LUST - 2014	77,935.02	1,660,466.85	
SHELL SERVICE STATION	98-080 KAMEHAMEHA HWY Aiea, HI. 96701		HDOH LUST - 2014	77,935.02	1,660,466.85	
SHELL SERVICE STATION	98-080 KAMEHAMEHA HWY Aiea, HI. 96701		HDOH LUST - 2014	77,935.02	1,660,466.85	
SHELL SERVICE STATION	98-080 KAMEHAMEHA HWY Aiea, HI. 96701		HDOH LUST - 2014	77,935.02	1,660,466.85	
Navy MFH McGrew Point		Found: Organochlorine pesticides in soil	HDOH SDAR - 2014	76,676.34	1,660,755.64	
98-273 Aiea Kai Place, sewage spill	98-273 Aiea Kai Pl, Aiea HI. 96701	Sewage	HDOH HEER	77,401.48	1660954.332	19960704-1351
99-302 Kamehameha Highway, sewage spill	99-302 Kamehameha Hwy, Aiea HI. 96701	Unknown	HDOH HEER	77,564.04	1661229.553	19981212-1454
WC-SO-432-433-556-625			Geotech Boring	71,755.97	1,661,637.10	20130620-1215
98-301 Kaamilo Street, sewage spill	98-301 Kaamilo St, Aiea HI. 96701	Sewage	HDOH HEER	77,543.79	1661641.552	19961124-2250
WC-SO-432-433-556-625			Geotech Boring	71,613.31	1,661,648.79	20120909-1251
AIEA CENTRAL OFFICE	98-327 KAAMILO ST Aiea, HI. 96701		HDOH LUST - 2014	77,351.59	1,661,967.04	
STEVEN'S SUPER SERVICE, INC.	98-360 KAMEHAMEHA HWY Aiea, HI. 96701		HDOH LUST - 2014	77,160.93	1,662,085.18	
Navy MFH Hokulani		Found: Organochlorine pesticides in soil	HDOH SDAR - 2014	64,917.12	1,662,177.21	
Wally's Service, Inc	98-380 Kamehameha Hwy, Aiea HI. 96701	antifreeze (ethylene glycol)	HDOH HEER	77,056.17	1662226.956	19940114-3
WALLYS SERVICE INC.	98-380 KAMEHAMEHA HWY Aiea, HI. 96701		HDOH LUST - 2014	77,054.92	1,662,231.86	
WALLYS SERVICE INC.	98-380 KAMEHAMEHA HWY Aiea, HI. 96701		HDOH LUST - 2014	77,054.92	1,662,231.86	
Hawaii Mercury	Kalaloa St	Found: Mercury spill.	HDOH SDAR - 2014	73,243.42	1,662,727.99	
Navy MFH Little Makalapa		Found: Organochlorine pesticides in soil	HDOH SDAR - 2014	69,786.50	1,662,851.62	
Navy MFH Makalapa		Found: Organochlorine pesticides in soil	HDOH SDAR - 2014	69,786.50	1,662,851.62	
PHPWC, Makalapa Landfill Area		Found: Study Area A: VOCs, metals, PCBs, MCs, TPH-d, TPH-l, SVOCs, PAHs, chlorinated herbicides, carbamates, & organochlorine pesticides in soil & GW + soil vapor. Study Areas B & C: metals, PCBs, and MCs in soil & GW. GW in all study areas: TDS + chlorid	HDOH SDAR - 2014	69,786.50	1,662,851.62	
99-002 Kauhale Street, sewage spill	99-002 Kauhale St, Aiea HI. 96701		HDOH HEER	76,552.27	1662862.154	20020127-1054
Hawaii Mercury	Kalaloa St	Found: Mercury spill.	HDOH SDAR - 2014	75,386.06	1,663,036.52	
FUDS Aiea Military Reservation		Found: PCBs (aroclor 1260), TPH-d, benzene, ethylbenzene, benzo(a)pyrene, naphthalene	HDOH SDAR - 2014	75,332.75	1,663,067.98	
Hawaii Mercury	Kalaloa St	Found: Mercury spill.	HDOH SDAR - 2014	75,332.75	1,663,067.98	
Air Force MFH HAFB Earhart I-2		Found: Organochlorine pesticides in soil	HDOH SDAR - 2014	62,239.93	1,663,252.34	
Air Force MFH HAFB Earhart I-3		Found: Organochlorine pesticides in soil	HDOH SDAR - 2014	62,239.93	1,663,252.34	
Air Force MFH HAFB Earhart I-4		Found: Organochlorine pesticides in soil	HDOH SDAR - 2014	62,239.93	1,663,252.34	
Air Force MFH Hickam Communities Remedial Action		Found: Organochlorine pesticides in soil	HDOH SDAR - 2014	62,239.93	1,663,252.34	
			Geotech Boring	75,648.97	1,663,318.63	20140724-1532
HALAWA MEDIUM SECURITY CORRECTIONAL FACILITY	99-902 MOANALUA HWY Aiea, HI. 96701		HDOH LUST - 2014	75,430.72	1,663,350.24	
HALAWA MEDIUM SECURITY CORRECTIONAL FACILITY	99-902 MOANALUA HWY Aiea, HI. 96701		HDOH LUST - 2014	75,430.72	1,663,350.24	
HALAWA HIGH SECURITY CORRECTIONAL FACILITY	99-902 MOANALUA HWY Aiea, HI. 96701		HDOH LUST - 2014	75,430.72	1,663,350.24	
C&CH MOKULELE FIRE STATION	890 VALKENBURGH ST Honolulu, HI. 96818		HDOH LUST - 2014	63,085.04	1,663,635.96	
PHPWC, Makalapa Pesticide Rinseate		Found: PCBs	HDOH SDAR - 2014	66,421.69	1,664,741.23	
PHPWC, Paint Shop Storage			HDOH SDAR - 2014	66,421.69	1,664,741.23	
Hawaii Fueling Facilities Corporation-Airport	3201 Aolele St		HDOH SDAR - 2014	54,290.79	1,665,314.60	

TABLE A-2

Known or Suspected Contaminated Sites

Environmental Hazard Evaluation and Environmental Hazard Management Plan

Honolulu Rail Transit Project, Oahu, Hawaii

Site Name	Address	Substance	Source	Easting[1]	Northing[1]	Release ID
Hawaii Fueling Facilities Corporation-Airport Jet A Cracked Drain Pipe	3201 Aolele St	Found: Drainpipe release did not affect groundwater. Overall site has free-product in the groundwater, with monitoring/recovery program in affect. Release is NFA.	HDOH SDAR - 2014	54,290.79	1,665,314.60	
Hawaii Fueling Facilities Corporation-Airport Relief Valve Release	3201 Aolele St	Found: Petroleum in soil and groundwater	HDOH SDAR - 2014	54,290.79	1,665,314.60	
Honolulu International Airport - United Airlines Gate 1	300 Rodgers St		HDOH SDAR - 2014	54,290.79	1,665,314.60	
Lockheed Air Terminal, Inc.	3071 Aolele St		HDOH SDAR - 2014	54,290.79	1,665,314.60	
Miyazaki Service Station	351 Rodgers Blvd		HDOH SDAR - 2014	54,290.79	1,665,314.60	
Honolulu Airport Operations	400 Rodgers Blvd, Honolulu HI. 96819	Unknown	HDOH HEER	60,451.06	1667008.815	20001021-1811
FAA - HNL RTR	HONOLULU INTERNATIONAL AIRPORT Honolulu, HI. 96825		HDOH LUST - 2014	60,389.15	1,667,166.50	
HAWAIIAN AIRLINES INC. (PMID 004101)	HONOLULU INTERNATIONAL AIRPORT Honolulu, HI. 96820		HDOH LUST - 2014	60,389.15	1,667,166.50	
FAA - HNL VORTAC (PMID 811107A)	HONOLULU INTERNTIONAL AIRPORT Honolulu, HI. 96825		HDOH LUST - 2014	60,389.15	1,667,166.50	
FAA - HNL ASR	HONOLULU INTERNATIONAL AIRPORT Honolulu, HI. 96819		HDOH LUST - 2014	60,389.15	1,667,166.50	
SOIL-RC-137			AIS Trench	60,709.78	1,667,279.68	20130207-1804
			Geotech Boring	60,709.78	1,667,279.68	20140505-0925
			Geotech Boring	60,709.78	1,667,279.68	20140512-0815
SOIL-RC-140			AIS Trench	60,698.83	1,667,408.79	20130207-1804
Avis Rent-A-Car, Honolulu International Airport	2912 Aolele St, Honolulu HI. 96819	Gasoline	HDOH HEER	60,579.42	1668882.749	19940824-2
Navy MFH Catlin Park		Found: Organochlorine pesticides in soil	HDOH SDAR - 2014	63,418.28	1,668,902.37	
Navy MFH Doris Miller Park		Found: Organochlorine pesticides in soil	HDOH SDAR - 2014	63,418.28	1,668,902.37	
Navy MFH Halsey Terrace		Found: Organochlorine pesticides in soil	HDOH SDAR - 2014	63,418.28	1,668,902.37	
Navy MFH Maloelap		Found: Organochlorine pesticides in soil	HDOH SDAR - 2014	63,418.28	1,668,902.37	
MIYAZAKI AIRPORT SERVICE STATION (PMID 001104)	351 RODGERS BLVD Honolulu, HI. 96819		HDOH LUST - 2014	60,509.66	1,669,100.17	
WC-SO-432-433-556-625			Geotech Boring	60,632.39	1,669,228.85	20130808-1205
			Geotech Boring	60,632.39	1,669,228.85	20140627-0948
			Geotech Boring	60,610.06	1,669,367.06	20140701-1000
Signature Flight Support	3255 Aolele St, Honolulu HI. 96819	Diesel Fuel	HDOH HEER	60,493.46	1669531.456	19971203-1055
International Air Cargo	3255 Aolele St, Honolulu HI. 96819	Unknown	HDOH HEER	60,493.46	1669531.456	20010113-1326
GTE Base Yard Sump	3239 Ualena St	Found: Petroleum products and metals in soil beneath the storm drain/sump.	HDOH SDAR - 2014	60,829.20	1,669,567.63	
GTE Base Yard Sump	3239 Ualena St	Found: Petroleum products and metals in soil beneath the storm drain/sump.	HDOH SDAR - 2014	61,101.03	1,669,694.85	
GTE Base Yard Sump	3239 Ualena St, Honolulu HI. 96819	Lead, Motor Oil	HDOH HEER	60,825.69	1669733.779	19990708-1453
			Geotech Boring	60,511.68	1,669,736.19	20140701-0958
			Geotech Boring	60,559.93	1,669,757.72	20130719-1315
			Geotech Boring	60,559.93	1,669,757.72	20140627-0949
WC-SO-561-568			Geotech Boring	60,537.27	1,669,876.64	20130327-1306
			Geotech Boring	60,540.03	1,669,877.35	20140718-0934
Hawaii Fueling Facilities Corporation-Airport	3201 Aolele St, Honolulu HI. 96819	Jet Fuel	HDOH HEER	60,513.01	1669891.155	19900618
Hawaii Fueling Facilities Corporation-Airport	3201 Aolele St, Honolulu HI. 96819	Jet Fuel	HDOH HEER	60,513.01	1669891.155	19930428-3
Hawaii Fueling Facilities Corporation-Airport	3201 Aolele St, Honolulu HI. 96819	Jet Fuel JP-8	HDOH HEER	60,513.01	1669891.155	20020315-1425
Hawaii Fueling Facilities Corporation-Airport Jet A Cracked Drain Pipe	3201 Aolele St, Honolulu HI. 96819	Jet Fuel A	HDOH HEER	60,513.01	1669891.155	20080822-1130
Hawaii Fueling Facilities Corporation-Airport Relief Valve Release	3201 Aolele St, Honolulu HI. 96819	Jet Fuel A	HDOH HEER	60,513.01	1669891.155	20100125-1510
Hawaii Fueling Facilities Corporation-Airport	3201 Aolele St		HDOH SDAR - 2014	60,320.21	1,669,896.66	

TABLE A-2

Known or Suspected Contaminated Sites

Environmental Hazard Evaluation and Environmental Hazard Management Plan

Honolulu Rail Transit Project, Oahu, Hawaii

Site Name	Address	Substance	Source	Easting[1]	Northing[1]	Release ID
Hawaii Fueling Facilities Corporation-Airport Jet A Cracked Drain Pipe	3201 Aolele St	Found: Drainpipe release did not affect groundwater. Overall site has free-product in the groundwater, with monitoring/recovery program in affect. Release is NFA.	HDOH SDAR - 2014	60,320.21	1,669,896.66	
			Geotech Boring	60,519.62	1,669,998.52	20130327-1306
Hawaii Fueling Facilities Corporation-Airport	3201 Aolele St		HDOH SDAR - 2014	60,288.07	1,670,096.80	
Hawaii Fueling Facilities Corporation-Airport Relief Valve Release	3201 Aolele St	Found: Petroleum in soil and groundwater	HDOH SDAR - 2014	60,288.07	1,670,096.80	
			Geotech Boring	60,497.71	1,670,136.82	20130320-1043
			Geotech Boring	60,497.71	1,670,136.82	20140618-1010
			Geotech Boring	60,475.76	1,670,275.08	20140627-0950
			Geotech Boring	60,475.76	1,670,275.08	20140618-1334
			Geotech Boring	60,456.15	1,670,398.53	20130320-1043
LUFTHANSA SERVICE SKY CHEFS (PMID 005105)	3129 UALENA ST Honolulu, HI. 96819		HDOH LUST - 2014	60,828.20	1,670,487.61	
			Geotech Boring	60,433.41	1,670,541.74	20130319-1104
DELTA AIRLINES INC. (PMID 001119)	3121 AOLELE ST Honolulu, HI. 96819		HDOH LUST - 2014	60,222.54	1,670,679.49	
Lockheed Air Terminal, Inc	3071 Aolele St, Honolulu HI. 96819	Jet Fuel A-1 Turbine	HDOH HEER	60,370.06	1670782.8	19901231-2
AIRPORT GROUP INTERNATIONAL INC (PMID001109)	3071 AOLELE ST Honolulu, HI. 96819		HDOH LUST - 2014	60,368.81	1,670,787.71	
UNITED AIRLINES CARGO FACILITY (PMID 001101)	3071 AOLELE ST Honolulu, HI. 96819		HDOH LUST - 2014	60,368.81	1,670,787.71	
UNITED AIRLINES CARGO FACILITY (PMID 001101)	3071 AOLELE ST Honolulu, HI. 96819		HDOH LUST - 2014	60,368.81	1,670,787.71	
WC-SO-561-568			Geotech Boring	60,388.09	1,670,828.13	20130314-0830
CLARKLIFT PACIFIC - E.M. ENTERPR (PMID 005106) - aka ""The Tennis Fa	3077 UALENA ST Honolulu, HI. 96819		HDOH LUST - 2014	60,596.31	1,670,840.06	
Airports Div Maintenance Base yard (PMID 3115)	2919 AOLELE ST Honolulu, HI. 96819		HDOH LUST - 2014	60,346.84	1,670,927.13	
			Geotech Boring	60,354.58	1,671,105.78	20140703-1054
THRIFTY RENT- A-CAR (PMID 005110)	3039 UALENA ST Honolulu, HI. 96819		HDOH LUST - 2014	60,515.41	1,671,334.63	
			Geotech Boring	60,312.67	1,671,506.29	20140710-0919
2988 Ualena Street	2988 Ualena St, Honolulu HI. 96819	Battery	HDOH HEER	60,711.54	1671888.788	19910412-1
Triple F Distributor	2969 Ualena St, Honolulu HI. 96819		HDOH HEER	60,447.92	1672063.198	19890808-1
OVERSEAS FREIGHT FORWARDERS, INC	2959 KOAPAKA ST Honolulu, HI. 96819		HDOH LUST - 2014	60,894.70	1,672,162.12	
SHERMAN ENTERPRISES INC (PMID 005117)	2959 UALENA ST Honolulu, HI. 96819		HDOH LUST - 2014	60,560.14	1,672,168.27	
2949 Koapaka Street	2949 Koapaka St, Honolulu HI.	Ethylbenzene	HDOH HEER	60,855.46	1672429.2	20090731-1003
2949 Koapaka Street	2949 Koapaka St, Honolulu HI.	Lead	HDOH HEER	60,855.46	1672429.2	20090731-1003
2949 Koapaka Street	2949 Koapaka St, Honolulu HI.	TPH gasoline	HDOH HEER	60,855.46	1672429.2	20090731-1003
K. YAMADA DISTRIBUTORS, LTD.	2939-2949 KOAPAKA ST Honolulu, HI. 96819		HDOH LUST - 2014	60,854.21	1,672,434.11	
S & M WELDING CO., LTD.	2928 UALENA ST Honolulu, HI. 96819		HDOH LUST - 2014	60,644.20	1,672,530.52	
Former Ziegler Steel Site	2919 Ualena St	Found: No contamination above HDOH EALs	HDOH SDAR - 2014	60,367.66	1,672,587.70	
SAVAGE WHOLESALE	2918 UALENA ST Honolulu, HI. 96819		HDOH LUST - 2014	60,627.91	1,672,632.97	
DuPont Refinish Service Center	2929 Koapaka St, Honolulu HI. 96813	Unknown	HDOH HEER	60,831.43	1672642.778	19900112
DuPont Refinish Service Center	2929 Koapaka St, Honolulu HI. 96813	Gasoline, Aviation	HDOH HEER	60,831.43	1672642.778	19941104-2
ATTCO	2855 Koapaka St, Honolulu HI. 96819	Gasoline	HDOH HEER	60,781.66	1673302.153	19951101
EDGARDO PUGLIA (PMID 005127)	2845 UALENA STREET Honolulu, HI. 96819		HDOH LUST - 2014	60,223.95	1,673,321.90	
AMERICAN INT. R.A.C.	2880 UALENA ST Honolulu, HI. 96819		HDOH LUST - 2014	60,430.50	1,673,442.90	
Culture Marble Inc	2870 Ualena St, Honolulu HI. 96819	Resin	HDOH HEER	60,431.61	1673446.776	19930309-1
2825 Koapaka Street	2825 Koapaka St, Honolulu HI. 96819	OIL, TRANSFORMER, POSSIBLE PCB	HDOH HEER	60,872.63	1673604.491	19891225
AIRPORT SHELL (PMID005130)	2805 UALENA ST Honolulu, HI. 96819		HDOH LUST - 2014	60,390.36	1,673,736.27	
AIRPORT SHELL (PMID005130)	2805 UALENA ST Honolulu, HI. 96819		HDOH LUST - 2014	60,390.36	1,673,736.27	
AIRPORT SHELL (PMID005130)	2805 UALENA ST Honolulu, HI. 96819		HDOH LUST - 2014	60,390.36	1,673,736.27	
WC-SO-ASG303			Geotech Boring	60,118.24	1,673,904.14	20140118-1200

TABLE A-2

Known or Suspected Contaminated Sites

Environmental Hazard Evaluation and Environmental Hazard Management Plan

Honolulu Rail Transit Project, Oahu, Hawaii

Site Name	Address	Substance	Source	Easting[1]	Northing[1]	Release ID
LAGOON CHEVRON SERVICE STATION	2604 WAIWAI LP Honolulu, HI. 96819		HDOH LUST - 2014	60,354.39	1,673,942.85	
LAGOON CHEVRON SERVICE STATION	2604 WAIWAI LP Honolulu, HI. 96819		HDOH LUST - 2014	60,354.39	1,673,942.85	
WC-SO-ASG303			Geotech Boring	60,292.28	1,673,961.47	20140118-1200
FORMER NEW AND USED CAR LOT	545 LAGOON DR Honolulu, HI. 96819		HDOH LUST - 2014	60,711.04	1,674,068.89	
PAN-PACIFIC CONSTRUCTION, INC.	2621 WAIWAI LP Honolulu, HI. 96819		HDOH LUST - 2014	60,427.12	1,674,184.58	
American Pacific Transport, Inc. Tank Removal	2635 Waiwai Lp	Found: Petroleum in soil from unregulated diesel tank	HDOH SDAR - 2014	60,142.00	1,674,269.50	
PEERLESS ROOFING CO., LTD.	2629 Waiwai Loop Honolulu, HI. 96819		HDOH LUST - 2014	60,390.48	1,674,275.00	
Alsco (American Linen) Tank	2771 Waiwai Lp, Honolulu HI. 96819	SMOKE	HDOH HEER	60,687.68	1674333.653	19900410-1
Alsco (American Linen) Tank	2771 Waiwai Lp, Honolulu HI. 96819	PAINT THINNER	HDOH HEER	60,687.68	1674333.653	19910626-3
Alsco (American Linen) Tank	2771 Waiwai Lp, Honolulu HI. 96819	Bunker fuel oil no. 6	HDOH HEER	60,687.68	1674333.653	19981201-1502
American Linen (Youngs Laundry & Dry Cleaning) Tank	2771 Waiwai Lp	Found: Diesel in soil and groundwater	HDOH SDAR - 2014	60,660.46	1,674,341.68	
AMERICAN PACIFIC TRANSPORT CO.	2635 WAIWAI LP Honolulu, HI. 96819		HDOH LUST - 2014	60,435.66	1,674,362.78	
			Geotech Boring	60,259.00	1,674,559.97	20130610-1300
Occidental Chem Co	2660 Waiwai Lp		HDOH SDAR - 2014	60,106.02	1,674,605.56	
Alakai Mechanical Corporation	2655 Waiwai Lp, Honolulu HI. 96819	Unknown	HDOH HEER	60,586.81	1674682.093	20020415-1130
Alakai Mechanical Corporation	2655 Waiwai Lp, Honolulu HI. 96819		HDOH HEER	60,586.81	1674682.093	20020415-1731
Soil-RC-12			AIS Trench	60,234.79	1,674,728.27	20121126-1700
AERONAUTICAL RADIO, INC	2668 WAIWAI LP Honolulu, HI. 96819		HDOH LUST - 2014	60,172.44	1,674,816.12	
HECO Transformers 2696 Waiwai Loop	2696 Waiwai Lp, Honolulu HI. 96819	Transformer Oil (mineral oil)	HDOH HEER	60,603.79	1675044.173	19951120-1
			Geotech Boring	60,484.25	1,676,885.44	20130719-1311
			Geotech Boring	60,464.99	1,677,251.73	20130626-1030
Middle Street Intermodal Center	Middle Street and Kamehameha Hwy Honolulu, HI. 96817		HDOH LUST - 2014	60,616.16	1,678,018.67	
WC-SO-432-433-556-625			Geotech Boring	60,391.31	1,678,026.18	20130522-0950
OAHU TIRE SERVICE & CO.	2808 KAMEHAMEHA HWY Honolulu, HI. 96819		HDOH LUST - 2014	60,602.07	1,678,075.48	
Middle Street Intermodal Center	611 Middle St	Found: TPH diesel and oil, arsenic, lead, chromium, chlordane and dieldrin, and PCB in soil. TPH diesel, lead, chromium, arsenic, dieldrin, DDT in the groundwater above HDOH EAL.	HDOH SDAR - 2014	60,700.92	1,678,298.01	
Gaspro Inc. HID980817712	2305 Kamehameha Hwy		HDOH SDAR - 2014	60,218.58	1,678,514.73	
Middle Street Intermodal Center	611 Middle St	Found: TPH diesel and oil, arsenic, lead, chromium, chlordane and dieldrin, and PCB in soil. TPH diesel, lead, chromium, arsenic, dieldrin, DDT in the groundwater above HDOH EAL.	HDOH SDAR - 2014	60,481.58	1,678,554.61	
Kamehameha Industrial Center	2339 Kamehameha Hwy, Honolulu HI.		HDOH HEER	60,016.40	1678569.595	19910619-1
Kamehameha Industrial Center	2339 Kamehameha Hwy, Honolulu HI.	Oil, Waste	HDOH HEER	60,016.40	1678569.595	19910731-2
Middle Street Intermodal Center	611 Middle St	Found: TPH diesel and oil, arsenic, lead, chromium, chlordane and dieldrin, and PCB in soil. TPH diesel, lead, chromium, arsenic, dieldrin, DDT in the groundwater above HDOH EAL.	HDOH SDAR - 2014	60,875.28	1,678,579.96	
WC-SO-630-637			Geotech Boring	60,264.62	1,678,605.48	20140218-1440
Middle Street Intermodal Center	611 Middle St	Found: TPH diesel and oil, arsenic, lead, chromium, chlordane and dieldrin, and PCB in soil. TPH diesel, lead, chromium, arsenic, dieldrin, DDT in the groundwater above HDOH EAL.	HDOH SDAR - 2014	60,584.02	1,678,611.02	

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Known or Suspected Contaminated Sites

Environmental Hazard Evaluation and Environmental Hazard Management Plan

Honolulu Rail Transit Project, Oahu, Hawaii

Site Name	Address	Substance	Source	Easting[1]	Northing[1]	Release ID
Middle Street Intermodal Center	611 Middle St	Found: TPH diesel and oil, arsenic, lead, chromium, chlordane and dieldrin, and PCB in soil. TPH diesel, lead, chromium, arsenic, dieldrin, DDT in the groundwater above HDOH EAL.	HDOH SDAR - 2014	60,470.14	1,678,623.05	
SOIL-RC-33			AIS Trench	60,319.78	1,678,647.21	20120921-0945
Middle Street Intermodal Center	611 Middle St	Found: TPH diesel and oil, arsenic, lead, chromium, chlordane and dieldrin, and PCB in soil. TPH diesel, lead, chromium, arsenic, dieldrin, DDT in the groundwater above HDOH EAL.	HDOH SDAR - 2014	60,490.75	1,678,725.07	
F.T. OPPERMAN & COMPANY	2340-B KAMEHAMEHA HWY Honolulu, HI. 96819		HDOH LUST - 2014	60,245.52	1,678,873.64	
HGP Inc	2305 Kamehameha Hwy, Honolulu HI. 96819	MANY PESTICIDES, LISTED IN NARRATIVE	HDOH HEER	60,041.32	1678881.335	19901218-2
Gaspro - Honolulu	2305 Kamehameha Hwy, Honolulu HI. 96819	GAS CYLINDER	HDOH HEER	60,041.32	1678881.335	19910610-2
Gaspro - Honolulu	2305 Kamehameha Hwy, Honolulu HI. 96819	Mineral Oil	HDOH HEER	60,041.32	1678881.335	19930310
Kalihi Stream at 2305 Kamehameha Highway	2305 Kamehameha Hwy, Honolulu HI. 96819	Oil	HDOH HEER	60,041.32	1678881.335	19930310-4
GASPRO (KALIHI FACILITY)	2305 KAMEHAMEHA HWY / P.O. BOX 30707 Honolulu, HI. 96820		HDOH LUST - 2014	60,040.07	1,678,886.25	
LENAKONA DEVELOPMENT, LTD	2305 KAMEHAMEHA HWY Honolulu, HI. 96800		HDOH LUST - 2014	60,040.07	1,678,886.25	
Yee Hop Property	621 Middle St	Presumed: Petroleum	HDOH SDAR - 2014	60,832.08	1,678,988.16	
House Foods, Hawaii (Foremost)	2277 Kamehameha Hwy	Found: Lead/TPH/Heptachlor	HDOH SDAR - 2014	59,818.70	1,679,054.21	
House Foods, Hawaii (Foremost)	2277 Kamehameha Hwy, Honolulu HI. 96819	Anhydrous Ammonia	HDOH HEER	59,839.49	1679076.16	20050822-0630
Hawaii Dairy Holdings, Inc DBA Foremost Dairies	2277 KAMEHAMEHA HWY Honolulu, HI. 96819		HDOH LUST - 2014	59,838.24	1,679,081.07	
Hawaii Dairy Holdings, Inc DBA Foremost Dairies	2277 KAMEHAMEHA HWY Honolulu, HI. 96819		HDOH LUST - 2014	59,838.24	1,679,081.07	
2312 Kamehameha Highway, 50-gallon sewage spill from 24 inch line	2312 Kamehameha Hwy, Honolulu HI. 96819	Sewage	HDOH HEER	60,333.31	1679188.73	19960831-1308
Gexpro	2312 Kamehameha Hwy, Honolulu HI. 96819	Hydraulic	HDOH HEER	60,333.31	1679188.73	20111202-1310
HARDERS CO.	2312 KAMEHAMEHA HWY, BLDG H-2 Honolulu, HI. 96819		HDOH LUST - 2014	60,332.06	1,679,193.64	
2310 Kamehameha Highway, sewage spill	2310 Kamehameha Hwy, Honolulu HI. 96819	Raw sewage	HDOH HEER	60,329.98	1679410.638	19960204-1528
WC-SO-630-637			Geotech Boring	59,871.00	1,679,476.10	20140123-1415
2238 Kaluaopalena Street, sewage/grease spill	2238 Kaluaopalena St, Honolulu HI. 96819	Sewage	HDOH HEER	60,174.46	1679741.056	19990412-1856
2238 Kaluaopalena Street, sewage/grease spill	2238 Kaluaopalena St, Honolulu HI. 96819	Sewage	HDOH HEER	60,174.46	1679741.056	20060115-1215
Oahu Community Correctional Center	2199 Kamehameha Hwy, Honolulu HI. 96819	Mercury	HDOH HEER	59,318.53	1679796.958	19980514-0805
2016 Hau Street	2016 Hau St, Honolulu HI.	Auto Paint	HDOH HEER	58,797.61	1680178.231	20100901-1514
2130 Kamehameha Highway, sewage spill caused by grease	2130 Kamehameha Hwy, Honolulu HI. 96819	Sewage	HDOH HEER	59,342.13	1680184.09	19960831-1324
2137 Kaumualii Street	2137 Kaumualii St, Honolulu HI. 96819	OIL, TRANSFORMER, POSSIBLE PCB	HDOH HEER	59,758.54	1680340.206	19890704
Dillingham Shell	2066 DILLINGHAM BLVD Honolulu, HI. 96819		HDOH LUST - 2014	59,286.55	1,680,394.14	
Dillingham Shell	2066 DILLINGHAM BLVD Honolulu, HI. 96819		HDOH LUST - 2014	59,286.55	1,680,394.14	
KEN T SERVICE	1901 DILLINGHAM BLVD Honolulu, HI. 96819		HDOH LUST - 2014	58,740.63	1,680,701.92	
KEN T SERVICE	1901 DILLINGHAM BLVD Honolulu, HI. 96819		HDOH LUST - 2014	58,740.63	1,680,701.92	
SOIL-RC-82	1901 Dillingham Blvd		AIS Trench	58,783.42	1,680,703.30	20121126-1701
SOIL-RC-82	1901 Dillingham Blvd		AIS Trench	58,793.02	1,680,712.10	20121126-1701
WC-SO-KH-1-2-3-4-5			Geotech Boring	58,735.62	1,680,731.58	20140122-1029
			AIS Trench	58,841.34	1,680,747.90	20121126-1701
WC-SO-KH-1-2-3-4-5			Geotech Boring	58,709.87	1,680,770.54	20140122-1029
HECO Transformer 4891	1930 Dillingham Blvd, Honolulu HI. 96813	Ergon Hy-Volt II Insulating Oil	HDOH HEER	58,903.58	1680822.58	20091028-1500
Dillingham and Mokauea	Dillingham Blvd & Mokauea St	Found: Petroleum free product	HDOH SDAR - 2014	58,854.77	1,680,871.17	
Edades Sausage Factory	1819 Dillingham Blvd, Honolulu HI. 96819	Solvents(Sanitizing detergennts	HDOH HEER	58,539.56	1680961.583	19960102-1325
Fantastik Auto Repair Shop Inc	1815 Dillingham Blvd, Honolulu HI. 96819		HDOH HEER	58,506.17	1680998.027	19990720-0804
IMM - Dillingham	1701 DILLINGHAM BLVD. Honolulu, HI. 96819		HDOH LUST - 2014	58,251.94	1,681,281.54	
IMM - Dillingham	1701 DILLINGHAM BLVD. Honolulu, HI. 96819		HDOH LUST - 2014	58,251.94	1,681,281.54	

TABLE A-2

Known or Suspected Contaminated Sites

Environmental Hazard Evaluation and Environmental Hazard Management Plan

Honolulu Rail Transit Project, Oahu, Hawaii

Site Name	Address	Substance	Source	Easting[1]	Northing[1]	Release ID
IMM - Dillingham	1701 DILLINGHAM BLVD. Honolulu, HI. 96819		HDOH LUST - 2014	58,251.94	1,681,281.54	
IMM - Dillingham	1701 DILLINGHAM BLVD. Honolulu, HI. 96819		HDOH LUST - 2014	58,251.94	1,681,281.54	
Checker Auto	1555 Dillingham Blvd, Honolulu HI. 96817	Paint	HDOH HEER	57,817.92	1681640.741	20110126-1255
SOIL-RC-71			AIS Trench	57,627.80	1,682,023.31	20121126-1702
TESORO GAS EXPRESS 12	1529 DILLINGHAM BLVD Honolulu, HI. 96817		HDOH LUST - 2014	57,656.72	1,682,041.79	
1470 Dillingham Boulevard, Bldg B, chemical odor	1470 Dillingham Blvd, Honolulu HI. 96817	chemical odor	HDOH HEER	57,616.97	1682474.512	19941226-2
Former General Tire Petroleum Contamination	505 Waiakamilo Rd		HDOH SDAR - 2014	56,740.31	1,682,509.92	
1385 Colburn Street	1385 Colburn St, Kapalama HI. 96817	Benzo(a)pyrene	HDOH HEER	56,718.09	1682516.809	20130221-1628
1385 Colburn Street	1385 Colburn St, Kapalama HI. 96817	Lead	HDOH HEER	56,718.09	1682516.809	20130221-1628
1385 Colburn Street	1385 Colburn St		HDOH SDAR - 2014	56,716.35	1,682,667.42	
Bob's Bar B Que	1366 Dillingham Blvd Honolulu, HI. 96817		HDOH LUST - 2014	57,096.23	1,682,812.43	
609 Waiakamilo Road	609 Waiakamilo Rd, Honolulu HI.	Diesel Fuel	HDOH HEER	57,115.98	1682863.943	20090331-1230
Property 64 warehouse	609 Waiakamilo Road Honolulu, HI. 96817		HDOH LUST - 2014	57,114.73	1,682,868.85	
Kamehameha Schools - 1336 Dillingham Boulevard	1336 Dillingham Blvd	Found: TCE in soil and groundwater	HDOH SDAR - 2014	57,011.67	1,683,046.54	
Aloha 7-Eleven City Square	1199 Dillingham Blvd, Honolulu HI. 96817	Petroleum Hydrocarbon	HDOH HEER	56,614.84	1683056.409	19980205-0952
Aloha 7-Eleven City Square	1199 Dillingham Blvd, Honolulu HI. 96817		HDOH HEER	56,614.84	1683056.409	20090514-0818
City Square 76 Gas Station	1199 DILLINGHAM BLVD Honolulu, HI. 96817		HDOH LUST - 2014	56,613.59	1,683,061.32	
City Square 76 Gas Station	1199 DILLINGHAM BLVD Honolulu, HI. 96817		HDOH LUST - 2014	56,613.59	1,683,061.32	
Kamehameha Schools - 1336 Dillingham Boulevard	1336 Dillingham Blvd, Honolulu HI. 96813	Chlorinated Cleaners TPH-Diesel	HDOH HEER	56,911.57	1683091.197	20090213-1326
			Geotech Boring	56,721.52	1,683,171.44	20140331-1011
SOIL-RC-28			AIS Trench	56,710.44	1,683,230.90	20121008-1510
Oahu Paint & Decoration Co.	549 Kokea St, Honolulu HI. 96817	PAINTS	HDOH HEER	56,137.53	1683288.071	19890407
WC-SO-675			Geotech Boring	56,647.29	1,683,290.20	20140331-1012
SOIL-RC-31			AIS Trench	56,612.51	1,683,386.53	20120920-1200
			Geotech Boring	56,573.06	1,683,408.90	20140331-1013
HECO Pad-Mount Transformer No. 71384	565 Kokea St, Honolulu HI. 96817	Transformer Oil	HDOH HEER	56,145.59	1683423.567	20100930-0902
			Geotech Boring	56,462.13	1,683,450.83	20140405-1015
Abandoned Drums 1218 Kaumualii Street	1218 Kaumualii St, Honolulu HI.	Motor Oil	HDOH HEER	56,803.65	1683722.665	20120731-1305
SOIL-RC-57	1111,1095 Dillingham Blvd		AIS Trench	56,266.54	1,683,744.08	20121126-1703
Affordable Clinic, dumping	100 Dillingham Blvd, Honolulu HI. 96817		HDOH HEER	56,378.19	1683752.485	20020321-1256
HONOLULU COMMUNITY COLLEGE	DILLINGHAM BLVD Honolulu, HI. 96817		HDOH LUST - 2014	56,376.95	1,683,757.40	
SOIL-RC-57	1111,1095 Dillingham Blvd		AIS Trench	56,290.03	1,683,760.91	20121126-1703
Sprint Lot	925 Dillingham Blvd	Found: Diesel, free product in soil groundwater, and soil vapor	HDOH SDAR - 2014	55,561.26	1,684,144.33	
Costco Gas Station	520 Alakawa St	Found: TPH-d,o BTEX free product in soil, groundwater and soil vapor	HDOH SDAR - 2014	55,412.55	1,684,148.73	
Costco Iwilei	525 Alakawa St		HDOH SDAR - 2014	55,412.55	1,684,148.73	
heco pole-mounted transformer #60822 release	985 Dillingham BLVD, Honolulu HI. 96817	Transformer Oil	HDOH HEER	55,893.33	1684212.993	20110404-1408
Costco Gas Station	520 Alakawa St	Found: TPH-d,o BTEX free product in soil, groundwater and soil vapor	HDOH SDAR - 2014	55,779.07	1,684,294.24	
Theo Davies Caterpillar Repair Site	935 Dillingham Blvd	Found: TPH -g,d methane in soil and soil vapor	HDOH SDAR - 2014	55,779.07	1,684,294.24	
Kapalama Incinerator Off-Site Contamination	757 Kokea St	Presumed: Lead in soil	HDOH SDAR - 2014	56,989.29	1,684,332.77	
Theo Davies Caterpillar Repair Site	935 Dillingham Blvd, Honolulu HI. 96817	Old weathered diesel fuel	HDOH HEER	55,787.52	1684356.548	19951130
Theo Davies Caterpillar Repair Site	935 Dillingham Blvd, Honolulu HI. 96817		HDOH HEER	55,787.52	1684356.548	20071211-1234
Kapalama Incinerator	757 Kokea St	Found: Lead in soil	HDOH SDAR - 2014	56,492.80	1,684,477.31	
Kapalama Incinerator Off-Site Contamination	757 Kokea St	Presumed: Lead in soil	HDOH SDAR - 2014	56,492.80	1,684,477.31	
Honolulu Community College Gas Station	874 Dillingham Blvd	Found: Petroleum in soil	HDOH SDAR - 2014	56,164.09	1,684,485.95	

TABLE A-2

Known or Suspected Contaminated Sites

Environmental Hazard Evaluation and Environmental Hazard Management Plan

Honolulu Rail Transit Project, Oahu, Hawaii

Site Name	Address	Substance	Source	Easting[1]	Northing[1]	Release ID
Kapalama Incinerator	757 Kokea St	Found: Lead in soil	HDOH SDAR - 2014	56,705.76	1,684,540.71	
Kapalama Incinerator Off-Site Contamination	757 Kokea St	Presumed: Lead in soil	HDOH SDAR - 2014	56,705.76	1,684,540.71	
Sprint Lot	925 Dillingham Blvd	Found: Diesel, free product in soil groundwater, and soil vapor	HDOH SDAR - 2014	55,722.02	1,684,548.66	
1150 North Alakawa Street, dumping of drums	1150 N Alakawa St, Honolulu HI. 96817		HDOH HEER	55,785.26	1684655.534	20000809-1330
Sprint Lot	925 Dillingham Blvd Honolulu, HI. 96817		HDOH LUST - 2014	55,611.82	1,684,736.39	
Kapalama Incinerator Off-Site Contamination	757 Kokea St	Presumed: Lead in soil	HDOH SDAR - 2014	56,642.91	1,684,798.63	
Dole Cannery	801 Dillingham Blvd	Found: petroleum in soil	HDOH SDAR - 2014	55,484.93	1,684,874.43	
Honolulu Community College Picric Acid Removal	874 Dillingham Blvd, Honolulu HI. 96817	Picric Acid	HDOH HEER	55,878.45	1684934.632	19920207-2
Honolulu Community College Gas Station	874 Dillingham Blvd, Honolulu HI. 96817	Unk Diesel Odor	HDOH HEER	55,878.45	1684934.632	19921003
Iwilei Business Center	501 Sumner St	Found: TPH-d in soil and groundwater. To be characterized and remediated when site is redevelped.	HDOH SDAR - 2014	54,634.19	1,685,044.97	
Travel Plaza Transportation, LLC	818 Pine St	Found: petroleum products from leaking UST	HDOH SDAR - 2014	54,806.30	1,685,287.18	
Travel Plaza Transportation, LLC	818 Pine St	Found: petroleum products from leaking UST	HDOH SDAR - 2014	54,806.30	1,685,287.18	
Cutter Dodge Dillingham	735 Dillingham Blvd, Honolulu HI. 96817	TEXTILE DYE	HDOH HEER	55,224.69	1685317.521	19900131
CUTTER DODGE AUTO SERVICE CENTER	735 DILLINGHAM BLVD Honolulu, HI. 96817		HDOH LUST - 2014	55,223.44	1,685,322.43	
TRAVEL PLAZA TRANSPORTATION, LLC	818 PINE ST Honolulu, HI. 96817		HDOH LUST - 2014	54,851.30	1,685,338.40	
TRAVEL PLAZA TRANSPORTATION, LLC	818 PINE ST Honolulu, HI. 96817		HDOH LUST - 2014	54,851.30	1,685,338.40	
505 Kuwili Street, Iwilei	505 Kuwili St, Honolulu HI. 96817	Unknown Liquid	HDOH HEER	54,851.57	1685463.516	19901119-2
HC Recycler Facility	455 Kuwili St, Honolulu HI. 96813	Old Oil	HDOH HEER	54,625.10	1685490.937	19920108-3
HECO Transformer 31250	455 Kuwili St, Honolulu HI. 96817	Transformer Oil	HDOH HEER	54,625.10	1685490.937	20030127-1953
RICHARD TOM	963 ROBELLO LN Honolulu, HI. 96817		HDOH LUST - 2014	55,733.10	1,685,547.84	
431 Kuwili Street, small diesel spill	431 Kuwili St, Honolulu HI. 96817	Diesel Fuel	HDOH HEER	54,459.18	1685592.851	20010708-1018
SOIL-RC-51	617, 621 Dillingham Blvd		AIS Trench	55,144.33	1,685,603.47	20121126-1704
C&CH PALOLO FIRE STATION	3345 KIWILI ST Honolulu, HI. 96816		HDOH LUST - 2014	54,510.37	1,685,663.68	
Rizzo Dye	935 Akepo Ln, Honolulu HI. 96817	dye	HDOH HEER	55,378.22	1685686.293	19950712
SOIL-RC-45	617, 621 Dillingham Blvd		AIS Trench	55,101.35	1,685,711.25	20121126-1704
YICK LUNG CO., INC.	602 DILLINGHAM BLVD Honolulu, HI. 96817		HDOH LUST - 2014	55,245.64	1,685,799.21	
			Geotech Boring	54,884.57	1,685,823.16	20130312-0820
WC-SO-698			Geotech Boring	54,923.04	1,685,844.94	20140215-1153
Soil-RC-48	549,555 Kaaahi St		AIS Trench	54,959.94	1,685,849.37	20120927-1441
SOIL-RC-90	545 Kaaahi St		AIS Trench	54,894.67	1,685,855.35	20121015-1112
SOIL-RC-47	549,555 Kaaahi St		AIS Trench	54,972.08	1,685,864.22	20121126-1704
373 North Nimitz Highway	373 N Nimitz Hwy	Found: Subsurface petroleum contaminationin soil and groundwater.	HDOH SDAR - 2014	53,865.52	1,685,867.36	
365 North Nimitz Highway	365 N Nimitz Hwy, Honolulu HI. 96817	Oil (3 ea Drums - 2 @ 55- Gal 1 @ 5- Gal)	HDOH HEER	53,586.39	1685898.301	19930318
373 North Nimitz Highway	373 N Nimitz Hwy, Honolulu HI. 96817		HDOH HEER	53,753.58	1685924.914	20000914-0905
373 North Nimitz Highway	373 N Nimitz Hwy, Honolulu HI. 96817	Oil	HDOH HEER	53,753.58	1685924.914	20051025-1618
STEELTECH INC	373 N NIMITZ HWY Honolulu, HI. 96817		HDOH LUST - 2014	53,752.34	1,685,929.82	
STEELTECH INC	373 N NIMITZ HWY Honolulu, HI. 96817		HDOH LUST - 2014	53,752.34	1,685,929.82	
The American Coating Co.	850 Iwilei Rd, Honolulu HI. 96817	Urethane (Neogard)	HDOH HEER	54,299.45	1685930.578	19920820
373 North Nimitz Highway	373 N Nimitz Hwy	Found: Subsurface petroleum contaminationin soil and groundwater.	HDOH SDAR - 2014	53,742.67	1,685,938.36	
YICK LUNG CO., INC.	580 DILLINGHAM BLVD Honolulu, HI. 96817		HDOH LUST - 2014	55,192.00	1,685,938.37	
373 North Nimitz Highway	373 N Nimitz Hwy	Found: Subsurface petroleum contaminationin soil and groundwater.	HDOH SDAR - 2014	53,514.94	1,685,948.18	

TABLE A-2

Known or Suspected Contaminated Sites

Environmental Hazard Evaluation and Environmental Hazard Management Plan

Honolulu Rail Transit Project, Oahu, Hawaii

Site Name	Address	Substance	Source	Easting[1]	Northing[1]	Release ID
Von Hamm Textiles	546 Kaaahi St	Found: Lead contamination in soil	HDOH SDAR - 2014	54,942.80	1,686,046.44	
Von Hamm Textiles	546 Kaaahi St	Found: Lead contamination in soil	HDOH SDAR - 2014	54,942.80	1,686,046.44	
Von Hamm Textiles	546 Kaaahi St, Honolulu HI. 96817	reported as chemicals	HDOH HEER	54,942.38	1686067.137	19901023
Von Hamm Textiles	546 Kaaahi St, Honolulu HI. 96817	Lead	HDOH HEER	54,942.38	1686067.137	19960521-40
WC-SO-701-702			Geotech Boring	54,664.08	1,686,075.34	20131121-1112
Nimitz Highway Water Improvement Project Sumner to Queen	N Nimitz Hwy	Presumed: Unknown	HDOH SDAR - 2014	53,789.52	1,686,083.55	
MAUNAWILI PRODUCE	906 KAAAHI PL Honolulu, HI. 96817		HDOH LUST - 2014	54,715.70	1,686,155.56	
WC-SO-701-702			Geotech Boring	54,538.28	1,686,157.37	20131206-1421
HECO Transformers 46551, 46552, 46553	535 Dillingham Blvd, Honolulu HI. 96817	Transformer Oil	HDOH HEER	55,051.10	1686233.762	20030629-1240
MAUNAWILI PRODUCE, INC.	914 KAAAHI PL Honolulu, HI. 96817		HDOH LUST - 2014	54,705.90	1,686,253.30	
SOIL-RC-75			AIS Trench	54,301.44	1,686,253.90	20121126-1705
Awa Wastewater Pump Station	190 N Nimitz Hwy, Honolulu HI. 96817	Oil	HDOH HEER	53,428.83	1686260.54	19930826
Security Breach at 131 Nimitz Highway	131 Nimitz Hwy, Honolulu HI.	Security Breach	HDOH HEER	53,172.96	1686272.332	20130208-0030
Pacific Marine & Supply Co., Ltd.			HDOH SDAR - 2014	52,366.77	1,686,273.78	
			Geotech Boring	53,527.11	1,686,279.21	20140512-0815
Nimitz highway petroleum contamination discovery	79 Nimitz Hwy, Honolulu HI.	Petroleum	HDOH HEER	53,013.36	1686282.442	20120817-1501
C&CH WATERFRONT FIRE STATION	111 N NIMITZ HWY Honolulu, HI. 96817		HDOH LUST - 2014	53,110.88	1,686,283.15	
PENCO, 65 North Nimitz Highway, Pier 14	65 N Nimitz Hwy, Honolulu HI. 96817		HDOH HEER	52,222.86	1686305.857	19980413-1047
American Marine Corp Facility- Pier 13, Honolulu Harbor	65 N Nimitz Hwy, Honolulu HI. 96817	Marine Diesel #2	HDOH HEER	52,222.86	1686305.857	20020715-2030
Pier 13	65 N Nimitz Hwy, Honolulu HI. 96816	Oil	HDOH HEER	52,222.86	1686305.857	20070418-0932
American Marine Corp Facility- Pier 13, Honolulu Harbor	65 N Nimitz Hwy, Honolulu HI. 96817	Hydraulic Oil	HDOH HEER	52,222.86	1686305.857	20080720-1315
American Marine Corp Facility- Pier 13, Honolulu Harbor	65 N Nimitz Hwy, Honolulu HI. 96817	Oily Water Mixture	HDOH HEER	52,222.86	1686305.857	20090421-1606
			Geotech Boring	53,026.48	1,686,325.56	20140411-0911
			Geotech Boring	52,996.62	1,686,328.37	20140505-0925
SOIL-RC-58			AIS Trench	52,646.81	1,686,345.33	20121126-1706
			Geotech Boring	52,767.85	1,686,350.34	20140416-0856
			Geotech Boring	52,671.02	1,686,369.53	20140415-0925
Iwilei Project Site	Iwilei Rd & N King St	Found: PAHs, VOCs, lead, and other metals in soil.	HDOH SDAR - 2014	54,253.51	1,686,400.75	
Liliha Civic Center	337 N King St		HDOH SDAR - 2014	54,253.51	1,686,400.75	
SOIL-RC-79			AIS Trench	52,753.42	1,686,405.94	20121126-1706
Alleged lead exposure	901 Kakaulike, Honolulu HI.	Lead	HDOH HEER	52,793.22	1686440.709	20130214-0845
Alleged lead exposure	901 Kakaulike, Honolulu HI.	Lead	HDOH HEER	52,793.22	1686440.709	20130214-0845
	168,174 N Nimitz Hwy		AIS Trench	53,014.72	1,686,445.93	20121128-1609
901 River Street, sewage spill	901 River St, Honolulu HI. 96817	Sewage	HDOH HEER	53,148.90	1686467.057	19970419-1222
SOIL-RC-80			AIS Trench	52,555.05	1,686,471.32	20121126-1706
215 North King Street Construction Site, Tanks 1 & 2	215 N King St		HDOH SDAR - 2014	53,698.70	1,686,472.96	
Unknown Sheen 930597	79 S Nimitz Hwy, Honolulu HI. 96813	Unknown	HDOH HEER	51,536.12	1686503.842	20100205-0810
SOIL-RC-67			AIS Trench	52,308.16	1,686,508.88	20121126-1706
SOIL-RC-68			AIS Trench	52,220.87	1,686,544.11	20121126-1706
WC-SO-722-723			Geotech Boring	52,180.56	1,686,583.02	20140404-0809
Iwilei Project Site	Iwilei Rd & N King St	Found: PAHs, VOCs, lead, and other metals in soil.	HDOH SDAR - 2014	53,836.43	1,686,592.32	
			AIS Trench	51,989.49	1,686,602.70	20121126-1706
SOIL-RC-63			AIS Trench	51,675.92	1,686,614.33	20121126-1706
411 North King Street, 75-gal sewage spill	411 N King St, Honolulu HI. 96817	Sewage	HDOH HEER	54,533.26	1686624.827	19990708-2200
411 North King Street, 108-gal sewage spill	411 N King St, Honolulu HI. 96817	sewage	HDOH HEER	54,533.26	1686624.827	20000902-1020
WC-SO-722-723			Geotech Boring	52,045.16	1,686,629.19	20140401-0922
Aloha Antiques	920 Maunakea St, Honolulu HI.	Mold	HDOH HEER	52,616.91	1686629.405	20050111-1322

TABLE A-2

Known or Suspected Contaminated Sites

Environmental Hazard Evaluation and Environmental Hazard Management Plan

Honolulu Rail Transit Project, Oahu, Hawaii

Site Name	Address	Substance	Source	Easting[1]	Northing[1]	Release ID
399 North King Street, sewage grease block	399 N King St, Honolulu HI. 96817	Sewage Spill	HDOH HEER	54,508.74	1686632.303	19920219-1
399 North King Street, 20-gallon spill	399 N King St, Honolulu HI. 96817	Sewage	HDOH HEER	54,508.74	1686632.303	19980131-1047
SOIL-RC-59			AIS Trench	51,290.97	1,686,640.24	20121126-1706
SOIL-RC-73			AIS Trench	51,868.70	1,686,647.65	20121126-1706
Ala Moana Storm Drain	100 Ala Moana Blvd, Honolulu HI. 96813	PAINT	HDOH HEER	51,357.97	1686658.879	19900627-1
SOIL-RC-70			AIS Trench	51,447.84	1,686,668.58	20121126-1706
Hawaiian Electric Company (HECO)-Honolulu Generating Station	170 Ala Moana Blvd	Found: Heavy fuel oil - probably not migrating; no contact hazard due to soil; may be probable release to surface water - 3/7/1996	HDOH SDAR - 2014	50,552.39	1,686,685.86	
Yee Hop Building Maunakea Street	950 Maunakea St	Found: Diesel in soil	HDOH SDAR - 2014	52,699.13	1,686,696.78	
Yee Hop Building Maunakea Street	950 Maunakea St	Found: Diesel in soil	HDOH SDAR - 2014	52,778.64	1,686,711.46	
175 N Hotel Street, sewage spill	175 N Hotel St, Honolulu HI. 96817	Sewage	HDOH HEER	53,356.84	1686780.922	19970330-2042
SOIL-RC-44			AIS Trench	51,044.59	1,686,793.24	20121126-1706
Hawaiian Electric Company (HECO)-Honolulu Generating Station	170 Ala Moana Blvd	Found: Heavy fuel oil - probably not migrating; no contact hazard due to soil; may be probable release to surface water - 3/7/1996	HDOH SDAR - 2014	50,613.17	1,686,831.06	
Harbor Court	66 Queen St		HDOH SDAR - 2014	51,759.65	1,686,846.97	
Kekaulike Diamond Head Block Revitalization	163 N Hotel St		HDOH SDAR - 2014	52,982.74	1,686,884.13	
Pacific Cruises	181 Ala Moana Blvd, Honolulu HI. 96813	Oil, Waste	HDOH HEER	50,817.28	1686892.012	20030409-1016
928 Nuuanu Avenue	928 Nuuanu Ave, Honolulu HI. 96817		HDOH HEER	52,278.60	1686913.383	19890928
Fantastique Dry Clean & Alteration	16 Merchant St, Honolulu HI. 96813	Perchloroethylene	HDOH HEER	52,097.60	1686919.701	20040630-1527
Fantastique Dry Clean & Alteration	16 Merchant St, Honolulu HI. 96813	Perchloroethylene	HDOH HEER	52,097.60	1686919.701	20040630-1527
Fantastique Dry Clean & Alteration	16 Merchant St, Honolulu HI. 96813	Perchloroethylene	HDOH HEER	52,097.60	1686919.701	20040630-1527
SOIL-RC-40			AIS Trench	50,823.97	1,686,939.81	20121126-1706
Hawaiian Electric Company (HECO)-Honolulu Generating Station	170 Ala Moana Blvd, Honolulu HI. 96813	Fuel Oil #6	HDOH HEER	50,882.34	1686940.667	19960214-1545
Hawaiian Electric Company (HECO)-Honolulu Generating Station	170 Ala Moana Blvd, Honolulu HI. 96813	Turbine Oil	HDOH HEER	50,882.34	1686940.667	19970218-1413
Hawaiian Electric Company (HECO)-Honolulu Generating Station	170 Ala Moana Blvd, Honolulu HI. 96813	Fuel Oil	HDOH HEER	50,882.34	1686940.667	19980415-0845
Hawaiian Electric Company (HECO)-Honolulu Generating Station	170 Ala Moana Blvd, Honolulu HI. 96813	Hydraulic Fluid	HDOH HEER	50,882.34	1686940.667	20011024-1407
Hawaiian Electric Company (HECO)-Honolulu Generating Station	170 Ala Moana Blvd, Honolulu HI. 96813	Oil Sheen	HDOH HEER	50,882.34	1686940.667	20040708-0700
Hawaiian Electric Company (HECO)-Honolulu Generating Station	170 Ala Moana Blvd, Honolulu HI. 96813	Shell Diala Oil	HDOH HEER	50,882.34	1686940.667	20041105-1850
Mystery Sheen NRC 893840	170 Ala Moana Blvd, Honolulu HI.	Oil	HDOH HEER	50,882.34	1686940.667	20090102-0830
Norwegian Cruise Line	700 Bishop St, Honolulu HI. 96813	Paint	HDOH HEER	51,284.65	1686942.565	20040811-1115
Norwegian Cruise Line	700 Bishop St, Honolulu HI. 96813	Hydraulic Oil	HDOH HEER	51,284.65	1686942.565	20060124-0813
WC-SO-735-736L-737R			Geotech Boring	50,762.27	1,686,981.78	20140225-0815
WC-SO-735-736L-737R			Geotech Boring	50,525.62	1,687,113.21	20140407-0835
Group 70 International, Inc	925 Bethel St, Honolulu HI. 96813		HDOH HEER	51,986.36	1687120.939	20011023-1126
WC-SO-735-736L-737R			Geotech Boring	50,541.61	1,687,161.63	20140311-1300
HARBOR SQUARE ASSOCIATION	700 RICHARDS ST Honolulu, HI. 96813		HDOH LUST - 2014	50,656.87	1,687,251.73	
USCG Marine Safety Office- Pier 4, Underground Pipeline/Pocket of Bun	300 Ala Moana Blvd, Honolulu HI. 96814	Bunker C - Black Oil	HDOH HEER	49,690.89	1687464.166	19920303
HECO Pad-Mount Transformer No. 55326	826 Mililani St, Honolulu HI. 96813	Transformer Oil	HDOH HEER	50,217.50	1687467.517	20100922-1423
MELIM BLDG	333 QUEEN ST Honolulu, HI. 96813		HDOH LUST - 2014	50,608.02	1,687,552.83	
			Geotech Boring	49,765.00	1,687,616.01	20140805-1010
HECO pad-mounted transformer #48969 release	555 Reed Lane, Honolulu HI. 96813	Transformer Oil	HDOH HEER	49,282.46	1687687.394	20111216-1128
Keelikolani Building	830 Punchbowl St, Honolulu HI. 96813	SEE INCIDENT DESCRIPTION	HDOH HEER	49,966.77	1687740.134	19921215-1515
REED LANE WAREHOUSE	556 REED LN Honolulu, HI. 96813		HDOH LUST - 2014	49,204.35	1,687,859.38	
EUROCARE/KEICO PACIFIC/SHONS AUT	545 SOUTH ST Honolulu, HI. 96813		HDOH LUST - 2014	48,978.76	1,687,925.08	
HECO pad-mounted transformer #50100 release	555 Halekauwila ST, Honolulu HI. 96813	Transformer Oil	HDOH HEER	49,356.94	1687941.789	20111216-1129

TABLE A-2

Known or Suspected Contaminated Sites

Environmental Hazard Evaluation and Environmental Hazard Management Plan

Honolulu Rail Transit Project, Oahu, Hawaii

Site Name	Address	Substance	Source	Easting[1]	Northing[1]	Release ID
Town Inn	248-258 N Beretania St	Found: TPH-D, BTEX, PAHs, and free product in soil and groundwater.	HDOH SDAR - 2014	54,308.13	1,687,986.60	
			Geotech Boring	49,173.60	1,688,085.98	20140820-0825
DAGS - AUTOMOTIVE MANAGEMENT DIVISION	869A PUNCHBOWL ST Honolulu, HI. 96813		HDOH LUST - 2014	49,835.71	1,688,086.18	
SOIL-RC-89	598 Halekauwila St		AIS Trench	49,204.94	1,688,128.34	20121015-1115
AMELCO BUILDING (SERVICE STATION)	603 HALEKAUWILA ST Honolulu, HI. 96813		HDOH LUST - 2014	49,121.60	1,688,140.95	
TIRE RECAP SERVICE	526 KEAWE ST Honolulu, HI. 96813		HDOH LUST - 2014	48,553.96	1,688,165.38	
HECO pad-mounted transformer #60329 release	614 South ST, Honolulu HI. 96813	Transformer Oil	HDOH HEER	49,216.98	1688198.791	20111213-1056
SOIL-RC-104			AIS Trench	49,101.52	1,688,203.10	20130207-1805
CBI, INC	614 SOUTH ST Honolulu, HI. 96813		HDOH LUST - 2014	49,215.74	1,688,203.70	
Board of Water Supply Pipeline	609 South St, Honolulu HI. 96814	Used MotorOil	HDOH HEER	49,102.01	1688232.697	20061002-0903
HECO pad-mounted transformer #56500 release	609 South St, Honolulu HI. 96813	Transformer Oil	HDOH HEER	49,102.01	1688232.697	20120401-1317
MOTOR IMPORTS SERVICE	609 SOUTH ST Honolulu, HI. 96813		HDOH LUST - 2014	49,100.76	1,688,237.61	
Na Keiki Law Office 547 Queen Street	547 Queen St, Honolulu HI.	Oil	HDOH HEER	49,587.68	1688238.221	20060609-1346
SOIL-RC-107			AIS Trench	48,996.05	1,688,290.36	20130207-1805
			Geotech Boring	48,885.19	1,688,303.84	20140731-1557
INTERNATIONAL LIFE SUPPORT	633 HALEKAUWILA ST Honolulu, HI. 96813		HDOH LUST - 2014	48,921.99	1,688,308.23	
C&CH KAKAAKO FIRE DEPT MECHANIC SHOP	620 SOUTH ST Honolulu, HI. 96813		HDOH LUST - 2014	49,219.43	1,688,310.52	
SOIL-RC-108			AIS Trench	48,939.75	1,688,337.10	20130207-1805
614 Keawe Street	614 Keawe St, Honolulu HI. 96813	oil	HDOH HEER	48,833.28	1688490.463	19940310
SOIL-RC-131			AIS Trench	48,642.07	1,688,550.18	20130207-1806
630 Keawe Street Service Bay	630 Keawe St, Honolulu HI. 96813	waste oil	HDOH HEER	49,024.81	1688592.212	19940210
630 Keawe Street Service Bay	630 Keawe St, Honolulu HI. 96813	Oil	HDOH HEER	49,024.81	1688592.212	19940506-1
GENSIRO KAWAMOTO	630 KEAWE ST Honolulu, HI. 96800		HDOH LUST - 2014	49,023.56	1,688,597.12	
HECO Pole Transformer 33277	670 Halekawila, Honolulu HI. 96814	Shell Diala Oil	HDOH HEER	48,736.65	1688600.164	20050930-1028
SOIL-RC-156			AIS Trench	47,903.60	1,688,612.34	20130207-1810
Cooke Street Lead Contamination	501 Cooke St	Found: lead in soil	HDOH SDAR - 2014	47,858.07	1,688,659.90	
GENSIRO KAWAMOTO	627 QUEEN ST Honolulu, HI. 96800		HDOH LUST - 2014	49,053.61	1,688,725.98	
805B Pohukaina Street	805 Pohukaina St, Honolulu HI. 96813	SOLVENT	HDOH HEER	47,624.60	1688740.703	19910709
600 Coral Street, sewage spill	600 Coral St, Honolulu HI. 96813	Raw Sewage	HDOH HEER	48,528.73	1688773.488	19960403-1042
POHULANI ELDERLY PROJECT	677 QUEEN ST Honolulu, HI. 96813		HDOH LUST - 2014	48,916.39	1,688,825.03	
SOIL-RC-162			AIS Trench	48,308.37	1,688,852.85	20130207-1807
HAWAII COMMUNITY DEVELOPMENT AUTHORITY	548 COOKE ST Honolulu, HI. 96813		HDOH LUST - 2014	48,216.35	1,688,854.08	
HECO transformer pad-mounted #59679 release	539 Cook ST, Honolulu HI. 96813	Transformer Oil	HDOH HEER	48,031.30	1688868.71	20120820-1421
SOIL-RC-15			AIS Trench	48,157.70	1,688,917.55	20121126-1708
SOIL-RC-50			AIS Trench	48,222.09	1,688,939.29	20121126-1707
LEX BRODIE TIRE CO.	701 S QUEEN ST Honolulu, HI. 96813		HDOH LUST - 2014	48,559.43	1,688,955.80	
Fiddler's Wood Shop	611 Cooke St, Honolulu HI. 96813	Gasoline	HDOH HEER	48,400.64	1689165.905	19910415
Todoki Machine & Marine Works Inc	810 Halekauwila St, Honolulu HI. 96813	Unknown	HDOH HEER	47,888.25	1689184.243	19910328
Hawaii Instrumentation & Controls, Inc	822 Halekauwila St, Honolulu HI.	UNKNOWN CHEMICAL	HDOH HEER	47,813.52	1689256.481	19910620-3
Hawaii Instrumentation & Controls, Inc	822 Halekauwila St, Honolulu HI.	unknown odor	HDOH HEER	47,813.52	1689256.481	19941216-4
320 Ward Avenue, paint dumping	320 Ward Ave, Honolulu HI. 96814	Paint	HDOH HEER	47,156.58	1689256.67	20000424-1445
Hawaii Instrumentation & Controls, Inc	822 Halekauwila St	Presumed: Solvent vapors encountered inside and around 822 Halekauwila St. Restroom renovation, and capping/sealing of grounds, alleviated the vapor intrusion problem.	HDOH SDAR - 2014	47,812.52	1,689,268.00	
WC-SO-764-767			Geotech Boring	47,654.46	1,689,306.95	20140106-1515

TABLE A-2

Known or Suspected Contaminated Sites

Environmental Hazard Evaluation and Environmental Hazard Management Plan

Honolulu Rail Transit Project, Oahu, Hawaii

Site Name	Address	Substance	Source	Easting[1]	Northing[1]	Release ID
812 Ilaniwai Street	812 Ilaniwai St, Honolulu HI. 96813	Oil, Engine	HDOH HEER	48,110.19	1689377.333	20040507-1145
			Geotech Boring	47,536.56	1,689,399.69	20140106-1516
WC-SO-764-767			Geotech Boring	47,369.78	1,689,567.59	20140109-1028
420 WARD AVE	420 WARD AVE/901 ILANIWAI ST Honolulu, HI. 96814		HDOH LUST - 2014	47,492.11	1,689,664.58	
UST discovered Ward Avenue	420 Ward Ave, Honolulu HI. 96814		HDOH HEER	47,476.84	1689672.585	20000504-1347
H. HAMADA STORE INC.	885 QUEEN ST Honolulu, HI. 96813		HDOH LUST - 2014	47,813.60	1,689,724.20	
Gems, Citri-Solv	333 Ward Ave, Honolulu HI. 96814		HDOH HEER	47,078.94	1689724.389	19940827
GEM DEPT	333 WARD AVE Honolulu, HI. 96800		HDOH LUST - 2014	47,077.69	1,689,729.30	
Ward Warehouse, sewage spill	1020 Auahi St, Honolulu HI. 96814	Raw Sewage	HDOH HEER	46,724.39	1689902.386	19960222-0506
Ward Warehouse, 170-gallon sewage spill	1020 Auahi St, Honolulu HI. 96814	Sewage	HDOH HEER	46,724.39	1689902.386	19970512-2357
2nd Row of Storm Drains from Building fronting Da Spirits Market	1020 Auahu St, Honolulu HI. 96814	Diesel Fuel	HDOH HEER	46,724.39	1689902.386	19930212
MARKET CENTER SS	1020 AUAHI ST Honolulu, HI. 96814		HDOH LUST - 2014	46,723.14	1,689,907.30	
MARKET CENTER SS	1020 AUAHI ST Honolulu, HI. 96814		HDOH LUST - 2014	46,723.14	1,689,907.30	
Commercial Enterprises, ammonia leak	935 Queen St, Honolulu HI. 96814	Ammonia	HDOH HEER	47,530.90	1690043.362	19980126-1230
Commercial Enterprises, ammonia leak	935 Queen St, Honolulu HI. 96814	Ammonia	HDOH HEER	47,530.90	1690043.362	19980126-1230
HAWAIIAN HARDWOOD CO., LTD	935 QUEEN ST Honolulu, HI. 96814		HDOH LUST - 2014	47,529.66	1,690,048.27	
RAY'S AUTO SERVICE	959 QUEEN ST Honolulu, HI. 96814		HDOH LUST - 2014	47,213.25	1,690,195.90	
955 Kawaiahao Street, abandoned drums	955 Kawaiahao St, Honolulu HI. 96814		HDOH HEER	47,434.78	1690349.427	19980514-1319
HECO Transformers 59734, 59735, 59736	955 Kawaiahao St, Honolulu HI.		HDOH HEER	47,434.78	1690349.427	20111211-1252
HECO pole-mounted transformer #59734,5,6 release	955 Kawaiahao St, Honolulu HI. 96814	Transformer Oil	HDOH HEER	47,434.78	1690349.427	20120113-1342
SunMac Warehouse	510 Cummings St/972 Queen St, Honolulu HI. 96814		HDOH HEER	47,250.60	1690374.109	20011017-1337
Hawaii Opera Theater Sets & Props Warehouse	962 Kawaiahao St, Honolulu HI.	Benzopyrene	HDOH HEER	47,442.57	1690521.336	20120201-1355
Hawaii Opera Theater Sets & Props Warehouse	962 Kawaiahao St, Honolulu HI.	TPH	HDOH HEER	47,442.57	1690521.336	20120201-1355
SERVICE AUTO MACHINE WORKS	518 CUMMINS ST Honolulu, HI. 96814		HDOH LUST - 2014	47,242.15	1,690,523.47	
U. Okada Company	1000 Queen St, Honolulu HI. 96814	Anhydrous Ammonia	HDOH HEER	46,996.51	1690537.275	20051230-1630
COMPUTER CITY AT WARD VILLAGE SHOPS	1108 AUAHI ST Honolulu, HI. 96814		HDOH LUST - 2014	46,155.51	1,690,643.20	
TAI HING CO., INC.	1023 KAWAIAHAO ST Honolulu, HI. 96814		HDOH LUST - 2014	47,017.09	1,690,732.20	
TLC Motorcycle Repair	535 Cummins St, Honolulu HI. 96814	oil	HDOH HEER	47,260.44	1690759.125	19940228
TLC Motorcycle Repair	535 Cummins St, Honolulu HI. 96814		HDOH HEER	47,260.44	1690759.125	19990405-1532
HECO transformer pad-mounted #58126 release	1028 Kawaiahao, Honolulu HI. 96814	Transformer Oil	HDOH HEER	47,034.57	1690764.545	20120719-0819
Trash Bin at Self Storage	1060 Kawaiahao St, Honolulu HI. 96814	Curtain Cleaner	HDOH HEER	46,854.45	1690904.665	19920917-1
Self Storage 1	438 Kamakee St, Honolulu HI. 96814	Oil/Hydraulic Fluid/Solvents	HDOH HEER	46,791.06	1691095.23	19981028-1300
Self Storage 1	438 Kamakee St, Honolulu HI. 96814	Oil/Hydraulic Fluid/Solvents	HDOH HEER	46,791.06	1691095.23	19981028-1300
Honolulu Laundry	438 Kamakee St		HDOH SDAR - 2014	46,796.28	1,691,095.93	
HONOLULU LAUNDRY CO., LTD.	438 KAMAKEE ST Honolulu, HI. 96814		HDOH LUST - 2014	46,789.82	1,691,100.14	
SOIL-RC-36			AIS Trench	46,263.06	1,691,101.93	20121126-1709
1111 Waimanu Street, Honda Dealer, Coolant onto Road	1111 Waimanu St, Honolulu HI. 96814		HDOH HEER	46,599.23	1691320.369	19990921-1631
HONOLULU HAWAII AUTO REPAIR	1111 WAIMANU ST Honolulu, HI. 96814		HDOH LUST - 2014	46,597.98	1,691,325.28	
Reserve Housing Tower Soil Contamination	1141 Waimanu St, Honolulu HI. 96813	oil/stained soil	HDOH HEER	46,240.05	1691330.991	19951025-2
SOIL-RC-74			AIS Trench	46,239.84	1,691,351.61	20121126-1709
BOB CISCO	1152 WAIMANU ST Honolulu, HI. 96814		HDOH LUST - 2014	46,388.44	1,691,578.22	
HECO transformer #70580 pad-mounted release	1142 Kona ST, Honolulu HI. 96814	Transformer Oil	HDOH HEER	46,651.80	1691676.787	20130304-1124
Koolani Tower Project	1189 Waimanu St, Honolulu HI. 96814	Diesel Fuel	HDOH HEER	46,018.69	1691757.427	20040615-1651
Koolani Tower Project	1189 Waimanu St	Found: Lead	HDOH SDAR - 2014	46,023.94	1,691,758.12	
Reserve Housing Tower Soil Contamination	1141 Waimanu St	Found: oil	HDOH SDAR - 2014	46,023.94	1,691,758.12	
Koolani Tower	1189 Waimanu Street Honolulu, HI. 96814		HDOH LUST - 2014	46,017.44	1,691,762.34	
Pacific Century Trust	1192 Waimanu St, Honolulu HI. 96814	Gas & Diesel Fuel	HDOH HEER	46,285.76	1691768.441	20000529-1200

TABLE A-2

Known or Suspected Contaminated Sites

Environmental Hazard Evaluation and Environmental Hazard Management Plan

Honolulu Rail Transit Project, Oahu, Hawaii

Site Name	Address	Substance	Source	Easting[1]	Northing[1]	Release ID
GTE HAWAIIAN TEL WAIMANU BASE YARD	1192 WAIMANU ST Honolulu, HI. 96814		HDOH LUST - 2014	46,284.52	1,691,773.35	
Koolani Tower Project	1189 Waimanu St	Found: Lead	HDOH SDAR - 2014	46,180.51	1,691,933.40	
HECO pad-mounted #68059 transformer release	1170 Hopaka ST, Honolulu HI. 96814	Transformer Oil	HDOH HEER	46,661.26	1692031.644	20110927-1309
Bradley Properties Ltd	1177 Kapiolani Blvd, Honolulu HI. 96814	Unk Drum	HDOH HEER	46,767.90	1692064.087	19911105-1
WES'S KAPIOLANI SHELL SS	1204 KAPIOLANI BLVD Honolulu, HI. 96814		HDOH LUST - 2014	46,799.14	1,692,268.73	
Durant Properties	1235 Kona St	Found: Nickel above Tier 1 EAL in GW and Cadmium above Tier 1 EAL in soil.	HDOH SDAR - 2014	46,219.55	1,692,427.45	
SOIL-RC-110			AIS Trench	46,244.34	1,692,552.56	20130207-1808
Evershine X	1230 Kapiolani Blvd	Found: Petroleum products	HDOH SDAR - 2014	46,784.28	1,692,560.30	
			Geotech Boring	46,200.51	1,692,692.32	20140617-1157
ALOHA ALA MOANA	451 PIIKOI ST Honolulu, HI. 96814		HDOH LUST - 2014	46,051.40	1,692,699.39	
SOIL-RC-114			AIS Trench	46,199.72	1,692,704.73	20130207-1809
1305 Hart Street	1305 Hart St		HDOH SDAR - 2014	46,726.18	1,692,986.62	
215 North King Street Construction Site, Tanks 1 & 2	215 N King St		HDOH SDAR - 2014	46,726.18	1,692,986.62	
Anin-Piikoi Building Site	1012 Piikoi St		HDOH SDAR - 2014	46,726.18	1,692,986.62	
Cartwright Neighborhood Park	Keeaumoku St & Matlock Ave	Found: Transformer oil (no PCBs) found on site.	HDOH SDAR - 2014	46,726.18	1,692,986.62	
Cutter Chevrolet Hydraulic Lift	1391 Kapiolani Blvd		HDOH SDAR - 2014	46,726.18	1,692,986.62	
Evershine X	1230 Kapiolani Blvd	Found: Petroleum products	HDOH SDAR - 2014	46,726.18	1,692,986.62	
Glover Building	1046 Waimanu St	Found: Hydraulic fluid	HDOH SDAR - 2014	46,726.18	1,692,986.62	
Grace Otsuka Apartment Complex	1233 Young St		HDOH SDAR - 2014	46,726.18	1,692,986.62	
Hakuyosha Hawaii, Inc.	730 Sheridan St	Found: tetrachloroethylene	HDOH SDAR - 2014	46,726.18	1,692,986.62	
Hall Mark Dry Cleaners	1470 Liliha St	Found: Diesel contamination from heating oil tank.	HDOH SDAR - 2014	46,726.18	1,692,986.62	
Hawaii Convention Center	1801 Kalakaua Ave		HDOH SDAR - 2014	46,726.18	1,692,986.62	
HECO Makaloa Substation	1544 Makaloa St	Found: COCs below DOH EALs, except arsenic in soil (20.7 mg/kg in one sample)	HDOH SDAR - 2014	46,726.18	1,692,986.62	
HECO Substation: Pukele Substation	2702 Myrtle St		HDOH SDAR - 2014	46,726.18	1,692,986.62	
Honolulu Laundry	438 Kamakee St		HDOH SDAR - 2014	46,726.18	1,692,986.62	
Iwilei Business Center	501 Sumner St	Found: TPH-d in soil and groundwater. To be characterized and remediated when site is redevelped.	HDOH SDAR - 2014	46,726.18	1,692,986.62	
Kakaako Brownfield Project-Unit 10		Presumed: Unknown	HDOH SDAR - 2014	46,726.18	1,692,986.62	
Kakaako Brownfield Project-Unit 2	Koula St	Found: Pb PAHs, PCBs in soil	HDOH SDAR - 2014	46,726.18	1,692,986.62	
Kakaako Brownfield Project-Unit 4	Koula St	Found: lead in soil	HDOH SDAR - 2014	46,726.18	1,692,986.62	
Kakaako Brownfield Project-Unit 5	Ahui St	Found: Lead in soil	HDOH SDAR - 2014	46,726.18	1,692,986.62	
Kakaako Brownfield Project-Unit 6	1011 Ala Moana Blvd	Found: Petroleum, PAHs, VOCs, lead, and other metals in soil.	HDOH SDAR - 2014	46,726.18	1,692,986.62	
Kakaako Brownfield Project-Unit 7	Ahui St	Found: Petroleum, PAHs, VOCs, lead, and other metals in soil.	HDOH SDAR - 2014	46,726.18	1,692,986.62	
Kakaako Brownfield Project-Unit 8	59 Ahui St	Found: Laboratory analytical results of soil samples collected from the site indicated elevated levels of Pb, As, and PAH's above DOH Tier I EAL in soil.	HDOH SDAR - 2014	46,726.18	1,692,986.62	
Kakaako Brownfield Project-Unit 9		Found: Benzend in water	HDOH SDAR - 2014	46,726.18	1,692,986.62	
Kakaako Makai Brownfields/HCDA			HDOH SDAR - 2014	46,726.18	1,692,986.62	
Koolani Tower Project	1189 Waimanu St	Found: Lead	HDOH SDAR - 2014	46,726.18	1,692,986.62	
Like Like Plaza Petroleum Contamination	745 Keeaumoku St	Found: petroleum-impacted soils	HDOH SDAR - 2014	46,726.18	1,692,986.62	
Meadow Gold Ice Cream Plant Fuel Oil Spill	1418 Young St	Found: Low levels of TPH diesel and oil in soil and groundwater - no EAL exceedances.	HDOH SDAR - 2014	46,726.18	1,692,986.62	

TABLE A-2

Known or Suspected Contaminated Sites

Environmental Hazard Evaluation and Environmental Hazard Management Plan

Honolulu Rail Transit Project, Oahu, Hawaii

Site Name	Address	Substance	Source	Easting[1]	Northing[1]	Release ID
Motor Supply	726 Sheridan St	Found: Tetrachloroethylene.	HDOH SDAR - 2014	46,726.18	1,692,986.62	
New Office Lounge	1551 Kapiolani Blvd		HDOH SDAR - 2014	46,726.18	1,692,986.62	
Safeway 1234 South Beretania Street Hydraulic Fluid	1234 S Beretania St	Found: Hydraulic Fluid	HDOH SDAR - 2014	46,726.18	1,692,986.62	
Y. Hata Company, Ltd.	Cooke St & Ilalo St		HDOH SDAR - 2014	46,726.18	1,692,986.62	
ALA MOANA UNOCAL	1322 KAPIOLANI BLVD Honolulu, HI. 96814		HDOH LUST - 2014	46,478.91	1,693,098.17	
1349 Kapiolani Boulevard, grease	1349 Kapiolani Blvd, Honolulu HI. 96814	Sewage Spill	HDOH HEER	46,332.36	1693219.192	19930829
1349 Kapiolani Boulevard, wastewater spill	1349 Kapiolani Blvd, Honolulu HI. 96814	wastewater	HDOH HEER	46,332.36	1693219.192	19940704
Soil-RC-89			AIS Trench	45,845.91	1,693,388.97	20121023-0820
Cutter Chevrolet	1391 Kapiolani Blvd, Honolulu HI. 96814	Engine Degreaser or Hand Soap	HDOH HEER	45,962.77	1693428.073	19930217-1348
CUTTER CHEVROLET	1391 KAPIOLANI BLVD Honolulu, HI. 96814		HDOH LUST - 2014	45,961.53	1,693,432.99	
Cutter Chevrolet Hydraulic Lift	1391 Kapiolani Blvd		HDOH SDAR - 2014	46,011.62	1,693,497.49	
SOIL-RC-92			AIS Trench	45,705.03	1,693,683.81	20121126-1710
Ala Moana Building, Anthrax Scare	1441 Kapiolani Blvd, Honolulu HI. 96814		HDOH HEER	45,811.00	1693861.737	19990223-1140
Al Philips, Ala Moana Center	1450 Ala Moana Blvd, Honolulu HI. 96814	Perchloro ethlene	HDOH HEER	45,295.37	1693877.808	19941215-2
Ala Moana Center, sewage spill	1450 Ala Moana Blvd, Honolulu HI. 96814	Sewage	HDOH HEER	45,295.37	1693877.808	19970519-2322
Ala Moana Center, cleaning chemicals	1450 Ala Moana Blvd, Honolulu HI. 96814		HDOH HEER	45,295.37	1693877.808	20001102-1124
SEARS ROEBUCK & COMPANY 1158	1450 ALA MOANA BLVD #1000 Honolulu, HI. 96814		HDOH LUST - 2014	45,294.13	1,693,882.72	
1551 Kapiolani Boulevard	1551 Kapiolani Blvd, Honolulu HI. 96814	Sewage Spill	HDOH HEER	45,685.21	1693982.173	19920405-2
1551 Kapiolani Boulevard	1551 Kapiolani Blvd, Honolulu HI. 96814	sewage	HDOH HEER	45,685.21	1693982.173	19940905-2
1551 Kapiolani Boulevard	1551 Kapiolani Blvd, Honolulu HI. 96814	Sewage	HDOH HEER	45,685.21	1693982.173	19970622-0950
NEW OFFICE LOUNGE	1551 KAPIOLANI BLVD Honolulu, HI. 96814		HDOH LUST - 2014	45,683.97	1,693,987.09	
NEW OFFICE LOUNGE	1551 KAPIOLANI BLVD Honolulu, HI. 96814		HDOH LUST - 2014	45,683.97	1,693,987.09	
1440 Kapiolani Blvd	1440 Kapiolani Blvd, Honolulu HI. 96814	Ammonia	HDOH HEER	46,140.02	1693996.017	19910517

Notes:

[1] Hawaii State Plane Zone 3 (Oahu) Coordinate System and North American Datum of 1983 [NAD83], High Accuracy Reference Network [HARN] datum projection

AFB = Air Force Base
AIS = Archeological Inventory Survey
AST = aboveground storage tank
AVGAS = aviation gasoline
bgs = below ground surface
BTEX = benzene, toluene, ethylbenzene, and xylenes
CVOC = chlorinated volatile organic compounds
DBCP = dibromo-3-chloropropane (
DDT = dichlorodiphenyltrichloroethane
EAL = Environmental Action Level
EDB = ethylene dibromide
HAFB = Hickam Air Force Base
HDOH = Hawaii Department of Health
HEER = Hazard Evaluation and Emergency Response
HVOC = halogenated volatile organic compound
JP-4 = jet propulsion fuel, grade 4
JP-5 = jet propulsion fuel, grade 5
JP-8 = jet propulsion fuel, grade 8
LFSO = low sulfur fuel oil
LUST = Leaking Underground Storage Tank
MCBH = Marine Corps Base Hawaii
MFH = military family housing
mg/kg = milligrams per kilogram
MTBE = methyl tertiary-butyl ether
NFA = no further action
PAH = polynuclear aromatic hydrocarbons
PCB = polychlorinated biphenyl
PCE = perchloroethene
ppb = parts per billion
ppm = parts per million
SDAR = Site Discovery and Remediation
SHWB = Solid and Hazardous Waste Branch
TCE = trichloroethylene
TCP = trichloropropane
TeCA = tetrachloroethane
TPH = total petroleum hydrocarbons
TPH-d = total petroleum hydrocarbons, diesel-range organics
TPH-g = total petroleum hydrocarbons, gasoline-range organics
TPH-o = total petroleum hydrocarbons, oil-range organics
UST = underground storage tank
VOC = volatile organic compounds

Appendix B
ATSDR ToxFAQs™

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Index

The following list of chemicals will be updated as new chemicals of potential concern are identified for this project. The original version of the ATSDR ToXFAQs can be downloaded at: http://www.atsdr.cdc.gov/toxfaqs/

NUMBER	TITLE
B.1	Aldrin and Dieldrin
B.2	Arsenic
B.3	Automotive Gasoline
B.4	Benzene
B.5	Cadmium
B.6	Chlordane
B.7	Chlorodibenzodioxins
B.8	Chlorodibenzofurans
B.9	Chromium
B.10	DCE
B.11	Ethylbenzene
B.12	Fuel Oils
B.13	Lead
B.14	Mercury
B.15	MTBE
B.16	Naphthalene
B.17	PAHs
B.18	PCBs
B.19	PCE
B.20	Stoddard
B.21	TCE
B.22	Toluene
B.23	TPH
B.24	Vinyl Chloride
B.25	Xylenes

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ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

ALDRIN and DIELDRIN

CAS # 309-00-2 and 60-57-1

Division of Toxicology ToxFAQs™ **September 2002**

This fact sheet answers the most frequently asked health questions (FAQs) about aldrin and dieldrin. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to aldrin and dieldrin happens mostly from eating contaminated foods, such as root crops, fish, or seafood. Aldrin and dieldrin build up in the body after years of exposure and can affect the nervous system. Aldrin has been found in at least 207 of the 1,613 National Priorities List sites identified by the Environmental Protection Agency (EPA). Dieldrin has been found in at least 287 of the 1,613 sites.

What are aldrin and dieldrin?

Aldrin and dieldrin are insecticides with similar chemical structures. They are discussed together in this fact sheet because aldrin quickly breaks down to dieldrin in the body and in the environment. Pure aldrin and dieldrin are white powders with a mild chemical odor. The less pure commercial powders have a tan color. Neither substance occurs naturally in the environment.

From the 1950s until 1970, aldrin and dieldrin were widely used pesticides for crops like corn and cotton. Because of concerns about damage to the environment and potentially to human health, EPA banned all uses of aldrin and dieldrin in 1974, except to control termites. In 1987, EPA banned all uses.

What happens to aldrin and dieldrin when they enter the environment?

❑ Sunlight and bacteria change aldrin to dieldrin so that we mostly find dieldrin in the environment.
❑ They bind tightly to soil and slowly evaporate to the air.
❑ Dieldrin in soil and water breaks down very slowly.
❑ Plants take in and store aldrin and dieldrin from the soil.
❑ Aldrin rapidly changes to dieldrin in plants and animals.
❑ Dieldrin is stored in the fat and leaves the body very slowly.

How might I be exposed to aldrin or dieldrin?

❑ Dieldrin is everywhere in the environment, but at very low levels.
❑ Eating food like fish or shellfish from lakes or streams contaminated with either chemical, or contaminated root crops, dairy products, or meats.
❑ Air, surface water, or soil near waste sites may contain higher levels.
❑ Living in homes that were once treated with aldrin or dieldrin to control termites.

How can aldrin and dieldrin affect my health?

People who have intentionally or accidentally ingested large amounts of aldrin or dieldrin have suffered convulsions and some died. Health effects may also occur after a longer period of exposure to smaller amounts because these chemicals build up in the body.

Some workers exposed to moderate levels in the air for a long time had headaches, dizziness, irritability, vomiting, and uncontrolled muscle movements. Workers removed from the source of exposure rapidly recovered from most of these effects.

Animals exposed to high amounts of aldrin or dieldrin also had nervous system effects. In animals, oral exposure to lower levels for a long period also affected the liver and decreased their ability to fight infections. We do not know whether aldrin or dieldrin affect the ability of people to fight disease.

Studies in animals have given conflicting results about whether aldrin and dieldrin affect reproduction in male animals and whether these chemicals may damage the sperm.

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We do not know whether aldrin or dieldrin affect reproduction in humans.

How likely are aldrin and dieldrin to cause cancer?

There is no conclusive evidence that aldrin or dieldrin cause cancer in humans. Aldrin and dieldrin have been shown to cause liver cancer in mice. The International Agency for Research on Cancer (IARC) has determined that aldrin and dieldrin are not classifiable as to human carcinogenicity. The EPA has determined that aldrin and dieldrin are probable human carcinogens.

How can aldrin and dieldrin affect children?

Children can be exposed to aldrin and dieldrin in the same way as adults. There are no known unique exposure pathways for children. Children who swallowed amounts of aldrin or dieldrin much larger than those found in the environment suffered convulsions and some died, as occurred in adults. However, we do not know whether children are more susceptible than adults to the effects of aldrin or dieldrin.

We do not know whether aldrin or dieldrin cause birth defects in humans. Pregnant animals that ingested aldrin or dieldrin had some babies with low birth weight and some with alterations in the skeleton. Dieldrin has been found in human breast milk, therefore, it can be passed to suckling infants.

How can families reduce the risk of exposure to aldrin and dieldrin?

❑ Since aldrin and dieldrin are no longer produced or used, exposure to these compounds will occur only from past usage.

❑ Because aldrin and dieldrin were applied to the basement of some homes for termite protection, before buying a home families should investigate what, if any, pesticides have been used within the home.

Is there a medical test to show whether I've been exposed to aldrin and dieldrin?

There are laboratory tests that can measure aldrin and dieldrin in your blood, urine, and body tissues. Because aldrin changes to dieldrin fairly quickly in the body, the test has to be done shortly after you are exposed to aldrin. Since dieldrin can stay in the body for months, measurements of dieldrin can be made much longer after exposure to either aldrin or dieldrin. The tests cannot tell you whether harmful health effects will occur. These tests are not routinely available at the doctor's office because they require special equipment.

Has the federal government made recommendations to protect human health?

The EPA limits the amount of aldrin and dieldrin that may be present in drinking water to 0.001 and 0.002 milligrams per liter (mg/L) of water, respectively, for protection against health effects other than cancer. The EPA has determined that a concentration of aldrin and dieldrin of 0.0002 mg/L in drinking water limits the lifetime risk of developing cancer from exposure to each compound to 1 in 10,000.

The Occupational Safety and Health Administration (OSHA) sets a maximum average of 0.25 milligrams of aldrin and dieldrin per cubic meter of air (0.25 mg/m^3) in the workplace during an 8-hour shift, 40 hour week. The National Institute for Occupational Safety and Health (NIOSH) also recommends a limit of 0.25 mg/m^3 for both compounds for up to a 10-hour work day, 40-hour week.

The Food and Drug Administration (FDA) regulates the residues of aldrin and dieldrin in raw foods. The allowable range is from 0 to 0.1 ppm, depending on the type of food product.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2002. Toxicological Profile for Aldrin/Dieldrin (Update). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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ARSENIC

CAS # 7440-38-2

Division of Toxicology and Environmental Medicine ToxFAQs™ **August 2007**

This fact sheet answers the most frequently asked health questions (FAQs) about arsenic. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to higher than average levels of arsenic occur mostly in the workplace, near hazardous waste sites, or in areas with high natural levels. At high levels, inorganic arsenic can cause death. Exposure to lower levels for a long time can cause a discoloration of the skin and the appearance of small corns or warts. Arsenic has been found in at least 1,149 of the 1,684 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is arsenic?

Arsenic is a naturally occurring element widely distributed in the earth's crust. In the environment, arsenic is combined with oxygen, chlorine, and sulfur to form inorganic arsenic compounds. Arsenic in animals and plants combines with carbon and hydrogen to form organic arsenic compounds.

Inorganic arsenic compounds are mainly used to preserve wood. Copper chromated arsenate (CCA) is used to make "pressure-treated" lumber. CCA is no longer used in the U.S. for residential uses; it is still used in industrial applications. Organic arsenic compounds are used as pesticides, primarily on cotton fields and orchards.

What happens to arsenic when it enters the environment?

❑ Arsenic occurs naturally in soil and minerals and may enter the air, water, and land from wind-blown dust and may get into water from runoff and leaching.
❑ Arsenic cannot be destroyed in the environment. It can only change its form.
❑ Rain and snow remove arsenic dust particles from the air.
❑ Many common arsenic compounds can dissolve in water. Most of the arsenic in water will ultimately end up in soil or sediment.
❑ Fish and shellfish can accumulate arsenic; most of this arsenic is in an organic form called arsenobetaine that is much less harmful.

How might I be exposed to arsenic?

❑ Ingesting small amounts present in your food and water or breathing air containing arsenic.
❑ Breathing sawdust or burning smoke from wood treated with arsenic.
❑ Living in areas with unusually high natural levels of arsenic in rock.
❑ Working in a job that involves arsenic production or use, such as copper or lead smelting, wood treating, or pesticide application.

How can arsenic affect my health?

Breathing high levels of inorganic arsenic can give you a sore throat or irritated lungs.

Ingesting very high levels of arsenic can result in death. Exposure to lower levels can cause nausea and vomiting, decreased production of red and white blood cells, abnormal heart rhythm, damage to blood vessels, and a sensation of "pins and needles" in hands and feet.

Ingesting or breathing low levels of inorganic arsenic for a long time can cause a darkening of the skin and the appearance of small "corns" or "warts" on the palms, soles, and torso.

Skin contact with inorganic arsenic may cause redness and swelling.

ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html

Almost nothing is known regarding health effects of organic arsenic compounds in humans. Studies in animals show that some simple organic arsenic compounds are less toxic than inorganic forms. Ingestion of methyl and dimethyl compounds can cause diarrhea and damage to the kidneys

How likely is arsenic to cause cancer?

Several studies have shown that ingestion of inorganic arsenic can increase the risk of skin cancer and cancer in the liver, bladder, and lungs. Inhalation of inorganic arsenic can cause increased risk of lung cancer. The Department of Health and Human Services (DHHS) and the EPA have determined that inorganic arsenic is a known human carcinogen. The International Agency for Research on Cancer (IARC) has determined that inorganic arsenic is carcinogenic to humans.

How can arsenic affect children?

There is some evidence that long-term exposure to arsenic in children may result in lower IQ scores. There is also some evidence that exposure to arsenic in the womb and early childhood may increase mortality in young adults.

There is some evidence that inhaled or ingested arsenic can injure pregnant women or their unborn babies, although the studies are not definitive. Studies in animals show that large doses of arsenic that cause illness in pregnant females, can also cause low birth weight, fetal malformations, and even fetal death. Arsenic can cross the placenta and has been found in fetal tissues. Arsenic is found at low levels in breast milk.

How can families reduce the risks of exposure to arsenic?

❑ If you use arsenic-treated wood in home projects, you should wear dust masks, gloves, and protective clothing to decrease exposure to sawdust.

❑ If you live in an area with high levels of arsenic in water or soil, you should use cleaner sources of water and limit contact with soil.

❑ If you work in a job that may expose you to arsenic, be aware that you may carry arsenic home on your clothing, skin, hair, or tools. Be sure to shower and change clothes before going home.

Is there a medical test to determine whether I've been exposed to arsenic?

There are tests available to measure arsenic in your blood, urine, hair, and fingernails. The urine test is the most reliable test for arsenic exposure within the last few days. Tests on hair and fingernails can measure exposure to high levels of arsenic over the past 6-12 months. These tests can determine if you have been exposed to above-average levels of arsenic. They cannot predict whether the arsenic levels in your body will affect your health.

Has the federal government made recommendations to protect human health?

The EPA has set limits on the amount of arsenic that industrial sources can release to the environment and has restricted or cancelled many of the uses of arsenic in pesticides. EPA has set a limit of 0.01 parts per million (ppm) for arsenic in drinking water.

The Occupational Safety and Health Administration (OSHA) has set a permissible exposure limit (PEL) of 10 micrograms of arsenic per cubic meter of workplace air (10 $\mu g/m^3$) for 8 hour shifts and 40 hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for Arsenic (Update). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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AUTOMOTIVE GASOLINE
CAS # 8006-61-9

Agency for Toxic Substances and Disease Registry ToxFAQs **September 1996**

This fact sheet answers the most frequently asked health questions (FAQs) about automobile gasoline. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to automotive gasoline most likely occurs from breathing its vapor at a service station while filling a car's fuel tank. At high levels, automotive gasoline is irritating to the lungs when breathed in and irritating to the lining of the stomach when swallowed. Exposure to high levels may also cause harmful effects to the nervous system. Automotive gasoline has been found in at least 23 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is automotive gasoline?

(Pronounced ô′tə-mō′tĭv găs′ə-lēn′)

The gasoline discussed in this fact sheet is automotive used as a fuel for engines in cars. Gasoline is a colorless, pale brown, or pink liquid, and is very flammable.

Gasoline is a manufactured mixture that does not exist naturally in the environment. Gasoline is produced from petroleum in the refining process.

Typically, gasoline contains more than 150 chemicals, including small amounts of benzene, toluene, xylene, and sometimes lead. How the gasoline is made determines which chemicals are present in the gasoline mixture and how much of each is present. The actual composition varies with the source of the crude petroleum, the manufacturer, and the time of year.

What happens to automotive gasoline when it enters the environment?

- Small amounts of the chemicals present in gasoline evaporate into the air when you fill the gas tank in your car or when gasoline is accidentally spilled onto surfaces and soils or into surface waters.
- Other chemicals in gasoline dissolve in water after spills to surface waters or underground storage tank leaks into the groundwater.
- In surface releases, most chemicals in gasoline will probably evaporate; others may dissolve and be carried away by water; a few will probably stick to soil.
- The chemicals that evaporate are broken down by sunlight and other chemicals in the air.
- The chemicals that dissolve in water also break down quickly by natural processes.

How might I be exposed to automotive gasoline?

- Breathing vapors at a service station when filling the car's fuel tank is the most likely way to be exposed.
- Working at a service station.
- Using equipment that runs on gasoline, such as a lawn mower.
- Drinking contaminated water.
- Being close to a spot where gasoline has spilled or leaked into the soil.

How can automotive gasoline affect my health?

Many of the harmful effects seen after exposure to gasoline are due to the individual chemicals in the gasoline mix-

ture, such as benzene and lead. Inhaling or swallowing large amounts of gasoline can cause death.

Inhaling high concentrations of gasoline is irritating to the lungs when breathed in and irritating to the lining of the stomach when swallowed. Gasoline is also a skin irritant. Breathing in high levels of gasoline for short periods or swallowing large amounts of gasoline may also cause harmful effects on the nervous system.

Serious nervous system effects include coma and the inability to breathe, while less serious effects include dizziness and headaches.

There is not enough information available to determine if gasoline causes birth defects or affects reproduction.

How likely is automotive gasoline to cause cancer?

The Department of Health and Human Services (DHHS) and the International Agency for Research on Cancer (IARC) have not classified automotive gasoline for carcinogenicity. Automotive gasoline is currently undergoing review by the EPA for cancer classification.

Some laboratory animals that breathed high concentrations of unleaded gasoline vapors continuously for 2 years developed liver and kidney tumors. However, there is no evidence that exposure to gasoline causes cancer in humans.

Is there a medical test to show whether I've been exposed to automotive gasoline?

Laboratory tests are available that can measure elevated blood or urine levels of lead (as an indication of exposure to leaded gasoline only), benzene, or other substances that may result from exposure to gasoline or other sources. These methods are sensitive enough to measure background levels and levels where health effects may occur. These tests aren't available in most doctors' offices, but can be done at special laboratories that have the right equipment.

Has the federal government made recommendations to protect human health?

The EPA has established many regulations to control air pollution. These are designed to protect the public from the possible harmful health effects of gasoline.

The American Conference of Governmental Industrial Hygienists (ACGIH) set a maximum level of 890 milligrams of gasoline per cubic meter of air (890 mg/m^3) for an 8-hour workday, 40-hour workweek.

Glossary

Carcinogenicity: Ability to cause cancer.

CAS: Chemical Abstracts Service.

Crude petroleum: Petroleum that has not been processed.

Dissolve: To disappear gradually.

Evaporate: To change into a vapor or a gas.

Irritant: A substance that causes an abnormal reaction.

Mixture: A combination of two or more components.

Refining process: The process by which petroleum is purified to form gasoline.

Tumor: An abnormal mass of tissue.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for automotive gasoline. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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BENZENE

CAS # 71-43-2

Division of Toxicology and Environmental Medicine ToxFAQs™ **August 2007**

This fact sheet answers the most frequently asked health questions (FAQs) about benzene. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Benzene is a widely used chemical formed from both natural processes and human activities. Breathing benzene can cause drowsiness, dizziness, and unconsciousness; long-term benzene exposure causes effects on the bone marrow and can cause anemia and leukemia. Benzene has been found in at least 1,000 of the 1,684 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is benzene?

Benzene is a colorless liquid with a sweet odor. It evaporates into the air very quickly and dissolves slightly in water. It is highly flammable and is formed from both natural processes and human activities.

Benzene is widely used in the United States; it ranks in the top 20 chemicals for production volume. Some industries use benzene to make other chemicals which are used to make plastics, resins, and nylon and other synthetic fibers. Benzene is also used to make some types of rubbers, lubricants, dyes, detergents, drugs, and pesticides. Natural sources of benzene include emissions from volcanoes and forest fires. Benzene is also a natural part of crude oil, gasoline, and cigarette smoke.

What happens to benzene when it enters the environment?

❑ Industrial processes are the main source of benzene in the environment.
❑ Benzene can pass into the air from water and soil.
❑ It reacts with other chemicals in the air and breaks down within a few days.
❑ Benzene in the air can attach to rain or snow and be carried back down to the ground.
❑ It breaks down more slowly in water and soil, and can pass through the soil into underground water.
❑ Benzene does not build up in plants or animals.

How might I be exposed to benzene?

❑ Outdoor air contains low levels of benzene from tobacco smoke, automobile service stations, exhaust from motor vehicles, and industrial emissions.
❑ Vapors (or gases) from products that contain benzene, such as glues, paints, furniture wax, and detergents, can also be a source of exposure.
❑ Air around hazardous waste sites or gas stations will contain higher levels of benzene.
❑ Working in industries that make or use benzene.

How can benzene affect my health?

Breathing very high levels of benzene can result in death, while high levels can cause drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion, and unconsciousness. Eating or drinking foods containing high levels of benzene can cause vomiting, irritation of the stomach, dizziness, sleepiness, convulsions, rapid heart rate, and death.

The major effect of benzene from long-term exposure is on the blood. Benzene causes harmful effects on the bone

marrow and can cause a decrease in red blood cells leading to anemia. It can also cause excessive bleeding and can affect the immune system, increasing the chance for infection.

Some women who breathed high levels of benzene for many months had irregular menstrual periods and a decrease in the size of their ovaries, but we do not know for certain that benzene caused the effects. It is not known whether benzene will affect fertility in men.

How likely is benzene to cause cancer?

Long-term exposure to high levels of benzene in the air can cause leukemia, particularly acute myelogenous leukemia, often referred to as AML. This is a cancer of the blood-forming organs. The Department of Health and Human Services (DHHS) has determined that benzene is a known carcinogen. The International Agency for Research on Cancer (IARC) and the EPA have determined that benzene is carcinogenic to humans.

How can benzene affect children?

Children can be affected by benzene exposure in the same ways as adults. It is not known if children are more susceptible to benzene poisoning than adults.

Benzene can pass from the mother's blood to a fetus. Animal studies have shown low birth weights, delayed bone formation, and bone marrow damage when pregnant animals breathed benzene.

How can families reduce the risks of exposure to benzene?

Benzene exposure can be reduced by limiting contact with gasoline and cigarette smoke. Families are encouraged not to smoke in their house, in enclosed environments, or near their children.

Is there a medical test to determine whether I've been exposed to benzene?

Several tests can show if you have been exposed to benzene. There is a test for measuring benzene in the breath; this test must be done shortly after exposure. Benzene can also be measured in the blood; however, since benzene disappears rapidly from the blood, this test is only useful for recent exposures.

In the body, benzene is converted to products called metabolites. Certain metabolites can be measured in the urine. The metabolite S-phenylmercapturic acid in urine is a sensitive indicator of benzene exposure. However, this test must be done shortly after exposure and is not a reliable indicator of how much benzene you have been exposed to, since the metabolites may be present in urine from other sources.

Has the federal government made recommendations to protect human health?

The EPA has set the maximum permissible level of benzene in drinking water at 5 parts benzene per billion parts of water (5 ppb).

The Occupational Safety and Health Administration (OSHA) has set limits of 1 part benzene per million parts of workplace air (1 ppm) for 8 hour shifts and 40 hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for Benzene (Update). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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CADMIUM

CAS # 7440-43-9

Division of Toxicology and Human Health Sciences ToxFAQs™ **October 2012**

This fact sheet answers the most frequently asked health questions (FAQs) about cadmium. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to cadmium happens mostly in the workplace where cadmium products are made. The general population is exposed from breathing cigarette smoke or eating cadmium contaminated foods. Cadmium damages the kidneys, lungs, and bones. Cadmium has been found in at least 1,014 of the 1,669 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is cadmium?

Cadmium is a natural element in the earth's crust. It is usually found as a mineral combined with other elements such as oxygen (cadmium oxide), chlorine (cadmium chloride), or sulfur (cadmium sulfate, cadmium sulfide).

All soils and rocks, including coal and mineral fertilizers, contain some cadmium. Most cadmium used in the United States is extracted during the production of other metals like zinc, lead, and copper. Cadmium does not corrode easily and has many uses, including batteries, pigments, metal coatings, and plastics.

What happens to cadmium when it enters the environment?

- Cadmium enters soil, water, and air from mining, industry, and burning coal and household wastes.
- Cadmium does not break down in the environment, but can change forms.
- Cadmium particles in air can travel long distances before falling to the ground or water.
- Some forms of cadmium dissolve in water.
- Cadmium binds strongly to soil particles.
- Fish, plants, and animals take up cadmium from the environment.

How might I be exposed to cadmium?

- Eating foods containing cadmium; low levels are found in all foods (highest levels are found in leafy vegetables, grains, legumes, and kidney meat).
- Smoking cigarettes or breathing cigarette smoke.
- Breathing contaminated workplace air.
- Drinking contaminated water.
- Living near industrial facilities which release cadmium into the air.

How can cadmium affect my health?

Breathing high levels of cadmium can severely damage the lungs. Eating food or drinking water with very high levels severely irritates the stomach, leading to vomiting and diarrhea.

Long-term exposure to lower levels of cadmium in air, food, or water leads to a buildup of cadmium in the kidneys and possible kidney disease. Other long-term effects are lung damage and fragile bones.

How likely is cadmium to cause cancer?

The Department of Health and Human Services (DHHS) and the International Agency for Research on Cancer (IARC) have determined that cadmium and cadmium

compounds are human carcinogens. The EPA determined that cadmium is a probable human carcinogen (group B1).

How can cadmium affect children?

The health effects in children are expected to be similar to the effects seen in adults (kidney and lung damage depending on the route of exposure).

A few studies in animals indicate that younger animals absorb more cadmium than adults. Animal studies also indicate that the young are more susceptible than adults to a loss of bone and decreased bone strength from exposure to cadmium.

We don't know if cadmium causes birth defects in people. Studies in animals exposed to high levels of cadmium during pregnancy have resulted in harmful effects to the young. Young animals exposed to cadmium before birth have shown effects on behavior and learning. There is also some information from animal studies that high enough exposures to cadmium before birth can reduce body weights and affect the skeleton in the developing young.

How can families reduce the risk of exposure to cadmium?

- Do not allow children to play with batteries. Dispose of nickel-cadmium batteries properly.
- Cadmium is a component of tobacco smoke. Avoid smoking and smoking in enclosed spaces like inside the home or car in order to limit exposure to children and other family members.
- If you work with cadmium, use all safety precautions to avoid carrying cadmium-containing dust home from work on your clothing, skin, hair, or tools.
- A balanced diet can reduce the amount of cadmium taken into the body from food and drink.

Is there a medical test to determine whether I've been exposed to cadmium?

Cadmium can be measured in blood, urine, hair, or nails. Urinary cadmium has been shown to accurately reflect the amount of cadmium in the body.

The amount of cadmium in your blood shows your recent exposure to cadmium. The amount of cadmium in your urine shows both your recent and your past exposure.

Has the federal government made recommendations to protect human health?

The EPA has determined that exposure to cadmium in drinking water at concentrations of 0.04 milligrams per liter (0.04 mg/L) for up to 10 days is not expected to cause any adverse effects in a child.

The EPA has determined that lifetime exposure to 0.005 mg/L cadmium is not expected to cause any adverse effects.

The FDA has determined that the cadmium concentration in bottled drinking water should not exceed 0.005 mg/L.

The Occupational Health and Safety Administration (OSHA) has limited workers' exposure to an average of 5 $\mu g/m^3$ for an 8-hour workday, 40-hour workweek.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2012. Toxicological Profile for Cadmium. Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

CHLORDANE
CAS # 12789-03-6

This fact sheet answers the most frequently asked health questions (FAQs) about chlordane. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to chlordane occurs mostly from eating contaminated foods, such as root crops, meats, fish, and shellfish, or from touching contaminated soil. High levels of chlordane can cause damage to the nervous system oliver. This chemical has been found in at least 171 of 1,416 National Priorities List sites identified by the Environmental Protection Agency.

What is chlordane?

(Pronounced klôr′dān′)

Chlordane is a manufactured chemical that was used as a pesticide in the United States from 1948 to 1988. Technical chlordane is not a single chemical, but is actually a mixture of pure chlordane mixed with many related chemicals. It doesn't occur naturally in the environment. It is a thick liquid whose color ranges from colorless to amber. Chlordane has a mild, irritating smell.

Some of its trade names are Octachlor and Velsicol 1068. Until 1983, chlordane was used as a pesticide on crops like corn and citrus and on home lawns and gardens.

Because of concern about damage to the environment and harm to human health, the Environmental Protection Agency (EPA) banned all uses of chlordane in 1983 except to control termites. In 1988, EPA banned all uses.

What happens to chlordane when it enters the environment?

- Chlordane entered the environment when it was used as a pesticide on crops, on lawns and gardens, and to control termites.
- Chlordane sticks strongly to soil particles at the surface and is not likely to enter groundwater.
- It can stay in the soil for over 20 years.
- Most chlordane leaves soil by evaporation to the air.
- It breaks down very slowly.
- Chlordane doesn't dissolve easily in water.
- It builds up in the tissues of fish, birds, and mammals.

How might I be exposed to chlordane?

- By eating crops grown in soil that contains chlordane.
- By eating fish or shellfish caught in water that is contaminated by chlordane.
- By breathing air or touching soil near homes treated for termites with chlordane.
- By breathing air or by touching soil near waste sites or landfills.

How can chlordane affect my health?

Chlordane affects the nervous system, the digestive system, and the liver in people and animals. Headaches, irritability, confusion, weakness, vision problems, vomiting, stomach cramps, diarrhea, and jaundice have occurred in people who breathed air containing high concentrations of chlordane or accidentally swallowed small amounts of chlordane. Large amounts of chlordane taken by mouth can cause convulsions and death in people.

ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html

A man who had long-term skin contact with soil containing high levels of chlordane had convulsions. Japanese workers who used chlordane over a long period of time had minor changes in liver function.

Animals given high levels of chlordane by mouth for short periods died or had convulsions. Long-term exposure caused harmful effects in the liver of test animals.

We do not know whether chlordane affects the ability of people to have children or whether it causes birth defects. Animals exposed before birth or while nursing developed behavioral effects later.

How likely is chlordane to cause cancer?

The International Agency for Research on Cancer has determined that chlordane is not classifiable as to its carcinogenicity to humans. Studies of workers who made or used chlordane do not show that exposure to chlordane is related to cancer, but the information is not sufficient to know for sure. Mice fed low levels of chlordane in food developed liver cancer.

Is there a medical test to show whether I've been exposed to chlordane?

Laboratory tests can measure chlordane and its breakdown products in blood, fat, urine, feces, and breast milk. The amount of breakdown products measured in body fat or breast milk does not tell how much or how long ago you were exposed to chlordane or if harmful effects will occur.

Has the federal government made recommendations to protect human health?

In 1988, the EPA banned all uses of chlordane. The EPA recommends that a child should not drink water with more than 60 parts of chlordane per billion parts of drinking water (60 ppb) for longer than 1 day. EPA has set a limit in drinking water of 2 ppb.

EPA requires spills or releases of chlordane into the environment of 1 pound or more to be reported to EPA.

The Food and Drug Administration (FDA) limits the amount of chlordane and its breakdown products in most fruits and vegetables to less than 300 ppb and in animal fat and fish to less than 100 ppb.

The Occupational Safety and Health Administration (OSHA), the National Institute for Occupational Health and Safety (NIOSH), and the American Conference of Governmental Industrial Hygienists (ACGIH) set a maximum level of 0.5 milligrams of chlordane per cubic meter (mg/m^3) in workplace air for an 8-hour workday, 40-hour workweek. These agencies have advised that eye and skin contact should be avoided because this may be a significant route of exposure.

Glossary

Carcinogenicity: Ability to cause cancer.

Long-term: Lasting one year or longer.

Milligram (mg): One thousandth of a gram.

Pesticide: A substance that kills pests.

ppb: Parts per billion.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1994. Toxicological profile for chlordane (update). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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CHLORINATED DIBENZO-p-DIOXINS (CDDs)

Division of Toxicology and Environmental Medicine ToxFAQs™ **February 1999**

This fact sheet answers the most frequently asked health questions (FAQs) about dibenzo-p-dioxins. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because these substances may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to chlorinated dibenzo-p-dioxins (CDDs) (75 chemicals) occurs mainly from eating food that contains the chemicals. One chemical in this group, 2,3,7,8-tetrachlorodibenzo-p-dioxin or 2,3,7,8-TCDD, has been shown to be very toxic in animal studies. It causes effects on the skin and may cause cancer in people. This chemical has been found in at least 91 of the 1,467 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are CDDs?

CDDs are a family of 75 chemically related compounds commonly known as chlorinated dioxins. One of these compounds is called 2,3,7,8-TCDD. It is one of the most toxic of the CDDs and is the one most studied.

In the pure form, CDDs are crystals or colorless solids. CDDs enter the environment as mixtures containing a number of individual components. 2,3,7,8-TCDD is odorless and the odors of the other CDDs are not known.

CDDs are not intentionally manufactured by industry except for research purposes. They (mainly 2,3,7,8-TCDD) may be formed during the chlorine bleaching process at pulp and paper mills. CDDs are also formed during chlorination by waste and drinking water treatment plants. They can occur as contaminants in the manufacture of certain organic chemicals. CDDs are released into the air in emissions from municipal solid waste and industrial incinerators.

What happens to CDDs when they enter the environment?

❑ When released into the air, some CDDs may be transported long distances, even around the globe.

❑ When released in waste waters, some CDDs are broken down by sunlight, some evaporate to air, but most attach to soil and settle to the bottom sediment in water.

❑ CDD concentrations may build up in the food chain, resulting in measurable levels in animals.

How might I be exposed to CDDs?

❑ Eating food, primarily meat, dairy products, and fish, makes up more than 90% of the intake of CDDs for the general population.

❑ Breathing low levels in air and drinking low levels in water.

❑ Skin contact with certain pesticides and herbicides.

❑ Living near an uncontrolled hazardous waste site containing CDDs or incinerators releasing CDDs.

❑ Working in industries involved in producing certain pesticides containing CDDs as impurities, working at paper and pulp mills, or operating incinerators.

How can CDDs affect my health?

The most noted health effect in people exposed to large amounts of 2,3,7,8-TCDD is chloracne. Chloracne is a severe skin disease with acne-like lesions that occur mainly on the face and upper body. Other skin effects noted in people exposed to high doses of 2,3,7,8-TCDD include skin rashes, discoloration, and excessive body hair. Changes in blood and urine that may indicate liver damage also are seen in people. Exposure to high concentrations of CDDs may induce longterm alterations in glucose metabolism and subtle changes in hormonal levels.

In certain animal species, 2,3,7,8-TCDD is especially harmful and can cause death after a single exposure. Exposure to lower levels can cause a variety of effects in

animals, such as weight loss, liver damage, and disruption of the endocrine system. In many species of animals, 2,3,7,8-TCDD weakens the immune system and causes a decrease in the system's ability to fight bacteria and viruses. In other animal studies, exposure to 2,3,7,8-TCDD has caused reproductive damage and birth defects. Some animal species exposed to CDDs during pregnancy had miscarriages and the offspring of animals exposed to 2,3,7,8-TCDD during pregnancy often had severe birth defects including skeletal deformities, kidney defects, and weakened immune responses.

How likely are CDDs to cause cancer?

Several studies suggest that exposure to 2,3,7,8-TCDD increases the risk of several types of cancer in people. Animal studies have also shown an increased risk of cancer from exposure to 2,3,7,8-TCDD.
The World Health Organization (WHO) has determined that 2,3,7,8-TCDD is a human carcinogen.
The Department of Health and Human Services (DHHS) has determined that 2,3,7,8-TCDD may reasonably be anticipated to cause cancer.

How can CDDs affect children?

Very few studies have looked at the effects of CDDs on children. Chloracne has been seen in children exposed to high levels of CDDs. We don't know if CDDs affect the ability of people to have children or if it causes birth defects, but given the effects observed in animal studies, this cannot be ruled out.

How can families reduce the risk of exposure to CDDs?

❏ Children should avoid playing in soils near uncontrolled hazardous waste sites.
❏ Discourage children from eating dirt or putting toys or other objects in their mouths.
❏ Everyone should wash hands frequently if playing or working near uncontrolled hazardous waste sites.
❏ For new mothers and young children, restrict eating foods from the proximity of uncontrolled sites with known CDDs.
❏ Children and adults should eat a balanced diet preferably containing low to moderate amounts of animal fats including meat and dairy products, and fish that contain lower amounts of CDDs and eat larger amounts of fruits, vegetables, and grains.

Is there a medical test to determine whether I've been exposed to CDDs?

Tests are available to measure CDD levels in body fat, blood, and breast milk, but these tests are not routinely available. Most people have low levels of CDDs in their body fat and blood, and levels considerably above these levels indicate past exposure to above-normal levels of 2,3,7,8-TCDD. Although CDDs stay in body fat for a long time, tests cannot be used to determine when exposure occurred.

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 0.00003 micrograms of 2,3,7,8-TCDD per liter of drinking water (0.00003 µg/L). Discharges, spills, or accidental releases of 1 pound or more of 2,3,7,8-TCDD must be reported to EPA. The Food and Drug Administration (FDA) recommends against eating fish and shellfish with levels of 2,3,7,8-TCDD greater than 50 parts per trillion (50 ppt).

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1998. Toxicological Profile for Chlorinated Dibenzo-p-Dioxins. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-62, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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CHLORODIBENZOFURANS (CDFs)

Agency for Toxic Substances and Disease Registry ToxFAQs **September 1995**

This fact sheet answers the most frequently asked health questions (FAQs) about chlorodibenzofurans (CDFs). For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to chlorodibenzofurans (CDFs) occurs mainly by eating certain contaminated foods. In people, exposure to CDFs is most likely to cause skin and eye irritation, and increased vulnerability to respiratory infection and nervous system effects. This chemical has been found in at least 51 of 1,416 National Priorities List sites identified by the Environmental Protection Agency.

What are chlorodibenzofurans (CDFs)?

(Pronounced klôr′ō dī bĕn′-zō fyŏor′ôn′)

Chlorinated dibenzofurans, or CDFs, are a family of chemicals that contain one to eight chlorine atoms attached to the carbon atoms of the parent chemical, dibenzofuran. There are 135 different types of CDFs with varying harmful health and environmental effects. The compounds that contain chlorine atoms at the 2,3,7,8-positions of the dibenzofuran molecule are known to be especially harmful.

Not all of the different types have been found in large enough quantities to study the physical properties. However, of those that have been studied, they do not dissolve in water easily and appear to be in the form of colorless solids.

There is no known use for these chemicals. Other than for research purposes, they are not deliberately produced by industry. Most CDFs are produced in small amounts as undesirable by-products of certain processes, such as manufacturing other chemicals or bleaching at paper and pulp mills. CDFs can also be released from incinerators.

What happens to CDFs when they enter the environment?

- CDFs exist in the air as solid particles and sometimes vapors.
- They can enter the environment from car exhausts or from burning coal, wood, or oil for home heating, and the production of electricity.
- Vaporized CDFs are broken down by other chemicals in the atmosphere.
- They can be removed from the air in snow and rain.
- They attach to soil and sediment in lakes and rivers.
- They are not likely to move into groundwater from soil.
- They accumulate in fish to tens of thousands times higher levels than in the water or sediment.
- They also build up in other animals, birds, and people that are exposed to CDFs in their food.

How might I be exposed to CDFs?

- Eating contaminated foods, such as meat, fish, and milk (90% of daily exposure, which is only a few picograms [pg], results from eating contaminated food).
- Breathing air or drinking water that is contaminated, or coming in contact with contaminated soil.
- Using products such as milk cartons, coffee filters, and tampons could result in very low exposures.
- Breathing contaminated workplace air.

ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html

How can CDFs affect my health?

Very little is known about the health effects in people or animals from breathing or touching CDFs. A study in mice showed that skin exposure to low levels over several weeks produced effects similar to those from ingesting CDFs.

Most of the information on the adverse health effects comes from studies in people who were accidentally exposed to food contaminated with CDFs. The amounts that these people were exposed to were much higher than are likely from environmental exposures or from a normal diet.

CDFs caused skin and eye irritations, including severe acne, darkened skin color, and swollen eyelids with discharge from the eyes. CDF poisoning also caused vomiting and diarrhea, anemia, more frequent lung infections, numbness, effects on the nervous system, and mild changes in the liver. Children born to exposed mothers had skin irritation and more difficulty learning.

Many of the same effects that occurred in people also occurred in laboratory animals that ate CDFs. Animals also had severe weight loss, and their stomachs, livers, kidneys, and immune systems were seriously injured. Some animals had birth defects and testicular damage, and in severe cases, some animals died. These effects in animals were seen when they were fed large amounts of CDFs over a short time, or small amounts over several weeks or months.

How likely are CDFs to cause cancer?

The Department of Health and Human Services, the International Agency for Research on Cancer, and the Environmental Protection Agency (EPA) have not classified CDFs for carcinogenicity.

It is not definitely known if CDFs cause cancer in people. There are no cancer studies in animals that ate or breathed CDFs. One study found that when CDFs were applied to the skin of animals, they did not cause cancer, but when they were applied with another compound called MNNG, which is known to initiate tumors, cancer did develop.

Is there a medical test to show whether I've been exposed to CDFs?

There are tests available to measure CDFs in your blood, body fat, and breast milk. The tests can tell you if you have been exposed, but they can't tell you the exact amount of CDFs or for how long you were exposed. The tests also cannot predict whether you will experience harmful health effects. Nearly everyone in the United States and other industrialized countries has been exposed to low levels of CDFs because they are in the environment.

Has the federal government made recommendations to protect human health?

There are no federal guidelines or recommendations for protecting human health or the environment from exposure to CDFs.

Glossary

Anemia: A decreased ability of the blood to transport oxygen.

Carcinogenicity: Ability to cause cancer.

Picogram (pg): One trillionth of a gram.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1994. Toxicological profile for chlorodibenzofurans. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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CHROMIUM

CAS # 7440-47-3

Division of Toxicology and Human Health Sciences ToxFAQs™ **October 2012**

This fact sheet answers the most frequently asked health questions (FAQs) about chromium. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to chromium occurs from ingesting contaminated food or drinking water or breathing contaminated workplace air. Chromium(VI) at high levels can damage the nose and cause cancer. Ingesting high levels of chromium(VI) may result in anemia or damage to the stomach or intestines. Chromium(III) is an essential nutrient. Chromium has been found in at least 1,127 of the 1,669 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is chromium?

Chromium is a naturally occurring element found in rocks, animals, plants, and soil. It can exist in several different forms. Depending on the form it takes, it can be a liquid, solid, or gas. The most common forms are chromium(0), chromium(III), and chromium(VI). No taste or odor is associated with chromium compounds.

The metal chromium, which is the chromium(0) form, is used for making steel. Chromium(VI) and chromium(III) are used for chrome plating, dyes and pigments, leather tanning, and wood preserving.

What happens to chromium when it enters the environment?

- Chromium can be found in air, soil, and water after release from the manufacture, use, and disposal of chromium-based products, and during the manufacturing process.
- Chromium does not usually remain in the atmosphere, but is deposited into the soil and water.
- Chromium can easily change from one form to another in water and soil, depending on the conditions present.
- Fish do not accumulate much chromium in their bodies from water.

How might I be exposed to chromium?

- Eating food containing chromium(III).
- Breathing contaminated workplace air or skin contact during use in the workplace.
- Drinking contaminated well water.
- Living near uncontrolled hazardous waste sites containing chromium or industries that use chromium.

How can chromium affect my health?

Chromium(III) is an essential nutrient that helps the body use sugar, protein, and fat.

Breathing high levels of chromium(VI) can cause irritation to the lining of the nose, nose ulcers, runny nose, and breathing problems, such as asthma, cough, shortness of breath, or wheezing. The concentrations of chromium in air that can cause these effects may be different for different types of chromium compounds, with effects occurring at much lower concentrations for chromium(VI) compared to chromium(III).

The main health problems seen in animals following ingestion of chromium(VI) compounds are irritation and ulcers in the stomach and small intestine and anemia. Chromium(III) compounds are much less toxic and do not appear to cause these problems.

Sperm damage and damage to the male reproductive system have also been seen in laboratory animals exposed to chromium(VI).

ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaqs/index.asp

Skin contact with certain chromium(VI) compounds can cause skin ulcers. Some people are extremely sensitive to chromium(VI) or chromium(III). Allergic reactions consisting of severe redness and swelling of the skin have been noted.

How likely is chromium to cause cancer?
The Department of Health and Human Services (DHHS), the International Agency for Research on Cancer (IARC), and the EPA have determined that chromium(VI) compounds are known human carcinogens.

In workers, inhalation of chromium(VI) has been shown to cause lung cancer. Chromium(VI) also causes lung cancer in animals. An increase in stomach tumors was observed in humans and animals exposed to chromium(VI) in drinking water.

How can chromium affect children?
It is likely that health effects seen in children exposed to high amounts of chromium will be similar to the effects seen in adults.

We do not know if exposure to chromium will result in birth defects or other developmental effects in people. Some developmental effects have been observed in animals exposed to chromium(VI).

How can families reduce the risk of exposure to chromium?

- Children should avoid playing in soils near uncontrolled hazardous waste sites where chromium may have been discarded.
- Chromium is a component of tobacco smoke. Avoid smoking in enclosed spaces like inside the home or car in order to limit exposure to children and other family members.
- Although chromium(III) is an essential nutrient, you should avoid excessive use of dietary supplements containing chromium.

Is there a medical test to determine whether I've been exposed to chromium?
Since chromium(III) is an essential element and naturally occurs in food, there will always be some level of chromium in your body. Chromium can be measured in hair, urine, and blood.

Higher than normal levels of chromium in blood or urine may indicate that a person has been exposed to chromium. However, increases in blood and urine chromium levels cannot be used to predict the kind of health effects that might develop from that exposure.

Has the federal government made recommendations to protect human health?
The EPA has established a maximum contaminant level of 0.1 mg/L for total chromium in drinking water.

The FDA has determined that the chromium concentration in bottled drinking water should not exceed 0.1 mg/L.

The Occupational Health and Safety Administration (OSHA) has limited workers' exposure to an average of 0.005 mg/m^3 chromium(VI), 0.5 mg/m^3 chromium(III), and 1.0 mg/m^3 chromium(0) for an 8-hour workday, 40-hour workweek.

References
Agency for Toxic Substances and Disease Registry (ATSDR). 2012. Toxicological Profile for Chromium. Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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1,2-DICHLOROETHENE
CAS # 540-59-0, 156-59-2, and 156-60-5

This fact sheet answers the most frequently asked health questions (FAQs) about 1,2-dichloroethene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to 1,2-dichloroethene occurs mainly in workplaces where it is made or used. Breathing high levels of 1,2-dichloroethene can make you feel nauseous, drowsy, and tired. *cis*-1,2-Dichloroethene has been found in at least 146 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA). *trans*-1,2-Dichloroethene was found in at least 563 NPL sites. 1,2-Dichloroethene was found at 336 sites, but the isomer (*cis*- or *trans*-) was not specified.

What is 1,2-dichloroethene?

(Pronounced 1,2-dī-klôrʹ ō-ĕthʹēn)

1,2-Dichloroethene, also called 1,2-dichloroethylene, is a highly flammable, colorless liquid with a sharp, harsh odor. It is used to produce solvents and in chemical mixtures. You can smell very small amounts of 1,2-dichloroethene in air (about 17 parts of 1,2-dichloroethene per million parts of air [17 ppm]).

There are two forms of 1,2-dichloroethene; one is called *cis*-1,2-dichloroethene and the other is called *trans*-1,2-dichloroethene. Sometimes both forms are present as a mixture.

What happens to 1,2-dichloroethene when it enters the environment?

- 1,2-Dichloroethene evaporates rapidly into air.
- In the air, it takes about 5-12 days for half of it to break down.
- Most 1,2-dichloroethene in the soil surface or bodies of water will evaporate into air.
- 1,2-Dichloroethene can travel through soil or dissolve in water in the soil. It is possible that it can contaminate groundwater.
- In groundwater, it takes about 13-48 weeks to break down.
- There is a slight chance that 1,2-dichloroethene will break down into vinyl chloride, a different chemical which is believed to be more toxic than 1,2-dichloroethene.

How might I be exposed to 1,2-dichloroethene?

- Breathing 1,2-dichloroethene that has leaked from hazardous waste sites and landfills.
- Drinking contaminated tap water or breathing vapors from contaminated water while cooking, bathing, or washing dishes.
- Breathing 1,2-dichloroethene, touching it, or touching contaminated materials in the workplace.

How can 1,2-dichloroethene affect my health?

Breathing high levels of 1,2-dichloroethene can make you feel nauseous, drowsy, and tired; breathing very high levels can kill you.

When animals breathed high levels of *trans*-1,2-dichloroethene for short or longer periods of time, their livers and lungs were damaged and the effects were more severe with longer exposure times. Animals that breathed very high

levels of *trans*-1,2-dichloroethene had damaged hearts.

Animals that ingested extremely high doses of *cis*- or *trans*-1,2-dichloroethene died.

Lower doses of *cis*-1,2-dichloroethene caused effects on the blood, such as decreased numbers of red blood cells, and also effects on the liver.

The long-term (365 days or longer) human health effects after exposure to low concentrations of 1,2-dichloroethene aren't known. One animal study suggested that an exposed fetus may not grow as quickly as one that hasn't been exposed.

Exposure to 1,2-dichloroethene hasn't been shown to affect fertility in people or animals.

How likely is 1,2-dichloroethene to cause cancer?

The EPA has determined that *cis*-1,2-dichloroethene is not classifiable as to its human carcinogenicity.

No EPA cancer classification is available for *trans*-1,2-dichloroethene.

Is there a medical test to show whether I've been exposed to 1,2-dichloroethene?

Tests are available to measure concentrations of the breakdown products of 1,2-dichloroethene in blood, urine, and tissues. However, these tests aren't used routinely to determine whether a person has been exposed to this compound. This is because after you are exposed to 1,2-dichloroethene, the breakdown products in your body that are detected with these tests may be the same as those that come from exposure to other chemicals. These tests aren't available in most doctors' offices, but can be done at special laboratories that have the right equipment.

Has the federal government made recommendations to protect human health?

The EPA has set the maximum allowable level of *cis*-1,2-dichloroethene in drinking water at 0.07 milligrams per liter of water (0.07 mg/L) and *trans*-1,2-dichloroethene at 0.1 mg/L.

The EPA requires that any spills or accidental release of 1,000 pounds or more of 1,2-dichloroethene must be reported to the EPA.

The Occupational Health Safety and Health Administration (OSHA) has set the maximum allowable amount of 1,2-dichloroethene in workroom air during an 8-hour workday in a 40-hour workweek at 200 parts of 1,2-dichloroethene per million parts of air (200 ppm).

Glossary

Carcinogenicity: Ability of a substance to cause cancer.

CAS: Chemical Abstracts Service.

Fertility: Ability to reproduce.

Ingest: To eat or drink something.

Milligram (mg): One thousandth of a gram.

ppm: Parts per million.

Solvent: A chemical that can dissolve other substances.

References

This ToxFAQs information is taken from the 1996 Toxicological Profile for 1,2-Dichloroethene produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

ETHYLBENZENE

CAS # 100-41-4

Division of Toxicology and Environmental Medicine ToxFAQs™ **September 2007**

This fact sheet answers the most frequently asked health questions (FAQs) about ethylbenzene. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Ethylbenzene is a colorless liquid found in a number of products including gasoline and paints. Breathing very high levels can cause dizziness and throat and eye irritation. Breathing lower levels has resulted in hearing effects and kidney damage in animals. Ethylbenzene has been found in at least 829 of 1,689 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is ethylbenzene?

Ethylbenzene is a colorless, flammable liquid that smells like gasoline.
It is naturally found in coal tar and petroleum and is also found in manufactured products such as inks, pesticides, and paints.
Ethylbenzene is used primarily to make another chemical, styrene. Other uses include as a solvent, in fuels, and to make other chemicals.

What happens to ethylbenzene when it enters the environment?

- ❏ Ethylbenzene moves easily into the air from water and soil.
- ❏ It takes about 3 days for ethylbenzene to be broken down in air into other chemicals.
- ❏ In surface water, ethylbenzene breaks down by reacting with other chemicals found naturally in water.
- ❏ Ethylbenzene can move through soil into groundwater
- ❏ In soil, it is broken down by bacteria.

How might I be exposed to ethylbenzene?

- ❏ If you live in a city or near many factories or heavily traveled highways, you may be exposed to ethylbenzene in air.
- ❏ Releases of ethylbenzene into the air occur from burning oil, gas, and coal and from industries using ethylbenzene.
- ❏ Ethylbenzene is not often found in drinking water. Higher levels may be found in residential drinking water wells near landfills, waste sites, or leaking underground fuel storage tanks.
- ❏ Working in an industry where ethylbenzene is used or made.
- ❏ Using products containing it, such as gasoline, carpet glues, varnishes, and paints.

How can ethylbenzene affect my health?

Exposure to high levels of ethylbenzene in air for short periods can cause eye and throat irritation. Exposure to higher levels can result in dizziness.
Irreversible damage to the inner ear and hearing has been observed in animals exposed to relatively low concentrations of ethylbenzene for several days to weeks.
Exposure to relatively low concentrations of ethylbenzene in air for several months to years causes kidney damage in animals.

How likely is ethylbenzene to cause cancer?

The International Agency for Research on Cancer (IARC) has determined that ethylbenzene is a possible human carcinogen.

ETHYLBENZENE
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How can ethylbenzene affect children?

There are no studies evaluating the effects of ethylbenzene exposure on children or immature animals. It is likely that children would have the same health effects as adults. We do not know whether children would be more sensitive than adults to the effects of ethylbenzene.

We do not know if ethylbenzene will cause birth defects in humans. Minor birth defects and low birth weight have occurred in newborn animals whose mothers were exposed to ethylbenzene in air during pregnancy.

How can families reduce the risks of exposure to ethylbenzene?

❑ Use adequate ventilation to reduce exposure to ethylbenzene vapors from consumer products such as gasoline, pesticides, varnishes and paints, and newly installed carpeting.

❑ Sometimes older children sniff household chemicals, including ethylbenzene, in an attempt to get high. Talk with your children about the dangers of sniffing chemicals.

❑ Household chemicals should be stored out of reach of children to prevent accidental poisoning. Always store household chemicals in their original containers; never store them in containers that children would find attractive to eat or drink from, such as old soda bottles. Gasoline should be stored in a gasoline can with a locked cap.

Is there a medical test to determine whether I've been exposed to ethylbenzene?

Ethylbenzene is found in the blood, urine, breath, and some body tissues of exposed people. The most common way to test for ethylbenzene is in the urine. This test measures substances formed by the breakdown of ethylbenzene. Because these substances leave the body very quickly, this test needs to be done within a few hours after exposure occurs.

These tests can show you were exposed to ethylbenzene, but cannot predict the kind of health effects that might occur.

Has the federal government made recommendations to protect human health?

The EPA has determined that exposure to ethylbenzene in drinking water at concentrations of 30 ppm for 1 day or 3 ppm for 10 days is not expected to cause any adverse effects in a child.

The EPA has determined that lifetime exposure to 0.7 ppm ethylbenzene is not expected to cause any adverse effects.

The Occupational Health and Safety Administration (OSHA) has limited workers' exposure to an average of 100 ppm for an 8-hour workday, 40-hour workweek.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for Ethylbenzene (Draft for Public Comment). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

FUEL OILS

CAS # 8008-20-6, 70892-10-3, 68476-30-2, 68476-34-6, 68476-31-3

This fact sheet answers the most frequently asked health questions (FAQs) about fuel oils. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Fuel oils are liquid mixtures produced from petroleum, and their use mostly involves burning them as fuels. Drinking or breathing fuel oils may cause nausea or nervous system effects. However, exposure under normal use conditions is not likely to be harmful. Fuel oils have been found in at least 26 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are fuel oils?

(Pronounced fyo͞o′əl oilz)

Fuel oils are a variety of yellowish to light brown liquid mixtures that come from crude petroleum. Some chemicals found in fuel oils may evaporate easily, while others may more easily dissolve in water.

Fuel oils are produced by different petroleum refining processes, depending on their intended uses. Fuel oils may be used as fuel for engines, lamps, heaters, furnaces, and stoves, or as solvents.

Some commonly found fuel oils include kerosene, diesel fuel, jet fuel, range oil, and home heating oil. These fuel oils differ from one another by their hydrocarbon compositions, boiling point ranges, chemical additives, and uses.

What happens to fuel oils when they enter the environment?

- Some chemicals found in fuel oils may evaporate into the air from open containers or contaminated soil or water.
- Some chemicals found in fuel oils may dissolve in water after spills to surface waters or leaks from underground storage tanks.
- Some chemicals found in fuel oils may stick to particles in water, which will eventually cause them to settle to the bottom sediment.
- Some of the chemicals found in fuel oils may be broken down slowly in air, water, and soil by sunlight or small organisms.
- Some of the chemicals found in fuel oils may build up significantly in plants and animals.

How might I be exposed to fuel oils?

- Using a home kerosene heater or stove, or using fuel oils at work.
- Breathing air in home or building basements that has been contaminated with fuel oil vapors entering from the soil.
- Drinking or swimming in water that has been contaminated with fuel oils from a spill or a leaking underground storage tank.
- Touching soil contaminated with fuel oils.
- Using fuel oils to wash paint or grease from skin or equipment.

How can fuel oils affect my health?

Little information is available about the health effects that may be caused by fuel oils. People who use kerosene

stoves for cooking do not seem to have any health problems related to their exposure.

Breathing some fuel oils for short periods may cause nausea, eye irritation, increased blood pressure, headache, lightheadedness, loss of appetite, poor coordination, and difficulty concentrating. Breathing diesel fuel vapors for long periods may cause kidney damage and lower your blood's ability to clot.

Drinking small amounts of kerosene may cause vomiting, diarrhea, coughing, stomach swelling and cramps, drowsiness, restlessness, painful breathing, irritability, and unconsciousness. Drinking large amounts of kerosene may cause convulsions, coma, or death. Skin contact with kerosene for short periods may cause itchy, red, sore, or peeling skin.

How likely are fuel oils to cause cancer?

The International Agency for Research on Cancer (IARC) has determined that some fuel oils (heavy) may possibly cause cancer in humans, but for other fuel oils (light) there is not enough information to make a determination. IARC has also determined that occupational exposures to fuel oils during petroleum refining are probably carcinogenic in humans.

Some studies with mice have suggested that repeated contact with fuel oils may cause liver or skin cancer. However, other mouse studies have found this not to be the case. No studies are available in other animals or in people on the carcinogenic effects of fuel oils.

Is there a medical test to show whether I've been exposed to fuel oils?

There is no medical test that shows if you have been exposed to fuel oils. Tests are available to determine if some of the chemicals commonly found in fuel oils are in your blood. However, the presence of these chemicals in blood may not necessarily mean that you have been exposed to fuel oils.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) and the Air Force Office of Safety and Health (AFOSH) have set a permissible exposure level (PEL) of 400 parts of petroleum distillates per million parts of air (400 ppm) for an 8-hour workday, 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) recommends that average workplace air levels not exceed 350 milligrams of petroleum distillates per cubic meter of air (350 mg/m^3) for a 40-hour workweek.

The Department of Transportation (DOT) lists fuel oils as hazardous materials and, therefore, regulates their transportation.

Glossary

Carcinogenic: Able to cause cancer.

CAS: Chemical Abstracts Service.

Evaporate: To change into a vapor or a gas.

Hydrocarbon: Any compound made up of hydrogen and carbon.

Milligram (mg): One thousandth of a gram.

ppm: Parts per million.

Sediment: Mud and debris that have settled to the bottom of a body of water.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for fuel oils. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone:1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

LEAD

CAS # 7439-92-1

Division of Toxicology and Environmental Medicine ToxFAQs™ **August 2007**

This fact sheet answers the most frequently asked health questions (FAQs) about lead. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to lead can happen from breathing workplace air or dust, eating contaminated foods, or drinking contaminated water. Children can be exposed from eating lead-based paint chips or playing in contaminated soil. Lead can damage the nervous system, kidneys, and reproductive system. Lead has been found in at least 1,272 of the 1,684 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is lead?

Lead is a naturally occurring bluish-gray metal found in small amounts in the earth's crust. Lead can be found in all parts of our environment. Much of it comes from human activities including burning fossil fuels, mining, and manufacturing.

Lead has many different uses. It is used in the production of batteries, ammunition, metal products (solder and pipes), and devices to shield X-rays. Because of health concerns, lead from paints and ceramic products, caulking, and pipe solder has been dramatically reduced in recent years. The use of lead as an additive to gasoline was banned in 1996 in the United States.

What happens to lead when it enters the environment?

❑ Lead itself does not break down, but lead compounds are changed by sunlight, air, and water.

❑ When lead is released to the air, it may travel long distances before settling to the ground.

❑ Once lead falls onto soil, it usually sticks to soil particles.

❑ Movement of lead from soil into groundwater will depend on the type of lead compound and the characteristics of the soil.

How might I be exposed to lead?

❑ Eating food or drinking water that contains lead. Water pipes in some older homes may contain lead solder. Lead can leach out into the water.

❑ Spending time in areas where lead-based paints have been used and are deteriorating. Deteriorating lead paint can contribute to lead dust.

❑ Working in a job where lead is used or engaging in certain hobbies in which lead is used, such as making stained glass.

❑ Using health-care products or folk remedies that contain lead.

How can lead affect my health?

The effects of lead are the same whether it enters the body through breathing or swallowing. Lead can affect almost every organ and system in your body. The main target for lead toxicity is the nervous system, both in adults and children. Long-term exposure of adults can result in decreased performance in some tests that measure functions of the nervous system. It may also cause weakness in fingers, wrists, or ankles. Lead exposure also causes small increases in blood pressure, particularly in middle-aged and older people and can cause anemia. Exposure to high lead levels can severely damage the brain and kidneys in adults or children and ultimately cause death. In pregnant women, high levels of exposure to lead may cause miscarriage. High-level exposure in men can damage the organs responsible for sperm production.

How likely is lead to cause cancer?

We have no conclusive proof that lead causes cancer in humans. Kidney tumors have developed in rats and mice that had been given large doses of some kind of lead compounds. The Department of Health and Human Services

(DHHS) has determined that lead and lead compounds are reasonably anticipated to be human carcinogens and the EPA has determined that lead is a probable human carcinogen. The International Agency for Research on Cancer (IARC) has determined that inorganic lead is probably carcinogenic to humans and that there is insufficient information to determine whether organic lead compounds will cause cancer in humans.

How can lead affect children?

Small children can be exposed by eating lead-based paint chips, chewing on objects painted with lead-based paint, or swallowing house dust or soil that contains lead.

Children are more vulnerable to lead poisoning than adults. A child who swallows large amounts of lead may develop blood anemia, severe stomachache, muscle weakness, and brain damage. If a child swallows smaller amounts of lead, much less severe effects on blood and brain function may occur. Even at much lower levels of exposure, lead can affect a child's mental and physical growth.

Exposure to lead is more dangerous for young and unborn children. Unborn children can be exposed to lead through their mothers. Harmful effects include premature births, smaller babies, decreased mental ability in the infant, learning difficulties, and reduced growth in young children. These effects are more common if the mother or baby was exposed to high levels of lead. Some of these effects may persist beyond childhood.

How can families reduce the risks of exposure to lead?

❏ Avoid exposure to sources of lead.

❏ Do not allow children to chew or mouth surfaces that may have been painted with lead-based paint.

❏ If you have a water lead problem, run or flush water that has been standing overnight before drinking or cooking with it.

❏ Some types of paints and pigments that are used as make-up or hair coloring contain lead. Keep these kinds of products away from children

❏ If your home contains lead-based paint or you live in an area contaminated with lead, wash children's hands and faces often to remove lead dusts and soil, and regularly clean the house of dust and tracked in soil.

Is there a medical test to determine whether I've been exposed to lead?

A blood test is available to measure the amount of lead in your blood and to estimate the amount of your recent exposure to lead. Blood tests are commonly used to screen children for lead poisoning. Lead in teeth or bones can be measured by X-ray techniques, but these methods are not widely available. Exposure to lead also can be evaluated by measuring erythrocyte protoporphyrin (EP) in blood samples. EP is a part of red blood cells known to increase when the amount of lead in the blood is high. However, the EP level is not sensitive enough to identify children with elevated blood lead levels below about 25 micrograms per deciliter (μg/dL). These tests usually require special analytical equipment that is not available in a doctor's office. However, your doctor can draw blood samples and send them to appropriate laboratories for analysis.

Has the federal government made recommendations to protect human health?

The Centers for Disease Control and Prevention (CDC) recommends that states test children at ages 1 and 2 years. Children should be tested at ages 3–6 years if they have never been tested for lead, if they receive services from public assistance programs for the poor such as Medicaid or the Supplemental Food Program for Women, Infants, and Children, if they live in a building or frequently visit a house built before 1950; if they visit a home (house or apartment) built before 1978 that has been recently remodeled; and/or if they have a brother, sister, or playmate who has had lead poisoning. CDC considers a blood lead level of 10 μg/dL to be a level of concern for children.

EPA limits lead in drinking water to 15 μg per liter.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for lead (Update). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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MERCURY
CAS # 7439-97-6

Agency for Toxic Substances and Disease Registry ToxFAQs **April 1999**

This fact sheet answers the most frequently asked health questions (FAQs) about mercury. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to mercury occurs from breathing contaminated air, ingesting contaminated water and food, and having dental and medical treatments. Mercury, at high levels, may damage the brain, kidneys, and developing fetus. This chemical has been found in at least 714 of 1,467 National Priorities List sites identified by the Environmental Protection Agency.

What is mercury?

(Pronounced mŭr′kyə-rē)

Mercury is a naturally occurring metal which has several forms. The metallic mercury is a shiny, silver-white, odorless liquid. If heated, it is a colorless, odorless gas.

Mercury combines with other elements, such as chlorine, sulfur, or oxygen, to form inorganic mercury compounds or "salts," which are usually white powders or crystals. Mercury also combines with carbon to make organic mercury compounds. The most common one, methylmercury, is produced mainly by microscopic organisms in the water and soil. More mercury in the environment can increase the amounts of methylmercury that these small organisms make.

Metallic mercury is used to produce chlorine gas and caustic soda, and is also used in thermometers, dental fillings, and batteries. Mercury salts are sometimes used in skin lightening creams and as antiseptic creams and ointments.

What happens to mercury when it enters the environment?

- Inorganic mercury (metallic mercury and inorganic mercury compounds) enters the air from mining ore deposits, burning coal and waste, and from manufacturing plants.
- It enters the water or soil from natural deposits, disposal of wastes, and volcanic activity.
- Methylmercury may be formed in water and soil by small organisms called bacteria.
- Methylmercury builds up in the tissues of fish. Larger and older fish tend to have the highest levels of mercury.

How might I be exposed to mercury?

- Eating fish or shellfish contaminated with methylmercury.
- Breathing vapors in air from spills, incinerators, and industries that burn mercury-containing fuels.
- Release of mercury from dental work and medical treatments.
- Breathing contaminated workplace air or skin contact during use in the workplace (dental, health services, chemical, and other industries that use mercury).
- Practicing rituals that include mercury.

How can mercury affect my health?

The nervous system is very sensitive to all forms of mercury. Methylmercury and metallic mercury vapors are more harmful than other forms, because more mercury in these forms reaches the brain. Exposure to high levels of metallic, inorganic, or organic mercury can permanently damage the brain, kidneys, and developing fetus. Effects on brain functioning may result in irritability, shyness, tremors, changes in vision or hearing, and memory problems.

Short-term exposure to high levels of metallic mercury vapors may cause effects including lung damage, nausea,

vomiting, diarrhea, increases in blood pressure or heart rate, skin rashes, and eye irritation.

How likely is mercury to cause cancer?

There are inadequate human cancer data available for all forms of mercury. Mercuric chloride has caused increases in several types of tumors in rats and mice, and methylmercury has caused kidney tumors in male mice. The EPA has determined that mercuric chloride and methylmercury are possible human carcinogens.

How can mercury affect children?

Very young children are more sensitive to mercury than adults. Mercury in the mother's body passes to the fetus and may accumulate there. It can also can pass to a nursing infant through breast milk. However, the benefits of breast feeding may be greater than the possible adverse effects of mercury in breast milk.

Mercury's harmful effects that may be passed from the mother to the fetus include brain damage, mental retardation, incoordination, blindness, seizures, and inability to speak. Children poisoned by mercury may develop problems of their nervous and digestive systems, and kidney damage.

How can families reduce the risk of exposure to mercury?

Carefully handle and dispose of products that contain mercury, such as thermometers or fluorescent light bulbs. Do not vacuum up spilled mercury, because it will vaporize and increase exposure. If a large amount of mercury has been spilled, contact your health department. Teach children not to play with shiny, silver liquids.

Properly dispose of older medicines that contain mercury. Keep all mercury-containing medicines away from children.

Pregnant women and children should keep away from rooms where liquid mercury has been used.

Learn about wildlife and fish advisories in your area from your public health or natural resources department.

Is there a medical test to show whether I've been exposed to mercury?

Tests are available to measure mercury levels in the body. Blood or urine samples are used to test for exposure to metallic mercury and to inorganic forms of mercury. Mercury in whole blood or in scalp hair is measured to determine exposure to methylmercury. Your doctor can take samples and send them to a testing laboratory.

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 2 parts of mercury per billion parts of drinking water (2 ppb).

The Food and Drug Administration (FDA) has set a maximum permissible level of 1 part of methylmercury in a million parts of seafood (1 ppm).

The Occupational Safety and Health Administration (OSHA) has set limits of 0.1 milligram of organic mercury per cubic meter of workplace air (0.1 mg/m^3) and 0.05 mg/m^3 of metallic mercury vapor for 8-hour shifts and 40-hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological profile for mercury. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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METHYL *TERT*-BUTYL ETHER (MTBE) CAS # 1634-04-4

Agency for Toxic Substances and Disease Registry ToxFAQs **September 1997**

This fact sheet answers the most frequently asked health questions (FAQs) about methyl *tert*-butyl ether (MTBE). For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Methyl *tert*-butyl ether (MTBE) is a flammable liquid which is used as an additive in unleaded gasoline. Drinking or breathing MTBE may cause nausea, nose and throat irritation, and nervous system effects. MTBE has been found in at least 11 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is methyl *tert*-butyl ether?

(Pronounced měthʹəl tūrʹshē-ĕrʹē byo͞otʹl ēʹthər)

Methyl *tert*-butyl ether (MTBE) is a flammable liquid with a distinctive, disagreeable odor. It is made from blending chemicals such as isobutylene and methanol, and has been used since the 1980s as an additive for unleaded gasolines to achieve more efficient burning.

MTBE is also used to dissolve gallstones. Patients treated in this way have MTBE delivered directly to their gall bladders through special tubes that are surgically inserted.

What happens to MTBE when it enters the environment?

- MTBE quickly evaporates from open containers and surface water, so it is commonly found as a vapor in the air.
- Small amounts of MTBE may dissolve in water and get into underground water.
- It remains in underground water for a long time.
- MTBE may stick to particles in water, which will cause it to eventually settle to the bottom sediment.
- MTBE may be broken down quickly in the air by sunlight.
- MTBE does not build up significantly in plants and animals.

How might I be exposed to MTBE?

- Touching the skin or breathing contaminated air while pumping gasoline.
- Breathing exhaust fumes while driving a car.
- Breathing air near highways or in cities.
- Drinking, swimming, or showering in water that has been contaminated with MTBE.
- Receiving MTBE treatment for gallstones.

How can MTBE affect my health?

Breathing small amounts of MTBE for short periods may cause nose and throat irritation. Some people exposed to MTBE while pumping gasoline, driving their cars, or working

in gas stations have reported having headaches, nausea, dizziness, and mental confusion. However, the actual levels of exposure in these cases are unknown. In addition, these symptoms may have been caused by exposure to other chemicals.

There are no data on the effects in people of drinking MTBE. Studies with rats and mice suggest that drinking MTBE may cause gastrointestinal irritation, liver and kidney damage, and nervous system effects.

How likely is MTBE to cause cancer?

There is no evidence that MTBE causes cancer in humans. One study with rats found that breathing high levels of MTBE for long periods may cause kidney cancer. Another study with mice found that breathing high levels of MTBE for long periods may cause liver cancer.

The Department of Health and Human Services (DHHS), the International Agency for Research on Cancer (IARC), and the EPA have not classified MTBE as to its carcinogenicity.

Is there a medical test to show whether I've been exposed to MTBE?

MTBE and its breakdown product, butyl alcohol, can be detected in your breath, blood, or urine for up to 1 or 2 days after exposure. These tests aren't available at most doctors' offices, but can be done at special laboratories that have the right equipment. There is no other test specific to determining MTBE exposure.

Has the federal government made recommendations to protect human health?

The EPA has issued guidelines recommending that, to protect children, drinking water levels of MTBE not exceed 4 milligrams per liter of water (4 mg/L) for an exposure of 1-10 days, and 3 mg/L for longer-term exposures.

The American Conference of Governmental Industrial Hygienists (ACGIH) has recommended an exposure limit of 40 parts of MTBE per million parts of air (40 ppm) for an 8-hour workday, 40-hour workweek.

Glossary

Carcinogenicity: Ability to cause cancer.

CAS: Chemical Abstracts Service.

Evaporate: To change into a vapor or gas.

Milligram (mg): One thousandth of a gram.

ppm: Parts per million.

Sediment: Mud and debris that have settled to the bottom of a body of water.

References

This ToxFAQs information is taken from the 1996 Toxicological Profile for Methyl *tert*-Butyl Ether produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

NAPHTHALENE
CAS # 91-20-3

1-METHYLNAPHTHALENE
CAS # 90-12-0

2-METHYLNAPHTHALENE
CAS # 91-57-6

This fact sheet answers the most frequently asked health questions (FAQs) about naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because these substances may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene happens mostly from breathing air contaminated from the burning of wood, tobacco, or fossil fuels, industrial discharges, or moth repellents. Exposure to large amounts of naphthalene may damage or destroy some of your red blood cells. Naphthalene has caused cancer in animals. Naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene have been found in at least 687, 36, and 412, respectively, of the 1,662 National Priority List sites identified by the Environmental Protection Agency (EPA).

What are naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene?

Naphthalene is a white solid that evaporates easily. Fuels such as petroleum and coal contain naphthalene. It is also called white tar, and tar camphor, and has been used in mothballs and moth flakes. Burning tobacco or wood produces naphthalene. It has a strong, but not unpleasant smell. The major commercial use of naphthalene is in the manufacture of polyvinyl chloride (PVC) plastics. Its major consumer use is in moth repellents and toilet deodorant blocks.

1-Methylnaphthalene and 2-methylnaphthalene are naphthalene-related compounds. 1-Methylnaphthalene is a clear liquid and 2-methylnaphthalene is a solid; both can be smelled in air and in water at very low concentrations.

1-Methylnaphthalene and 2-methylnaphthalene are used to make other chemicals such as dyes and resins. 2-Methylnaphthalene is also used to make vitamin K.

What happens to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene when they enter the environment?

❏ Naphthalene enters the environment from industrial and domestic sources, and from accidental spills.

❏ Naphthalene can dissolve in water to a limited degree and may be present in drinking water from wells close to hazardous waste sites and landfills.

❏ Naphthalene can become weakly attached to soil or pass through soil into underground water.

❏ In air, moisture and sunlight break it down within 1 day. In water, bacteria break it down or it evaporates into the air.

❏ Naphthalene does not accumulate in the flesh of animals or fish that you might eat.

❏ 1-Methylnaphthalene and 2-methylnaphthalene are expected to act like naphthalene in air, water, or soil because they have similar chemical and physical properties.

How might I be exposed to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene?

❏ Breathing low levels in outdoor air.

❏ Breathing air contaminated from industrial discharges or smoke from burning wood, tobacco, or fossil fuels.

❏ Using or making moth repellents, coal tar products, dyes or inks could expose you to these chemicals in the air.

❏ Drinking water from contaminated wells.

❏ Touching fabrics that are treated with moth repellents containing naphthalene.

❏ Exposure to naphthalene, 1-methylnaphthalene and 2-methylnaphthalene from eating foods or drinking beverages is unlikely.

How can naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene affect my health?

Exposure to large amounts of naphthalene may damage or destroy some of your red blood cells. This could cause you to have too few red blood cells until your body replaces the destroyed cells. This condition is called hemolytic anemia. Some symptoms of hemolytic anemia are fatigue, lack of appetite, restlessness, and pale skin. Exposure to large amounts of naphthalene may also cause nausea, vomiting, diarrhea, blood in the urine, and a yellow color to the skin. Animals sometimes develop cloudiness in their eyes after swallowing high amounts of naphthalene. It is not clear whether this also develops in people. Rats and mice that breathed naphthalene vapors daily for a lifetime developed irritation and inflammation of their nose and lungs. It is unclear if naphthalene

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causes reproductive effects in animals; most evidence says it does not.

There are no studies of humans exposed to 1-methylnaphthalene or 2-methylnaphthalene.

Mice fed food containing 1-methylnaphthalene and 2-methylnaphthalene for most of their lives had part of their lungs filled with an abnormal material.

How likely are naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene to cause cancer?

There is no direct evidence in humans that naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene cause cancer. However, cancer from naphthalene exposure has been seen in animal studies. Some female mice that breathed naphthalene vapors daily for a lifetime developed lung tumors. Some male and female rats exposed to naphthalene in a similar manner also developed nose tumors.

Based on the results from animal studies, the Department of Health and Humans Services (DHHS) concluded that naphthalene is reasonably anticipated to be a human carcinogen. The International Agency for Research on Cancer (IARC) concluded that naphthalene is possibly carcinogenic to humans. The EPA determined that naphthalene is a possible human carcinogen (Group C) and that the data are inadequate to assess the human carcinogenic potential of 2-methylnaphthalene.

How can naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene affect children?

Hospitals have reported many cases of hemolytic anemia in children, including newborns and infants, who either ate naphthalene mothballs or deodorants cakes or who were in close contact with clothing or blankets stored in naphthalene mothballs. Naphthalene can move from a pregnant woman's blood to the unborn baby's blood. Naphthalene has been detected in some samples of breast milk from the general U.S. population, but not at levels that are expected to be of concern.

There is no information on whether naphthalene has affected development in humans. No developmental abnormalities were observed in the offspring from rats, mice, and rabbits fed naphthalene during pregnancy.

We do not have any information on possible health effects of 1-methylnaphthalene or 2-methylnaphthalene on children.

How can families reduce the risks of exposure to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene?

❑ Families can reduce the risks of exposure to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene by avoiding smoking tobacco, generating smoke during cooking, or using fireplaces or heating appliances in the their homes.

❑ If families use naphthalene-containing moth repellents, the material should be enclosed in containers that prevent vapors from escaping, and kept out of the reach from children.

❑ Blankets and clothing stored with naphthalene moth repellents should be aired outdoors to remove naphthalene odors and washed before they are used.

❑ Families should inform themselves of the contents of air deodorizers that are used in their homes and refrain from using deodorizers with naphthalene.

Is there a medical test to determine whether I've been exposed to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene?

Tests are available that measure levels of these chemicals and their breakdown products in samples of urine, feces, blood, maternal milk, or body fat. These tests are not routinely available in a doctor's office because they require special equipment, but samples can be sent to special testing laboratories. These tests cannot determine exactly how much naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene you were exposed to or predict whether harmful effects will occur. If the samples are collected within a day or two of exposure, then the tests can show if you were exposed to a large or small amount of naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene.

Has the federal government made recommendations to protect human health?

The EPA recommends that children not drink water with over 0.5 parts per million (0.5 ppm) naphthalene for more than 10 days or over 0.4 ppm for any longer than 7 years. Adults should not drink water with more than 1 ppm for more than 7 years. For water consumed over a lifetime (70 years), the EPA suggests that it contain no more than 0.1 ppm naphthalene.

The Occupational Safety and Health Administration (OSHA) set a limit of 10 ppm for the level of naphthalene in workplace air during an 8-hour workday, 40-hour workweek. The National Institute for Occupational Safety and Health (NIOSH) considers more than 500 ppm of naphthalene in air to be immediately dangerous to life or health. This is the exposure level of a chemical that is likely to impair a worker's ability to leave a contaminate area and therefore, results in permanent health problems or death.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2005. Toxicological Profile for Naphthalene, 1-Methylnaphthalene, and 2-Methylnaphthalene (Update). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)

Agency for Toxic Substances and Disease Registry ToxFAQs **September 1996**

This fact sheet answers the most frequently asked health questions (FAQs) about polycyclic aromatic hydrocarbons (PAHs). For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to polycyclic aromatic hydrocarbons usually occurs by breathing air contaminated by wild fires or coal tar, or by eating foods that have been grilled. PAHs have been found in at least 600 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are polycyclic aromatic hydrocarbons?

(Pronounced pŏl′ĭ-sī′klĭk ăr′ə-măt′ĭk hī′drə-kar′bənz)

Polycyclic aromatic hydrocarbons (PAHs) are a group of over 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat. PAHs are usually found as a mixture containing two or more of these compounds, such as soot.

Some PAHs are manufactured. These pure PAHs usually exist as colorless, white, or pale yellow-green solids. PAHs are found in coal tar, crude oil, creosote, and roofing tar, but a few are used in medicines or to make dyes, plastics, and pesticides.

What happens to PAHs when they enter the environment?

- PAHs enter the air mostly as releases from volcanoes, forest fires, burning coal, and automobile exhaust.
- PAHs can occur in air attached to dust particles.
- Some PAH particles can readily evaporate into the air from soil or surface waters.
- PAHs can break down by reacting with sunlight and other chemicals in the air, over a period of days to weeks.
- PAHs enter water through discharges from industrial and wastewater treatment plants.
- Most PAHs do not dissolve easily in water. They stick to solid particles and settle to the bottoms of lakes or rivers.
- Microorganisms can break down PAHs in soil or water after a period of weeks to months.
- In soils, PAHs are most likely to stick tightly to particles; certain PAHs move through soil to contaminate underground water.
- PAH contents of plants and animals may be much higher than PAH contents of soil or water in which they live.

How might I be exposed to PAHs?

- Breathing air containing PAHs in the workplace of coking, coal-tar, and asphalt production plants; smokehouses; and municipal trash incineration facilities.
- Breathing air containing PAHs from cigarette smoke, wood smoke, vehicle exhausts, asphalt roads, or agricultural burn smoke.
- Coming in contact with air, water, or soil near hazardous waste sites.
- Eating grilled or charred meats; contaminated cereals, flour, bread, vegetables, fruits, meats; and processed or pickled foods.
- Drinking contaminated water or cow's milk.

ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html

- Nursing infants of mothers living near hazardous waste sites may be exposed to PAHs through their mother's milk.

How can PAHs affect my health?

Mice that were fed high levels of one PAH during pregnancy had difficulty reproducing and so did their offspring. These offspring also had higher rates of birth defects and lower body weights. It is not known whether these effects occur in people.

Animal studies have also shown that PAHs can cause harmful effects on the skin, body fluids, and ability to fight disease after both short- and long-term exposure. But these effects have not been seen in people.

How likely are PAHs to cause cancer?

The Department of Health and Human Services (DHHS) has determined that some PAHs may reasonably be expected to be carcinogens.

Some people who have breathed or touched mixtures of PAHs and other chemicals for long periods of time have developed cancer. Some PAHs have caused cancer in laboratory animals when they breathed air containing them (lung cancer), ingested them in food (stomach cancer), or had them applied to their skin (skin cancer).

Is there a medical test to show whether I've been exposed to PAHs?

In the body, PAHs are changed into chemicals that can attach to substances within the body. There are special tests that can detect PAHs attached to these substances in body tissues or blood. However, these tests cannot tell whether any health effects will occur or find out the extent or source of your exposure to the PAHs. The tests aren't usually available in your doctor's office because special equipment is needed to conduct them.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) has set a limit of 0.2 milligrams of PAHs per cubic meter of air (0.2 mg/m^3). The OSHA Permissible Exposure Limit (PEL) for mineral oil mist that contains PAHs is 5 mg/m^3 averaged over an 8-hour exposure period.

The National Institute for Occupational Safety and Health (NIOSH) recommends that the average workplace air levels for coal tar products not exceed 0.1 mg/m^3 for a 10-hour workday, within a 40-hour workweek. There are other limits for workplace exposure for things that contain PAHs, such as coal, coal tar, and mineral oil.

Glossary

Carcinogen: A substance that can cause cancer.

Ingest: Take food or drink into your body.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for polycyclic aromatic hydrocarbons. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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POLYCHLORINATED BIPHENYLS

Division of Toxicology ToxFAQs™ **February 2001**

This fact sheet answers the most frequently asked health questions (FAQs) about polychlorinated biphenyls. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Polychlorinated biphenyls (PCBs) are a mixture of individual chemicals which are no longer produced in the United States, but are still found in the environment. Health effects that have been associated with exposure to PCBs include acne-like skin conditions in adults and neurobehavioral and immunological changes in children. PCBs are known to cause cancer in animals. PCBs have been found in at least 500 of the 1,598 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are polychlorinated biphenyls?

Polychlorinated biphenyls are mixtures of up to 209 individual chlorinated compounds (known as congeners). There are no known natural sources of PCBs. PCBs are either oily liquids or solids that are colorless to light yellow. Some PCBs can exist as a vapor in air. PCBs have no known smell or taste. Many commercial PCB mixtures are known in the U.S. by the trade name Aroclor.

PCBs have been used as coolants and lubricants in transformers, capacitors, and other electrical equipment because they don't burn easily and are good insulators. The manufacture of PCBs was stopped in the U.S. in 1977 because of evidence they build up in the environment and can cause harmful health effects. Products made before 1977 that may contain PCBs include old fluorescent lighting fixtures and electrical devices containing PCB capacitors, and old microscope and hydraulic oils.

What happens to PCBs when they enter the environment?

❑ PCBs entered the air, water, and soil during their manufacture, use, and disposal; from accidental spills and leaks during their transport; and from leaks or fires in products containing PCBs.

❑ PCBs can still be released to the environment from hazardous waste sites; illegal or improper disposal of industrial wastes and consumer products; leaks from old electrical transformers containing PCBs; and burning of some wastes in incinerators.

❑ PCBs do not readily break down in the environment and thus may remain there for very long periods of time. PCBs can travel long distances in the air and be deposited in areas far away from where they were released. In water, a small amount of PCBs may remain dissolved, but most stick to organic particles and bottom sediments. PCBs also bind strongly to soil.

❑ PCBs are taken up by small organisms and fish in water. They are also taken up by other animals that eat these aquatic animals as food. PCBs accumulate in fish and marine mammals, reaching levels that may be many thousands of times higher than in water.

How might I be exposed to PCBs?

❑ Using old fluorescent lighting fixtures and electrical devices and appliances, such as television sets and refrigerators, that were made 30 or more years ago. These items may leak small amounts of PCBs into the air when they get hot during operation, and could be a source of skin exposure.

❑ Eating contaminated food. The main dietary sources of PCBs are fish (especially sportfish caught in contaminated lakes or rivers), meat, and dairy products.

❑ Breathing air near hazardous waste sites and drinking contaminated well water.

❑ In the workplace during repair and maintenance of PCB transformers; accidents, fires or spills involving transformers, fluorescent lights, and other old electrical devices; and disposal of PCB materials.

How can PCBs affect my health?

The most commonly observed health effects in people exposed to large amounts of PCBs are skin conditions such as acne and rashes. Studies in exposed workers have shown changes in blood and urine that may indicate liver damage. PCB exposures in the general population are not likely to result in skin and liver effects. Most of the studies of health effects of PCBs in the general population examined children of mothers who were exposed to PCBs.

Animals that ate food containing large amounts of PCBs for short periods of time had mild liver damage and some died. Animals that ate smaller amounts of PCBs in food over several weeks or months developed various kinds of health effects, including anemia; acne-like skin conditions; and liver, stomach, and thyroid gland injuries. Other effects

of PCBs in animals include changes in the immune system, behavioral alterations, and impaired reproduction. PCBs are not known to cause birth defects.

How likely are PCBs to cause cancer?

Few studies of workers indicate that PCBs were associated with certain kinds of cancer in humans, such as cancer of the liver and biliary tract. Rats that ate food containing high levels of PCBs for two years developed liver cancer. The Department of Health and Human Services (DHHS) has concluded that PCBs may reasonably be anticipated to be carcinogens. The EPA and the International Agency for Research on Cancer (IARC) have determined that PCBs are probably carcinogenic to humans.

How can PCBs affect children?

Women who were exposed to relatively high levels of PCBs in the workplace or ate large amounts of fish contaminated with PCBs had babies that weighed slightly less than babies from women who did not have these exposures. Babies born to women who ate PCB-contaminated fish also showed abnormal responses in tests of infant behavior. Some of these behaviors, such as problems with motor skills and a decrease in short-term memory, lasted for several years. Other studies suggest that the immune system was affected in children born to and nursed by mothers exposed to increased levels of PCBs. There are no reports of structural birth defects caused by exposure to PCBs or of health effects of PCBs in older children. The most likely way infants will be exposed to PCBs is from breast milk. Transplacental transfers of PCBs were also reported In most cases, the benefits of breast-feeding outweigh any risks from exposure to PCBs in mother's milk.

How can families reduce the risk of exposure to PCBs?

❑ You and your children may be exposed to PCBs by eating fish or wildlife caught from contaminated locations. Certain states, Native American tribes, and U.S. territories have issued advisories to warn people about PCB-contaminated fish and fish-eating wildlife. You can reduce your family's exposure to PCBs by obeying these advisories.

❑ Children should be told not play with old appliances, electrical equipment, or transformers, since they may contain PCBs.

❑ Children should be discouraged from playing in the dirt near hazardous waste sites and in areas where there was a transformer fire. Children should also be discouraged from eating dirt and putting dirty hands, toys or other objects in their mouths, and should wash hands frequently.

❑ If you are exposed to PCBs in the workplace it is possible to carry them home on your clothes, body, or tools. If this is the case, you should shower and change clothing before leaving work, and your work clothes should be kept separate from other clothes and laundered separately.

Is there a medical test to show whether I've been exposed to PCBs?

Tests exist to measure levels of PCBs in your blood, body fat, and breast milk, but these are not routinely conducted. Most people normally have low levels of PCBs in their body because nearly everyone has been environmentally exposed to PCBs. The tests can show if your PCB levels are elevated, which would indicate past exposure to above-normal levels of PCBs, but cannot determine when or how long you were exposed or whether you will develop health effects.

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 0.0005 milligrams of PCBs per liter of drinking water (0.0005 mg/L). Discharges, spills or accidental releases of 1 pound or more of PCBs into the environment must be reported to the EPA. The Food and Drug Administration (FDA) requires that infant foods, eggs, milk and other dairy products, fish and shellfish, poultry and red meat contain no more than 0.2-3 parts of PCBs per million parts (0.2-3 ppm) of food. Many states have established fish and wildlife consumption advisories for PCBs.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2000. Toxicological profile for polychlorinated biphenyls (PCBs). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html . ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

TETRACHLOROETHYLENE
CAS # 127-18-4

This fact sheet answers the most frequently asked health questions (FAQs) about tetrachloroethylene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Tetrachloroethylene is a manufactured chemical used for dry cleaning and metal degreasing. Exposure to very high concentrations of tetrachloroethylene can cause dizziness, headaches, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, and death. Tetrachloroethylene has been found in at least 771 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is tetrachloroethylene?

(Pronounced tĕt′rə-klôr′ ō-ĕth′ə-lēn′)

Tetrachloroethylene is a manufactured chemical that is widely used for dry cleaning of fabrics and for metal-degreasing. It is also used to make other chemicals and is used in some consumer products.

Other names for tetrachloroethylene include perchloroethylene, PCE, and tetrachloroethene. It is a nonflammable liquid at room temperature. It evaporates easily into the air and has a sharp, sweet odor. Most people can smell tetrachloroethylene when it is present in the air at a level of 1 part tetrachloroethylene per million parts of air (1 ppm) or more, although some can smell it at even lower levels.

What happens to tetrachloroethylene when it enters the environment?

- Much of the tetrachloroethylene that gets into water or soil evaporates into the air.
- Microorganisms can break down some of the tetrachloroethylene in soil or underground water.
- In the air, it is broken down by sunlight into other chemicals or brought back to the soil and water by rain.
- It does not appear to collect in fish or other animals that live in water.

How might I be exposed to tetrachloroethylene?

- When you bring clothes from the dry cleaners, they will release small amounts of tetrachloroethylene into the air.
- When you drink water containing tetrachloroethylene, you are exposed to it.

How can tetrachloroethylene affect my health?

High concentrations of tetrachloroethylene (particularly in closed, poorly ventilated areas) can cause dizziness, headache, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, and death.

Irritation may result from repeated or extended skin contact with it. These symptoms occur almost entirely in work (or hobby) environments when people have been accidentally exposed to high concentrations or have intentionally used tetrachloroethylene to get a "high."

In industry, most workers are exposed to levels lower than those causing obvious nervous system effects. The health effects of breathing in air or drinking water with low levels of tetrachloroethylene are not known.

Results from some studies suggest that women who work in dry cleaning industries where exposures to tetrachloroethyl-

ene can be quite high may have more menstrual problems and spontaneous abortions than women who are not exposed. However, it is not known if tetrachloroethylene was responsible for these problems because other possible causes were not considered.

Results of animal studies, conducted with amounts much higher than those that most people are exposed to, show that tetrachloroethylene can cause liver and kidney damage. Exposure to very high levels of tetrachloroethylene can be toxic to the unborn pups of pregnant rats and mice. Changes in behavior were observed in the offspring of rats that breathed high levels of the chemical while they were pregnant.

How likely is tetrachloroethylene to cause cancer?

The Department of Health and Human Services (DHHS) has determined that tetrachloroethylene may reasonably be anticipated to be a carcinogen. Tetrachloroethylene has been shown to cause liver tumors in mice and kidney tumors in male rats.

Is there a medical test to show whether I've been exposed to tetrachloroethylene?

One way of testing for tetrachloroethylene exposure is to measure the amount of the chemical in the breath, much the same way breath-alcohol measurements are used to determine the amount of alcohol in the blood.

Because it is stored in the body's fat and slowly released into the bloodstream, tetrachloroethylene can be detected in the breath for weeks following a heavy exposure.

Tetrachloroethylene and trichloroacetic acid (TCA), a breakdown product of tetrachloroethylene, can be detected in the blood. These tests are relatively simple to perform. These tests aren't available at most doctors' offices, but can be performed at special laboratories that have the right equipment.

Because exposure to other chemicals can produce the same breakdown products in the urine and blood, the tests for breakdown products cannot determine if you have been exposed to tetrachloroethylene or the other chemicals.

Has the federal government made recommendations to protect human health?

The EPA maximum contaminant level for the amount of tetrachloroethylene that can be in drinking water is 0.005 milligrams tetrachloroethylene per liter of water (0.005 mg/L).

The Occupational Safety and Health Administration (OSHA) has set a limit of 100 ppm for an 8-hour workday over a 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) recommends that tetrachloroethylene be handled as a potential carcinogen and recommends that levels in workplace air should be as low as possible.

Glossary

Carcinogen: A substance with the ability to cause cancer.

CAS: Chemical Abstracts Service.

Milligram (mg): One thousandth of a gram.

Nonflammable: Will not burn.

References

This ToxFAQs information is taken from the 1997 Toxicological Profile for Tetrachloroethylene (update) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone:1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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STODDARD SOLVENT
CAS # 8052-41-3

Agency for Toxic Substances and Disease Registry ToxFAQs **September 1996**

This fact sheet answers the most frequently asked health questions (FAQs) about Stoddard solvent. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to Stoddard solvent occurs mainly in the workplace. People who breathe Stoddard solvent can experience headaches; dizziness; and eye, skin, or throat irritation. This substance has been found in at least 7 of the 1,430 National Priorities List Sites identified by the Environmental Protection Agency (EPA).

What is Stoddard solvent?

(Pronounced stŏd′ərd sŏl′vənt)

Stoddard solvent is a colorless, flammable liquid that smells and tastes like kerosene. It will turn into a vapor at temperatures of 150–200 °C.

Stoddard solvent is a petroleum mixture that is also known as dry cleaning safety solvent, petroleum solvent, and varnoline; its registered trade names are Texsolve S® and Varsol 1®. It is a chemical mixture that is similar to white spirits.

Stoddard solvent is used as a paint thinner; in some types of photocopier toners, printing inks, and adhesives; as a dry cleaning solvent; and as a general cleaner and degreaser.

Use of trade names is for identification only and does not imply endorsement by the Agency for Toxic Substances and Disease Registry (ATSDR) the Public Health Service, or the U.S. Department of Health and Human Services (DHHS).

What happens to Stoddard solvent when it enters the environment?

Because Stoddard solvent is a mixture of many chemicals, these chemicals may react differently in the environment. Some of these chemicals can:

- Be broken down by sunlight or other chemicals in the air;
- Attach to particles in soil or water;
- Sink down to the sediment in water; and
- Be broken down by microorganisms in water, soil, or sediment.

It is not known whether Stoddard solvent will build up in plants or animals living in contaminated soil or water, but some of the chemicals that make up Stoddard solvent might build up in these situations.

How might I be exposed to Stoddard solvent?

- Using products containing Stoddard solvent such as a paint or paint thinner, and breathing the vapors, or getting the vapors in your eyes.
- Breathing contaminated air where Stoddard solvent is manufactured, used, or spilled.
- Breathing contaminated air at or near hazardous waste sites.
- Drinking or bathing in contaminated water.
- Ingesting contaminated soil or water near waste sites containing Stoddard solvent.

ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html

- Touching contaminated soil or water.

How can Stoddard solvent affect my health?

Most of the information on the health effects of Stoddard solvent comes from studies in which it is breathed; there are fewer studies of exposure to the eyes or skin.

Exposure to Stoddard solvent in the air can affect your nervous system and cause dizziness, headaches, or a prolonged reaction time. It can also cause eye, skin, or throat irritation.

Rats, cats, and dogs that breathed in large amounts of Stoddard solvent for several hours suffered seizures. Breathing Stoddard solvent has caused bronchitis in guinea pigs, but neither seizures nor bronchitis have been reported when humans breathed it. The effects of swallowing Stoddard solvent are not known.

It is not known whether Stoddard solvent can cause birth defects or affect reproduction.

How likely is Stoddard solvent to cause cancer?

The International Agency for Research on Cancer (IARC) has determined that Stoddard solvent is not classifiable as to its carcinogenicity to humans.

Very few studies have been located that study the carcinogenic effects of Stoddard solvent in humans or animals.

Is there a medical test to show whether I've been exposed to Stoddard solvent?

There is no routinely used test to show whether you have been exposed to Stoddard solvent. Because Stoddard solvent is a mixture of many chemicals, some of these chemicals can be detected in your breath, blood, urine, and fat. However, the tests cannot tell you if you have been exposed to the specific mixture of chemicals found in Stoddard solvent. They also cannot tell whether you will suffer any health effects.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) has set a maximum exposure limit of 500 parts of Stoddard solvent per 1 million parts of air (500 ppm) for an 8-hour workday, 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) recommends that the average workplace air levels not be more than 60 ppm in workplace air for a 10-hour workday, 40-hour workweek.

Glossary

Carcinogenicity: Ability to cause cancer.

CAS: Chemical Abstracts Service.

Ingesting: Taking food or drink into your body.

ppm: Parts per million.

Sediment: Mud and debris that have settled at the bottom of a body of water.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for Stoddard solvent. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone:1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

TRICHLOROETHYLENE

CAS # 79-01-6

Division of Toxicology ToxFAQs™ **July 2003**

This fact sheet answers the most frequently asked health questions (FAQs) about trichloroethylene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Trichloroethylene is a colorless liquid which is used as a solvent for cleaning metal parts. Drinking or breathing high levels of trichloroethylene may cause nervous system effects, liver and lung damage, abnormal heartbeat, coma, and possibly death. Trichloroethylene has been found in at least 852 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is trichloroethylene?

Trichloroethylene (TCE) is a nonflammable, colorless liquid with a somewhat sweet odor and a sweet, burning taste. It is used mainly as a solvent to remove grease from metal parts, but it is also an ingredient in adhesives, paint removers, typewriter correction fluids, and spot removers.

Trichloroethylene is not thought to occur naturally in the environment. However, it has been found in underground water sources and many surface waters as a result of the manufacture, use, and disposal of the chemical.

What happens to trichloroethylene when it enters the environment?

- Trichloroethylene dissolves a little in water, but it can remain in ground water for a long time.
- Trichloroethylene quickly evaporates from surface water, so it is commonly found as a vapor in the air.
- Trichloroethylene evaporates less easily from the soil than from surface water. It may stick to particles and remain for a long time.
- Trichloroethylene may stick to particles in water, which will cause it to eventually settle to the bottom sediment.
- Trichloroethylene does not build up significantly in plants and animals.

How might I be exposed to trichloroethylene?

- Breathing air in and around the home which has been contaminated with trichloroethylene vapors from shower water or household products such as spot removers and typewriter correction fluid.
- Drinking, swimming, or showering in water that has been contaminated with trichloroethylene.
- Contact with soil contaminated with trichloroethylene, such as near a hazardous waste site.
- Contact with the skin or breathing contaminated air while manufacturing trichloroethylene or using it at work to wash paint or grease from skin or equipment.

How can trichloroethylene affect my health?

Breathing small amounts may cause headaches, lung irritation, dizziness, poor coordination, and difficulty concentrating.

Breathing large amounts of trichloroethylene may cause impaired heart function, unconsciousness, and death. Breathing it for long periods may cause nerve, kidney, and liver damage.

ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html

Drinking large amounts of trichloroethylene may cause nausea, liver damage, unconsciousness, impaired heart function, or death.

Drinking small amounts of trichloroethylene for long periods may cause liver and kidney damage, impaired immune system function, and impaired fetal development in pregnant women, although the extent of some of these effects is not yet clear.

Skin contact with trichloroethylene for short periods may cause skin rashes.

How likely is trichloroethylene to cause cancer?

Some studies with mice and rats have suggested that high levels of trichloroethylene may cause liver, kidney, or lung cancer. Some studies of people exposed over long periods to high levels of trichloroethylene in drinking water or in workplace air have found evidence of increased cancer. Although, there are some concerns about the studies of people who were exposed to trichloroethylene, some of the effects found in people were similar to effects in animals.

In its 9th Report on Carcinogens, the National Toxicology Program (NTP) determined that trichloroethylene is "reasonably anticipated to be a human carcinogen." The International Agency for Research on Cancer (IARC) has determined that trichloroethylene is "probably carcinogenic to humans."

Is there a medical test to show whether I've been exposed to trichloroethylene?

If you have recently been exposed to trichloroethylene, it can be detected in your breath, blood, or urine. The breath test, if it is performed soon after exposure, can tell if you have been exposed to even a small amount of trichloroethylene.

Exposure to larger amounts is assessed by blood and urine tests, which can detect trichloroethylene and many of its breakdown products for up to a week after exposure. However, exposure to other similar chemicals can produce the same breakdown products, so their detection is not absolute proof of exposure to trichloroethylene. This test isn't available at most doctors' offices, but can be done at special laboratories that have the right equipment.

Has the federal government made recommendations to protect human health?

The EPA has set a maximum contaminant level for trichloroethylene in drinking water at 0.005 milligrams per liter (0.005 mg/L) or 5 parts of TCE per billion parts water.

The EPA has also developed regulations for the handling and disposal of trichloroethylene.

The Occupational Safety and Health Administration (OSHA) has set an exposure limit of 100 parts of trichloroethylene per million parts of air (100 ppm) for an 8-hour workday, 40-hour workweek.

Glossary

Carcinogenicity: The ability of a substance to cause cancer.
CAS: Chemical Abstracts Service.
Evaporate: To change into a vapor or gas.
Milligram (mg): One thousandth of a gram.
Nonflammable: Will not burn.
ppm: Parts per million.
Sediment: Mud and debris that have settled to the bottom of a body of water.
Solvent: A chemical that dissolves other substances.

References

This ToxFAQs information is taken from the 1997 Toxicological Profile for Trichloroethylene (update) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html . ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

TOLUENE
CAS # 108-88-3

Division of Toxicology ToxFAQs™ **February 2001**

This fact sheet answers the most frequently asked health questions (FAQs) about toluene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to toluene occurs from breathing contaminated workplace air, in automobile exhaust, some consumer products paints, paint thinners, fingernail polish, lacquers, and adhesives. Toluene affects the nervous system. Toluene has been found at 959 of the 1,591 National Priority List sites identified by the Environmental Protection Agency

What is toluene?

Toluene is a clear, colorless liquid with a distinctive smell. Toluene occurs naturally in crude oil and in the tolu tree. It is also produced in the process of making gasoline and other fuels from crude oil and making coke from coal.

Toluene is used in making paints, paint thinners, fingernail polish, lacquers, adhesives, and rubber and in some printing and leather tanning processes.

What happens to toluene when it enters the environment?

❑ Toluene enters the environment when you use materials that contain it. It can also enter surface water and groundwater from spills of solvents and petrolieum products as well as from leasking underground storage tanks at gasoline stations and other facilities.

❑ When toluene-containing products are placed in landfills or waste disposal sites, the toluene can enter the soil or water near the waste site.

❑ Toluene does not usually stay in the environment long.

❑ Toluene does not concentrate or buildup to high levels in animals.

How might I be exposed to toluene?

❑ Breathing contaminated workplace air or automobile exhaust.

❑ Working with gasoline, kerosene, heating oil, paints, and lacquers.

❑ Drinking contaminated well-water.

❑ Living near uncontrolled hazardous waste sites containing toluene products.

How can toluene affect my health?

Toluene may affect the nervous system. Low to moderate levles can cause tiredness, confusion, weakness, drunken-type actions, memory loss, nausea, loss of appetite, and

hearing and color vision loss. These symptoms usually disappear when exposure is stopped.

Inhaling High levels of toluene in a short time can make you feel light-headed, dizzy, or sleepy. It can also cause unconsciousness, and even death.

High levels of toluene may affect your kidneys.

How likely is toluene to cause cancer?

Studies in humans and animals generally indicate that toluene does not cause cancer.

The EPA has determined that the carcinogenicity of toluene can not be classified.

How can toluene affect children?

It is likely that health effects seen in children exposed to toluene will be similar to the effects seen in adults. Some studies in animals suggest that babies may be more sensitive than adults.

Breathing very high levels of toluene during pregnancy can result in children with birth defects and retard mental abilities, and growth. We do not know if toluene harms the unborn child if the mother is exposed to low levels of toluene during pregnancy.

How can families reduce the risk of exposure to toluene?

❑ Use toluene-containing products in well-ventilated areas.

❑ When not in use, toluene-containing products should be tightly covered to prevent evaporation into the air.

Is there a medical test to show whether I've been exposed to toluene?

There are tests to measure the level of toluene or its breakdown products in exhaled air, urine, and blood. To determine if you have been exposed to toluene, your urine or blood must be checked within 12 hours of exposure. Several other chemicals are also changed into the same breakdown products as toluene, so some of these tests are not specific for toluene.

Has the federal government made recommendations to protect human health?

EPA has set a limit of 1 milligram per liter of drinking water (1 mg/L).

Discharges, releases, or spills of more than 1,000 pounds of toluene must be reported to the National Response Center.

The Occupational Safety and Health Administration has set a limit of 200 parts toluene per million of workplace air (200 ppm).

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2000. Toxicological Profile for Toluene. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html . ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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TOTAL PETROLEUM HYDROCARBONS (TPH)

Agency for Toxic Substances and Disease Registry ToxFAQs **August 1999**

This fact sheet answers the most frequently asked health questions (FAQs) about total petroleum hydrocarbons (TPH). For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: TPH is a mixture of many different compounds. Everyone is exposed to TPH from many sources, including gasoline pumps, spilled oil on pavement, and chemicals used at home or work. Some TPH compounds can affect your nervous system, causing headaches and dizziness. TPH has been found in at least 23 of the 1,467 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are total petroleum hydrocarbons?

(Pronounced tōt′l pə-trō′lē-əm hī′drə-kär′bənz)

Total petroleum hydrocarbons (TPH) is a term used to describe a large family of several hundred chemical compounds that originally come from crude oil. Crude oil is used to make petroleum products, which can contaminate the environment. Because there are so many different chemicals in crude oil and in other petroleum products, it is not practical to measure each one separately. However, it is useful to measure the total amount of TPH at a site.

TPH is a mixture of chemicals, but they are all made mainly from hydrogen and carbon, called hydrocarbons. Scientists divide TPH into groups of petroleum hydrocarbons that act alike in soil or water. These groups are called petroleum hydrocarbon fractions. Each fraction contains many individual chemicals.

Some chemicals that may be found in TPH are hexane, jet fuels, mineral oils, benzene, toluene, xylenes, naphthalene, and fluorene, as well as other petroleum products and gasoline components. However, it is likely that samples of TPH will contain only some, or a mixture, of these chemicals.

What happens to TPH when it enters the environment?

- ❑ TPH may enter the environment through accidents, from industrial releases, or as byproducts from commercial or private uses.
- ❑ TPH may be released directly into water through spills or leaks.
- ❑ Some TPH fractions will float on the water and form surface films.
- ❑ Other TPH fractions will sink to the bottom sediments.
- ❑ Bacteria and microorganisms in the water may break down some of the TPH fractions.
- ❑ Some TPH fractions will move into the soil where they may stay for a long time.

How might I be exposed to TPH?

- ❑ Everyone is exposed to TPH from many sources.
- ❑ Breathing air at gasoline stations, using chemicals at home or work, or using certain pesticides.
- ❑ Drinking water contaminated with TPH.
- ❑ Working in occupations that use petroleum products.
- ❑ Living in an area near a spill or leak of petroleum products.
- ❑ Touching soil contaminated with TPH.

ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html

How can TPH affect my health?

Some of the TPH compounds can affect your central nervous system. One compound can cause headaches and dizziness at high levels in the air. Another compound can cause a nerve disorder called "peripheral neuropathy," consisting of numbness in the feet and legs. Other TPH compounds can cause effects on the blood, immune system, lungs, skin, and eyes.

Animal studies have shown effects on the lungs, central nervous system, liver, and kidney from exposure to TPH compounds. Some TPH compounds have also been shown to affect reproduction and the developing fetus in animals.

How likely is TPH to cause cancer?

The International Agency for Research on Cancer (IARC) has determined that one TPH compound (benzene) is carcinogenic to humans. IARC has determined that other TPH compounds (benzo[a]pyrene and gasoline) are probably and possibly carcinogenic to humans. Most of the other TPH compounds are considered not to be classifiable by IARC.

Is there a medical test to show whether I've been exposed to TPH?

There is no medical test that shows if you have been exposed to TPH. However, there are methods to determine if you have been exposed to some TPH compounds. Exposure to kerosene can be determined by its smell on the breath or clothing. Benzene can be measured in exhaled air and a breakdown product of benzene can be measured in urine. Other TPH compounds can be measured in blood, urine, breath, and some body tissues.

Has the federal government made recommendations to protect human health?

There are no regulations or advisories specific to TPH. The following are recommendations for some of the TPH fractions and compounds:

The EPA requires that spills or accidental releases into the environment of 10 pounds or more of benzene be reported to the EPA.

The Occupational Safety and Health Administration has set an exposure limit of 500 parts of petroleum distillates per million parts of air (500 ppm) for an 8-hour workday, 40-hour workweek.

Glossary

Carcinogenicity: Ability to cause cancer.

CAS: Chemical Abstracts Service.

Immune system: Body organs and cells that fight disease.

Pesticides: Chemicals used to kill pests.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological profile for total petroleum hydrocarbons (TPH). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

VINYL CHLORIDE

CAS # 75-01-4

Division of Toxicology and Environmental Medicine ToxFAQs™ **July 2006**

This fact sheet answers the most frequently asked health questions (FAQs) about vinyl chloride. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to vinyl chloride occurs mainly in the workplace. Breathing high levels of vinyl chloride for short periods of time can cause dizziness, sleepiness, unconsciousness, and at extremely high levels can cause death. Breathing vinyl chloride for long periods of time can result in permanent liver damage, immune reactions, nerve damage, and liver cancer. This substance has been found in at least 616 of the 1,662 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is vinyl chloride?

Vinyl chloride is a colorless gas. It burns easily and it is not stable at high temperatures. It has a mild, sweet odor. It is a manufactured substance that does not occur naturally. It can be formed when other substances such as trichloroethane, trichloroethylene, and tetrachloroethylene are broken down. Vinyl chloride is used to make polyvinyl chloride (PVC). PVC is used to make a variety of plastic products, including pipes, wire and cable coatings, and packaging materials.

Vinyl chloride is also known as chloroethene, chloroethylene, and ethylene monochloride.

What happens to vinyl chloride when it enters the environment?

❑ Liquid vinyl chloride evaporates easily. Vinyl chloride in water or soil evaporates rapidly if it is near the surface.
❑ Vinyl chloride in the air breaks down in a few days to other substances, some of which can be harmful.
❑ Small amounts of vinyl chloride can dissolve in water.
❑ Vinyl chloride is unlikely to build up in plants or animals that you might eat.

How might I be exposed to vinyl chloride?

❑ Breathing vinyl chloride that has been released from plastics industries, hazardous waste sites, and landfills.
❑ Breathing vinyl chloride in air or during contact with your skin or eyes in the workplace.
❑ Drinking water from contaminated wells.

How can vinyl chloride affect my health?

Breathing high levels of vinyl chloride can cause you to feel dizzy or sleepy. Breathing very high levels can cause you to pass out, and breathing extremely high levels can cause death.

Some people who have breathed vinyl chloride for several years have changes in the structure of their livers. People are more likely to develop these changes if they breathe high levels of vinyl chloride. Some people who work with vinyl chloride have nerve damage and develop immune reactions. The lowest levels that produce liver changes, nerve damage, and immune reaction in people are not known. Some workers exposed to very high levels of vinyl chloride have problems with the blood flow in their hands. Their fingers turn white and hurt when they go into the cold.

The effects of drinking high levels of vinyl chloride are unknown. If you spill vinyl chloride on your skin, it will cause numbness, redness, and blisters.

Animal studies have shown that long-term exposure to vinyl chloride can damage the sperm and testes.

How likely is vinyl chloride to cause cancer?

The U.S. Department of Health and Human Services has determined that vinyl chloride is a known carcinogen. Studies in workers who have breathed vinyl chloride over many years showed an increased risk of liver, brain, lung cancer, and some cancers of the blood have also been observed in workers.

How can vinyl chloride affect children?

It has not been proven that vinyl chloride causes birth defects in humans, but studies in animals suggest that vinyl chloride might affect growth and development. Animal studies also suggest that infants and young children might be more susceptible than adults to vinyl chloride-induced cancer.

How can families reduce the risk of exposure to vinyl chloride?

Tobacco smoke contains low levels of vinyl chloride, so limiting your family's exposure to cigarette or cigar smoke may help reduce their exposure to vinyl chloride.

Is there a medical test to show whether I've been exposed to vinyl chloride?

The results of several tests can sometimes show if you have been exposed to vinyl chloride. Vinyl chloride can be measured in your breath, but the test must be done shortly after exposure. This is not helpful for measuring very low levels of vinyl chloride.

The amount of the major breakdown product of vinyl chloride, thiodiglycolic acid, in the urine may give some information about exposure. However, this test must be done shortly after exposure and does not reliably indicate the level of exposure.

Has the federal government made recommendations to protect human health?

Vinyl chloride is regulated in drinking water, food, and air. The EPA requires that the amount of vinyl chloride in drinking water not exceed 0.002 milligrams per liter (mg/L) of water.

The Occupational Safety and Health Administration (OSHA) has set a limit of 1 part vinyl chloride per 1 million parts of air (1 ppm) in the workplace.

The Food and Drug Administration (FDA) regulates the vinyl chloride content of various plastics. These include plastics that carry liquids and plastics that contact food. The limits for vinyl chloride content vary depending on the nature of the plastic and its use.

Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2006. Toxicological Profile for Vinyl Chloride (Update). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

XYLENE
CAS # 1330-20-7

Division of Toxicology and Environmental Medicine ToxFAQs™ **September 2005**

This fact sheet answers the most frequently asked health questions (FAQs) about xylene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to xylene occurs in the workplace and when you use paint, gasoline, paint thinners and other products that contain it. People who breathe high levels may have dizziness, confusion, and a change in their sense of balance. Xylene has been found in at least 844 of the 1,662 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is xylene?

There are three forms of xylene in which the methyl groups vary on the benzene ring: *meta*-xylene, *ortho*-xylene, and *para*-xylene (*m*-, *o*-, and *p*-xylene). These different forms are referred to as isomers.

Xylene is a colorless, sweet-smelling liquid that catches on fire easily. It occurs naturally in petroleum and coal tar. Chemical industries produce xylene from petroleum. It is one of the top 30 chemicals produced in the United States in terms of volume.

Xylene is used as a solvent and in the printing, rubber, and leather industries. It is also used as a cleaning agent, a thinner for paint, and in paints and varnishes. It is found in small amounts in airplane fuel and gasoline.

What happens to xylene when it enters the environment?

❏ Xylene evaporates quickly from the soil and surface water into the air.
❏ In the air, it is broken down by sunlight into other less harmful chemicals.
❏ It is broken down by microorganisms in soil and water.
❏ Only a small amount of it builds up in fish, shellfish, plants, and other animals living in xylene-contaminated water.

How might I be exposed to xylene?

❏ Using a variety of consumer products including gasoline, pain, varnish, shellac, rust preventives, and cigarette smoke. Xylene can be absorbed through the respiratory tract and through the skin.
❏ Ingesting xylene-contaminated food or water, although these levels are likely to be very low.
❏ Working in a job that involves the use of xylene such as painters, paint industry workers, biomedical laboratory workers, automobile garage workers, metal workers, and furniture refinishers.

How can xylene affect my health?

No health effects have been noted at the background levels that people are exposed to on a daily basis.

High levels of exposure for short or long periods can cause headaches, lack of muscle coordination, dizziness, confusion, and changes in one's sense of balance. Exposure of people to high levels of xylene for short periods can also cause irritation of the skin, eyes, nose, and throat; difficulty in breathing; problems with the lungs; delayed reaction time; memory difficulties; stomach discomfort; and possibly changes in the liver and kidneys. It can cause unconsciousness and even death at very high levels.

How likely is xylene to cause cancer?

Both the International Agency for Research on Cancer (IARC) and the EPA have found that there is insufficient information to determine whether or not xylene is carcinogenic.

How can xylene affect children?

The effects of xylene have not been studied in children, but it is likely that they would be similar to those seen in exposed adults. Although there is no direct evidence, children may be more sensitive to acute inhalation exposure than adults because their narrower airways would be more sensitive to swelling effects.

Studies of unborn animals indicate that high concentrations of xylene may cause increased numbers of deaths, and delayed growth and development. In many instances, these same concentrations also cause damage to the mothers. We do not know if xylene harms the unborn child if the mother is exposed to low levels of xylene during pregnancy.

How can families reduce the risks of exposure to xylene?

❑ Exposure to xylene as solvents (in paints or gasoline) can be reduced if the products are used with adequate ventilation and if they are stored in tightly closed containers out of the reach of small children.

❑ Sometimes older children sniff household chemicals in attempt to get high. Talk with your children about the dangers of sniffing xylene.

❑ If products containing xylene are spilled on the skin, then the excess should be wiped off and the area cleaned with soap and water.

Is there a medical test to determine whether I've been exposed to xylene?

Laboratory tests can detect xylene or its breakdown products in exhaled air, blood, or urine. There is a high degree of agreement between the levels of exposure to xylene and the levels of xylene breakdown products in the urine. However, a urine sample must be provided very soon after exposure ends because xylene quickly leaves the body. These tests are not routinely available at your doctor's office.

Has the federal government made recommendations to protect human health?

The EPA set a limit of 10 parts xylene per million parts drinking water (10 ppm).

The Occupational Safety and Health Administration (OSHA) has set limits of 100 parts xylene per million parts of workplace air (100 ppm) for 8 hour shifts and 40 hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2005. Toxicological Profile for Xylene (Draft for Public Comment). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Appendix C
HDOH EALs

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State of Hawaii Department of Health Tier I Environmental Action Levels (EALs) are updated periodically. The EALs presented in this document are effective as of Fall 2011 (revised January 2012). For accuracy, always check for the latest EALs at http://eha-web.doh.hawaii.gov/eha-cma/Leaders/HEER/environmental-hazard-evaluation-and-environmental-action-levels.

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TABLE A. ENVIRONMENTAL ACTION LEVELS (EALs)
Groundwater IS Current or Potential Source of Drinking Water

	>150m to Surface Water Body		≤150m to Surface Water Body	
CONTAMINANT	[1]Soil (mg/kg)	[2]Groundwater (ug/L)	[1]Soil (mg/kg)	[2]Groundwater (ug/L)
ACENAPHTHENE	1.2E+02	2.0E+01	1.2E+02	2.0E+01
ACENAPHTHYLENE	1.0E+02	2.4E+02	1.3E+01	3.0E+01
ACETONE	1.0E+00	1.5E+03	1.0E+00	1.5E+03
ALDRIN	9.2E-01	4.0E-03	9.2E-01	4.0E-03
AMETRYN	1.1E+01	1.5E+02	1.1E+00	1.5E+01
AMINO,2- DINITROTOLUENE,4,6-	3.4E+00	7.3E+01	7.0E-01	1.5E+01
AMINO,4- DINITROTOLUENE,2,6-	3.4E+00	7.3E+01	7.0E-01	1.5E+01
ANTHRACENE	4.3E+00	2.2E+01	4.3E+00	7.3E-01
ANTIMONY	2.4E+00	6.0E+00	2.4E+00	6.0E+00
ARSENIC	2.4E+01	1.0E+01	2.4E+01	1.0E+01
ATRAZINE	1.1E-01	3.0E+00	1.1E-01	3.0E+00
BARIUM	1.0E+03	1.0E+03	1.0E+03	2.0E+02
BENZENE	3.0E-01	5.0E+00	3.0E-01	5.0E+00
BENZO(a)ANTHRACENE	1.5E+00	9.2E-02	1.5E+00	2.7E-02
BENZO(a)PYRENE	1.5E-01	2.0E-01	1.5E-01	1.4E-02
BENZO(b)FLUORANTHENE	1.5E+00	9.2E-02	1.5E+00	9.2E-02
BENZO(g,h,i)PERYLENE	3.5E+01	1.3E-01	2.7E+01	1.0E-01
BENZO(k)FLUORANTHENE	1.5E+01	4.0E-01	1.5E+01	4.0E-01
BERYLLIUM	3.1E+01	4.0E+00	3.1E+01	2.7E+00
BIPHENYL, 1,1-	1.0E+01	5.0E-01	1.0E+01	5.0E-01
BIS(2-CHLOROETHYL)ETHER	6.4E-05	1.2E-02	6.4E-05	1.2E-02
BIS(2-CHLOROISOPROPYL)ETHER	3.5E-03	3.2E-01	3.5E-03	3.2E-01
BIS(2-ETHYLHEXYL)PHTHALATE	3.5E+01	6.0E+00	3.5E+01	6.0E+00
BORON	1.0E+02	7.3E+03	1.0E+02	7.3E+03
BROMODICHLOROMETHANE	2.2E-03	1.2E-01	2.2E-03	1.2E-01
BROMOFORM	6.9E-01	8.0E+01	6.9E-01	8.0E+01
BROMOMETHANE	2.2E-01	8.7E+00	2.2E-01	8.7E+00
CADMIUM	1.4E+01	3.0E+00	1.4E+01	3.0E+00
CARBON TETRACHLORIDE	8.7E-02	5.0E+00	8.7E-02	5.0E+00
CHLORDANE (TECHNICAL)	1.6E+01	9.0E-02	1.6E+01	4.0E-03
CHLOROANILINE, p-	6.3E-03	3.4E-01	6.3E-03	3.4E-01
CHLOROBENZENE	2.2E+00	5.0E+01	1.5E+00	2.5E+01
CHLOROETHANE	1.1E+00	1.6E+01	1.1E+00	1.6E+01
CHLOROFORM	2.3E-02	7.0E+01	2.3E-02	7.0E+01
CHLOROMETHANE	1.0E-01	1.8E+00	1.0E-01	1.8E+00
CHLOROPHENOL, 2-	9.2E-03	1.8E-01	9.2E-03	1.8E-01
CHROMIUM (Total)	1.1E+03	1.0E+02	1.1E+03	7.4E+01
CHROMIUM III	1.0E+03	5.7E+02	1.0E+03	7.4E+01
CHROMIUM VI	2.9E+01	1.3E+01	2.9E+01	1.1E+01
CHRYSENE	3.0E+01	1.0E+00	1.0E+01	3.5E-01
COBALT	8.0E+01	3.0E+00	8.0E+01	3.0E+00
COPPER	6.3E+02	2.9E+00	6.3E+02	2.9E+00
CYANIDE (Free)	1.0E+02	1.0E+00	1.0E+02	1.0E+00
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	9.0E-03	6.1E-01	9.0E-03	6.1E-01
DALAPON	1.1E-01	2.0E+02	1.1E-01	2.0E+02
DIBENZO(a,h)ANTHTRACENE	1.5E-01	9.2E-03	1.5E-01	9.2E-03
DIBROMO,1,2- CHLOROPROPANE,3-	9.0E-04	4.0E-02	9.0E-04	4.0E-02
DIBROMOCHLOROMETHANE	1.6E-03	1.6E-01	1.6E-03	1.6E-01
DIBROMOETHANE, 1,2-	3.7E-04	4.0E-02	3.7E-04	4.0E-02
DICHLOROBENZENE, 1,2-	7.5E-01	1.0E+01	7.5E-01	1.0E+01
DICHLOROBENZENE, 1,3-	5.7E-01	5.0E+00	5.7E-01	5.0E+00
DICHLOROBENZENE, 1,4-	4.7E-02	5.0E+00	4.7E-02	5.0E+00
DICHLOROBENZIDINE, 3,3-	7.9E-02	1.5E-01	7.9E-02	1.5E-01
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.0E+00	2.8E-01	2.0E+00	1.0E-03
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.4E+00	2.0E-01	1.4E+00	1.0E-03
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.7E+00	1.3E-02	1.7E+00	1.0E-03
DICHLOROETHANE, 1,1-	9.7E-02	2.4E+00	9.7E-02	2.4E+00
DICHLOROETHANE, 1,2-	2.1E-03	1.5E-01	2.1E-03	1.5E-01
DICHLOROETHYLENE, 1,1-	1.2E+00	7.0E+00	1.2E+00	7.0E+00
DICHLOROETHYLENE, Cis 1,2-	3.1E-01	7.0E+01	3.1E-01	7.0E+01
DICHLOROETHYLENE, Trans 1,2-	2.7E+00	1.0E+02	2.7E+00	1.0E+02
DICHLOROPHENOL, 2,4-	2.5E-02	3.0E-01	2.5E-02	3.0E-01
DICHLOROPHENOXYACETIC ACID (2,4-D)	3.4E-01	7.0E+01	2.0E-01	4.0E+01
DICHLOROPROPANE, 1,2-	5.2E-02	5.0E+00	5.2E-02	5.0E+00
DICHLOROPROPENE, 1,3-	1.5E-02	4.3E-01	1.5E-02	4.3E-01
DIELDRIN	1.5E+00	4.2E-03	1.5E+00	1.9E-03

TABLE A. ENVIRONMENTAL ACTION LEVELS (EALs)
Groundwater IS Current or Potential Source of Drinking Water

	>150m to Surface Water Body		≤150m to Surface Water Body	
CONTAMINANT	[1]Soil (mg/kg)	[2]Groundwater (ug/L)	[1]Soil (mg/kg)	[2]Groundwater (ug/L)
DIETHYLPHTHALATE	1.6E+01	9.4E+02	2.6E-02	1.5E+00
DIMETHYLPHENOL, 2,4-	9.9E+00	1.2E+02	9.0E+00	1.1E+02
DIMETHYLPHTHALATE	2.2E+01	9.4E+02	3.5E-02	1.5E+00
DINITROBENZENE, 1,3-	2.1E-01	3.7E+00	2.1E-01	3.7E+00
DINITROPHENOL, 2,4-	5.6E+00	7.3E+01	5.6E+00	7.3E+01
DINITROTOLUENE, 2,4- (2,4-DNT)	2.1E-02	2.2E-01	2.1E-02	2.2E-01
DINITROTOLUENE, 2,6- (2,6-DNT)	3.6E+00	3.7E+01	3.6E+00	3.7E+01
DIOXANE, 1,4-	3.1E-04	6.7E-01	3.1E-04	6.7E-01
DIOXINS (TEQ)	2.4E-04	3.0E-05	2.4E-04	5.0E-06
DIURON	1.3E+00	7.3E+01	1.1E+00	6.0E+01
ENDOSULFAN	1.8E+01	3.4E-02	1.8E+01	8.7E-03
ENDRIN	3.7E+00	3.7E-02	3.7E+00	2.3E-03
ETHANOL	4.5E+00	5.0E+04	4.5E+00	5.0E+04
ETHYLBENZENE	3.7E+00	3.0E+01	3.7E+00	3.0E+01
FLUORANTHENE	4.6E+02	1.3E+02	8.7E+01	8.0E+00
FLUORENE	1.0E+02	2.4E+02	1.0E+02	3.9E+00
GLYPHOSATE	1.0E-01	6.0E+02	1.1E-02	6.5E+01
HEPTACHLOR	1.1E-01	5.3E-02	1.1E-01	3.6E-03
HEPTACHLOR EPOXIDE	5.3E-02	5.3E-02	5.3E-02	3.6E-03
HEXACHLOROBENZENE	3.0E-01	1.0E+00	3.0E-01	1.0E+00
HEXACHLOROBUTADIENE	1.8E-01	8.6E-01	1.8E-01	8.6E-01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	7.5E-02	1.6E-01	3.7E-02	8.0E-02
HEXACHLOROETHANE	2.7E-01	4.8E+00	2.7E-01	4.8E+00
HEXAZINONE	2.6E+01	1.2E+03	2.6E+01	1.2E+03
INDENO(1,2,3-cd)PYRENE	1.5E+00	9.2E-02	1.5E+00	9.2E-02
ISOPHORONE	7.7E-01	7.1E+01	7.7E-01	7.1E+01
LEAD	2.0E+02	1.5E+01	2.0E+02	5.6E+00
MERCURY	4.7E+00	2.0E+00	4.7E+00	2.5E-02
METHOXYCHLOR	1.6E+01	3.0E-02	1.6E+01	3.0E-02
METHYL ETHYL KETONE	7.7E+00	7.1E+03	7.7E+00	7.1E+03
METHYL ISOBUTYL KETONE	5.0E-01	1.7E+02	5.0E-01	1.7E+02
METHYL MERCURY	1.6E+00	3.0E-03	1.6E+00	3.0E-03
METHYL TERT BUTYL ETHER	2.8E-02	5.0E+00	2.8E-02	5.0E+00
METHYLENE CHLORIDE	1.1E-01	4.8E+00	1.1E-01	4.8E+00
METHYLNAPHTHALENE, 1-	1.8E+00	4.7E+00	7.9E-01	2.1E+00
METHYLNAPHTHALENE, 2-	4.1E+00	1.0E+01	8.7E-01	2.1E+00
MOLYBDENUM	7.8E+01	1.8E+02	7.8E+01	1.8E+02
NAPHTHALENE	4.4E+00	1.7E+01	4.4E+00	1.7E+01
NICKEL	7.6E+02	5.0E+00	7.6E+02	5.0E+00
NITROBENZENE	4.6E-03	1.2E-01	4.6E-03	1.2E-01
NITROGLYCERIN	7.0E-02	3.7E+00	7.0E-02	3.7E+00
NITROTOLUENE, 2-	3.8E-03	6.2E-02	3.8E-03	6.2E-02
NITROTOLUENE, 3-	7.3E+00	1.2E+02	7.3E+00	1.2E+02
NITROTOLUENE, 4-	2.5E-01	4.2E+00	2.5E-01	4.2E+00
PENTACHLOROPHENOL	8.2E-01	1.0E+00	8.2E-01	1.0E+00
PENTAERYTHRITOLTETRANITRATE (PETN)	4.2E-01	1.7E+01	4.2E-01	1.7E+01
PERCHLORATE	7.0E-03	2.6E+01	7.0E-03	2.6E+01
PHENANTHRENE	4.4E+02	2.4E+02	6.9E+01	4.6E+00
PHENOL	1.6E-01	5.0E+00	1.6E-01	5.0E+00
POLYCHLORINATED BIPHENYLS (PCBs)	1.1E+00	5.0E-01	1.1E+00	1.4E-02
PROPICONAZOLE	6.6E+01	2.6E+02	6.6E+00	2.6E+01
PYRENE	4.4E+01	6.8E+01	4.4E+01	2.0E+00
SELENIUM	7.8E+01	2.0E+01	7.8E+01	5.0E+00
SILVER	7.8E+01	1.0E+00	7.8E+01	1.0E+00
SIMAZINE	9.8E-02	4.0E+00	4.9E-02	2.0E+00
STYRENE	9.1E-01	1.0E+01	9.1E-01	1.0E+01
TERBACIL	3.9E+00	4.7E+02	3.9E+00	4.7E+02
tert-BUTYL ALCOHOL	2.8E-02	4.5E+00	2.8E-02	4.5E+00
TETRACHLOROETHANE, 1,1,1,2-	1.5E-02	5.2E-01	1.5E-02	5.2E-01
TETRACHLOROETHANE, 1,1,2,2-	1.2E-03	6.7E-02	1.2E-03	6.7E-02
TETRACHLOROETHYLENE	8.8E-02	5.0E+00	8.8E-02	5.0E+00
TETRACHLOROPHENOL, 2,3,4,6-	4.9E+00	1.0E+01	5.9E-01	1.2E+00

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Groundwater IS Current or Potential Source of Drinking Water

	>150m to Surface Water Body		≤150m to Surface Water Body	
CONTAMINANT	[1]Soil (mg/kg)	[2]Groundwater (ug/L)	[1]Soil (mg/kg)	[2]Groundwater (ug/L)
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	1.6E+02	1.8E+03	2.9E+01	3.3E+02
THALLIUM	7.8E-01	2.0E+00	7.8E-01	2.0E+00
TOLUENE	3.2E+00	4.0E+01	3.2E+00	4.0E+01
TOXAPHENE	4.4E-01	2.1E-01	4.4E-01	2.0E-04
TPH (gasolines)	1.0E+02	1.0E+02	1.0E+02	1.0E+02
TPH (middle distillates)	1.0E+02	1.0E+02	1.0E+02	1.0E+02
TPH (residual fuels)	5.0E+02	1.0E+02	5.0E+02	1.0E+02
TRICHLOROBENZENE, 1,2,4-	9.8E-02	7.0E+01	9.8E-02	2.5E+01
TRICHLOROETHANE, 1,1,1-	2.3E+01	2.0E+02	7.0E+00	6.2E+01
TRICHLOROETHANE, 1,1,2-	8.9E-03	5.0E+00	8.9E-03	5.0E+00
TRICHLOROETHYLENE	2.6E-01	5.0E+00	2.6E-01	5.0E+00
TRICHLOROPHENOL, 2,4,5-	2.9E+01	1.0E+02	3.2E+00	1.1E+01
TRICHLOROPHENOL, 2,4,6-	1.8E+00	6.1E+00	1.8E+00	6.1E+00
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	6.5E+00	3.7E+02	6.5E+00	3.7E+02
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	8.7E-01	3.0E+01	8.7E-01	3.0E+01
TRICHLOROPROPANE, 1,2,3-	1.3E-03	6.0E-01	1.3E-03	6.0E-01
TRICHLOROPROPENE, 1,2,3-	1.2E-01	6.2E-01	1.2E-01	6.2E-01
TRIFLURALIN	2.4E+01	8.7E+00	2.4E+01	8.7E+00
TRINITROBENZENE, 1,3,5-	3.9E+01	1.4E+02	8.4E+00	3.0E+01
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.9E+01	1.5E+02	4.9E+01	1.5E+02
TRINITROTOLUENE, 2,4,6- (TNT)	1.0E+00	2.2E+00	1.0E+00	2.2E+00
VANADIUM	7.7E+02	1.9E+01	7.7E+02	1.9E+01

TABLE A. ENVIRONMENTAL ACTION LEVELS (EALs)
Groundwater IS Current or Potential Source of Drinking Water

	>150m to Surface Water Body		≤150m to Surface Water Body	
CONTAMINANT	**[1]Soil (mg/kg)**	**[2]Groundwater (ug/L)**	**[1]Soil (mg/kg)**	**[2]Groundwater (ug/L)**
VINYL CHLORIDE	7.2E-02	2.0E+00	7.2E-02	2.0E+00
XYLENES	2.1E+00	2.0E+01	2.1E+00	2.0E+01
ZINC	1.0E+03	2.2E+01	1.0E+03	2.2E+01
Electrical Conductivity (mS/cm, USEPA Method 120.1 MOD)	2.0	0.0E+00	4.0	0.0E+00
Sodium Adsorption Ratio	5.0	0.0E+00	12	0.0E+00

Notes:

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

2. Assumes potential impacts to drinking water source and discharge of groundwater into a freshwater, marine or estuary surface water system.

Source of Soil Action Levels: Refer to Appendix 1, Tables A-1 and A-2.

Source of Groundwater Action Levels: Appendix 1, Table D-1a (≤150m to Surface Water Body) and Table D-1b (>150m to Surface Water Body).

Soil data should be reported on dry-weight basis (see Appendix 1, Section 6.2).

Soil Action Levels intended to address direct-exposure, vapor intrusion, groundwater protection (leaching) and gross contamination hazards. Soil gas data should b collected for additional evaluation of potential vapor intrusion hazards at sites with significant areas of VOC-impacted soil. See also Section 4.4 and Table C. The need for a site-specific, ecological risk assessment should be evaluated if sensitive, terrestrial or aquatic habitats are within or nearby areas of contaminated soil.

Groundwater Action Levels intended to address surface water impacts, vapor intrusion and nuisance hazards Use in conjunction with soil gas action levels to evaluate potential impacts to vapor intrusion hazards if groundwater action levels for this concern approached or exceeded (refer to Table C-1a in Appendix 1). See also Section 4.4 and Table C.

Groundwater action levels should be compared to dissolved-phase chemical concentrations unless otherwise instructed by HIDOH.

Groundwater ALs >150m to Surface Water Body: Groundwater screened with respect to acute surface water goals (See Table D-1b).

Groundwater ALs ≤150m to Surface Water Body: Groundwater screened with respect to chronic surface water goals (see Table D-1a).

TPH -Total Petroleum Hydrocarbons: TPH Action Levels must be used in conjunction with Action Levels for related chemicals (e.g., BTEX, PAHs, oxidizers, etc.). See Section 2.6 in text.

TPH soil action levels for gross contamination hazards in isolated soils may be used as final cleanup levels if soil situated >3m deep at residential site and >1m (or otherwise capped) at commercial sites AND site data indicate that remaining contamination will not pose leaching or vapor intrusion hazards (refer to Table F-3 in Appendix 1; TPHg = 4,500 mg/kg, TPHmd & TPHrf = 5,000 mg/kg). TPH soil action levels noted in above table should be applied at sites with elevated threats to drinking water resources or aquatic habitats. Refer to Section 2.6 in text.

TABLE B. ENVIRONMENTAL ACTION LEVELS (EALs)
Groundwater IS NOT Current or Potential Source of Drinking Water

	>150m to Surface Water Body		≤150m to Surface Water Body	
CONTAMINANT	[1]Soil (mg/kg)	[2]Groundwater (ug/L)	[1]Soil (mg/kg)	[2]Groundwater (ug/L)
ACENAPHTHENE	1.2E+02	2.0E+02	1.2E+02	2.3E+01
ACENAPHTHYLENE	1.3E+02	3.0E+02	1.3E+01	3.0E+01
ACETONE	1.0E+00	1.5E+03	1.0E+00	1.5E+03
ALDRIN	9.2E-01	1.3E+00	9.2E-01	1.3E-01
AMETRYN	1.1E+01	1.5E+02	1.1E+00	1.5E+01
AMINO,2- DINITROTOLUENE,4,6-	7.0E+00	1.5E+02	7.0E-01	1.5E+01
AMINO,4- DINITROTOLUENE,2,6-	7.0E+00	1.5E+02	7.0E-01	1.5E+01
ANTHRACENE	4.3E+00	2.2E+01	4.3E+00	7.3E-01
ANTIMONY	2.4E+00	1.5E+03	2.4E+00	3.0E+01
ARSENIC	2.4E+01	6.9E+01	2.4E+01	3.6E+01
ATRAZINE	2.1E+00	3.5E+02	4.5E-01	1.2E+01
BARIUM	1.0E+03	1.0E+03	1.0E+03	2.0E+02
BENZENE	6.7E-01	1.7E+03	6.7E-01	4.6E+01
BENZO(a)ANTHRACENE	1.5E+00	4.7E+00	1.5E+00	2.7E-02
BENZO(a)PYRENE	1.5E-01	8.1E-01	1.5E-01	1.4E-02
BENZO(b)FLUORANTHENE	1.5E+00	7.5E-01	1.5E+00	7.5E-01
BENZO(g,h,i)PERYLENE	3.5E+01	1.3E-01	2.7E+01	1.0E-01
BENZO(k)FLUORANTHENE	1.5E+01	4.0E-01	1.5E+01	4.0E-01
BERYLLIUM	3.1E+01	4.3E+01	3.1E+01	2.7E+00
BIPHENYL, 1,1-	1.0E+01	5.0E+00	1.0E+01	5.0E+00
BIS(2-CHLOROETHYL)ETHER	4.5E-03	1.3E+02	4.5E-03	6.1E+01
BIS(2-CHLOROISOPROPYL)ETHER	3.3E+00	3.2E+03	6.6E-01	6.1E+01
BIS(2-ETHYLHEXYL)PHTHALATE	3.5E+01	3.2E+01	3.5E+01	3.2E+01
BORON	1.0E+02	7.3E+03	1.0E+02	7.3E+03
BROMODICHLOROMETHANE	1.4E-02	9.8E+01	1.4E-02	9.8E+01
BROMOFORM	4.4E+01	5.1E+03	2.8E+01	3.2E+03
BROMOMETHANE	2.2E-01	4.6E+02	2.2E-01	1.6E+02
CADMIUM	1.4E+01	3.0E+00	1.4E+01	3.0E+00
CARBON TETRACHLORIDE	8.7E-02	9.8E+01	8.7E-02	9.8E+00
CHLORDANE (TECHNICAL)	1.6E+01	9.0E-02	1.6E+01	4.0E-03
CHLOROANILINE, p-	9.4E-02	5.0E+00	9.4E-02	5.0E+00
CHLOROBENZENE	2.2E+00	1.6E+02	1.5E+00	2.5E+01
CHLOROETHANE	1.1E+01	1.6E+02	1.1E+01	1.6E+02
CHLOROFORM	2.3E-02	9.4E+01	2.3E-02	9.4E+01
CHLOROMETHANE	2.9E-01	3.7E+02	2.9E-01	3.7E+02
CHLOROPHENOL, 2-	9.2E-02	1.8E+00	9.2E-02	1.8E+00
CHROMIUM (Total)	1.1E+03	5.7E+02	1.1E+03	7.4E+01
CHROMIUM III	1.0E+03	5.7E+02	1.0E+03	7.4E+01
CHROMIUM VI	2.9E+01	1.6E+01	2.9E+01	1.1E+01
CHRYSENE	3.0E+01	1.0E+00	1.0E+01	3.5E-01
COBALT	8.0E+01	3.0E+00	8.0E+01	3.0E+00
COPPER	6.3E+02	2.9E+00	6.3E+02	2.9E+00
CYANIDE (Free)	1.0E+02	1.0E+00	1.0E+02	1.0E+00
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	5.5E+00	1.4E+03	2.8E+00	1.9E+02
DALAPON	1.6E+00	3.0E+03	1.6E-01	3.0E+02
DIBENZO(a,h)ANTHTRACENE	1.5E-01	5.2E-01	1.5E-01	5.2E-01
DIBROMO,1,2- CHLOROPROPANE,3-	9.0E-04	4.0E-02	9.0E-04	4.0E-02
DIBROMOCHLOROMETHANE	2.2E-02	3.4E+02	2.2E-02	3.4E+02
DIBROMOETHANE, 1,2-	8.7E-04	1.6E+01	8.7E-04	1.6E+01
DICHLOROBENZENE, 1,2-	7.5E+00	1.0E+02	1.1E+00	1.4E+01
DICHLOROBENZENE, 1,3-	4.2E+01	3.7E+02	7.4E+00	6.5E+01
DICHLOROBENZENE, 1,4-	4.7E-02	1.1E+02	4.7E-02	1.5E+01
DICHLOROBENZIDINE, 3,3-	1.1E+00	2.5E+02	1.1E+00	2.5E+02
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.0E+00	6.0E-01	2.0E+00	1.0E-03
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.4E+00	1.1E+00	1.4E+00	1.0E-03
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.7E+00	1.3E-02	1.7E+00	1.0E-03
DICHLOROETHANE, 1,1-	3.3E-01	4.7E+01	3.3E-01	4.7E+01
DICHLOROETHANE, 1,2-	2.0E-02	1.6E+02	2.0E-02	1.6E+02
DICHLOROETHYLENE, 1,1-	8.9E+00	3.9E+03	4.3E+00	2.5E+01

TABLE B. ENVIRONMENTAL ACTION LEVELS (EALs)
Groundwater IS NOT Current or Potential Source of Drinking Water

	>150m to Surface Water Body		≤150m to Surface Water Body	
CONTAMINANT	**[1]Soil (mg/kg)**	**[2]Groundwater (ug/L)**	**[1]Soil (mg/kg)**	**[2]Groundwater (ug/L)**
DICHLOROETHYLENE, Cis 1,2-	3.1E-01	1.1E+03	3.1E-01	5.9E+02
DICHLOROETHYLENE, Trans 1,2-	2.7E+00	2.6E+03	2.7E+00	5.9E+02
DICHLOROPHENOL, 2,4-	2.5E-01	3.0E+00	2.5E-01	3.0E+00
DICHLOROPHENOXYACETIC ACID (2,4-D)	9.8E-01	2.0E+02	2.0E-01	4.0E+01
DICHLOROPROPANE, 1,2-	5.2E-02	1.0E+02	5.2E-02	1.0E+02
DICHLOROPROPENE, 1,3-	1.3E-01	2.6E+02	1.3E-01	1.2E+02
DIELDRIN	1.5E+00	7.1E-01	1.5E+00	1.9E-03
DIETHYLPHTHALATE	1.6E+01	9.4E+02	2.6E-02	1.5E+00
DIMETHYLPHENOL, 2,4-	2.2E+01	2.7E+02	9.0E+00	1.1E+02
DIMETHYLPHTHALATE	2.2E+01	9.4E+02	3.5E-02	1.5E+00
DINITROBENZENE, 1,3-	1.2E+00	1.1E+02	1.2E+00	3.0E+01
DINITROPHENOL, 2,4-	1.8E+01	2.3E+02	5.7E+00	7.5E+01
DINITROTOLUENE, 2,4- (2,4-DNT)	1.6E+00	1.1E+02	1.6E+00	4.4E+01
DINITROTOLUENE, 2,6- (2,6-DNT)	1.1E+01	1.1E+02	4.3E+00	4.4E+01
DIOXANE, 1,4-	4.9E+00	5.0E+04	4.9E+00	5.0E+04
DIOXINS (TEQ)	2.4E-04	3.0E-03	2.4E-04	5.0E-06
DIURON	3.6E+00	2.0E+02	1.1E+00	6.0E+01
ENDOSULFAN	1.8E+01	3.4E-02	1.8E+01	8.7E-03
ENDRIN	3.7E+00	3.7E-02	3.7E+00	2.3E-03
ETHANOL	4.5E+00	5.0E+04	4.5E+00	5.0E+04
ETHYLBENZENE	2.1E+01	3.0E+02	2.1E+01	2.9E+02
FLUORANTHENE	4.6E+02	1.3E+02	8.7E+01	8.0E+00
FLUORENE	1.0E+02	3.0E+02	1.0E+02	3.9E+00
GLYPHOSATE	1.0E-01	6.0E+02	1.1E-02	6.5E+01
HEPTACHLOR	1.1E-01	5.3E-02	1.1E-01	3.6E-03
HEPTACHLOR EPOXIDE	5.3E-02	5.3E-02	5.3E-02	3.6E-03
HEXACHLOROBENZENE	3.0E-01	3.1E+00	3.0E-01	3.1E+00
HEXACHLOROBUTADIENE	2.2E+00	1.1E+01	9.5E-01	4.7E+00
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	7.5E-02	1.6E-01	3.7E-02	8.0E-02
HEXACHLOROETHANE	5.7E+00	1.0E+02	6.8E-01	1.2E+01
HEXAZINONE	4.0E+02	5.0E+04	1.1E+02	5.0E+03
INDENO(1,2,3-cd)PYRENE	1.5E+00	9.5E-02	1.5E+00	9.5E-02
ISOPHORONE	4.7E+01	4.3E+03	1.4E+00	1.3E+02
LEAD	2.0E+02	2.9E+01	2.0E+02	5.6E+00
MERCURY	4.7E+00	2.1E+00	4.7E+00	2.5E-02
METHOXYCHLOR	1.6E+01	3.0E-02	1.6E+01	3.0E-02
METHYL ETHYL KETONE	1.5E+01	1.4E+04	1.5E+01	1.4E+04
METHYL ISOBUTYL KETONE	5.0E-01	1.7E+02	5.0E-01	1.7E+02
METHYL MERCURY	1.6E+00	3.0E-03	1.6E+00	3.0E-03
METHYL TERT BUTYL ETHER	2.0E+00	1.8E+03	2.0E+00	1.8E+03
METHYLENE CHLORIDE	1.1E+00	3.9E+03	1.1E+00	2.2E+03
METHYLNAPHTHALENE, 1-	2.6E+01	1.0E+02	7.9E-01	2.1E+00
METHYLNAPHTHALENE, 2-	2.8E+01	1.0E+02	8.7E-01	2.1E+00
MOLYBDENUM	7.8E+01	2.4E+02	7.8E+01	2.4E+02
NAPHTHALENE	4.5E+00	2.1E+02	4.5E+00	2.4E+01
NICKEL	7.6E+02	5.0E+00	7.6E+02	5.0E+00
NITROBENZENE	4.8E+00	2.0E+03	2.3E+00	6.0E+01
NITROGLYCERIN	1.2E+00	1.4E+02	1.2E+00	1.4E+02
NITROTOLUENE, 2-	1.9E+00	7.5E+03	1.9E+00	1.0E+03
NITROTOLUENE, 3-	2.3E+02	3.8E+03	2.3E+01	3.8E+02
NITROTOLUENE, 4-	3.0E+01	3.3E+03	3.0E+01	1.6E+03
PENTACHLOROPHENOL	8.9E-01	1.3E+01	8.9E-01	7.9E+00
PENTAERYTHRITOLTETRANITRATE (PETN)	2.4E+01	2.2E+04	2.4E+01	2.2E+04
PERCHLORATE	1.2E+00	6.0E+02	1.2E+00	6.0E+02
PHENANTHRENE	4.4E+02	3.0E+02	6.9E+01	4.6E+00

TABLE B. ENVIRONMENTAL ACTION LEVELS (EALs)
Groundwater IS NOT Current or Potential Source of Drinking Water

	>150m to Surface Water Body		≤150m to Surface Water Body	
CONTAMINANT	**[1]Soil (mg/kg)**	**[2]Groundwater (ug/L)**	**[1]Soil (mg/kg)**	**[2]Groundwater (ug/L)**
PHENOL	1.1E+02	3.4E+03	4.0E+01	1.3E+03
POLYCHLORINATED BIPHENYLS (PCBs)	1.1E+00	2.0E+00	1.1E+00	1.4E-02
PROPICONAZOLE	6.6E+01	2.6E+02	6.6E+00	2.6E+01
PYRENE	4.4E+01	6.8E+01	4.4E+01	2.0E+00
SELENIUM	7.8E+01	2.0E+01	7.8E+01	5.0E+00
SILVER	7.8E+01	1.0E+00	7.8E+01	1.0E+00
SIMAZINE	2.4E-01	1.0E+01	4.9E-02	2.0E+00
STYRENE	2.9E+00	3.2E+01	2.9E+00	3.2E+01
TERBACIL	1.6E+02	2.3E+04	1.9E+01	2.3E+03
tert-BUTYL ALCOHOL	8.1E+01	5.0E+04	8.1E+01	1.8E+04
TETRACHLOROETHANE, 1,1,1,2-	1.9E+00	3.1E+03	1.9E+00	3.1E+02
TETRACHLOROETHANE, 1,1,2,2-	9.0E-03	2.0E+02	9.0E-03	2.0E+02
TETRACHLOROETHYLENE	8.8E-02	1.8E+02	8.8E-02	1.2E+02
TETRACHLOROPHENOL, 2,3,4,6-	4.9E+00	1.0E+01	5.9E-01	1.2E+00
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	1.7E+02	1.9E+03	2.9E+01	3.3E+02
THALLIUM	7.8E-01	4.7E+02	7.8E-01	2.0E+01
TOLUENE	3.2E+01	4.0E+02	1.0E+01	1.3E+02
TOXAPHENE	4.4E-01	2.1E-01	4.4E-01	2.0E-04
TPH (gasolines)	1.0E+02	5.0E+03	1.0E+02	5.0E+02
TPH (middle distillates)	5.0E+02	2.5E+03	5.0E+02	6.4E+02
TPH (residual fuels)	5.0E+02	2.5E+03	5.0E+02	6.4E+02
TRICHLOROBENZENE, 1,2,4-	9.8E-02	1.6E+02	9.8E-02	2.5E+01
TRICHLOROETHANE, 1,1,1-	2.2E+02	6.0E+03	7.0E+00	6.2E+01
TRICHLOROETHANE, 1,1,2-	8.9E-03	1.0E+02	8.9E-03	1.0E+02
TRICHLOROETHYLENE	2.6E-01	6.1E+02	2.6E-01	3.6E+02
TRICHLOROPHENOL, 2,4,5-	2.9E+01	1.0E+02	3.2E+00	1.1E+01
TRICHLOROPHENOL, 2,4,6-	1.2E+01	4.9E+02	1.2E+01	4.9E+02
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	1.2E+01	6.9E+02	1.2E+01	6.9E+02
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	8.7E-01	3.0E+01	8.7E-01	3.0E+01
TRICHLOROPROPANE, 1,2,3-	1.3E-03	1.4E+02	1.3E-03	1.4E+01
TRICHLOROPROPENE, 1,2,3-	1.2E-01	6.2E-01	1.2E-01	6.2E-01
TRIFLURALIN	5.4E+01	2.0E+01	5.4E+01	2.0E+01
TRINITROBENZENE, 1,3,5-	3.9E+01	1.4E+02	8.4E+00	3.0E+01
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.9E+01	1.5E+02	4.9E+01	1.5E+02
TRINITROTOLUENE, 2,4,6- (TNT)	7.2E+00	5.7E+02	7.2E+00	1.3E+02
VANADIUM	7.7E+02	1.9E+01	7.7E+02	1.9E+01

TABLE B. ENVIRONMENTAL ACTION LEVELS (EALs)
Groundwater IS NOT Current or Potential Source of Drinking Water

	>150m to Surface Water Body		≤150m to Surface Water Body	
CONTAMINANT	**[1]Soil (mg/kg)**	**[2]Groundwater (ug/L)**	**[1]Soil (mg/kg)**	**[2]Groundwater (ug/L)**
VINYL CHLORIDE	7.2E-02	6.2E+01	7.2E-02	6.2E+01
XYLENES	4.5E+01	1.0E+03	1.1E+01	1.0E+02
ZINC	1.0E+03	2.2E+01	1.0E+03	2.2E+01
Electrical Conductivity (mS/cm, USEPA Method 120.1 MOD)	2.0	0.0E+00	4.0	0.0E+00
Sodium Adsorption Ratio	5.0	0.0E+00	12	0.0E+00

Notes:

1. Based on unrestricted current or future land use. Considered adequate for residential housing, schools, medical facilities, day-care centers, parks and other sensitive uses.
2. Assumes potential discharge of groundwater into a freshwater, marine or estuary surface water system.

Source of Soil Action Levels: Refer to Appendix 1, Tables B-1 and B-2.

Source of Groundwater Action Levels: Appendix 1, Table D-1c (≤150m to Surface Water Body) and Table D-1d (>150m to Surface Water Body).

Soil data should be reported on dry-weight basis (see Appendix 1, Section 6.2).

Soil Action Levels intended to address direct-exposure, vapor intrusion, groundwater protection (leaching) and gross contamination hazards. Soil gas data should be collected for additional evaluation of potential vapor intrusion hazards at sites with significant areas of VOC-impacted soil. See also Section 4.4 and Table C. The need for a site-specific, ecological risk assessment should be evaluated if sensitive, terrestrial or aquatic habitats are within or nearby areas of contaminated soil.

Groundwater Action Levels intended to address surface water impacts, vapor intrusion and nuisance hazards Use in conjunction with soil gas action levels to evaluate potential impacts to vapor intrusion hazards if groundwater action levels for this concern approached or exceeded (refer to Table C-1a in Appendix 1). See also Section 4.4 and Table C.

Groundwater action levels should be compared to dissolved-phase chemical concentrations unless otherwise instructed by HIDOH.

Groundwater ALs >150m to Surface Water Body: Groundwater screened with respect to acute surface water goals (See Table D-1d).

Groundwater ALs ≤150m to Surface Water Body: Groundwater screened with respect to chronic surface water goals (see Table D-1c).

TPH -Total Petroleum Hydrocarbons: TPH Action Levels must be used in conjunction with Action Levels for related chemicals (e.g., BTEX, PAHs, oxidizers, etc.). See Section 2.6 in text.

TPH soil action levels for gross contamination hazards in isolated soils may be used as final cleanup levels if soil situated >3m deep at residential site and >1m (or otherwise capped) at commercial sites AND site data indicate that remaining contamination will not pose leaching or vapor intrusion hazards (refer to Table F-3 in Appendix 1; TPHg = 4,500 mg/kg, TPHmd & TPHrf = 5,000 mg/kg). TPH soil action levels noted in above table should be applied at sites with elevated threats to drinking water resources or aquatic habitats. Refer to Section 2.6 in text.

TABLE C. ENVIRONMENTAL ACTION LEVELS (EALs)
Indoor Air and Soil Gas
(Vapor Intrusion Hazards)

CHEMICAL PARAMETER	Physical State		INDOOR AIR ACTION LEVELS [1]Residential (ug/m3)	INDOOR AIR ACTION LEVELS Commercial/ Industrial (ug/m^3)	[2]SHALLOW SOIL GAS ACTION LEVELS [1]Residential (ug/m3)	[2]SHALLOW SOIL GAS ACTION LEVELS Commercial/ Industrial (ug/m^3)
ACENAPHTHENE	V	S	4.4E+01	6.1E+01	4.4E+04	1.2E+05
ACENAPHTHYLENE	V	S	2.9E+01	4.1E+01	2.9E+04	8.2E+04
ACETONE	V	L	6.5E+03	9.1E+03	6.5E+06	1.8E+07
ALDRIN	NV	S				
AMETRYN	NV	S				
AMINO,2- DINITROTOLUENE,4,6-	NV	S				
AMINO,4- DINITROTOLUENE,2,6-	NV	S				
ANTHRACENE	V	S	2.2E+02	3.1E+02	2.2E+05	6.1E+05
ANTIMONY	NV	S				
ARSENIC	NV	S				
ATRAZINE	NV	S				
BARIUM	NV	S				
BENZENE	V	L	3.1E-01	5.2E-01	3.1E+02	1.0E+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	8.3E-02	1.2E-01	8.3E+01	2.3E+02
BIS(2-CHLOROETHYL)ETHER	V	L	7.4E-03	1.2E-02	7.4E+00	2.5E+01
BIS(2-CHLOROISOPROPYL)ETHER	V	L	2.4E-01	4.1E-01	2.4E+02	8.2E+02
BIS(2-ETHYLHEXYL)PHTHALATE	NV	S				
BORON	NV	S				
BROMODICHLOROMETHANE	V	L	6.6E-02	1.1E-01	6.6E+01	2.2E+02
BROMOFORM	NV	S				
BROMOMETHANE	V	G	1.0E+00	1.5E+00	1.0E+03	2.9E+03
CADMIUM	NV	S				
CARBON TETRACHLORIDE	V	L	4.1E-01	6.8E-01	4.1E+02	1.4E+03
CHLORDANE (TECHNICAL)	NV	S				
CHLOROANILINE, p-	NV	S				
CHLOROBENZENE	V	L	1.0E+01	1.5E+01	1.0E+04	2.9E+04
CHLOROETHANE	V	G	2.1E+03	2.9E+03	2.1E+06	5.8E+06
CHLOROFORM	V	L	1.1E-01	1.8E-01	1.1E+02	3.6E+02
CHLOROMETHANE	V	G	1.4E+00	2.3E+00	1.4E+03	4.5E+03
CHLOROPHENOL, 2-	V	L	3.7E+00	5.1E+00	3.7E+03	1.0E+04
CHROMIUM (Total)	NV	S				
CHROMIUM III	NV	S				
CHROMIUM VI	NV	S				
CHRYSENE	NV	S				
COBALT	NV	S				
COPPER	NV	S				
CYANIDE (Free)	V	S				
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	NV	S				
DALAPON	NV	L				
DIBENZO(a,h)ANTHTRACENE	NV	S				
DIBROMO,1,2- CHLOROPROPANE,3-	V	L	4.1E-04	6.8E-04	4.1E-01	1.4E+00
DIBROMOCHLOROMETHANE	V	S	1.0E-01	1.7E-01	1.0E+02	3.4E+02
DIBROMOETHANE, 1,2-	V	S	4.1E-03	6.8E-03	4.1E+00	1.4E+01
DICHLOROBENZENE, 1,2-	V	L	4.2E+01	5.8E+01	4.2E+04	1.2E+05
DICHLOROBENZENE, 1,3-	V	L	2.2E+01	3.1E+01	2.2E+04	6.1E+04
DICHLOROBENZENE, 1,4-	V	S	2.2E-01	3.7E-01	2.2E+02	7.4E+02
DICHLOROBENZIDINE, 3,3-	NV	S				
DICHLORODIPHENYLDICHLOROETHANE (DDD)	NV	S				
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	NV	S				
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	NV	S				
DICHLOROETHANE, 1,1-	V	L	1.5E+00	2.6E+00	1.5E+03	5.1E+03

TABLE C. ENVIRONMENTAL ACTION LEVELS (EALs)
Indoor Air and Soil Gas
(Vapor Intrusion Hazards)

			INDOOR AIR ACTION LEVELS		[2]SHALLOW SOIL GAS ACTION LEVELS	
CHEMICAL PARAMETER	Physical State		[1]Residential (ug/m3)	Commercial/ Industrial (ug/m^3)	[1]Residential (ug/m3)	Commercial/ Industrial (ug/m^3)
DICHLOROETHANE, 1,2-	V	L	9.4E-02	1.6E-01	9.4E+01	3.1E+02
DICHLOROETHYLENE, 1,1-	V	L	4.2E+01	5.8E+01	4.2E+04	1.2E+05
DICHLOROETHYLENE, Cis 1,2-	V	L	1.5E+00	2.0E+00	1.5E+03	4.1E+03
DICHLOROETHYLENE, Trans 1,2-	V	L	1.3E+01	1.8E+01	1.3E+04	3.5E+04
DICHLOROPHENOL, 2,4-	NV	S				
DICHLOROPHENOXYACETIC ACID (2,4-D)	NV	S				
DICHLOROPROPANE, 1,2-	V	L	2.4E-01	4.1E-01	2.4E+02	8.2E+02
DICHLOROPROPENE, 1,3-	V	L	6.1E-01	1.0E+00	6.1E+02	2.0E+03
DIELDRIN	NV	S				
DIETHYLPHTHALATE	NV	S				
DIMETHYLPHENOL, 2,4-	V	S	1.5E+01	2.0E+01	1.5E+04	4.1E+04
DIMETHYLPHTHALATE	NV	S				
DINITROBENZENE, 1,3-	NV	S				
DINITROPHENOL, 2,4-	NV	S				
DINITROTOLUENE, 2,4- (2,4-DNT)	NV	S				
DINITROTOLUENE, 2,6- (2,6-DNT)	NV	S				
DIOXANE, 1,4-	NV	L				
DIOXINS (TEQ)	NV	S				
DIURON	NV	S				
ENDOSULFAN	NV	S				
ENDRIN	NV	S				
ETHANOL	NV	L				
ETHYLBENZENE	V	L	9.7E-01	1.6E+00	9.7E+02	3.3E+03
FLUORANTHENE	NV	S				
FLUORENE	V	S	2.9E+01	4.1E+01	2.9E+04	8.2E+04
GLYPHOSATE	NV	S				
HEPTACHLOR	NV	S				
HEPTACHLOR EPOXIDE	NV	S				
HEXACHLOROBENZENE	NV	S				
HEXACHLOROBUTADIENE	NV	S				
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	NV	S				
HEXACHLOROETHANE	NV	S				
HEXAZINONE	NV	S				
INDENO(1,2,3-cd)PYRENE	NV	S				
ISOPHORONE	NV	L				
LEAD	NV	S				
MERCURY	V	S	6.3E-03	8.8E-03	6.3E+00	1.8E+01
METHOXYCHLOR	NV	S				
METHYL ETHYL KETONE	V	L	1.0E+03	1.5E+03	1.0E+06	2.9E+06
METHYL ISOBUTYL KETONE	V	L	6.3E+02	8.8E+02	6.3E+05	1.8E+06
METHYL MERCURY	NV	S				
METHYL TERT BUTYL ETHER	V	L	9.4E+00	1.6E+01	9.4E+03	3.1E+04
METHYLENE CHLORIDE	V	L	5.2E+00	8.7E+00	5.2E+03	1.7E+04
METHYLNAPHTHALENE, 1-	V	S	2.9E-01	4.9E-01	2.9E+02	9.9E+02
METHYLNAPHTHALENE, 2-	V	S	2.9E+00	4.1E+00	2.9E+03	8.2E+03
MOLYBDENUM	NV	S				
NAPHTHALENE	V	S	7.2E-02	1.2E-01	7.2E+01	2.4E+02
NICKEL	NV	S				
NITROBENZENE	V	L	6.1E-02	1.0E-01	6.1E+01	2.0E+02
NITROGLYCERIN	NV	L				
NITROTOLUENE, 2-	V	S	3.9E-02	6.5E-02	3.9E+01	1.3E+02
NITROTOLUENE, 3-	V	S	1.5E+01	2.0E+01	1.5E+04	4.1E+04
NITROTOLUENE, 4-	NV	S				

TABLE C. ENVIRONMENTAL ACTION LEVELS (EALs)
Indoor Air and Soil Gas
(Vapor Intrusion Hazards)

			INDOOR AIR ACTION LEVELS		[2]SHALLOW SOIL GAS ACTION LEVELS	
CHEMICAL PARAMETER	Physical State		[1]Residential (ug/m3)	Commercial/ Industrial (ug/m^3)	[1]Residential (ug/m3)	Commercial/ Industrial (ug/m^3)
PENTACHLOROPHENOL	NV	S				
PENTAERYTHRITOLTETRANITRATE (PETN)	NV	S				
PERCHLORATE	NV	S				
PHENANTHRENE	V	S	2.9E+01	4.1E+01	2.9E+04	8.2E+04
PHENOL	NV	S				
POLYCHLORINATED BIPHENYLS (PCBs)	NV	S				
PROPICONAZOLE	NV	L				
PYRENE	V	S	2.2E+01	3.1E+01	2.2E+04	6.1E+04
SELENIUM	NV	S				
SILVER	NV	S				
SIMAZINE	NV	S				
STYRENE	V	L	2.1E+02	2.9E+02	2.1E+05	5.8E+05
TERBACIL	NV	S				
tert-BUTYL ALCOHOL	V	L	2.8E+00	4.8E+00	2.8E+03	9.5E+03
TETRACHLOROETHANE, 1,1,1,2-	V	L	3.3E-01	5.5E-01	3.3E+02	1.1E+03
TETRACHLOROETHANE, 1,1,2,2-	V	L	4.2E-02	7.0E-02	4.2E+01	1.4E+02
TETRACHLOROETHYLENE	V	L	4.1E-01	6.9E-01	4.1E+02	1.4E+03
TETRACHLOROPHENOL, 2,3,4,6-	NV	S				
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	NV	S				
THALLIUM	NV	S				
TOLUENE	V	L	1.0E+03	1.5E+03	1.0E+06	2.9E+06
TOXAPHENE	NV	S				
TPH (gasolines)	V	L	1.3E+02	1.8E+02	1.3E+05	3.7E+05
TPH (middle distillates)	V	L	1.3E+02	1.8E+02	1.3E+05	3.7E+05
TPH (residual fuels)	NV	L				
TRICHLOROBENZENE, 1,2,4-	V	S	2.9E-01	4.9E-01	2.9E+02	9.9E+02
TRICHLOROETHANE, 1,1,1-	V	L	1.0E+03	1.5E+03	1.0E+06	2.9E+06
TRICHLOROETHANE, 1,1,2-	V	L	4.2E-02	5.8E-02	4.2E+01	1.2E+02
TRICHLOROETHYLENE	V	L	1.2E+00	2.0E+00	1.2E+03	4.1E+03
TRICHLOROPHENOL, 2,4,5-	NV	S				
TRICHLOROPHENOL, 2,4,6-	NV	S				
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	NV	S				
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	NV	S				
TRICHLOROPROPANE, 1,2,3-	V	L	2.8E-04	4.8E-04	2.8E-01	9.5E-01
TRICHLOROPROPENE, 1,2,3-	V	L	6.3E-02	8.8E-02	6.3E+01	1.8E+02
TRIFLURALIN	NV	S				
TRINITROBENZENE, 1,3,5-	NV	S				
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	NV	S				
TRINITROTOLUENE, 2,4,6- (TNT)	NV	S				
VANADIUM	NV	S				

TABLE C. ENVIRONMENTAL ACTION LEVELS (EALs)
Indoor Air and Soil Gas
(Vapor Intrusion Hazards)

CHEMICAL PARAMETER	Physical State		INDOOR AIR ACTION LEVELS		[2]SHALLOW SOIL GAS ACTION LEVELS	
			[1]Residential (ug/m3)	Commercial/ Industrial (ug/m^3)	[1]Residential (ug/m3)	Commercial/ Industrial (ug/m^3)
VINYL CHLORIDE	V	G	5.5E-01	9.3E-01	5.5E+02	1.9E+03
XYLENES	V	L	2.1E+01	2.9E+01	2.1E+04	5.8E+04
ZINC	NV	S				
Electrical Conductivity (mS/cm, USEPA Method 120.1 MOD)			not applicable	not applicable	not apploicable	not applicable
Sodium Adsorption Ratio			not applicable	not applicable	not applicable	not applicable

Notes:

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

2. Soil Gas: Screening levels based on soil gas data collected immediately beneath a building slab or within 1.5 meters (five feet) ground surface in open areas. Intended for evaluation of potential vapor intrusion hazards.

Soil gas action levels apply to areas that overlie contaminated soil and/or contaminated groundwater.

TPH -Total Petroleum Hydrocarbons. TPH (or equivalent) must be included in analyses for soil gas collected at petroleum release sites, in addition to individual, targeted VOCs (e.g., BTEX, etc.). See Volume 1, Section 2.6 and Appendix 1, Chapter 5.

TABLE D. ENVIRONMENTAL ACTION LEVELS (EALs)
[1]Surface Water Bodies

CHEMICAL PARAMETER	SURFACE WATER ACTION LEVELS		
	[2]Freshwater (ug/L)	[3]Marine (ug/L)	[4]Estuarine (ug/L)
ACENAPHTHENE	2.0E+01	2.0E+01	2.0E+01
ACENAPHTHYLENE	3.0E+01	3.0E+01	3.0E+01
ACETONE	1.5E+03	1.5E+03	1.5E+03
ALDRIN	2.6E-05	2.6E-05	2.6E-05
AMETRYN	1.5E+01	1.5E+01	1.5E+01
AMINO,2- DINITROTOLUENE,4,6-	1.5E+01	1.5E+01	1.5E+01
AMINO,4- DINITROTOLUENE,2,6-	1.5E+01	1.5E+01	1.5E+01
ANTHRACENE	7.3E-01	7.3E-01	7.3E-01
ANTIMONY	6.0E+00	5.0E+02	3.0E+01
ARSENIC	1.4E-01	1.4E-01	1.4E-01
ATRAZINE	3.0E+00	2.6E+01	1.2E+01
BARIUM	2.0E+02	2.0E+02	2.0E+02
BENZENE	5.0E+00	1.3E+01	1.3E+01
BENZO(a)ANTHRACENE	1.8E-02	1.8E-02	1.8E-02
BENZO(a)PYRENE	1.4E-02	1.4E-02	1.4E-02
BENZO(b)FLUORANTHENE	1.8E-02	1.8E-02	1.8E-02
BENZO(g,h,i)PERYLENE	1.0E-01	1.0E-01	1.0E-01
BENZO(k)FLUORANTHENE	1.8E-02	1.8E-02	1.8E-02
BERYLLIUM	3.8E-02	3.8E-02	3.8E-02
BIPHENYL, 1,1-	5.0E-01	5.0E-01	5.0E-01
BIS(2-CHLOROETHYL)ETHER	1.2E-02	4.4E-01	4.4E-01
BIS(2-CHLOROISOPROPYL)ETHER	3.2E-01	6.1E+01	6.1E+01
BIS(2-ETHYLHEXYL)PHTHALATE	2.2E+00	2.2E+00	2.2E+00
BORON	7.3E+03	7.3E+03	7.3E+03
BROMODICHLOROMETHANE	1.2E-01	3.2E+03	3.2E+03
BROMOFORM	8.0E+01	1.4E+02	1.4E+02
BROMOMETHANE	8.7E+00	1.5E+03	1.6E+02
CADMIUM	3.0E+00	9.3E+00	3.0E+00
CARBON TETRACHLORIDE	2.3E+00	2.3E+00	2.3E+00
CHLORDANE (TECHNICAL)	1.6E-05	1.6E-05	1.6E-05
CHLOROANILINE, p-	3.4E-01	5.0E+00	5.0E+00
CHLOROBENZENE	2.5E+01	5.0E+01	2.5E+01
CHLOROETHANE	1.6E+01	1.6E+01	1.6E+01
CHLOROFORM	5.1E+00	5.1E+00	5.1E+00
CHLOROMETHANE	1.8E+00	3.2E+03	3.2E+03
CHLOROPHENOL, 2-	1.8E-01	1.8E-01	1.8E-01
CHROMIUM (Total)	7.4E+01	1.0E+04	7.4E+01
CHROMIUM III	7.4E+01	7.4E+01	7.4E+01
CHROMIUM VI	1.1E+01	5.0E+01	1.1E+01
CHRYSENE	1.8E-02	1.8E-02	1.8E-02
COBALT	3.0E+00	3.0E+00	3.0E+00
COPPER	6.0E+00	2.9E+00	2.9E+00
CYANIDE (Free)	5.2E+00	1.0E+00	1.0E+00
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	6.1E-01	1.9E+02	1.9E+02
DALAPON	2.0E+02	3.0E+02	3.0E+02
DIBENZO(a,h)ANTHTRACENE	9.2E-03	1.8E-02	1.8E-02
DIBROMO,1,2- CHLOROPROPANE,3-	4.0E-02	4.0E-02	4.0E-02

TABLE D. ENVIRONMENTAL ACTION LEVELS (EALs)
[1]Surface Water Bodies

CHEMICAL PARAMETER	SURFACE WATER ACTION LEVELS [2]Freshwater (ug/L)	[3]Marine (ug/L)	[4]Estuarine (ug/L)
DIBROMOCHLOROMETHANE	1.6E-01	1.3E+01	1.3E+01
DIBROMOETHANE, 1,2-	4.0E-02	1.4E+03	1.4E+03
DICHLOROBENZENE, 1,2-	1.0E+01	1.0E+01	1.0E+01
DICHLOROBENZENE, 1,3-	7.1E+01	6.5E+01	6.5E+01
DICHLOROBENZENE, 1,4-	5.0E+00	1.1E+01	1.1E+01
DICHLOROBENZIDINE, 3,3-	7.0E-03	7.0E-03	7.0E-03
DICHLORODIPHENYLDICHLOROETHANE (DDD)	3.1E-04	3.1E-04	3.1E-04
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.2E-04	2.2E-04	2.2E-04
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	8.0E-06	8.0E-06	8.0E-06
DICHLOROETHANE, 1,1-	2.4E+00	4.7E+01	4.7E+01
DICHLOROETHANE, 1,2-	1.5E-01	7.9E+01	7.9E+01
DICHLOROETHYLENE, 1,1-	6.0E-01	6.0E-01	6.0E-01
DICHLOROETHYLENE, Cis 1,2-	7.0E+01	5.9E+02	5.9E+02
DICHLOROETHYLENE, Trans 1,2-	1.0E+02	2.6E+02	2.6E+02
DICHLOROPHENOL, 2,4-	3.0E-01	3.0E-01	3.0E-01
DICHLOROPHENOXYACETIC ACID (2,4-D)	7.0E+01	4.0E+01	4.0E+01
DICHLOROPROPANE, 1,2-	5.0E+00	1.0E+01	1.0E+01
DICHLOROPROPENE, 1,3-	4.3E-01	4.6E+00	4.6E+00
DIELDRIN	2.5E-05	2.5E-05	2.5E-05
DIETHYLPHTHALATE	1.5E+00	1.7E+00	1.5E+00
DIMETHYLPHENOL, 2,4-	1.2E+02	1.1E+02	1.1E+02
DIMETHYLPHTHALATE	1.5E+00	1.7E+00	1.5E+00
DINITROBENZENE, 1,3-	3.7E+00	3.0E+01	3.0E+01
DINITROPHENOL, 2,4-	7.3E+01	7.5E+01	7.5E+01
DINITROTOLUENE, 2,4- (2,4-DNT)	2.2E-01	3.0E+00	3.0E+00
DINITROTOLUENE, 2,6- (2,6-DNT)	3.7E+01	6.7E+01	4.4E+01
DIOXANE, 1,4-	6.7E-01	5.0E+04	5.0E+04
DIOXINS (TEQ)	5.0E-09	5.0E-09	5.0E-09
DIURON	6.0E+01	6.0E+01	6.0E+01
ENDOSULFAN	5.6E-02	8.7E-03	8.7E-03
ENDRIN	2.3E-03	2.3E-03	2.3E-03
ETHANOL	5.0E+04	5.0E+04	5.0E+04
ETHYLBENZENE	3.0E+01	3.0E+01	3.0E+01
FLUORANTHENE	8.1E+00	8.0E+00	8.0E+00
FLUORENE	3.9E+00	3.9E+00	3.9E+00
GLYPHOSATE	6.5E+01	6.5E+01	6.5E+01
HEPTACHLOR	9.0E-05	9.0E-05	9.0E-05
HEPTACHLOR EPOXIDE	3.9E-05	3.9E-05	3.9E-05
HEXACHLOROBENZENE	2.4E-04	2.4E-04	2.4E-04
HEXACHLOROBUTADIENE	8.6E-01	4.7E+00	4.7E+00
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	2.0E-02	2.0E-02	2.0E-02
HEXACHLOROETHANE	2.9E+00	2.9E+00	2.9E+00
HEXAZINONE	1.2E+03	5.0E+03	5.0E+03
INDENO(1,2,3-cd)PYRENE	1.8E-02	1.8E-02	1.8E-02
ISOPHORONE	7.1E+01	1.3E+02	1.3E+02
LEAD	1.5E+01	5.6E+00	5.6E+00
MERCURY	4.7E-02	2.5E-02	2.5E-02

TABLE D. ENVIRONMENTAL ACTION LEVELS (EALs)
[1]Surface Water Bodies

CHEMICAL PARAMETER	SURFACE WATER ACTION LEVELS [2]Freshwater (ug/L)	[3]Marine (ug/L)	[4]Estuarine (ug/L)
METHOXYCHLOR	3.0E-02	3.0E-02	3.0E-02
METHYL ETHYL KETONE	7.1E+03	8.4E+03	8.4E+03
METHYL ISOBUTYL KETONE	1.7E+02	1.7E+02	1.7E+02
METHYL MERCURY	3.0E-03	3.0E-03	3.0E-03
METHYL TERT BUTYL ETHER	5.0E+00	1.8E+02	1.8E+02
METHYLENE CHLORIDE	4.8E+00	5.9E+02	5.9E+02
METHYLNAPHTHALENE, 1-	2.1E+00	2.1E+00	2.1E+00
METHYLNAPHTHALENE, 2-	2.1E+00	2.1E+00	2.1E+00
MOLYBDENUM	1.8E+02	2.4E+02	2.4E+02
NAPHTHALENE	1.7E+01	2.1E+01	2.1E+01
NICKEL	5.0E+00	8.3E+00	5.0E+00
NITROBENZENE	1.2E-01	6.0E+01	6.0E+01
NITROGLYCERIN	3.7E+00	1.4E+02	1.4E+02
NITROTOLUENE, 2-	6.2E-02	1.0E+03	1.0E+03
NITROTOLUENE, 3-	1.2E+02	3.8E+02	3.8E+02
NITROTOLUENE, 4-	4.2E+00	1.6E+03	1.6E+03
PENTACHLOROPHENOL	1.0E+00	3.0E+00	3.0E+00
PENTAERYTHRITOLTETRANITRATE (PETN)	1.7E+01	2.2E+04	2.2E+04
PERCHLORATE	2.6E+01	6.0E+02	6.0E+02
PHENANTHRENE	6.3E+00	4.6E+00	4.6E+00
PHENOL	5.0E+00	1.3E+03	1.3E+03
POLYCHLORINATED BIPHENYLS (PCBs)	7.9E-05	7.9E-05	7.9E-05
PROPICONAZOLE	4.2E+01	2.6E+01	2.6E+01
PYRENE	2.0E+00	2.0E+00	2.0E+00
SELENIUM	5.0E+00	7.1E+01	5.0E+00
SILVER	1.0E+00	1.0E+00	1.0E+00
SIMAZINE	4.0E+00	2.0E+00	2.0E+00
STYRENE	1.0E+01	1.1E+01	1.1E+01
TERBACIL	4.7E+02	2.3E+03	2.3E+03
tert-BUTYL ALCOHOL	4.5E+00	1.8E+04	1.8E+04
TETRACHLOROETHANE, 1,1,1,2-	5.2E-01	3.1E+02	3.1E+02
TETRACHLOROETHANE, 1,1,2,2-	6.7E-02	3.5E+00	3.5E+00
TETRACHLOROETHYLENE	2.9E+00	2.9E+00	2.9E+00
TETRACHLOROPHENOL, 2,3,4,6-	1.2E+00	4.0E+00	1.2E+00
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	3.3E+02	3.3E+02	3.3E+02
THALLIUM	2.0E+00	1.6E+01	1.6E+01
TOLUENE	4.0E+01	4.0E+01	4.0E+01
TOXAPHENE	2.0E-04	2.0E-04	2.0E-04
TPH (gasolines)	1.0E+02	3.7E+03	5.0E+02
TPH (middle distillates)	1.0E+02	6.4E+02	6.4E+02
TPH (residual fuels)	1.0E+02	6.4E+02	6.4E+02
TRICHLOROBENZENE, 1,2,4-	2.5E+01	6.5E+01	2.5E+01
TRICHLOROETHANE, 1,1,1-	6.2E+01	6.2E+01	6.2E+01
TRICHLOROETHANE, 1,1,2-	5.0E+00	1.4E+01	1.4E+01
TRICHLOROETHYLENE	5.0E+00	2.6E+01	2.6E+01
TRICHLOROPHENOL, 2,4,5-	6.3E+01	1.1E+01	1.1E+01
TRICHLOROPHENOL, 2,4,6-	1.2E+00	1.2E+00	1.2E+00

TABLE D. ENVIRONMENTAL ACTION LEVELS (EALs)
[1]Surface Water Bodies

CHEMICAL PARAMETER	SURFACE WATER ACTION LEVELS [2]Freshwater (ug/L)	[3]Marine (ug/L)	[4]Estuarine (ug/L)
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	3.7E+02	6.9E+02	6.9E+02
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	3.0E+01	3.0E+01	3.0E+01
TRICHLOROPROPANE, 1,2,3-	6.0E-01	1.4E+01	1.4E+01
TRICHLOROPROPENE, 1,2,3-	6.2E-01	6.2E-01	6.2E-01
TRIFLURALIN	8.7E+00	2.0E+01	2.0E+01
TRINITROBENZENE, 1,3,5-	3.0E+01	3.0E+01	3.0E+01
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	1.5E+02	1.5E+02	1.5E+02
TRINITROTOLUENE, 2,4,6- (TNT)	2.2E+00	2.0E+01	2.0E+01
VANADIUM	1.9E+01	1.9E+01	1.9E+01
VINYL CHLORIDE	2.0E+00	1.7E+02	1.7E+02
XYLENES	2.0E+01	1.0E+02	1.0E+02
ZINC	2.2E+01	8.6E+01	2.2E+01
Electrical Conductivity (mS/cm, USEPA Method 120.1 MOD)	not applicable	not applicable	not applicable
Sodium Adsorption Ratio	not applicable	not applicable	not applicable

Notes:

1. Compiled for screening of contaminated groundwater that could discharge to surface water. Check with agency overseeing surface water quality for application to aquatic habitats.

2. Source of Freshwater EALs: Refer to Appendix 1, Table D-2a for basis. Includes consideration of drinking water action levels.

3. Source of Marine EALs: Refer to Appendix 1, Table D-2b for basis.

4. Source of Estuarine EALs: Refer to Appendix 1, Table D-2c for basis.

Surface water action levels lowest of drinking water goal (freshwater only), chronic aquatic habitat goal, goal to address bioaccumulation in aquatic organisms and subsequent consumption by humans, and general nuisance goal (odors, etc.). Refer to Chapter 2 of text and Appendix 1 for details.

Estuarine action levels lowest of freshwater and marine action levels.

Water EALs for ethanol based on gross contamination concerns (see Appendix 1, Chapter 5 and related tables).

TPH -Total Petroleum Hydrocarbons. TPH EALs must be used in conjunction with EALs for related chemicals (e.g., BTEX, PAHs, oxidizers, etc.). See Section 2.6 and Appendix 1, Chapter 5, and HEER office Technical Guidance Manual.

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

	(mg/kg)							
						[1]Human Health		Leaching & Groundwater Protection
CHEMICAL PARAMETER	Final EAL	Basis	[1]Gross Contamination (Odors, etc.) Table F-2	Terrestrial Ecotoxicity Table L	Background Table K	Direct Exposure Table I-1	Vapor Intrusion Into Buildings Table C-1b	Drinking Water Resource Table E
ACENAPHTHENE	1.2E+02	Vapor Intrusion	1.0E+03	site-specific		6.2E+02	1.2E+02	1.2E+02
ACENAPHTHYLENE	1.0E+02	Groundwater Protection	5.0E+02	site-specific		3.2E+02	(Use soil gas)	1.0E+02
ACETONE	1.0E+00	Groundwater Protection	5.0E+02	site-specific		1.2E+04	1.4E+04	1.0E+00
ALDRIN	9.2E-01	Direct Exposure	1.0E+03	site-specific		9.2E-01		8.4E+00
AMETRYN	1.1E+01	Groundwater Protection	5.0E+02	site-specific		1.1E+02		1.1E+01
AMINO,2- DINITROTOLUENE,4,6-	3.4E+00	Groundwater Protection	5.0E+02	site-specific		3.1E+01		3.4E+00
AMINO,4- DINITROTOLUENE,2,6-	3.4E+00	Groundwater Protection	5.0E+02	site-specific		3.1E+01		3.4E+00
ANTHRACENE	4.3E+00	Vapor Intrusion	5.0E+02	site-specific		3.3E+03	4.3E+00	5.9E+01
ANTIMONY	2.4E+00	Background	1.0E+03	site-specific	2.4E+00	1.6E+00		(Use batch test)
ARSENIC	2.4E+01	Background	1.0E+03	site-specific	2.4E+01	2.3E+01		(Use batch test)
ATRAZINE	1.1E-01	Groundwater Protection	5.0E+02	site-specific		2.1E+00		1.1E-01
BARIUM	1.0E+03	Ceiling Value	1.0E+03	site-specific	6.9E+02	3.1E+03		(Use batch test)
BENZENE	3.0E-01	Groundwater Protection	5.0E+02	site-specific		1.1E+00	6.7E-01	3.0E-01
BENZO(a)ANTHRACENE	1.5E+00	Direct Exposure	5.0E+02	site-specific		1.5E+00		1.0E+01
BENZO(a)PYRENE	1.5E-01	Direct Exposure	5.0E+02	site-specific		1.5E-01		2.0E+01
BENZO(b)FLUORANTHENE	1.5E+00	Direct Exposure	5.0E+02	site-specific		1.5E+00		9.2E+00
BENZO(g,h,i)PERYLENE	3.5E+01	Groundwater Protection	5.0E+02	site-specific		4.6E+02		3.5E+01
BENZO(k)FLUORANTHENE	1.5E+01	Direct Exposure	5.0E+02	site-specific		1.5E+01		3.9E+01
BERYLLIUM	3.1E+01	Direct Exposure	1.0E+03	site-specific	3.0E+00	3.1E+01		(Use batch test)
BIPHENYL, 1,1-	1.0E+01	Direct Exposure	5.0E+02	site-specific		1.0E+01	(Use soil gas)	2.1E+02
BIS(2-CHLOROETHYL)ETHER	6.4E-05	Groundwater Protection	5.0E+02	site-specific		2.1E-01	4.5E-03	6.4E-05
BIS(2-CHLOROISOPROPYL)ETHER	3.5E-03	Groundwater Protection	5.0E+02	site-specific		3.3E+00	(Use soil gas)	3.5E-03
BIS(2-ETHYLHEXYL)PHTHALATE	3.5E+01	Direct Exposure	5.0E+02	site-specific		3.5E+01		1.9E+02
BORON	1.0E+02	Ceiling Value	1.0E+02	site-specific		3.1E+03		(Use batch test)
BROMODICHLOROMETHANE	2.2E-03	Groundwater Protection	9.3E+02	site-specific		2.8E-01	1.4E-02	2.2E-03
BROMOFORM	6.9E-01	Groundwater Protection	5.0E+02	site-specific		6.1E+01		6.9E-01
BROMOMETHANE	2.2E-01	Vapor Intrusion	5.0E+02	site-specific		1.6E+00	2.2E-01	3.6E-01
CADMIUM	1.4E+01	Direct Exposure	1.0E+03	site-specific	2.3E+00	1.4E+01		(Use batch test)
CARBON TETRACHLORIDE	8.7E-02	Vapor Intrusion	4.5E+02	site-specific		6.2E-01	8.7E-02	8.7E-01
CHLORDANE (TECHNICAL)	1.6E+01	Direct Exposure	1.0E+03	site-specific		1.6E+01		2.9E+01
CHLOROANILINE, p-	6.3E-03	Groundwater Protection	1.0E+03	site-specific		2.4E+00		6.3E-03
CHLOROBENZENE	2.2E+00	Vapor Intrusion	5.0E+02	site-specific		5.9E+01	2.2E+00	2.9E+00
CHLOROETHANE	1.1E+00	Groundwater Protection	5.0E+02	site-specific		2.1E+03	4.5E+02	1.1E+00
CHLOROFORM	2.3E-02	Vapor Intrusion	5.0E+02	site-specific		3.0E-01	2.3E-02	2.0E+00
CHLOROMETHANE	1.0E-01	Groundwater Protection	1.0E+02	site-specific		1.7E+00	2.9E-01	1.0E-01
CHLOROPHENOL, 2-	9.2E-03	Groundwater Protection	1.0E+02	site-specific		6.7E+01	1.5E+01	9.2E-03
CHROMIUM (Total)	1.1E+03	Background	-	site-specific	1.1E+03			(Use batch test)
CHROMIUM III	1.0E+03	Ceiling Value	1.0E+03	site-specific		2.3E+04		(Use batch test)
CHROMIUM VI	2.9E+01	Direct Exposure	1.0E+03	site-specific		2.9E+01		(Use batch test)
CHRYSENE	3.0E+01	Groundwater Protection	1.0E+03	site-specific		1.5E+02		3.0E+01
COBALT	8.0E+01	Background	1.0E+03	site-specific	8.0E+01	4.7E+00		(Use batch test)
COPPER	6.3E+02	Direct Exposure	1.0E+03	site-specific	2.5E+02	6.3E+02		(Use batch test)
CYANIDE (Free)	1.0E+02	Ceiling Value	1.0E+02	site-specific		3.1E+02	(Use soil gas)	(Use batch test)
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	9.0E-03	Groundwater Protection	5.0E+02	site-specific		5.5E+00		9.0E-03
DALAPON	1.1E-01	Groundwater Protection	5.0E+02	site-specific		3.7E+02		1.1E-01

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

	(mg/kg)							
						[1]Human Health		Leaching & Groundwater Protection
CHEMICAL PARAMETER	Final EAL	Basis	[1]Gross Contamination (Odors, etc.) Table F-2	Terrestrial Ecotoxicity Table L	Background Table K	Direct Exposure Table I-1	Vapor Intrusion Into Buildings Table C-1b	Drinking Water Resource Table E
DIBENZO(a,h)ANTHTRACENE	1.5E-01	Direct Exposure	5.0E+02	site-specific		1.5E-01		1.2E+01
DIBROMO,1,2- CHLOROPROPANE,3-	9.0E-04	Groundwater Protection	5.0E+02	site-specific		5.7E-03	(Use soil gas)	9.0E-04
DIBROMOCHLOROMETHANE	1.6E-03	Groundwater Protection	1.0E+02	site-specific		7.8E-01	2.2E-02	1.6E-03
DIBROMOETHANE, 1,2-	3.7E-04	Groundwater Protection	5.0E+02	site-specific		3.2E-02	8.7E-04	3.7E-04
DICHLOROBENZENE, 1,2-	7.5E-01	Groundwater Protection	1.9E+02	site-specific		1.9E+02	8.9E+00	7.5E-01
DICHLOROBENZENE, 1,3-	5.7E-01	Groundwater Protection	1.0E+02	site-specific		1.9E+02	(Use soil gas)	5.7E-01
DICHLOROBENZENE, 1,4-	4.7E-02	Vapor Intrusion	5.0E+02	site-specific		2.5E+00	4.7E-02	3.9E-01
DICHLOROBENZIDINE, 3,3-	7.9E-02	Groundwater Protection	5.0E+02	site-specific		1.1E+00		7.9E-02
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.0E+00	Direct Exposure	5.0E+02	site-specific		2.0E+00		6.3E+01
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.4E+00	Direct Exposure	5.0E+02	site-specific		1.4E+00		2.8E+01
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.7E+00	Direct Exposure	1.0E+03	site-specific		1.7E+00		5.6E+00
DICHLOROETHANE, 1,1-	9.7E-02	Groundwater Protection	5.0E+02	site-specific		3.3E+00	3.3E-01	9.7E-02
DICHLOROETHANE, 1,2-	2.1E-03	Groundwater Protection	5.0E+02	site-specific		4.4E-01	2.0E-02	2.1E-03
DICHLOROETHYLENE, 1,1-	1.2E+00	Groundwater Protection	5.0E+02	site-specific		4.9E+01	8.9E+00	1.2E+00
DICHLOROETHYLENE, Cis 1,2-	3.1E-01	Vapor Intrusion	1.0E+02	site-specific		3.5E+00	3.1E-01	2.3E+00
DICHLOROETHYLENE, Trans 1,2-	2.7E+00	Vapor Intrusion	5.0E+02	site-specific		2.2E+01	2.7E+00	6.4E+00
DICHLOROPHENOL, 2,4-	2.5E-02	Groundwater Protection	5.0E+02	site-specific		3.7E+01		2.5E-02
DICHLOROPHENOXYACETIC ACID (2,4-D)	3.4E-01	Groundwater Protection	5.0E+02	site-specific		1.4E+02		3.4E-01
DICHLOROPROPANE, 1,2-	5.2E-02	Vapor Intrusion	1.0E+02	site-specific		8.9E-01	5.2E-02	1.4E-01
DICHLOROPROPENE, 1,3-	1.5E-02	Groundwater Protection	5.0E+02	site-specific		1.7E+00	1.3E-01	1.5E-02
DIELDRIN	1.5E+00	Direct Exposure	1.0E+03	site-specific		1.5E+00		3.0E+01
DIETHYLPHTHALATE	1.6E+01	Groundwater Protection	5.0E+02	site-specific		9.8E+03		1.6E+01
DIMETHYLPHENOL, 2,4-	9.9E+00	Groundwater Protection	1.0E+02	site-specific		2.4E+02	1.1E+03	9.9E+00
DIMETHYLPHTHALATE	2.2E+01	Groundwater Protection	5.0E+02	site-specific		1.2E+05		2.2E+01
DINITROBENZENE, 1,3-	2.1E-01	Groundwater Protection	5.0E+02	site-specific		1.2E+00		2.1E-01
DINITROPHENOL, 2,4-	5.6E+00	Groundwater Protection	5.0E+02	site-specific		2.4E+01		5.6E+00
DINITROTOLUENE, 2,4- (2,4-DNT)	2.1E-02	Groundwater Protection	5.0E+02	site-specific		1.6E+00		2.1E-02
DINITROTOLUENE, 2,6- (2,6-DNT)	3.6E+00	Groundwater Protection	5.0E+02	site-specific		1.2E+01		3.6E+00
DIOXANE, 1,4-	3.1E-04	Groundwater Protection	5.0E+02	site-specific		4.9E+00		3.1E-04
DIOXINS (TEQ)	2.4E-04	Direct Exposure	1.0E+03	site-specific	2.0E-05	2.4E-04		1.8E-01
DIURON	1.3E+00	Groundwater Protection	5.0E+02	site-specific		2.4E+01		1.3E+00
ENDOSULFAN	1.8E+01	Groundwater Protection	5.0E+02	site-specific		7.3E+01		1.8E+01
ENDRIN	3.7E+00	Direct Exposure	5.0E+02	site-specific		3.7E+00		3.0E+01
ETHANOL	4.5E+00	Groundwater Protection	5.0E+02	site-specific				4.5E+00
ETHYLBENZENE	3.7E+00	Groundwater Protection	4.8E+02	site-specific		5.5E+01	2.1E+01	3.7E+00
FLUORANTHENE	4.6E+02	Direct Exposure	5.0E+02	site-specific		4.6E+02		1.2E+03
FLUORENE	1.0E+02	Vapor Intrusion	5.0E+02	site-specific		4.4E+02	1.0E+02	3.7E+02
GLYPHOSATE	1.0E-01	Groundwater Protection	5.0E+02	site-specific		1.2E+03		1.0E-01
HEPTACHLOR	1.1E-01	Direct Exposure	1.0E+03	site-specific		1.1E-01		4.5E+01
HEPTACHLOR EPOXIDE	5.3E-02	Direct Exposure	1.0E+03	site-specific		5.3E-02		1.2E+01
HEXACHLOROBENZENE	3.0E-01	Direct Exposure	5.0E+02	site-specific		3.0E-01		1.0E+00
HEXACHLOROBUTADIENE	1.8E-01	Groundwater Protection	5.0E+02	site-specific		6.2E+00		1.8E-01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	7.5E-02	Groundwater Protection	5.0E+02	site-specific		5.2E-01		7.5E-02
HEXACHLOROETHANE	2.7E-01	Groundwater Protection	5.0E+02	site-specific		1.2E+01		2.7E-01
HEXAZINONE	2.6E+01	Groundwater Protection	5.0E+02	site-specific		4.0E+02		2.6E+01

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

	(mg/kg)							
						[1]Human Health		Leaching & Groundwater Protection
CHEMICAL PARAMETER	Final EAL	Basis	[1]Gross Contamination (Odors, etc.) Table F-2	Terrestrial Ecotoxicity Table L	Background Table K	Direct Exposure Table I-1	Vapor Intrusion Into Buildings Table C-1b	Drinking Water Resource Table E
INDENO(1,2,3-cd)PYRENE	1.5E+00	Direct Exposure	5.0E+02	site-specific		1.5E+00		3.0E+01
ISOPHORONE	7.7E-01	Groundwater Protection	5.0E+02	site-specific		5.1E+02		7.7E-01
LEAD	2.0E+02	Direct Exposure	1.0E+03	site-specific	7.3E+01	2.0E+02		(Use batch test)
MERCURY	4.7E+00	Direct Exposure	5.0E+02	site-specific	7.2E-01	4.7E+00	(Use soil gas)	(Use batch test)
METHOXYCHLOR	1.6E+01	Groundwater Protection	5.0E+02	site-specific		6.1E+01		1.6E+01
METHYL ETHYL KETONE	7.7E+00	Groundwater Protection	5.0E+02	site-specific		5.6E+03	2.2E+03	7.7E+00
METHYL ISOBUTYL KETONE	5.0E-01	Groundwater Protection	1.0E+02	site-specific		1.1E+03	1.3E+03	5.0E-01
METHYL MERCURY	1.6E+00	Direct Exposure	1.0E+02	site-specific		1.6E+00		(Use batch test)
METHYL TERT BUTYL ETHER	2.8E-02	Groundwater Protection	1.0E+02	site-specific		4.4E+01	2.0E+00	2.8E-02
METHYLENE CHLORIDE	1.1E-01	Groundwater Protection	5.0E+02	site-specific		1.1E+01	1.1E+00	1.1E-01
METHYLNAPHTHALENE, 1-	1.8E+00	Groundwater Protection	5.0E+02	site-specific		9.8E+01	2.6E+01	1.8E+00
METHYLNAPHTHALENE, 2-	4.1E+00	Groundwater Protection	5.0E+02	site-specific		4.7E+01	2.8E+01	4.1E+00
MOLYBDENUM	7.8E+01	Direct Exposure	1.0E+03	site-specific	4.0E+00	7.8E+01		(Use batch test)
NAPHTHALENE	4.4E+00	Groundwater Protection	5.0E+02	site-specific		2.8E+01	4.5E+00	4.4E+00
NICKEL	7.6E+02	Direct Exposure	1.0E+03	site-specific	4.1E+02	7.6E+02		(Use batch test)
NITROBENZENE	4.6E-03	Groundwater Protection	5.0E+02	site-specific		4.8E+00	(Use soil gas)	4.6E-03
NITROGLYCERIN	7.0E-02	Groundwater Protection	5.0E+02	site-specific		1.2E+00		7.0E-02
NITROTOLUENE, 2-	3.8E-03	Groundwater Protection	5.0E+02	site-specific		1.9E+00	(Use soil gas)	3.8E-03
NITROTOLUENE, 3-	7.3E+00	Groundwater Protection	5.0E+02	site-specific		2.5E+02	(Use soil gas)	7.3E+00
NITROTOLUENE, 4-	2.5E-01	Groundwater Protection	5.0E+02	site-specific		3.0E+01		2.5E-01
PENTACHLOROPHENOL	8.2E-01	Groundwater Protection	5.0E+02	site-specific		8.9E-01		8.2E-01
PENTAERYTHRITOLTETRANITRATE (PETN)	4.2E-01	Groundwater Protection	5.0E+02	site-specific		2.4E+01		4.2E-01
PERCHLORATE	7.0E-03	Groundwater Protection	1.0E+03	site-specific		1.1E+01		7.0E-03
PHENANTHRENE	4.4E+02	Direct Exposure	5.0E+02	site-specific		4.4E+02	(Use soil gas)	5.7E+02
PHENOL	1.6E-01	Groundwater Protection	5.0E+02	site-specific		3.7E+03		1.6E-01
POLYCHLORINATED BIPHENYLS (PCBs)	1.1E+00	Direct Exposure	5.0E+02	site-specific		1.1E+00		6.3E+00
PROPICONAZOLE	6.6E+01	Groundwater Protection	5.0E+02	site-specific		1.6E+02		6.6E+01
PYRENE	4.4E+01	Vapor Intrusion	5.0E+02	site-specific		3.4E+02	4.4E+01	6.1E+02
SELENIUM	7.8E+01	Direct Exposure	1.0E+03	site-specific	7.1E+00	7.8E+01		(Use batch test)
SILVER	7.8E+01	Direct Exposure	1.0E+03	site-specific	1.5E+00	7.8E+01		(Use batch test)
SIMAZINE	9.8E-02	Groundwater Protection	5.0E+02	site-specific		4.0E+00		9.8E-02
STYRENE	9.1E-01	Groundwater Protection	5.0E+02	site-specific		8.7E+02	4.5E+02	9.1E-01
TERBACIL	3.9E+00	Groundwater Protection	5.0E+02	site-specific		1.6E+02		3.9E+00
tert-BUTYL ALCOHOL	2.8E-02	Groundwater Protection	1.0E+02	site-specific		8.1E+01	(Use soil gas)	2.8E-02
TETRACHLOROETHANE, 1,1,1,2-	1.5E-02	Groundwater Protection	1.0E+02	site-specific		1.9E+00	(Use soil gas)	1.5E-02
TETRACHLOROETHANE, 1,1,2,2-	1.2E-03	Groundwater Protection	5.0E+02	site-specific		5.7E-01	9.0E-03	1.2E-03
TETRACHLOROETHYLENE	8.8E-02	Vapor Intrusion	1.7E+02	site-specific		5.6E-01	8.8E-02	6.2E-01
TETRACHLOROPHENOL, 2,3,4,6-	4.9E+00	Groundwater Protection	5.0E+02	site-specific		3.7E+02		4.9E+00
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	1.6E+02	Groundwater Protection	5.0E+02	site-specific		7.7E+02		1.6E+02
THALLIUM	7.8E-01	Direct Exposure	1.0E+03	site-specific	2.5E-01	7.8E-01		(Use batch test)
TOLUENE	3.2E+00	Groundwater Protection	5.0E+02	site-specific		8.2E+02	8.2E+02	3.2E+00
TOXAPHENE	4.4E-01	Direct Exposure	5.0E+02	site-specific		4.4E-01		2.5E+02
TPH (gasolines)	1.0E+02	Ceiling Value	1.0E+02	site-specific		5.0E+02	(Use soil gas)	1.0E+02
TPH (middle distillates)	1.0E+02	Groundwater Protection	5.0E+02	site-specific		5.0E+02	(Use soil gas)	1.0E+02
TPH (residual fuels)	5.0E+02	Ceiling Value	5.0E+02	site-specific		9.4E+03		1.0E+03

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

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

Notes:

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

Final Environmental Action Level is lowest of gross contamination, ecotoxicity, direct-exposure, vapor intrusion and leaching action levels.

Assumes soil pH 5.0 to 9.0.

Soil data should be reported on dry-weight basis (see Chapter 7).

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

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

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

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

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

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

	(mg/kg)							
						[1]Human Health		Leaching & Groundwater Protection
CHEMICAL PARAMETER	Final EAL	Basis	[1]Gross Contamination (Odors, etc.) Table F-2	Terrestrial Ecotoxicity Table L	Background Table K	Direct Exposure Table I-1	Vapor Intrusion Into Buildings Table C-1b	Drinking Water Resource Table E
INDENO(1,2,3-cd)PYRENE	1.5E+00	Direct Exposure	5.0E+02	site-specific		1.5E+00		3.0E+01
ISOPHORONE	7.7E-01	Groundwater Protection	5.0E+02	site-specific		5.1E+02		7.7E-01
LEAD	2.0E+02	Direct Exposure	1.0E+03	site-specific	7.3E+01	2.0E+02		(Use batch test)
MERCURY	4.7E+00	Direct Exposure	5.0E+02	site-specific	7.2E-01	4.7E+00	(Use soil gas)	(Use batch test)
METHOXYCHLOR	1.6E+01	Groundwater Protection	5.0E+02	site-specific		6.1E+01		1.6E+01
METHYL ETHYL KETONE	7.7E+00	Groundwater Protection	5.0E+02	site-specific		5.6E+03	2.2E+03	7.7E+00
METHYL ISOBUTYL KETONE	5.0E-01	Groundwater Protection	1.0E+02	site-specific		1.1E+03	1.3E+03	5.0E-01
METHYL MERCURY	1.6E+00	Direct Exposure	1.0E+02	site-specific		1.6E+00		(Use batch test)
METHYL TERT BUTYL ETHER	2.8E-02	Groundwater Protection	1.0E+02	site-specific		4.4E+01	2.0E+00	2.8E-02
METHYLENE CHLORIDE	1.1E-01	Groundwater Protection	5.0E+02	site-specific		1.1E+01	1.1E+00	1.1E-01
METHYLNAPHTHALENE, 1-	7.9E-01	Groundwater Protection	5.0E+02	site-specific		9.8E+01	2.6E+01	7.9E-01
METHYLNAPHTHALENE, 2-	8.7E-01	Groundwater Protection	5.0E+02	site-specific		4.7E+01	2.8E+01	8.7E-01
MOLYBDENUM	7.8E+01	Direct Exposure	1.0E+03	site-specific	4.0E+00	7.8E+01		(Use batch test)
NAPHTHALENE	4.4E+00	Groundwater Protection	5.0E+02	site-specific		2.8E+01	4.5E+00	4.4E+00
NICKEL	7.6E+02	Direct Exposure	1.0E+03	site-specific	4.1E+02	7.6E+02		(Use batch test)
NITROBENZENE	4.6E-03	Groundwater Protection	5.0E+02	site-specific		4.8E+00	(Use soil gas)	4.6E-03
NITROGLYCERIN	7.0E-02	Groundwater Protection	5.0E+02	site-specific		1.2E+00		7.0E-02
NITROTOLUENE, 2-	3.8E-03	Groundwater Protection	5.0E+02	site-specific		1.9E+00	(Use soil gas)	3.8E-03
NITROTOLUENE, 3-	7.3E+00	Groundwater Protection	5.0E+02	site-specific		2.5E+02	(Use soil gas)	7.3E+00
NITROTOLUENE, 4-	2.5E-01	Groundwater Protection	5.0E+02	site-specific		3.0E+01		2.5E-01
PENTACHLOROPHENOL	8.2E-01	Groundwater Protection	5.0E+02	site-specific		8.9E-01		8.2E-01
PENTAERYTHRITOLTETRANITRATE (PETN)	4.2E-01	Groundwater Protection	5.0E+02	site-specific		2.4E+01		4.2E-01
PERCHLORATE	7.0E-03	Groundwater Protection	1.0E+03	site-specific		1.1E+01		7.0E-03
PHENANTHRENE	6.9E+01	Groundwater Protection	5.0E+02	site-specific		4.4E+02	(Use soil gas)	6.9E+01
PHENOL	1.6E-01	Groundwater Protection	5.0E+02	site-specific		3.7E+03		1.6E-01
POLYCHLORINATED BIPHENYLS (PCBs)	1.1E+00	Direct Exposure	5.0E+02	site-specific		1.1E+00		6.3E+00
PROPICONAZOLE	6.6E+00	Groundwater Protection	5.0E+02	site-specific		1.6E+02		6.6E+00
PYRENE	4.4E+01	Vapor Intrusion	5.0E+02	site-specific		3.4E+02	4.4E+01	4.4E+01
SELENIUM	7.8E+01	Direct Exposure	1.0E+03	site-specific	7.1E+00	7.8E+01		(Use batch test)
SILVER	7.8E+01	Direct Exposure	1.0E+03	site-specific	1.5E+00	7.8E+01		(Use batch test)
SIMAZINE	4.9E-02	Groundwater Protection	5.0E+02	site-specific		4.0E+00		4.9E-02
STYRENE	9.1E-01	Groundwater Protection	5.0E+02	site-specific		8.7E+02	4.5E+02	9.1E-01
TERBACIL	3.9E+00	Groundwater Protection	5.0E+02	site-specific		1.6E+02		3.9E+00
tert-BUTYL ALCOHOL	2.8E-02	Groundwater Protection	1.0E+02	site-specific		8.1E+01	(Use soil gas)	2.8E-02
TETRACHLOROETHANE, 1,1,1,2-	1.5E-02	Groundwater Protection	1.0E+02	site-specific		1.9E+00	(Use soil gas)	1.5E-02
TETRACHLOROETHANE, 1,1,2,2-	1.2E-03	Groundwater Protection	5.0E+02	site-specific		5.7E-01	9.0E-03	1.2E-03
TETRACHLOROETHYLENE	8.8E-02	Vapor Intrusion	1.7E+02	site-specific		5.6E-01	8.8E-02	6.2E-01
TETRACHLOROPHENOL, 2,3,4,6-	5.9E-01	Groundwater Protection	5.0E+02	site-specific		3.7E+02		5.9E-01
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	2.9E+01	Groundwater Protection	5.0E+02	site-specific		7.7E+02		2.9E+01
THALLIUM	7.8E-01	Direct Exposure	1.0E+03	site-specific	2.5E-01	7.8E-01		(Use batch test)
TOLUENE	3.2E+00	Groundwater Protection	5.0E+02	site-specific		8.2E+02	8.2E+02	3.2E+00
TOXAPHENE	4.4E-01	Direct Exposure	5.0E+02	site-specific		4.4E-01		2.5E+02
TPH (gasolines)	1.0E+02	Ceiling Value	1.0E+02	site-specific		5.0E+02	(Use soil gas)	1.0E+02
TPH (middle distillates)	1.0E+02	Groundwater Protection	5.0E+02	site-specific		5.0E+02	(Use soil gas)	1.0E+02
TPH (residual fuels)	5.0E+02	Ceiling Value	5.0E+02	site-specific		9.4E+03		1.0E+03

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

	(mg/kg)							
						[1]Human Health		Leaching & Groundwater Protection
CHEMICAL PARAMETER	Final EAL	Basis	[1]Gross Contamination (Odors, etc.) Table F-2	Terrestrial Ecotoxicity Table L	Background Table K	Direct Exposure Table I-1	Vapor Intrusion Into Buildings Table C-1b	Drinking Water Resource Table E
TRICHLOROBENZENE, 1,2,4-	9.8E-02	Vapor Intrusion	5.0E+02	site-specific		6.6E+00	9.8E-02	5.8E+00
TRICHLOROETHANE, 1,1,1-	7.0E+00	Groundwater Protection	5.0E+02	site-specific		6.4E+02	2.2E+02	7.0E+00
TRICHLOROETHANE, 1,1,2-	8.9E-03	Vapor Intrusion	1.0E+02	site-specific		3.2E-01	8.9E-03	7.6E-02
TRICHLOROETHYLENE	2.6E-01	Vapor Intrusion	5.0E+02	site-specific		2.8E+00	2.6E-01	3.5E-01
TRICHLOROPHENOL, 2,4,5-	3.2E+00	Groundwater Protection	1.0E+02	site-specific		1.2E+03		3.2E+00
TRICHLOROPHENOL, 2,4,6-	1.8E+00	Groundwater Protection	5.0E+02	site-specific		1.2E+01		1.8E+00
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	6.5E+00	Groundwater Protection	1.0E+03	site-specific		1.2E+02		6.5E+00
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	8.7E-01	Groundwater Protection	5.0E+02	site-specific		9.8E+01		8.7E-01
TRICHLOROPROPANE, 1,2,3-	1.3E-03	Direct Exposure	1.0E+02	site-specific		1.3E-03	(Use soil gas)	1.1E-02
TRICHLOROPROPENE, 1,2,3-	1.2E-01	Direct Exposure	1.0E+02	site-specific		1.2E-01	(Use soil gas)	1.2E-01
TRIFLURALIN	2.4E+01	Groundwater Protection	1.0E+02	site-specific		6.3E+01		2.4E+01
TRINITROBENZENE, 1,3,5-	8.4E+00	Groundwater Protection	5.0E+02	site-specific		4.5E+02		8.4E+00
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.9E+01	Direct Exposure	5.0E+02	site-specific		4.9E+01		1.1E+02
TRINITROTOLUENE, 2,4,6- (TNT)	1.0E+00	Groundwater Protection	5.0E+02	site-specific		7.2E+00		1.0E+00
VANADIUM	7.7E+02	Background	1.0E+03	site-specific	7.7E+02	7.8E+01		(Use batch test)
VINYL CHLORIDE	7.2E-02	Direct Exposure	5.0E+02	site-specific		7.2E-02	1.2E-01	3.4E-01
XYLENES	2.1E+00	Groundwater Protection	3.9E+02	site-specific		1.2E+02	4.5E+01	2.1E+00
ZINC	1.0E+03	Ceiling Value	1.0E+03	site-specific	3.5E+02	4.7E+03		(Use batch test)
Electrical Conductivity (mS/cm, USEPA Method 120.1 MOD)	4.0	-	-	-	-	-	-	-
Sodium Adsorption Ratio	12	-	-	-	-	-	-	-

Notes:

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

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

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

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

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

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

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

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

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

	(mg/kg)							
						[1]Human Health		Leaching & Groundwater Protection
CHEMICAL PARAMETER	Final EAL	Basis	[1]Gross Contamination (Odors, etc.) Table F-2	Terrestrial Ecotoxicity Table L	Background Table K	Direct Exposure Table I-1	Vapor Intrusion Into Buildings Table C-1b	NON-Drinking Water Resource Table E
TPH (middle distillates)	5.0E+02	Ceiling Value	5.0E+02	site-specific		5.0E+02	(Use soil gas)	5.0E+03
TPH (residual fuels)	5.0E+02	Ceiling Value	5.0E+02	site-specific		9.4E+03		5.0E+03
TRICHLOROBENZENE, 1,2,4-	9.8E-02	Vapor Intrusion	5.0E+02	site-specific		6.6E+00	9.8E-02	3.7E+01
TRICHLOROETHANE, 1,1,1-	2.2E+02	Vapor Intrusion	5.0E+02	site-specific		6.4E+02	2.2E+02	6.8E+02
TRICHLOROETHANE, 1,1,2-	8.9E-03	Vapor Intrusion	1.0E+02	site-specific		3.2E-01	8.9E-03	1.6E+00
TRICHLOROETHYLENE	2.6E-01	Vapor Intrusion	5.0E+02	site-specific		2.8E+00	2.6E-01	4.3E+01
TRICHLOROPHENOL, 2,4,5-	2.9E+01	Groundwater Protection	1.0E+02	site-specific		1.2E+03		2.9E+01
TRICHLOROPHENOL, 2,4,6-	1.2E+01	Direct Exposure	5.0E+02	site-specific		1.2E+01		1.4E+02
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	1.2E+01	Groundwater Protection	1.0E+03	site-specific		1.2E+02		1.2E+01
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	8.7E-01	Groundwater Protection	5.0E+02	site-specific		9.8E+01		8.7E-01
TRICHLOROPROPANE, 1,2,3-	1.3E-03	Direct Exposure	1.0E+02	site-specific		1.3E-03	(Use soil gas)	2.5E+00
TRICHLOROPROPENE, 1,2,3-	1.2E-01	Direct Exposure	1.0E+02	site-specific		1.2E-01	(Use soil gas)	1.2E-01
TRIFLURALIN	5.4E+01	Groundwater Protection	1.0E+02	site-specific		6.3E+01		5.4E+01
TRINITROBENZENE, 1,3,5-	3.9E+01	Groundwater Protection	5.0E+02	site-specific		4.5E+02		3.9E+01
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.9E+01	Direct Exposure	5.0E+02	site-specific		4.9E+01		1.1E+02
TRINITROTOLUENE, 2,4,6- (TNT)	7.2E+00	Direct Exposure	5.0E+02	site-specific		7.2E+00		2.7E+02
VANADIUM	7.7E+02	Background	1.0E+03	site-specific	7.7E+02	7.8E+01		(Use batch test)
VINYL CHLORIDE	7.2E-02	Direct Exposure	5.0E+02	site-specific		7.2E-02	1.2E-01	1.1E+01
XYLENES	4.5E+01	Vapor Intrusion	3.9E+02	site-specific		1.2E+02	4.5E+01	1.1E+02
ZINC	1.0E+03	Ceiling Value	1.0E+03	site-specific	3.5E+02	4.7E+03		(Use batch test)
Electrical Conductivity (mS/cm, USEPA Method 120.1 MOD)	2.0	-	-	-	-	-	-	-
Sodium Adsorption Ratio	5.0	-	-	-	-	-	-	-

Notes:

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

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

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

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

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

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

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

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

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

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

Notes:

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

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

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

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

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

CHEMICAL PARAMETER	Physical State		[1,3]Unrestricted Land Use (ug/L)	Commercial/ Industrial Land Use Only (ug/L)
DICHLOROETHANE, 1,1-	V	L	9.4E+02	3.1E+03
DICHLOROETHANE, 1,2-	V	L	1.6E+02	5.3E+02
DICHLOROETHYLENE, 1,1-	V	L	6.4E+03	1.8E+04
DICHLOROETHYLENE, Cis 1,2-	V	L	1.1E+03	3.1E+03
DICHLOROETHYLENE, Trans 1,2-	V	L	5.0E+03	1.4E+04
DICHLOROPHENOL, 2,4-	NV	S		
DICHLOROPHENOXYACETIC ACID (2,4-D)	NV	S		
DICHLOROPROPANE, 1,2-	V	L	2.6E+02	8.9E+02
DICHLOROPROPENE, 1,3-	V	L	5.5E+02	1.9E+03
DIELDRIN	NV	S		
DIETHYLPHTHALATE	NV	S		
#DIMETHYLPHENOL, 2,4-	V	S	1.5E+06	4.2E+06
DIMETHYLPHTHALATE	NV	S		
DINITROBENZENE, 1,3-	NV	S		
DINITROPHENOL, 2,4-	NV	S		
DINITROTOLUENE, 2,4- (2,4-DNT)	NV	S		
DINITROTOLUENE, 2,6- (2,6-DNT)	NV	S		
DIOXANE, 1,4-	NV	L		
DIOXINS (TEQ)	NV	S		
DIURON	NV	S		
ENDOSULFAN	NV	S		
ENDRIN	NV	S		
ETHANOL	NV	L		
#ETHYLBENZENE	V	L	6.6E+04	1.7E+05
FLUORANTHENE	NV	S		
#FLUORENE	V	S	1.9E+03	1.9E+03
GLYPHOSATE	NV	S		
HEPTACHLOR	NV	S		
HEPTACHLOR EPOXIDE	NV	S		
HEXACHLOROBENZENE	NV	S		
HEXACHLOROBUTADIENE	NV	S		
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	NV	S		
HEXACHLOROETHANE	NV	S		
HEXAZINONE	NV	S		
INDENO(1,2,3-cd)PYRENE	NV	S		
ISOPHORONE	NV	L		
LEAD	NV	S		
MERCURY	V	S	(Use soil gas)	(Use soil gas)
METHOXYCHLOR	NV	S		
#METHYL ETHYL KETONE	V	L	1.9E+08	2.2E+08
#METHYL ISOBUTYL KETONE	V	L	1.9E+07	1.9E+07
METHYL MERCURY	NV	S		
METHYL TERT BUTYL ETHER	V	L	2.6E+04	8.9E+04
METHYLENE CHLORIDE	V	L	3.9E+03	1.3E+04
#METHYLNAPHTHALENE, 1-	V	S	2.5E+04	2.5E+04
#METHYLNAPHTHALENE, 2-	V	S	2.5E+04	2.5E+04
MOLYBDENUM	NV	S		
#NAPHTHALENE	V	S	2.8E+04	3.1E+04
NICKEL	NV	S		
NITROBENZENE	V	L	(Use soil gas)	(Use soil gas)
NITROGLYCERIN	NV	L		
NITROTOLUENE, 2-	V	S	(Use soil gas)	(Use soil gas)
NITROTOLUENE, 3-	V	S	(Use soil gas)	(Use soil gas)
NITROTOLUENE, 4-	NV	S		
PENTACHLOROPHENOL	NV	S		
PENTAERYTHRITOLTETRANITRATE (PETN)	NV	S		

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

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

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

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

Notes:

1. Based on unrestricted current or future land use. Considered adequate for residential housing, schools, medical facilities, day-care centers and other sensitive uses.
2. Soil model: One meter dry sandy soil (92% sand, 5% silt, 3% clay) over one meter moist clayey loam (33% sand, 34% silt, 33% clay). Used to reflect general field calibration of groundwater data to soil gas data.
3. For inclusion in Tier 1 action levels, all groundwater assumed to potentially migrate under a residential area. Action levels for protection of indoor air under a residential exposure scenario carried forward for use at both residential and commercial/industrial sites (see Table D series).

Action levels calculated using spreadsheet provided with User's Guide for the USEPA vapor intrusion guidance (USEPA 2004)
Assumed vadose-zone thickness/depth to groundwater three meters. See Appendix 1 text for model details.
Physical state of chemical at ambient conditions (V - volatile, NV - nonvolatile, S -solid, L - liquid, G - gas).
Chemical considered to be "volatile" if Henry's number (atm m3/mole) >0.00001 and molecular weight <200.
Dibromochloromethane, dibromochloropropane and pyrene considered volatile for purposes of modeling (USEPA 2004, 2008).
Target cancer risk = 1E-06, Target Hazard Quotient = 0.2 except as noted.
"#": Nonchlorinated VOCs (except MTBE) adjusted upwards by factor of ten to account for assumed biodegradation in vadose-zone prior to emission at surface.

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

CHEMICAL PARAMETER	Physical State		[1]Unrestricted Land Use (mg/kg)	Commercial/ Industrial Land Use Only (mg/kg)
#ACENAPHTHENE	V	S	1.2E+02	1.2E+02
ACENAPHTHYLENE	V	S	(Use soil gas)	(Use soil gas)
#ACETONE	V	L	1.4E+04	3.2E+04
ALDRIN	NV	S		
AMETRYN	NV	S		
AMINO,2- DINITROTOLUENE,4,6-	NV	S		
AMINO,4- DINITROTOLUENE,2,6-	NV	S		
#ANTHRACENE	V	S	4.3E+00	4.3E+00
ANTIMONY	NV	S		
ARSENIC	NV	S		
ATRAZINE	NV	S		
BARIUM	NV	S		
#BENZENE	V	L	6.7E-01	1.9E+00
BENZO(a)ANTHRACENE	NV	S		
BENZO(a)PYRENE	NV	S		
BENZO(b)FLUORANTHENE	NV	S		
BENZO(g,h,i)PERYLENE	NV	S		
BENZO(k)FLUORANTHENE	NV	S		
BERYLLIUM	NV	S		
BIPHENYL, 1,1-	V	S	(Use soil gas)	(Use soil gas)
BIS(2-CHLOROETHYL)ETHER	V	L	4.5E-03	1.4E-02
BIS(2-CHLOROISOPROPYL)ETHER	V	L	(Use soil gas)	(Use soil gas)
BIS(2-ETHYLHEXYL)PHTHALATE	NV	S		
BORON	NV	S		
BROMODICHLOROMETHANE	V	L	1.4E-02	3.9E-02
BROMOFORM	NV	S		
BROMOMETHANE	V	G	2.2E-01	5.2E-01
CADMIUM	NV	S		
CARBON TETRACHLORIDE	V	L	8.7E-02	2.4E-01
CHLORDANE (TECHNICAL)	NV	S		
CHLOROANILINE, p-	NV	S		
CHLOROBENZENE	V	L	2.2E+00	5.2E+00
CHLOROETHANE	V	G	4.5E+02	1.0E+03
CHLOROFORM	V	L	2.3E-02	6.3E-02
CHLOROMETHANE	V	G	2.9E-01	8.1E-01
CHLOROPHENOL, 2-	V	L	1.5E+01	4.3E+01
CHROMIUM (Total)	NV	S		
CHROMIUM III	NV	S		
CHROMIUM VI	NV	S		
CHRYSENE	NV	S		
COBALT	NV	S		
COPPER	NV	S		
CYANIDE (Free)	V	S	(Use soil gas)	(Use soil gas)
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	NV	S		
DALAPON	NV	L		
DIBENZO(a,h)ANTHTRACENE	NV	S		
DIBROMO,1,2- CHLOROPROPANE,3-	V	L	(Use soil gas)	4.7E-04
DIBROMOCHLOROMETHANE	V	S	2.2E-02	(Use soil gas)
DIBROMOETHANE, 1,2-	V	S	8.7E-04	2.4E-03
DICHLOROBENZENE, 1,2-	V	L	8.9E+00	2.1E+01
DICHLOROBENZENE, 1,3-	V	L	(Use soil gas)	(Use soil gas)
DICHLOROBENZENE, 1,4-	V	S	4.7E-02	1.3E-01
DICHLOROBENZIDINE, 3,3-	NV	S		
DICHLORODIPHENYLDICHLOROETHANE (DDD)	NV	S		
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	NV	S		

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

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

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

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

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

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

Notes:

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

Action levels calculated using spreadsheet provided with User's Guide for the USEPA vapor intrusion guidance (USEPA 2004)
Soil model: Two meters dry sandy soil (92% sand, 5% silt, 3% clay) directly underlying building foundation.
Physical state of chemical at ambient conditions (V - volatile, NV - nonvolatile, S -solid, L - liquid, G - gas).
Chemical considered to be "volatile" if Henry's number (atm m3/mole) >0.00001 and molecular weight <200.
Dibromochloromethane, dibromochloropropane and pyrene considered volatile for purposes of modeling (USEPA 2004, 2008).
Target cancer risk = 1E-06, Target Hazard Quotient = 0.2 except as noted.
"#": Nonchlorinated VOCs (except MTBE) adjusted upwards by factor of ten to account for assumed biodegradation in vadose-zone prior to emission at surface.

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

			[2]Unrestricted Land Use			Commercial/Industrial Land Use Only		
			Lowest	Carcinogenic	Noncarcinogenic	Lowest	Carcinogenic	Noncarcinogenic
	Physical		Residential	Effects	Effects	C/I	Effects	Effects
CHEMICAL PARAMETER	State		(ug/m^3)	(ug/m^3)	(ug/m^3)	(ug/m^3)	(ug/m^3)	(ug/m^3)
ACENAPHTHENE	V	S	4.4E+04		4.4E+04	1.2E+05		1.2E+05
ACENAPHTHYLENE	V	S	2.9E+04		2.9E+04	8.2E+04		8.2E+04
ACETONE	V	L	6.5E+06		6.5E+06	1.8E+07		1.8E+07
ALDRIN	NV	S						
AMETRYN	NV	S						
AMINO,2- DINITROTOLUENE,4,6-	NV	S						
AMINO,4- DINITROTOLUENE,2,6-	NV	S						
ANTHRACENE	V	S	2.2E+05		2.2E+05	6.1E+05		6.1E+05
ANTIMONY	NV	S						
ARSENIC	NV	S						
ATRAZINE	NV	S						
BARIUM	NV	S						
BENZENE	V	L	3.1E+02	3.1E+02	6.3E+03	1.0E+03	1.0E+03	1.8E+04
BENZO(a)ANTHRACENE	NV	S						
BENZO(a)PYRENE	NV	S						
BENZO(b)FLUORANTHENE	NV	S						
BENZO(g,h,i)PERYLENE	NV	S						
BENZO(k)FLUORANTHENE	NV	S						
BERYLLIUM	NV	S						
BIPHENYL, 1,1-	V	S	8.3E+01	1.1E+03	8.3E+01	2.3E+02	3.6E+03	2.3E+02
BIS(2-CHLOROETHYL)ETHER	V	L	7.4E+00	7.4E+00		2.5E+01	2.5E+01	
BIS(2-CHLOROISOPROPYL)ETHER	V	L	2.4E+02	2.4E+02	2.9E+04	8.2E+02	8.2E+02	8.2E+04
BIS(2-ETHYLHEXYL)PHTHALATE	NV	S						
BORON	NV	S						
BROMODICHLOROMETHANE	V	L	6.6E+01	6.6E+01	1.5E+04	2.2E+02	2.2E+02	4.1E+04
BROMOFORM	NV	S						
BROMOMETHANE	V	G	1.0E+03		1.0E+03	2.9E+03		2.9E+03
CADMIUM	NV	S						
CARBON TETRACHLORIDE	V	L	4.1E+02	4.1E+02	2.1E+04	1.4E+03	1.4E+03	5.8E+04
CHLORDANE (TECHNICAL)	NV	S						
CHLOROANILINE, p-	NV	S						
CHLOROBENZENE	V	L	1.0E+04		1.0E+04	2.9E+04		2.9E+04
CHLOROETHANE	V	G	2.1E+06		2.1E+06	5.8E+06		5.8E+06
CHLOROFORM	V	L	1.1E+02	1.1E+02	2.0E+04	3.6E+02	3.6E+02	5.7E+04
CHLOROMETHANE	V	G	1.4E+03	1.4E+03	1.9E+04	4.5E+03	4.5E+03	5.3E+04
CHLOROPHENOL, 2-	V	L	3.7E+03		3.7E+03	1.0E+04		1.0E+04
CHROMIUM (Total)	NV	S						
CHROMIUM III	NV	S						
CHROMIUM VI	NV	S						
CHRYSENE	NV	S						
COBALT	NV	S						
COPPER	NV	S						
CYANIDE (Free)	V	S						
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	NV	S						
DALAPON	NV	L						
DIBENZO(a,h)ANTHTRACENE	NV	S						

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

CHEMICAL PARAMETER	Physical State		[2]Unrestricted Land Use			Commercial/Industrial Land Use Only		
			Lowest Residential (ug/m^3)	Carcinogenic Effects (ug/m^3)	Noncarcinogenic Effects (ug/m^3)	Lowest C/I (ug/m^3)	Carcinogenic Effects (ug/m^3)	Noncarcinogenic Effects (ug/m^3)
DIBROMO,1,2- CHLOROPROPANE,3-	V	L	4.1E-01	4.1E-01	4.2E+01	1.4E+00	1.4E+00	1.2E+02
DIBROMOCHLOROMETHANE	V	S	1.0E+02	1.0E+02	1.5E+04	3.4E+02	3.4E+02	4.1E+04
DIBROMOETHANE, 1,2-	V	S	4.1E+00	4.1E+00	1.9E+03	1.4E+01	1.4E+01	5.3E+03
DICHLOROBENZENE, 1,2-	V	L	4.2E+04		4.2E+04	1.2E+05		1.2E+05
DICHLOROBENZENE, 1,3-	V	L	2.2E+04		2.2E+04	6.1E+04		6.1E+04
DICHLOROBENZENE, 1,4-	V	S	2.2E+02	2.2E+02	1.7E+05	7.4E+02	7.4E+02	4.7E+05
DICHLOROBENZIDINE, 3,3-	NV	S						
DICHLORODIPHENYLDICHLOROETHANE (DDD)	NV	S						
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	NV	S						
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	NV	S						
DICHLOROETHANE, 1,1-	V	L	1.5E+03	1.5E+03	1.5E+05	5.1E+03	5.1E+03	4.1E+05
DICHLOROETHANE, 1,2-	V	L	9.4E+01	9.4E+01	1.5E+03	3.1E+02	3.1E+02	4.1E+03
DICHLOROETHYLENE, 1,1-	V	L	4.2E+04		4.2E+04	1.2E+05		1.2E+05
DICHLOROETHYLENE, Cis 1,2-	V	L	1.5E+03		1.5E+03	4.1E+03		4.1E+03
DICHLOROETHYLENE, Trans 1,2-	V	L	1.3E+04		1.3E+04	3.5E+04		3.5E+04
DICHLOROPHENOL, 2,4-	NV	S						
DICHLOROPHENOXYACETIC ACID (2,4-D)	NV	S						
DICHLOROPROPANE, 1,2-	V	L	2.4E+02	2.4E+02	8.3E+02	8.2E+02	8.2E+02	2.3E+03
DICHLOROPROPENE, 1,3-	V	L	6.1E+02	6.1E+02	4.2E+03	2.0E+03	2.0E+03	1.2E+04
DIELDRIN	NV	S						
DIETHYLPHTHALATE	NV	S						
DIMETHYLPHENOL, 2,4-	V	S	1.5E+04		1.5E+04	4.1E+04		4.1E+04
DIMETHYLPHTHALATE	NV	S						
DINITROBENZENE, 1,3-	NV	S						
DINITROPHENOL, 2,4-	NV	S						
DINITROTOLUENE, 2,4- (2,4-DNT)	NV	S						
DINITROTOLUENE, 2,6- (2,6-DNT)	NV	S						
DIOXANE, 1,4-	NV	L						
DIOXINS (TEQ)	NV	S						
DIURON	NV	S						
ENDOSULFAN	NV	S						
ENDRIN	NV	S						
ETHANOL	NV	L						
ETHYLBENZENE	V	L	9.7E+02	9.7E+02	2.1E+05	3.3E+03	3.3E+03	5.8E+05
FLUORANTHENE	NV	S						
FLUORENE	V	S	2.9E+04		2.9E+04	8.2E+04		8.2E+04
GLYPHOSATE	NV	S						
HEPTACHLOR	NV	S						
HEPTACHLOR EPOXIDE	NV	S						
HEXACHLOROBENZENE	NV	S						
HEXACHLOROBUTADIENE	NV	S						
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	NV	S						
HEXACHLOROETHANE	NV	S						
HEXAZINONE	NV	S						
INDENO(1,2,3-cd)PYRENE	NV	S						
ISOPHORONE	NV	L						

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

			[2]Unrestricted Land Use			Commercial/Industrial Land Use Only		
			Lowest	Carcinogenic	Noncarcinogenic	Lowest	Carcinogenic	Noncarcinogenic
	Physical		Residential	Effects	Effects	C/I	Effects	Effects
CHEMICAL PARAMETER	State		(ug/m^3)	(ug/m^3)	(ug/m^3)	(ug/m^3)	(ug/m^3)	(ug/m^3)
LEAD	NV	S						
MERCURY	V	S	6.3E+00		6.3E+00	1.8E+01		1.8E+01
METHOXYCHLOR	NV	S						
METHYL ETHYL KETONE	V	L	1.0E+06		1.0E+06	2.9E+06		2.9E+06
METHYL ISOBUTYL KETONE	V	L	6.3E+05		6.3E+05	1.8E+06		1.8E+06
METHYL MERCURY	NV	S						
METHYL TERT BUTYL ETHER	V	L	9.4E+03	9.4E+03	6.3E+05	3.1E+04	3.1E+04	1.8E+06
METHYLENE CHLORIDE	V	L	5.2E+03	5.2E+03	2.3E+05	1.7E+04	1.7E+04	6.4E+05
METHYLNAPHTHALENE, 1-	V	S	2.9E+02	2.9E+02	5.1E+04	9.9E+02	9.9E+02	1.4E+05
METHYLNAPHTHALENE, 2-	V	S	2.9E+03		2.9E+03	8.2E+03		8.2E+03
MOLYBDENUM	NV	S						
NAPHTHALENE	V	S	7.2E+01	7.2E+01	6.3E+02	2.4E+02	2.4E+02	1.8E+03
NICKEL	NV	S						
NITROBENZENE	V	L	6.1E+01	6.1E+01	1.9E+03	2.0E+02	2.0E+02	5.3E+03
NITROGLYCERIN	NV	L						
NITROTOLUENE, 2-	V	S	3.9E+01	3.9E+01	6.6E+02	1.3E+02	1.3E+02	1.8E+03
NITROTOLUENE, 3-	V	S	1.5E+04		1.5E+04	4.1E+04		4.1E+04
NITROTOLUENE, 4-	NV	S						
PENTACHLOROPHENOL	NV	S						
PENTAERYTHRITOLTETRANITRATE (PETN)	NV	S						
PERCHLORATE	NV	S						
PHENANTHRENE	V	S	2.9E+04		2.9E+04	8.2E+04		8.2E+04
PHENOL	NV	S						
POLYCHLORINATED BIPHENYLS (PCBs)	NV	S						
PROPICONAZOLE	NV	L						
PYRENE	V	S	2.2E+04		2.2E+04	6.1E+04		6.1E+04
SELENIUM	NV	S						
SILVER	NV	S						
SIMAZINE	NV	S						
STYRENE	V	L	2.1E+05		2.1E+05	5.8E+05		5.8E+05
TERBACIL	NV	S						
tert-BUTYL ALCOHOL	V	L	2.8E+03	2.8E+03		9.5E+03	9.5E+03	
TETRACHLOROETHANE, 1,1,1,2-	V	L	3.3E+02	3.3E+02	2.2E+04	1.1E+03	1.1E+03	6.1E+04
TETRACHLOROETHANE, 1,1,2,2-	V	L	4.2E+01	4.2E+01		1.4E+02	1.4E+02	
TETRACHLOROETHYLENE	V	L	4.1E+02	4.1E+02	5.6E+04	1.4E+03	1.4E+03	1.6E+05
TETRACHLOROPHENOL, 2,3,4,6-	NV	S						
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	NV	S						
THALLIUM	NV	S						
TOLUENE	V	L	1.0E+06		1.0E+06	2.9E+06		2.9E+06
TOXAPHENE	NV	S						
TPH (gasolines)	V	L	1.3E+05		1.3E+05	3.7E+05		3.7E+05
TPH (middle distillates)	V	L	1.3E+05		1.3E+05	3.7E+05		3.7E+05
TPH (residual fuels)	NV	L						
TRICHLOROBENZENE, 1,2,4-	V	S	2.9E+02	2.9E+02	4.2E+02	9.9E+02	9.9E+02	1.2E+03
TRICHLOROETHANE, 1,1,1-	V	L	1.0E+06		1.0E+06	2.9E+06		2.9E+06
TRICHLOROETHANE, 1,1,2-	V	L	4.2E+01	1.5E+02	4.2E+01	1.2E+02	5.1E+02	1.2E+02

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

CHEMICAL PARAMETER	Physical State		[2]Unrestricted Land Use: Lowest Residential (ug/m^3)	[2]Unrestricted Land Use: Carcinogenic Effects (ug/m^3)	[2]Unrestricted Land Use: Noncarcinogenic Effects (ug/m^3)	Commercial/Industrial Land Use Only: Lowest C/I (ug/m^3)	Commercial/Industrial Land Use Only: Carcinogenic Effects (ug/m^3)	Commercial/Industrial Land Use Only: Noncarcinogenic Effects (ug/m^3)
TRICHLOROETHYLENE	V	L	1.2E+03	1.2E+03	2.1E+03	4.1E+03	4.1E+03	5.8E+03
TRICHLOROPHENOL, 2,4,5-	NV	S						
TRICHLOROPHENOL, 2,4,6-	NV	S						
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	NV	S						
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	NV	S						
TRICHLOROPROPANE, 1,2,3-	V	L	2.8E-01	2.8E-01	6.3E+01	9.5E-01	9.5E-01	1.8E+02
TRICHLOROPROPENE, 1,2,3-	V	L	6.3E+01		6.3E+01	1.8E+02		1.8E+02
TRIFLURALIN	NV	S						
TRINITROBENZENE, 1,3,5-	NV	S						
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	NV	S						
TRINITROTOLUENE, 2,4,6- (TNT)	NV	S						
VANADIUM	NV	S						
VINYL CHLORIDE	V	G	5.5E+02	5.5E+02	2.1E+04	1.9E+03	1.9E+03	5.8E+04
XYLENES	V	L	2.1E+04		2.1E+04	5.8E+04		5.8E+04
ZINC	NV	S						

Notes:

1. Shallow soil gas defined as soil gas sample data collected within 1.5 meters (five feet) from a building foundation or the ground surface. Assumes very permeable (e.g., sandy) fill material immediately beneath building slab or could be present below future buildings following redevelopment. Evaluation of deeper soil gas data (e.g., >1.5m bgs) should be carried out on a site-specific basis.
2. Based on unrestricted current or future land use. Considered adequate for residential housing, schools, medical facilities, day-care centers and other sensitive uses.

Soil gas action levels intended to be protective of indoor air quality, calculated for volatile chemicals only.
Physical state of chemical at ambient conditions (V - volatile, NV - nonvolatile, S - solid, L - liquid, G - gas).
Chemical considered to be "volatile" if Henry's number (atm m3/mole) >0.00001 and molecular weight <200.
Dibromochloromethane, dibromochloropropane and pyrene considered volatile for purposes of modeling (USEPA 2004, 2008).
Target cancer risk = 1E-06, Target Hazard Quotient = 0.2 for all chemicals except as noted.
Target Hazard Quotient = 1.0 for TPH.
Residential soil gas:indoor air attenuation factor = 0.001 (1/1000). Commercial/industrial soil gas:indoor air attenuation factor = 0.0005 (1/2000). Refer to Section 3.3.
Soil gas action levels for TPHgasolines based on action levels for TPHmiddle distillates due to potential for mixture of fuel types at release sites.
Soil gas action level for ethanol based on potential indoor air nuisance concerns (refer to Chapter 6 and Table F series).
Soil gas action levels do not address mass-balance issues. May be overly conservative for sites with low permeability soils immediately beneath a building slab or limited soil impacts and no source of VOCs in groundwater.
Indoor-air sampling and/or passive vapor mitigation measures may be prudent for sites where concentrations of chemicals in soil gas approach but do not exceed action levels. Consider other sources of VOCs in all indoor air studies

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

CHEMICAL PARAMETER	Physical State		Health-Based Action Levels								50% Odor Recognition Threshold (Table F-2) (ug/m^3)
			Unit Risk Factor URF $(ug/m^3)^{-1}$	Reference Concentration RfC (ug/m^3)	[1]Unrestricted Land Use			Commercial/Industrial Use Only			
					Lowest Residential (ug/m^3)	Indoor Air (carcinogens) (ug/m^3)	Indoor Air (noncarcinogens) (ug/m^3)	Lowest C/I (ug/m^3)	Indoor Air (carcinogens) (ug/m^3)	Indoor Air (noncarcinogens) (ug/m^3)	
ACENAPHTHENE	V	S		2.1E+02	4.4E+01		4.4E+01	6.1E+01		6.1E+01	5.13E+02
ACENAPHTHYLENE	V	S		1.4E+02	2.9E+01		2.9E+01	4.1E+01		4.1E+01	-
ACETONE	V	L		3.1E+04	6.5E+03		6.5E+03	9.1E+03		9.1E+03	3.09E+04
ALDRIN	NV	S									2.63E+02
AMETRYN	NV	S									-
AMINO,2- DINITROTOLUENE,4,6-	NV	S									-
AMINO,4- DINITROTOLUENE,2,6-	NV	S									-
ANTHRACENE	V	S		1.1E+03	2.2E+02		2.2E+02	3.1E+02		3.1E+02	-
ANTIMONY	NV	S									-
ARSENIC	NV	S									-
ATRAZINE	NV	S									-
BARIUM	NV	S									-
BENZENE	V	L	7.8E-06	3.0E+01	3.1E-01	3.1E-01	6.3E+00	5.2E-01	5.2E-01	8.8E+00	4.89E+03
BENZO(a)ANTHRACENE	NV	S									-
BENZO(a)PYRENE	NV	S									-
BENZO(b)FLUORANTHENE	NV	S									-
BENZO(g,h,i)PERYLENE	NV	S									-
BENZO(k)FLUORANTHENE	NV	S									-
BERYLLIUM	NV	S									-
BIPHENYL, 1,1-	V	S	2.3E-06	4.0E-01	8.3E-02	1.1E+00	8.3E-02	1.2E-01	1.8E+00	1.2E-01	6.00E+01
BIS(2-CHLOROETHYL)ETHER	V	L	3.3E-04		7.4E-03	7.4E-03		1.2E-02	1.2E-02		2.87E+02
BIS(2-CHLOROISOPROPYL)ETHER	V	L	1.0E-05	1.4E+02	2.4E-01	2.4E-01	2.9E+01	4.1E-01	4.1E-01	4.1E+01	2.24E+03
BIS(2-ETHYLHEXYL)PHTHALATE	NV	S									-
BORON	NV	S									-
BROMODICHLOROMETHANE	V	L	3.7E-05	7.0E+01	6.6E-02	6.6E-02	1.5E+01	1.1E-01	1.1E-01	2.0E+01	1.10E+07
BROMOFORM	NV	S									1.35E+04
BROMOMETHANE	V	G		5.0E+00	1.0E+00		1.0E+00	1.5E+00		1.5E+00	8.00E+04
CADMIUM	NV	S									-
CARBON TETRACHLORIDE	V	L	6.0E-06	1.0E+02	4.1E-01	4.1E-01	2.1E+01	6.8E-01	6.8E-01	2.9E+01	6.30E+04
CHLORDANE (TECHNICAL)	NV	S									8.40E+00
CHLOROANILINE, p-	NV	S									-
CHLOROBENZENE	V	L		5.0E+01	1.0E+01		1.0E+01	1.5E+01		1.5E+01	1.00E+03
CHLOROETHANE	V	G		1.0E+04	2.1E+03		2.1E+03	2.9E+03		2.9E+03	3.80E+05
CHLOROFORM	V	L	2.3E-05	9.8E+01	1.1E-01	1.1E-01	2.0E+01	1.8E-01	1.8E-01	2.9E+01	4.22E+05
CHLOROMETHANE	V	G	1.8E-06	9.0E+01	1.4E+00	1.4E+00	1.9E+01	2.3E+00	2.3E+00	2.6E+01	-
CHLOROPHENOL, 2-	V	L		1.8E+01	3.7E+00		3.7E+00	5.1E+00		5.1E+00	1.90E+01
CHROMIUM (Total)	NV	S									-
CHROMIUM III	NV	S									-
CHROMIUM VI	NV	S									-
CHRYSENE	NV	S									-
COBALT	NV	S									-
COPPER	NV	S									-
CYANIDE (Free)	V	S									6.52E+02
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	NV	S									-
DALAPON	NV	L									-

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

CHEMICAL PARAMETER	Physical State		Health-Based Action Levels								50% Odor Recognition Threshold (Table F-2) (ug/m^3)
			Unit Risk Factor URF (ug/m^3)$^{-1}$	Reference Concentration RfC (ug/m^3)	[1]Unrestricted Land Use			Commercial/Industrial Use Only			
					Lowest Residential (ug/m^3)	Indoor Air (carcinogens) (ug/m^3)	Indoor Air (noncarcinogens) (ug/m^3)	Lowest C/I (ug/m^3)	Indoor Air (carcinogens) (ug/m^3)	Indoor Air (noncarcinogens) (ug/m^3)	
DIBENZO(a,h)ANTHTRACENE	NV	S									-
DIBROMO,1,2- CHLOROPROPANE,3-	V	L	6.0E-03	2.0E-01	4.1E-04	4.1E-04	4.2E-02	6.8E-04	6.8E-04	5.8E-02	-
DIBROMOCHLOROMETHANE	V	S	2.4E-05	7.0E+01	1.0E-01	1.0E-01	1.5E+01	1.7E-01	1.7E-01	2.0E+01	-
DIBROMOETHANE, 1,2-	V	S	6.0E-04	9.0E+00	4.1E-03	4.1E-03	1.9E+00	6.8E-03	6.8E-03	2.6E+00	2.00E+05
DICHLOROBENZENE, 1,2-	V	L		2.0E+02	4.2E+01		4.2E+01	5.8E+01		5.8E+01	3.05E+05
DICHLOROBENZENE, 1,3-	V	L		1.1E+02	2.2E+01		2.2E+01	3.1E+01		3.1E+01	-
DICHLOROBENZENE, 1,4-	V	S	1.1E-05	8.0E+02	2.2E-01	2.2E-01	1.7E+02	3.7E-01	3.7E-01	2.3E+02	1.10E+03
DICHLOROBENZIDINE, 3,3-	NV	S									-
DICHLORODIPHENYLDICHLOROETHANE (DDD)	NV	S									-
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	NV	S									-
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	NV	S									-
DICHLOROETHANE, 1,1-	V	L	1.6E-06	7.0E+02	1.5E+00	1.5E+00	1.5E+02	2.6E+00	2.6E+00	2.0E+02	1.25E+05
DICHLOROETHANE, 1,2-	V	L	2.6E-05	7.0E+00	9.4E-02	9.4E-02	1.5E+00	1.6E-01	1.6E-01	2.0E+00	2.42E+03
DICHLOROETHYLENE, 1,1-	V	L		2.0E+02	4.2E+01		4.2E+01	5.8E+01		5.8E+01	2.00E+06
DICHLOROETHYLENE, Cis 1,2-	V	L		7.0E+00	1.5E+00		1.5E+00	2.0E+00		2.0E+00	-
DICHLOROETHYLENE, Trans 1,2-	V	L		6.0E+01	1.3E+01		1.3E+01	1.8E+01		1.8E+01	6.73E+04
DICHLOROPHENOL, 2,4-	NV	S									1.40E+03
DICHLOROPHENOXYACETIC ACID (2,4-D)	NV	S									-
DICHLOROPROPANE, 1,2-	V	L	1.0E-05	4.0E+00	2.4E-01	2.4E-01	8.3E-01	4.1E-01	4.1E-01	1.2E+00	1.19E+03
DICHLOROPROPENE, 1,3-	V	L	4.0E-06	2.0E+01	6.1E-01	6.1E-01	4.2E+00	1.0E+00	1.0E+00	5.8E+00	4.16E+03
DIELDRIN	NV	S									-
DIETHYLPHTHALATE	NV	S									-
DIMETHYLPHENOL, 2,4-	V	S		7.0E+01	1.5E+01		1.5E+01	2.0E+01		2.0E+01	1.00E+00
DIMETHYLPHTHALATE	NV	S									-
DINITROBENZENE, 1,3-	NV	S									-
DINITROPHENOL, 2,4-	NV	S									-
DINITROTOLUENE, 2,4- (2,4-DNT)	NV	S									-
DINITROTOLUENE, 2,6- (2,6-DNT)	NV	S									-
DIOXANE, 1,4-	NV	L									6.12E+05
DIOXINS (TEQ)	NV	S									-
DIURON	NV	S									-
ENDOSULFAN	NV	S									-
ENDRIN	NV	S									-
ETHANOL	NV	L									1.92E+04
ETHYLBENZENE	V	L	2.5E-06	1.0E+03	9.7E-01	9.7E-01	2.1E+02	1.6E+00	1.6E+00	2.9E+02	2.00E+03
FLUORANTHENE	NV	S									-
FLUORENE	V	S		1.4E+02	2.9E+01		2.9E+01	4.1E+01		4.1E+01	-
GLYPHOSATE	NV	S									-
HEPTACHLOR	NV	S									3.00E+02
HEPTACHLOR EPOXIDE	NV	S									3.00E+02
HEXACHLOROBENZENE	NV	S									-
HEXACHLOROBUTADIENE	NV	S									1.20E+04
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	NV	S									-
HEXACHLOROETHANE	NV	S									-
HEXAZINONE	NV	S									-

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

CHEMICAL PARAMETER	Physical State		Health-Based Action Levels								50% Odor Recognition Threshold (Table F-2) (ug/m³)
			Unit Risk Factor URF (ug/m³)⁻¹	Reference Concentration RfC (ug/m³)	[1]Unrestricted Land Use			Commercial/Industrial Use Only			
					Lowest Residential (ug/m³)	Indoor Air (carcinogens) (ug/m³)	Indoor Air (noncarcinogens) (ug/m³)	Lowest C/I (ug/m³)	Indoor Air (carcinogens) (ug/m³)	Indoor Air (noncarcinogens) (ug/m³)	
INDENO(1,2,3-cd)PYRENE	NV	S									-
ISOPHORONE	NV	L									-
LEAD	NV	S									-
MERCURY	V	S		3.0E-02	6.3E-03		6.3E-03	8.8E-03		8.8E-03	-
METHOXYCHLOR	NV	S									-
METHYL ETHYL KETONE	V	L		5.0E+03	1.0E+03		1.0E+03	1.5E+03		1.5E+03	3.20E+04
METHYL ISOBUTYL KETONE	V	L		3.0E+03	6.3E+02		6.3E+02	8.8E+02		8.8E+02	4.20E+02
METHYL MERCURY	NV	S									-
METHYL TERT BUTYL ETHER	V	L	2.6E-07	3.0E+03	9.4E+00	9.4E+00	6.3E+02	1.6E+01	1.6E+01	8.8E+02	5.30E+02
METHYLENE CHLORIDE	V	L	4.7E-07	1.1E+03	5.2E+00	5.2E+00	2.3E+02	8.7E+00	8.7E+00	3.2E+02	5.60E+05
METHYLNAPHTHALENE, 1-	V	S	8.3E-06	2.5E+02	2.9E-01	2.9E-01	5.1E+01	4.9E-01	4.9E-01	7.2E+01	6.80E+01
METHYLNAPHTHALENE, 2-	V	S		1.4E+01	2.9E+00		2.9E+00	4.1E+00		4.1E+00	6.80E+01
MOLYBDENUM	NV	S									-
NAPHTHALENE	V	S	3.4E-05	3.0E+00	7.2E-02	7.2E-02	6.3E-01	1.2E-01	1.2E-01	8.8E-01	4.40E+02
NICKEL	NV	S									-
NITROBENZENE	V	L	4.0E-05	9.0E+00	6.1E-02	6.1E-02	1.9E+00	1.0E-01	1.0E-01	2.6E+00	-
NITROGLYCERIN	NV	L									-
NITROTOLUENE, 2-	V	S	6.3E-05	3.2E+00	3.9E-02	3.9E-02	6.6E-01	6.5E-02	6.5E-02	9.2E-01	-
NITROTOLUENE, 3-	V	S		7.0E+01	1.5E+01		1.5E+01	2.0E+01		2.0E+01	-
NITROTOLUENE, 4-	NV	S									-
PENTACHLOROPHENOL	NV	S									-
PENTAERYTHRITOLTETRANITRATE (PETN)	NV	S									-
PERCHLORATE	NV	S									-
PHENANTHRENE	V	S		1.4E+02	2.9E+01		2.9E+01	4.1E+01		4.1E+01	5.50E+01
PHENOL	NV	S									1.56E+02
POLYCHLORINATED BIPHENYLS (PCBs)	NV	S									-
PROPICONAZOLE	NV	L									-
PYRENE	V	S		1.1E+02	2.2E+01		2.2E+01	3.1E+01		3.1E+01	-
SELENIUM	NV	S									-
SILVER	NV	S									-
SIMAZINE	NV	S									-
STYRENE	V	L		1.0E+03	2.1E+02		2.1E+02	2.9E+02		2.9E+02	1.36E+03
TERBACIL	NV	S									-
tert-BUTYL ALCOHOL	V	L	8.6E-07		2.8E+00	2.8E+00		4.8E+00	4.8E+00		-
TETRACHLOROETHANE, 1,1,1,2-	V	L	7.4E-06	1.1E+02	3.3E-01	3.3E-01	2.2E+01	5.5E-01	5.5E-01	3.1E+01	-
TETRACHLOROETHANE, 1,1,2,2-	V	L	5.8E-05		4.2E-02	4.2E-02		7.0E-02	7.0E-02		1.05E+04
TETRACHLOROETHYLENE	V	L	5.9E-06	2.7E+02	4.1E-01	4.1E-01	5.6E+01	6.9E-01	6.9E-01	7.9E+01	3.17E+04
TETRACHLOROPHENOL, 2,3,4,6-	NV	S									-
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	NV	S									-
THALLIUM	NV	S									-
TOLUENE	V	L		5.0E+03	1.0E+03		1.0E+03	1.5E+03		1.5E+03	3.00E+04
TOXAPHENE	NV	S									-
TPH (gasolines)	V	L		1.3E+02	1.3E+02		1.3E+02	1.8E+02		1.8E+02	1.00E+03
TPH (middle distillates)	V	L		1.3E+02	1.3E+02		1.3E+02	1.8E+02		1.8E+02	1.00E+03
TPH (residual fuels)	NV	L									-

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

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

Notes:

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

Target cancer risk = 1E-06, Target Hazard Quotient = 0.2 for all chemicals except as noted.

Target Hazard Quotient = 1.0 for TPH (see Appendix 1 and Appendix 9 Fall 2011 EAL update memo).

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

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

Dibromochloromethane, dibromochloropropane and pyrene considered volatile for purposes of modeling (USEPA 2004, 2011).

Action levels calculated using spreadhseet provided with User's Guide for the USEPA vapor intrusion guidance (USEPA 2004, refer to Appendix 2 for equations and default input parameter values).

Indoor air action levels listed only for volatile chemicals included in database of referenced model spreadsheet (plus MTBE).

RfC and indoor air action levels for TPHgasolines based on RfC for TPHmiddle distillates due to potential for mixture of fuel types at release sites (see Table H and Appendix 6). Action levels may exceed ambient, background TPH in indoor and outdoor air from petroleum-based cleaners, auto exhaust, etc.

Indoor air action level for ethanol based on potential odor concerns (refer to Chapter 4 and Table F series). Human health risk toxicity data not available but likely to exceed odor thresholds.

50% Odor Recognition Thresholds from Massachusetts Department of Environmental Protection (MADEP, 1994) and ATSDR; included for reference (potential nuisance concerns, see Table F series).

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

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Taste & Odors, etc.) Table G-1	Drinking Water Toxicity Table D-3a	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (chronic) Table D-4a
ACENAPHTHENE	2.0E+01	Gross Contamination	2.0E+01	3.7E+02	3.9E+03	2.3E+01
ACENAPHTHYLENE	3.0E+01	Aquatic Habitat Goal	2.0E+03	2.4E+02	(Use soil gas)	3.0E+01
ACETONE	1.5E+03	Aquatic Habitat Goal	2.0E+04	2.2E+04	5.6E+08	1.5E+03
ALDRIN	4.0E-03	Drinking Water Toxicity	8.5E+00	4.0E-03		1.3E-01
AMETRYN	1.5E+01	Aquatic Habitat Goal	5.0E+04	3.3E+02		1.5E+01
AMINO,2- DINITROTOLUENE,4,6-	1.5E+01	Aquatic Habitat Goal	5.0E+04	7.3E+01		1.5E+01
AMINO,4- DINITROTOLUENE,2,6-	1.5E+01	Aquatic Habitat Goal	5.0E+04	7.3E+01		1.5E+01
ANTHRACENE	7.3E-01	Aquatic Habitat Goal	2.2E+01	1.8E+03	4.3E+01	7.3E-01
ANTIMONY	6.0E+00	Drinking Water Toxicity	5.0E+04	6.0E+00		3.0E+01
ARSENIC	1.0E+01	Drinking Water Toxicity	5.0E+04	1.0E+01		3.6E+01
ATRAZINE	3.0E+00	Drinking Water Toxicity	2.0E+01	3.0E+00		1.2E+01
BARIUM	2.0E+02	Aquatic Habitat Goal	5.0E+04	2.0E+03		2.0E+02
BENZENE	5.0E+00	Drinking Water Toxicity	1.7E+02	5.0E+00	1.9E+03	4.6E+01
BENZO(a)ANTHRACENE	2.7E-02	Aquatic Habitat Goal	4.7E+00	9.2E-02		2.7E-02
BENZO(a)PYRENE	1.4E-02	Aquatic Habitat Goal	8.1E-01	2.0E-01		1.4E-02
BENZO(b)FLUORANTHENE	9.2E-02	Drinking Water Toxicity	7.5E-01	9.2E-02		9.1E+00
BENZO(g,h,i)PERYLENE	1.0E-01	Aquatic Habitat Goal	1.3E-01	1.5E+03		1.0E-01
BENZO(k)FLUORANTHENE	4.0E-01	Gross Contamination	4.0E-01	9.2E-01		3.7E+00
BERYLLIUM	2.7E+00	Aquatic Habitat Goal	5.0E+04	4.0E+00		2.7E+00
BIPHENYL, 1,1-	5.0E-01	Gross Contamination	5.0E-01	8.3E-01	(Use soil gas)	1.4E+01
BIS(2-CHLOROETHYL)ETHER	1.2E-02	Drinking Water Toxicity	3.6E+02	1.2E-02	1.3E+02	6.1E+01
BIS(2-CHLOROISOPROPYL)ETHER	3.2E-01	Drinking Water Toxicity	3.2E+02	3.2E-01	(Use soil gas)	6.1E+01
BIS(2-ETHYLHEXYL)PHTHALATE	6.0E+00	Drinking Water Toxicity	1.4E+02	6.0E+00		3.2E+01
BORON	7.3E+03	Aquatic Habitat Goal	5.0E+04	7.3E+03		7.3E+03
BROMODICHLOROMETHANE	1.2E-01	Drinking Water Toxicity	5.0E+04	1.2E-01	9.8E+01	3.2E+03
BROMOFORM	8.0E+01	Drinking Water Toxicity	5.1E+02	8.0E+01		3.2E+03
BROMOMETHANE	8.7E+00	Drinking Water Toxicity	5.0E+04	8.7E+00	4.6E+02	1.6E+02
CADMIUM	3.0E+00	Aquatic Habitat Goal	5.0E+04	5.0E+00		3.0E+00
CARBON TETRACHLORIDE	5.0E+00	Drinking Water Toxicity	5.2E+02	5.0E+00	9.8E+01	9.8E+00
CHLORDANE (TECHNICAL)	4.0E-03	Aquatic Habitat Goal	2.5E+00	2.0E+00		4.0E-03
CHLOROANILINE, p-	3.4E-01	Drinking Water Toxicity	5.0E+04	3.4E-01		5.0E+00
CHLOROBENZENE	2.5E+01	Aquatic Habitat Goal	5.0E+01	1.0E+02	1.2E+04	2.5E+01
CHLOROETHANE	1.6E+01	Gross Contamination	1.6E+01	2.1E+04	5.5E+05	2.1E+04
CHLOROFORM	7.0E+01	Drinking Water Toxicity	2.4E+03	7.0E+01	9.4E+01	6.2E+02
CHLOROMETHANE	1.8E+00	Drinking Water Toxicity	5.0E+04	1.8E+00	3.7E+02	3.2E+03
CHLOROPHENOL, 2-	1.8E-01	Gross Contamination	1.8E-01	3.0E+01	7.3E+04	1.4E+02
CHROMIUM (Total)	7.4E+01	Aquatic Habitat Goal	5.0E+04	1.0E+02		7.4E+01
CHROMIUM III	7.4E+01	Aquatic Habitat Goal	5.0E+04	5.5E+04		7.4E+01
CHROMIUM VI	1.1E+01	Aquatic Habitat Goal	5.0E+04	1.3E+01		1.1E+01
CHRYSENE	3.5E-01	Aquatic Habitat Goal	1.0E+00	9.2E+00		3.5E-01
COBALT	3.0E+00	Aquatic Habitat Goal	5.0E+04	1.1E+01		3.0E+00
COPPER	2.9E+00	Aquatic Habitat Goal	1.0E+03	1.3E+03		2.9E+00
CYANIDE (Free)	1.0E+00	Aquatic Habitat Goal	1.7E+02	2.0E+02	(Use soil gas)	1.0E+00
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	6.1E-01	Drinking Water Toxicity	3.0E+04	6.1E-01		1.9E+02
DALAPON	2.0E+02	Drinking Water Toxicity	5.0E+04	2.0E+02		3.0E+02
DIBENZO(a,h)ANTHTRACENE	9.2E-03	Drinking Water Toxicity	5.2E-01	9.2E-03		7.5E+00

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

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Taste & Odors, etc.) Table G-1	Drinking Water Toxicity Table D-3a	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (chronic) Table D-4a
DIBROMO,1,2- CHLOROPROPANE,3-	4.0E-02	Aquatic Habitat Goal	1.0E+01	4.0E-02	(Use soil gas)	4.0E-02
DIBROMOCHLOROMETHANE	1.6E-01	Drinking Water Toxicity	5.0E+04	1.6E-01	3.4E+02	3.2E+03
DIBROMOETHANE, 1,2-	4.0E-02	Drinking Water Toxicity	5.0E+04	4.0E-02	1.6E+01	1.4E+03
DICHLOROBENZENE, 1,2-	1.0E+01	Gross Contamination	1.0E+01	6.0E+02	8.0E+04	1.4E+01
DICHLOROBENZENE, 1,3-	5.0E+00	Gross Contamination	5.0E+00	1.8E+02	(Use soil gas)	6.5E+01
DICHLOROBENZENE, 1,4-	5.0E+00	Gross Contamination	5.0E+00	7.5E+01	3.8E+02	1.5E+01
DICHLOROBENZIDINE, 3,3-	1.5E-01	Drinking Water Toxicity	1.6E+03	1.5E-01		2.5E+02
DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.0E-03	Aquatic Habitat Goal	4.5E+01	2.8E-01		1.0E-03
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.0E-03	Aquatic Habitat Goal	2.0E+01	2.0E-01		1.0E-03
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.0E-03	Aquatic Habitat Goal	2.8E+00	2.0E-01		1.0E-03
DICHLOROETHANE, 1,1-	2.4E+00	Drinking Water Toxicity	5.0E+04	2.4E+00	9.4E+02	4.7E+01
DICHLOROETHANE, 1,2-	1.5E-01	Drinking Water Toxicity	7.0E+03	1.5E-01	1.6E+02	1.0E+04
DICHLOROETHYLENE, 1,1-	7.0E+00	Drinking Water Toxicity	1.5E+03	7.0E+00	6.4E+03	2.5E+01
DICHLOROETHYLENE, Cis 1,2-	7.0E+01	Drinking Water Toxicity	5.0E+04	7.0E+01	1.1E+03	5.9E+02
DICHLOROETHYLENE, Trans 1,2-	1.0E+02	Drinking Water Toxicity	2.6E+02	1.0E+02	5.0E+03	5.9E+02
DICHLOROPHENOL, 2,4-	3.0E-01	Gross Contamination	3.0E-01	1.1E+02		1.8E+02
DICHLOROPHENOXYACETIC ACID (2,4-D)	4.0E+01	Aquatic Habitat Goal	5.0E+04	7.0E+01		4.0E+01
DICHLOROPROPANE, 1,2-	5.0E+00	Drinking Water Toxicity	1.0E+01	5.0E+00	2.6E+02	1.5E+03
DICHLOROPROPENE, 1,3-	4.3E-01	Drinking Water Toxicity	5.0E+04	4.3E-01	5.5E+02	1.2E+02
DIELDRIN	1.9E-03	Aquatic Habitat Goal	4.1E+01	4.2E-03		1.9E-03
DIETHYLPHTHALATE	1.5E+00	Aquatic Habitat Goal	5.0E+04	2.9E+04		1.5E+00
DIMETHYLPHENOL, 2,4-	1.1E+02	Aquatic Habitat Goal	4.0E+02	1.2E+02	1.5E+06	1.1E+02
DIMETHYLPHTHALATE	1.5E+00	Aquatic Habitat Goal	5.0E+04	3.7E+05		1.5E+00
DINITROBENZENE, 1,3-	3.7E+00	Drinking Water Toxicity	5.0E+04	3.7E+00		3.0E+01
DINITROPHENOL, 2,4-	7.3E+01	Drinking Water Toxicity	5.0E+04	7.3E+01		7.5E+01
DINITROTOLUENE, 2,4- (2,4-DNT)	2.2E-01	Drinking Water Toxicity	5.0E+04	2.2E-01		4.4E+01
DINITROTOLUENE, 2,6- (2,6-DNT)	3.7E+01	Drinking Water Toxicity	5.0E+04	3.7E+01		4.4E+01
DIOXANE, 1,4-	6.7E-01	Drinking Water Toxicity	5.0E+04	6.7E-01		3.4E+05
DIOXINS (TEQ)	5.0E-06	Aquatic Habitat Goal	6.0E-02	3.0E-05		5.0E-06
DIURON	6.0E+01	Aquatic Habitat Goal	2.1E+04	7.3E+01		6.0E+01
ENDOSULFAN	8.7E-03	Aquatic Habitat Goal	2.3E+02	2.2E+02		8.7E-03
ENDRIN	2.3E-03	Aquatic Habitat Goal	4.1E+01	2.0E+00		2.3E-03
ETHANOL	5.0E+04	Gross Contamination	5.0E+04			
ETHYLBENZENE	3.0E+01	Gross Contamination	3.0E+01	7.0E+02	6.6E+04	2.9E+02
FLUORANTHENE	8.0E+00	Aquatic Habitat Goal	1.3E+02	1.5E+03		8.0E+00
FLUORENE	3.9E+00	Aquatic Habitat Goal	9.5E+02	2.4E+02	1.9E+03	3.9E+00
GLYPHOSATE	6.5E+01	Aquatic Habitat Goal	5.0E+04	7.0E+02		6.5E+01
HEPTACHLOR	3.6E-03	Aquatic Habitat Goal	2.0E+01	4.0E-01		3.6E-03
HEPTACHLOR EPOXIDE	3.6E-03	Aquatic Habitat Goal	1.0E+02	2.0E-01		3.6E-03
HEXACHLOROBENZENE	1.0E+00	Drinking Water Toxicity	3.1E+00	1.0E+00		3.7E+00
HEXACHLOROBUTADIENE	8.6E-01	Drinking Water Toxicity	6.0E+00	8.6E-01		4.7E+00
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	8.0E-02	Aquatic Habitat Goal	4.0E+03	2.0E-01		8.0E-02
HEXACHLOROETHANE	4.8E+00	Drinking Water Toxicity	1.0E+01	4.8E+00		1.2E+01
HEXAZINONE	1.2E+03	Drinking Water Toxicity	5.0E+04	1.2E+03		5.0E+03
INDENO(1,2,3-cd)PYRENE	9.2E-02	Drinking Water Toxicity	9.5E-02	9.2E-02		4.3E+00

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

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Taste & Odors, etc.) Table G-1	Drinking Water Toxicity Table D-3a	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (chronic) Table D-4a
ISOPHORONE	7.1E+01	Drinking Water Toxicity	5.0E+04	7.1E+01		1.3E+02
LEAD	5.6E+00	Aquatic Habitat Goal	5.0E+04	1.5E+01		5.6E+00
MERCURY	2.5E-02	Aquatic Habitat Goal	3.0E+01	2.0E+00	(Use soil gas)	2.5E-02
METHOXYCHLOR	3.0E-02	Aquatic Habitat Goal	5.0E+01	4.0E+01		3.0E-02
METHYL ETHYL KETONE	7.1E+03	Drinking Water Toxicity	8.4E+03	7.1E+03	1.9E+08	1.4E+04
METHYL ISOBUTYL KETONE	1.7E+02	Aquatic Habitat Goal	1.3E+03	2.0E+03	1.9E+07	1.7E+02
METHYL MERCURY	3.0E-03	Aquatic Habitat Goal	5.0E+04	3.7E+00		3.0E-03
METHYL TERT BUTYL ETHER	5.0E+00	Gross Contamination	5.0E+00	1.2E+01	2.6E+04	1.8E+04
METHYLENE CHLORIDE	4.8E+00	Drinking Water Toxicity	9.1E+03	4.8E+00	3.9E+03	2.2E+03
METHYLNAPHTHALENE, 1-	2.1E+00	Aquatic Habitat Goal	1.0E+01	4.7E+00	2.5E+04	2.1E+00
METHYLNAPHTHALENE, 2-	2.1E+00	Aquatic Habitat Goal	1.0E+01	2.4E+01	2.5E+04	2.1E+00
MOLYBDENUM	1.8E+02	Drinking Water Toxicity	5.0E+04	1.8E+02		2.4E+02
NAPHTHALENE	1.7E+01	Drinking Water Toxicity	2.1E+01	1.7E+01	2.8E+04	2.4E+01
NICKEL	5.0E+00	Aquatic Habitat Goal	5.0E+04	1.8E+03		5.0E+00
NITROBENZENE	1.2E-01	Drinking Water Toxicity	5.0E+04	1.2E-01	(Use soil gas)	6.0E+01
NITROGLYCERIN	3.7E+00	Drinking Water Toxicity	5.0E+04	3.7E+00		1.4E+02
NITROTOLUENE, 2-	6.2E-02	Drinking Water Toxicity	5.0E+04	6.2E-02	(Use soil gas)	1.0E+03
NITROTOLUENE, 3-	1.2E+02	Drinking Water Toxicity	5.0E+04	1.2E+02	(Use soil gas)	3.8E+02
NITROTOLUENE, 4-	4.2E+00	Drinking Water Toxicity	5.0E+04	4.2E+00		1.6E+03
PENTACHLOROPHENOL	1.0E+00	Drinking Water Toxicity	3.0E+01	1.0E+00		7.9E+00
PENTAERYTHRITOLTETRANITRATE (PETN)	1.7E+01	Drinking Water Toxicity	2.2E+04	1.7E+01		8.5E+04
PERCHLORATE	2.6E+01	Drinking Water Toxicity	5.0E+04	2.6E+01		6.0E+02
PHENANTHRENE	4.6E+00	Aquatic Habitat Goal	4.1E+02	2.4E+02	(Use soil gas)	4.6E+00
PHENOL	5.0E+00	Gross Contamination	5.0E+00	1.1E+04		1.3E+03
POLYCHLORINATED BIPHENYLS (PCBs)	1.4E-02	Aquatic Habitat Goal	1.6E+01	5.0E-01		1.4E-02
PROPICONAZOLE	2.6E+01	Aquatic Habitat Goal	5.0E+04	4.7E+02		2.6E+01
PYRENE	2.0E+00	Aquatic Habitat Goal	6.8E+01	1.8E+02	1.4E+02	2.0E+00
SELENIUM	5.0E+00	Aquatic Habitat Goal	5.0E+04	5.0E+01		5.0E+00
SILVER	1.0E+00	Aquatic Habitat Goal	1.0E+02	1.8E+02		1.0E+00
SIMAZINE	2.0E+00	Aquatic Habitat Goal	3.1E+03	4.0E+00		2.0E+00
STYRENE	1.0E+01	Gross Contamination	1.0E+01	1.0E+02	3.1E+05	3.2E+01
TERBACIL	4.7E+02	Drinking Water Toxicity	5.0E+04	4.7E+02		2.3E+03
tert-BUTYL ALCOHOL	4.5E+00	Drinking Water Toxicity	5.0E+04	4.5E+00	(Use soil gas)	1.8E+04
TETRACHLOROETHANE, 1,1,1,2-	5.2E-01	Drinking Water Toxicity	5.0E+04	5.2E-01	(Use soil gas)	3.1E+02
TETRACHLOROETHANE, 1,1,2,2-	6.7E-02	Drinking Water Toxicity	5.0E+02	6.7E-02	2.0E+02	4.2E+02
TETRACHLOROETHYLENE	5.0E+00	Drinking Water Toxicity	1.7E+02	5.0E+00	1.8E+02	1.2E+02
TETRACHLOROPHENOL, 2,3,4,6-	1.2E+00	Aquatic Habitat Goal	1.2E+04	1.1E+03		1.2E+00
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	3.3E+02	Aquatic Habitat Goal	5.0E+04	1.8E+03		3.3E+02
THALLIUM	2.0E+00	Drinking Water Toxicity	5.0E+04	2.0E+00		2.0E+01
TOLUENE	4.0E+01	Gross Contamination	4.0E+01	1.0E+03	5.3E+05	1.3E+02
TOXAPHENE	2.0E-04	Aquatic Habitat Goal	1.4E+02	3.0E+00		2.0E-04
TPH (gasolines)	1.0E+02	Gross Contamination	1.0E+02	1.0E+02	(Use soil gas)	5.0E+02
TPH (middle distillates)	1.0E+02	Gross Contamination	1.0E+02	1.9E+02	(Use soil gas)	6.4E+02
TPH (residual fuels)	1.0E+02	Gross Contamination	1.0E+02	4.4E+03		6.4E+02
TRICHLOROBENZENE, 1,2,4-	2.5E+01	Aquatic Habitat Goal	3.0E+03	7.0E+01	8.8E+02	2.5E+01

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

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Taste & Odors, etc.) Table G-1	Drinking Water Toxicity Table D-3a	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (chronic) Table D-4a
TRICHLOROETHANE, 1,1,1-	6.2E+01	Aquatic Habitat Goal	9.7E+02	2.0E+02	3.4E+05	6.2E+01
TRICHLOROETHANE, 1,1,2-	5.0E+00	Drinking Water Toxicity	5.0E+04	5.0E+00	1.0E+02	4.7E+03
TRICHLOROETHYLENE	5.0E+00	Drinking Water Toxicity	3.1E+02	5.0E+00	6.1E+02	3.6E+02
TRICHLOROPHENOL, 2,4,5-	1.1E+01	Aquatic Habitat Goal	2.0E+02	3.7E+03		1.1E+01
TRICHLOROPHENOL, 2,4,6-	6.1E+00	Drinking Water Toxicity	1.0E+02	6.1E+00		4.9E+02
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	3.7E+02	Drinking Water Toxicity	5.0E+04	3.7E+02		6.9E+02
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	3.0E+01	Aquatic Habitat Goal	5.0E+04	5.0E+01		3.0E+01
TRICHLOROPROPANE, 1,2,3-	6.0E-01	Drinking Water Toxicity	5.0E+04	6.0E-01	(Use soil gas)	1.4E+01
TRICHLOROPROPENE, 1,2,3-	6.2E-01	Aquatic Habitat Goal	5.0E+04	6.2E-01	(Use soil gas)	6.2E-01
TRIFLURALIN	8.7E+00	Drinking Water Toxicity	9.2E+01	8.7E+00		2.0E+01
TRINITROBENZENE, 1,3,5-	3.0E+01	Aquatic Habitat Goal	5.0E+04	1.1E+03		3.0E+01
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	1.5E+02	Aquatic Habitat Goal	3.7E+04	1.5E+02		1.5E+02
TRINITROTOLUENE, 2,4,6- (TNT)	2.2E+00	Drinking Water Toxicity	5.0E+04	2.2E+00		1.3E+02
VANADIUM	1.9E+01	Aquatic Habitat Goal	5.0E+04	1.8E+02		1.9E+01
VINYL CHLORIDE	2.0E+00	Drinking Water Toxicity	3.4E+03	2.0E+00	6.2E+01	7.8E+02
XYLENES	2.0E+01	Gross Contamination	2.0E+01	1.0E+04	1.5E+05	1.0E+02
ZINC	2.2E+01	Aquatic Habitat Goal	5.0E+03	1.1E+04		2.2E+01

Notes:

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

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

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

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

Vapor Intrusion: Addresses potential emission of volatile chemicals from groundwater into buildings and subsequent impact on indoor air. Assumes moderately permeable, sandy soil or fill material immediately beneath building slab and unrestricted ("residential") land use (refer to Chapter 5).

Aquatic Habitat Impacts: Addresses potential discharge of groundwater to estuarine aquatic habitat and subsequent impact on aquatic life; dilution of groundwater upon discharge to surface water not considered, in order to take into account potential impacts to benthic organisms (see Chapter 5).

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

Method reporting limits and background concentrations replace final screening level as appropriat

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

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

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

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

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

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Taste & Odors, etc.) Table G-1	Drinking Water Toxicity Table D-3a	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (acute) Table D-4a
LEAD	1.5E+01	Drinking Water Toxicity	5.0E+04	1.5E+01		2.9E+01
MERCURY	2.0E+00	Drinking Water Toxicity	3.0E+01	2.0E+00	(Use soil gas)	2.1E+00
METHOXYCHLOR	3.0E-02	Aquatic Habitat Goal	5.0E+01	4.0E+01		3.0E-02
METHYL ETHYL KETONE	7.1E+03	Drinking Water Toxicity	8.4E+03	7.1E+03	1.9E+08	1.4E+04
METHYL ISOBUTYL KETONE	1.7E+02	Aquatic Habitat Goal	1.3E+03	2.0E+03	1.9E+07	1.7E+02
METHYL MERCURY	3.0E-03	Aquatic Habitat Goal	5.0E+04	3.7E+00		3.0E-03
METHYL TERT BUTYL ETHER	5.0E+00	Gross Contamination	5.0E+00	1.2E+01	2.6E+04	5.3E+04
METHYLENE CHLORIDE	4.8E+00	Drinking Water Toxicity	9.1E+03	4.8E+00	3.9E+03	1.1E+04
METHYLNAPHTHALENE, 1-	4.7E+00	Drinking Water Toxicity	1.0E+01	4.7E+00	2.5E+04	3.0E+02
METHYLNAPHTHALENE, 2-	1.0E+01	Gross Contamination	1.0E+01	2.4E+01	2.5E+04	3.0E+02
MOLYBDENUM	1.8E+02	Drinking Water Toxicity	5.0E+04	1.8E+02		2.4E+02
NAPHTHALENE	1.7E+01	Drinking Water Toxicity	2.1E+01	1.7E+01	2.8E+04	7.7E+02
NICKEL	5.0E+00	Aquatic Habitat Goal	5.0E+04	1.8E+03		5.0E+00
NITROBENZENE	1.2E-01	Drinking Water Toxicity	5.0E+04	1.2E-01	(Use soil gas)	2.0E+03
NITROGLYCERIN	3.7E+00	Drinking Water Toxicity	5.0E+04	3.7E+00		1.4E+02
NITROTOLUENE, 2-	6.2E-02	Drinking Water Toxicity	5.0E+04	6.2E-02	(Use soil gas)	7.5E+03
NITROTOLUENE, 3-	1.2E+02	Drinking Water Toxicity	5.0E+04	1.2E+02	(Use soil gas)	3.8E+03
NITROTOLUENE, 4-	4.2E+00	Drinking Water Toxicity	5.0E+04	4.2E+00		3.3E+03
PENTACHLOROPHENOL	1.0E+00	Drinking Water Toxicity	3.0E+01	1.0E+00		1.3E+01
PENTAERYTHRITOLTETRANITRATE (PETN)	1.7E+01	Drinking Water Toxicity	2.2E+04	1.7E+01		4.3E+04
PERCHLORATE	2.6E+01	Drinking Water Toxicity	5.0E+04	2.6E+01		6.0E+02
PHENANTHRENE	2.4E+02	Drinking Water Toxicity	4.1E+02	2.4E+02	(Use soil gas)	3.0E+02
PHENOL	5.0E+00	Gross Contamination	5.0E+00	1.1E+04		3.4E+03
POLYCHLORINATED BIPHENYLS (PCBs)	5.0E-01	Drinking Water Toxicity	1.6E+01	5.0E-01		2.0E+00
PROPICONAZOLE	2.6E+02	Aquatic Habitat Goal	5.0E+04	4.7E+02		2.6E+02
PYRENE	6.8E+01	Gross Contamination	6.8E+01	1.8E+02	1.4E+02	3.0E+02
SELENIUM	2.0E+01	Aquatic Habitat Goal	5.0E+04	5.0E+01		2.0E+01
SILVER	1.0E+00	Aquatic Habitat Goal	1.0E+02	1.8E+02		1.0E+00
SIMAZINE	4.0E+00	Drinking Water Toxicity	3.1E+03	4.0E+00		1.0E+01
STYRENE	1.0E+01	Gross Contamination	1.0E+01	1.0E+02	3.1E+05	3.2E+01
TERBACIL	4.7E+02	Drinking Water Toxicity	5.0E+04	4.7E+02		2.3E+04
tert-BUTYL ALCOHOL	4.5E+00	Drinking Water Toxicity	5.0E+04	4.5E+00	(Use soil gas)	1.8E+05
TETRACHLOROETHANE, 1,1,1,2-	5.2E-01	Drinking Water Toxicity	5.0E+04	5.2E-01	(Use soil gas)	3.1E+03
TETRACHLOROETHANE, 1,1,2,2-	6.7E-02	Drinking Water Toxicity	5.0E+02	6.7E-02	2.0E+02	3.0E+03
TETRACHLOROETHYLENE	5.0E+00	Drinking Water Toxicity	1.7E+02	5.0E+00	1.8E+02	1.8E+03
TETRACHLOROPHENOL, 2,3,4,6-	1.0E+01	Aquatic Habitat Goal	1.2E+04	1.1E+03		1.0E+01
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	1.8E+03	Drinking Water Toxicity	5.0E+04	1.8E+03		1.9E+03
THALLIUM	2.0E+00	Drinking Water Toxicity	5.0E+04	2.0E+00		4.7E+02
TOLUENE	4.0E+01	Gross Contamination	4.0E+01	1.0E+03	5.3E+05	5.8E+03
TOXAPHENE	2.1E-01	Aquatic Habitat Goal	1.4E+02	3.0E+00		2.1E-01
TPH (gasolines)	1.0E+02	Gross Contamination	1.0E+02	1.0E+02	(Use soil gas)	5.0E+03
TPH (middle distillates)	1.0E+02	Gross Contamination	1.0E+02	1.9E+02	(Use soil gas)	2.5E+03
TPH (residual fuels)	1.0E+02	Gross Contamination	1.0E+02	4.4E+03		2.5E+03
TRICHLOROBENZENE, 1,2,4-	7.0E+01	Drinking Water Toxicity	3.0E+03	7.0E+01	8.8E+02	1.6E+02
TRICHLOROETHANE, 1,1,1-	2.0E+02	Drinking Water Toxicity	9.7E+02	2.0E+02	3.4E+05	6.0E+03
TRICHLOROETHANE, 1,1,2-	5.0E+00	Drinking Water Toxicity	5.0E+04	5.0E+00	1.0E+02	6.0E+03

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

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Taste & Odors, etc.) Table G-1	Drinking Water Toxicity Table D-3a	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (acute) Table D-4a
TRICHLOROETHYLENE	5.0E+00	Drinking Water Toxicity	3.1E+02	5.0E+00	6.1E+02	7.0E+02
TRICHLOROPHENOL, 2,4,5-	1.0E+02	Aquatic Habitat Goal	2.0E+02	3.7E+03		1.0E+02
TRICHLOROPHENOL, 2,4,6-	6.1E+00	Drinking Water Toxicity	1.0E+02	6.1E+00		4.9E+02
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	3.7E+02	Drinking Water Toxicity	5.0E+04	3.7E+02		6.9E+02
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	3.0E+01	Aquatic Habitat Goal	5.0E+04	5.0E+01		3.0E+01
TRICHLOROPROPANE, 1,2,3-	6.0E-01	Drinking Water Toxicity	5.0E+04	6.0E-01	(Use soil gas)	1.4E+02
TRICHLOROPROPENE, 1,2,3-	6.2E-01	Aquatic Habitat Goal	5.0E+04	6.2E-01	(Use soil gas)	6.2E-01
TRIFLURALIN	8.7E+00	Drinking Water Toxicity	9.2E+01	8.7E+00		2.0E+01
TRINITROBENZENE, 1,3,5-	1.4E+02	Aquatic Habitat Goal	5.0E+04	1.1E+03		1.4E+02
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	1.5E+02	Aquatic Habitat Goal	3.7E+04	1.5E+02		1.5E+02
TRINITROTOLUENE, 2,4,6- (TNT)	2.2E+00	Drinking Water Toxicity	5.0E+04	2.2E+00		5.7E+02
VANADIUM	1.9E+01	Aquatic Habitat Goal	5.0E+04	1.8E+02		1.9E+01
VINYL CHLORIDE	2.0E+00	Drinking Water Toxicity	3.4E+03	2.0E+00	6.2E+01	7.8E+02
XYLENES	2.0E+01	Gross Contamination	2.0E+01	1.0E+04	1.5E+05	1.0E+03
ZINC	2.2E+01	Aquatic Habitat Goal	5.0E+03	1.1E+04		2.2E+01

Notes:

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

TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.
Gross Contamination: Odor threshold, 1/2 solubility or 50000 ug/L maximum, whichever is lower. Intended to limit general groundwater resource degradation.
Drinking Water Toxicity: Based on primary maximum concentration levels (MCLs), or equivalent. Considered protective of human health.
Vapor Intrusion: Addresses potential emission of volatile chemicals from groundwater into buildings and subsequent impact on indoor air. Assumes moderately permeable, sandy soil or fill material immediately beneath building slab and unrestricted ("residential") land use (refer to Chapter 5).
Aquatic Habitat Impacts: Addresses potential discharge of groundwater to estuarine aquatic habitat and subsequent impact on aquatic life; dilution of groundwater upon discharge to surface water not considered, in order to take into account potential impacts to benthic organisms (see Chapter 5).
Review of aquatic ecotoxicty data for ethanol underway. Based on preliminary review of available data, chronic toxicity screening levels likely to be significantly greater than ceiling level of 50,000 ug/L (refer to USEPA 2003b, ECOTOX database).
Method reporting limits and background concentrations replace final screening level as appropriate.

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

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Odors, etc.) Table G-2	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (chronic) Table D-4a
ACENAPHTHENE	2.3E+01	Aquatic Habitat Goal	2.0E+02	3.9E+03	2.3E+01
ACENAPHTHYLENE	3.0E+01	Aquatic Habitat Goal	2.0E+03	(Use soil gas)	3.0E+01
ACETONE	1.5E+03	Aquatic Habitat Goal	5.0E+04	5.6E+08	1.5E+03
ALDRIN	1.3E-01	Aquatic Habitat Goal	8.5E+00		1.3E-01
AMETRYN	1.5E+01	Aquatic Habitat Goal	5.0E+04		1.5E+01
AMINO,2- DINITROTOLUENE,4,6-	1.5E+01	Aquatic Habitat Goal	5.0E+04		1.5E+01
AMINO,4- DINITROTOLUENE,2,6-	1.5E+01	Aquatic Habitat Goal	5.0E+04		1.5E+01
ANTHRACENE	7.3E-01	Aquatic Habitat Goal	2.2E+01	4.3E+01	7.3E-01
ANTIMONY	3.0E+01	Aquatic Habitat Goal	5.0E+04		3.0E+01
ARSENIC	3.6E+01	Aquatic Habitat Goal	5.0E+04		3.6E+01
ATRAZINE	1.2E+01	Aquatic Habitat Goal	1.7E+04		1.2E+01
BARIUM	2.0E+02	Aquatic Habitat Goal	5.0E+04		2.0E+02
BENZENE	4.6E+01	Aquatic Habitat Goal	2.0E+04	1.9E+03	4.6E+01
BENZO(a)ANTHRACENE	2.7E-02	Aquatic Habitat Goal	4.7E+00		2.7E-02
BENZO(a)PYRENE	1.4E-02	Aquatic Habitat Goal	8.1E-01		1.4E-02
BENZO(b)FLUORANTHENE	7.5E-01	Gross Contamination	7.5E-01		9.1E+00
BENZO(g,h,i)PERYLENE	1.0E-01	Aquatic Habitat Goal	1.3E-01		1.0E-01
BENZO(k)FLUORANTHENE	4.0E-01	Gross Contamination	4.0E-01		3.7E+00
BERYLLIUM	2.7E+00	Aquatic Habitat Goal	5.0E+04		2.7E+00
BIPHENYL, 1,1-	5.0E+00	Gross Contamination	5.0E+00	(Use soil gas)	1.4E+01
BIS(2-CHLOROETHYL)ETHER	6.1E+01	Aquatic Habitat Goal	3.6E+03	1.3E+02	6.1E+01
BIS(2-CHLOROISOPROPYL)ETHER	6.1E+01	Aquatic Habitat Goal	3.2E+03	(Use soil gas)	6.1E+01
BIS(2-ETHYLHEXYL)PHTHALATE	3.2E+01	Aquatic Habitat Goal	1.4E+02		3.2E+01
BORON	7.3E+03	Aquatic Habitat Goal	5.0E+04		7.3E+03
BROMODICHLOROMETHANE	9.8E+01	Vapor Intrusion	5.0E+04	9.8E+01	3.2E+03
BROMOFORM	3.2E+03	Aquatic Habitat Goal	5.1E+03		3.2E+03
BROMOMETHANE	1.6E+02	Aquatic Habitat Goal	5.0E+04	4.6E+02	1.6E+02
CADMIUM	3.0E+00	Aquatic Habitat Goal	5.0E+04		3.0E+00
CARBON TETRACHLORIDE	9.8E+00	Aquatic Habitat Goal	5.2E+03	9.8E+01	9.8E+00
CHLORDANE (TECHNICAL)	4.0E-03	Aquatic Habitat Goal	2.5E+01		4.0E-03
CHLOROANILINE, p-	5.0E+00	Aquatic Habitat Goal	5.0E+04		5.0E+00
CHLOROBENZENE	2.5E+01	Aquatic Habitat Goal	5.0E+02	1.2E+04	2.5E+01
CHLOROETHANE	1.6E+02	Gross Contamination	1.6E+02	5.5E+05	2.1E+04
CHLOROFORM	9.4E+01	Vapor Intrusion	2.4E+04	9.4E+01	6.2E+02
CHLOROMETHANE	3.7E+02	Vapor Intrusion	5.0E+04	3.7E+02	3.2E+03
CHLOROPHENOL, 2-	1.8E+00	Gross Contamination	1.8E+00	7.3E+04	1.4E+02
CHROMIUM (Total)	7.4E+01	Aquatic Habitat Goal	5.0E+04		7.4E+01
CHROMIUM III	7.4E+01	Aquatic Habitat Goal	5.0E+04		7.4E+01
CHROMIUM VI	1.1E+01	Aquatic Habitat Goal	5.0E+04		1.1E+01
CHRYSENE	3.5E-01	Aquatic Habitat Goal	1.0E+00		3.5E-01
COBALT	3.0E+00	Aquatic Habitat Goal	5.0E+04		3.0E+00
COPPER	2.9E+00	Aquatic Habitat Goal	5.0E+04		2.9E+00
CYANIDE (Free)	1.0E+00	Aquatic Habitat Goal	1.7E+03	(Use soil gas)	1.0E+00
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	1.9E+02	Aquatic Habitat Goal	3.0E+04		1.9E+02
DALAPON	3.0E+02	Aquatic Habitat Goal	5.0E+04		3.0E+02

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

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Odors, etc.) Table G-2	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (chronic) Table D-4a
DIBENZO(a,h)ANTHTRACENE	5.2E-01	Gross Contamination	5.2E-01		7.5E+00
DIBROMO,1,2- CHLOROPROPANE,3-	4.0E-02	Aquatic Habitat Goal	1.0E+02	(Use soil gas)	4.0E-02
DIBROMOCHLOROMETHANE	3.4E+02	Vapor Intrusion	5.0E+04	3.4E+02	3.2E+03
DIBROMOETHANE, 1,2-	1.6E+01	Vapor Intrusion	5.0E+04	1.6E+01	1.4E+03
DICHLOROBENZENE, 1,2-	1.4E+01	Aquatic Habitat Goal	1.0E+02	8.0E+04	1.4E+01
DICHLOROBENZENE, 1,3-	6.5E+01	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	6.5E+01
DICHLOROBENZENE, 1,4-	1.5E+01	Aquatic Habitat Goal	1.1E+02	3.8E+02	1.5E+01
DICHLOROBENZIDINE, 3,3-	2.5E+02	Aquatic Habitat Goal	1.6E+03		2.5E+02
DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.0E-03	Aquatic Habitat Goal	4.5E+01		1.0E-03
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.0E-03	Aquatic Habitat Goal	2.0E+01		1.0E-03
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.0E-03	Aquatic Habitat Goal	2.8E+00		1.0E-03
DICHLOROETHANE, 1,1-	4.7E+01	Aquatic Habitat Goal	5.0E+04	9.4E+02	4.7E+01
DICHLOROETHANE, 1,2-	1.6E+02	Vapor Intrusion	5.0E+04	1.6E+02	1.0E+04
DICHLOROETHYLENE, 1,1-	2.5E+01	Aquatic Habitat Goal	1.5E+04	6.4E+03	2.5E+01
DICHLOROETHYLENE, Cis 1,2-	5.9E+02	Aquatic Habitat Goal	5.0E+04	1.1E+03	5.9E+02
DICHLOROETHYLENE, Trans 1,2-	5.9E+02	Aquatic Habitat Goal	2.6E+03	5.0E+03	5.9E+02
DICHLOROPHENOL, 2,4-	3.0E+00	Gross Contamination	3.0E+00		1.8E+02
DICHLOROPHENOXYACETIC ACID (2,4-D)	4.0E+01	Aquatic Habitat Goal	5.0E+04		4.0E+01
DICHLOROPROPANE, 1,2-	1.0E+02	Gross Contamination	1.0E+02	2.6E+02	1.5E+03
DICHLOROPROPENE, 1,3-	1.2E+02	Aquatic Habitat Goal	5.0E+04	5.5E+02	1.2E+02
DIELDRIN	1.9E-03	Aquatic Habitat Goal	1.3E+02		1.9E-03
DIETHYLPHTHALATE	1.5E+00	Aquatic Habitat Goal	5.0E+04		1.5E+00
DIMETHYLPHENOL, 2,4-	1.1E+02	Aquatic Habitat Goal	4.0E+03	1.5E+06	1.1E+02
DIMETHYLPHTHALATE	1.5E+00	Aquatic Habitat Goal	5.0E+04		1.5E+00
DINITROBENZENE, 1,3-	3.0E+01	Aquatic Habitat Goal	5.0E+04		3.0E+01
DINITROPHENOL, 2,4-	7.5E+01	Aquatic Habitat Goal	5.0E+04		7.5E+01
DINITROTOLUENE, 2,4- (2,4-DNT)	4.4E+01	Aquatic Habitat Goal	5.0E+04		4.4E+01
DINITROTOLUENE, 2,6- (2,6-DNT)	4.4E+01	Aquatic Habitat Goal	5.0E+04		4.4E+01
DIOXANE, 1,4-	5.0E+04	Gross Contamination	5.0E+04		3.4E+05
DIOXINS (TEQ)	5.0E-06	Aquatic Habitat Goal	6.0E-02		5.0E-06
DIURON	6.0E+01	Aquatic Habitat Goal	2.1E+04		6.0E+01
ENDOSULFAN	8.7E-03	Aquatic Habitat Goal	2.3E+02		8.7E-03
ENDRIN	2.3E-03	Aquatic Habitat Goal	1.3E+02		2.3E-03
ETHANOL	5.0E+04	Gross Contamination	5.0E+04		
ETHYLBENZENE	2.9E+02	Aquatic Habitat Goal	3.0E+02	6.6E+04	2.9E+02
FLUORANTHENE	8.0E+00	Aquatic Habitat Goal	1.3E+02		8.0E+00
FLUORENE	3.9E+00	Aquatic Habitat Goal	9.5E+02	1.9E+03	3.9E+00
GLYPHOSATE	6.5E+01	Aquatic Habitat Goal	5.0E+04		6.5E+01
HEPTACHLOR	3.6E-03	Aquatic Habitat Goal	9.0E+01		3.6E-03
HEPTACHLOR EPOXIDE	3.6E-03	Aquatic Habitat Goal	1.0E+02		3.6E-03
HEXACHLOROBENZENE	3.1E+00	Gross Contamination	3.1E+00		3.7E+00
HEXACHLOROBUTADIENE	4.7E+00	Aquatic Habitat Goal	6.0E+01		4.7E+00
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	8.0E-02	Aquatic Habitat Goal	4.0E+03		8.0E-02
HEXACHLOROETHANE	1.2E+01	Aquatic Habitat Goal	1.0E+02		1.2E+01
HEXAZINONE	5.0E+03	Aquatic Habitat Goal	5.0E+04		5.0E+03

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

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Odors, etc.) Table G-2	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (chronic) Table D-4a
INDENO(1,2,3-cd)PYRENE	9.5E-02	Gross Contamination	9.5E-02		4.3E+00
ISOPHORONE	1.3E+02	Aquatic Habitat Goal	5.0E+04		1.3E+02
LEAD	5.6E+00	Aquatic Habitat Goal	5.0E+04		5.6E+00
MERCURY	2.5E-02	Aquatic Habitat Goal	3.0E+01	(Use soil gas)	2.5E-02
METHOXYCHLOR	3.0E-02	Aquatic Habitat Goal	5.0E+01		3.0E-02
METHYL ETHYL KETONE	1.4E+04	Aquatic Habitat Goal	5.0E+04	1.9E+08	1.4E+04
METHYL ISOBUTYL KETONE	1.7E+02	Aquatic Habitat Goal	1.3E+04	1.9E+07	1.7E+02
METHYL MERCURY	3.0E-03	Aquatic Habitat Goal	5.0E+04		3.0E-03
METHYL TERT BUTYL ETHER	1.8E+03	Gross Contamination	1.8E+03	2.6E+04	1.8E+04
METHYLENE CHLORIDE	2.2E+03	Aquatic Habitat Goal	5.0E+04	3.9E+03	2.2E+03
METHYLNAPHTHALENE, 1-	2.1E+00	Aquatic Habitat Goal	1.0E+02	2.5E+04	2.1E+00
METHYLNAPHTHALENE, 2-	2.1E+00	Aquatic Habitat Goal	1.0E+02	2.5E+04	2.1E+00
MOLYBDENUM	2.4E+02	Aquatic Habitat Goal	5.0E+04		2.4E+02
NAPHTHALENE	2.4E+01	Aquatic Habitat Goal	2.1E+02	2.8E+04	2.4E+01
NICKEL	5.0E+00	Aquatic Habitat Goal	5.0E+04		5.0E+00
NITROBENZENE	6.0E+01	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	6.0E+01
NITROGLYCERIN	1.4E+02	Aquatic Habitat Goal	5.0E+04		1.4E+02
NITROTOLUENE, 2-	1.0E+03	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	1.0E+03
NITROTOLUENE, 3-	3.8E+02	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	3.8E+02
NITROTOLUENE, 4-	1.6E+03	Aquatic Habitat Goal	5.0E+04		1.6E+03
PENTACHLOROPHENOL	7.9E+00	Aquatic Habitat Goal	5.9E+03		7.9E+00
PENTAERYTHRITOLTETRANITRATE (PETN)	2.2E+04	Gross Contamination	2.2E+04		8.5E+04
PERCHLORATE	6.0E+02	Aquatic Habitat Goal	5.0E+04		6.0E+02
PHENANTHRENE	4.6E+00	Aquatic Habitat Goal	4.1E+02	(Use soil gas)	4.6E+00
PHENOL	1.3E+03	Aquatic Habitat Goal	5.0E+04		1.3E+03
POLYCHLORINATED BIPHENYLS (PCBs)	1.4E-02	Aquatic Habitat Goal	1.6E+01		1.4E-02
PROPICONAZOLE	2.6E+01	Aquatic Habitat Goal	5.0E+04		2.6E+01
PYRENE	2.0E+00	Aquatic Habitat Goal	6.8E+01	1.4E+02	2.0E+00
SELENIUM	5.0E+00	Aquatic Habitat Goal	5.0E+04		5.0E+00
SILVER	1.0E+00	Aquatic Habitat Goal	5.0E+04		1.0E+00
SIMAZINE	2.0E+00	Aquatic Habitat Goal	3.1E+03		2.0E+00
STYRENE	3.2E+01	Aquatic Habitat Goal	1.1E+02	3.1E+05	3.2E+01
TERBACIL	2.3E+03	Aquatic Habitat Goal	5.0E+04		2.3E+03
tert-BUTYL ALCOHOL	1.8E+04	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	1.8E+04
TETRACHLOROETHANE, 1,1,1,2-	3.1E+02	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	3.1E+02
TETRACHLOROETHANE, 1,1,2,2-	2.0E+02	Vapor Intrusion	5.0E+03	2.0E+02	4.2E+02
TETRACHLOROETHYLENE	1.2E+02	Aquatic Habitat Goal	3.0E+03	1.8E+02	1.2E+02
TETRACHLOROPHENOL, 2,3,4,6-	1.2E+00	Aquatic Habitat Goal	1.2E+04		1.2E+00
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	3.3E+02	Aquatic Habitat Goal	5.0E+04		3.3E+02
THALLIUM	2.0E+01	Aquatic Habitat Goal	5.0E+04		2.0E+01
TOLUENE	1.3E+02	Aquatic Habitat Goal	4.0E+02	5.3E+05	1.3E+02
TOXAPHENE	2.0E-04	Aquatic Habitat Goal	1.4E+02		2.0E-04
TPH (gasolines)	5.0E+02	Aquatic Habitat Goal	5.0E+03	(Use soil gas)	5.0E+02
TPH (middle distillates)	6.4E+02	Aquatic Habitat Goal	2.5E+03	(Use soil gas)	6.4E+02
TPH (residual fuels)	6.4E+02	Aquatic Habitat Goal	2.5E+03		6.4E+02

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

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Odors, etc.) Table G-2	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (chronic) Table D-4a
TRICHLOROBENZENE, 1,2,4-	2.5E+01	Aquatic Habitat Goal	2.5E+04	8.8E+02	2.5E+01
TRICHLOROETHANE, 1,1,1-	6.2E+01	Aquatic Habitat Goal	5.0E+04	3.4E+05	6.2E+01
TRICHLOROETHANE, 1,1,2-	1.0E+02	Vapor Intrusion	5.0E+04	1.0E+02	4.7E+03
TRICHLOROETHYLENE	3.6E+02	Aquatic Habitat Goal	5.0E+04	6.1E+02	3.6E+02
TRICHLOROPHENOL, 2,4,5-	1.1E+01	Aquatic Habitat Goal	2.0E+03		1.1E+01
TRICHLOROPHENOL, 2,4,6-	4.9E+02	Aquatic Habitat Goal	1.0E+03		4.9E+02
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	6.9E+02	Aquatic Habitat Goal	5.0E+04		6.9E+02
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	3.0E+01	Aquatic Habitat Goal	5.0E+04		3.0E+01
TRICHLOROPROPANE, 1,2,3-	1.4E+01	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	1.4E+01
TRICHLOROPROPENE, 1,2,3-	6.2E-01	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	6.2E-01
TRIFLURALIN	2.0E+01	Aquatic Habitat Goal	9.2E+01		2.0E+01
TRINITROBENZENE, 1,3,5-	3.0E+01	Aquatic Habitat Goal	5.0E+04		3.0E+01
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	1.5E+02	Aquatic Habitat Goal	3.7E+04		1.5E+02
TRINITROTOLUENE, 2,4,6- (TNT)	1.3E+02	Aquatic Habitat Goal	5.0E+04		1.3E+02
VANADIUM	1.9E+01	Aquatic Habitat Goal	5.0E+04		1.9E+01
VINYL CHLORIDE	6.2E+01	Vapor Intrusion	3.4E+04	6.2E+01	7.8E+02
XYLENES	1.0E+02	Aquatic Habitat Goal	5.3E+03	1.5E+05	1.0E+02
ZINC	2.2E+01	Aquatic Habitat Goal	5.0E+04		2.2E+01

Notes:

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

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

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

Vapor Intrusion: Addresses potential emission of volatile chemicals from groundwater into buildings and subsequent impact on indoor air. Assumes moderately permeable, sandy soil or fill material immediately beneath building slab and unrestricted ("residential") land use (refer to Chapter 5).

Aquatic Habitat Impacts: Addresses potential discharge of groundwater to estuarine aquatic habitat and subsequent impact on aquatic life; dilution of groundwater upon discharge to surface water not considered, in order to take into account potential impacts to benthic organisms (see Chapter 5).

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

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

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

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

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

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Odors, etc.) Table G-2	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (acute) Table D-4a
DIBENZO(a,h)ANTHTRACENE	5.2E-01	Gross Contamination	5.2E-01		3.0E+02
DIBROMO,1,2- CHLOROPROPANE,3-	4.0E-02	Aquatic Habitat Goal	1.0E+02	(Use soil gas)	4.0E-02
DIBROMOCHLOROMETHANE	3.4E+02	Vapor Intrusion	5.0E+04	3.4E+02	1.1E+04
DIBROMOETHANE, 1,2-	1.6E+01	Vapor Intrusion	5.0E+04	1.6E+01	1.4E+03
DICHLOROBENZENE, 1,2-	1.0E+02	Gross Contamination	1.0E+02	8.0E+04	3.7E+02
DICHLOROBENZENE, 1,3-	3.7E+02	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	3.7E+02
DICHLOROBENZENE, 1,4-	1.1E+02	Gross Contamination	1.1E+02	3.8E+02	3.7E+02
DICHLOROBENZIDINE, 3,3-	2.5E+02	Aquatic Habitat Goal	1.6E+03		2.5E+02
DICHLORODIPHENYLDICHLOROETHANE (DDD)	6.0E-01	Aquatic Habitat Goal	4.5E+01		6.0E-01
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.1E+00	Aquatic Habitat Goal	2.0E+01		1.1E+00
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.3E-02	Aquatic Habitat Goal	2.8E+00		1.3E-02
DICHLOROETHANE, 1,1-	4.7E+01	Aquatic Habitat Goal	5.0E+04	9.4E+02	4.7E+01
DICHLOROETHANE, 1,2-	1.6E+02	Vapor Intrusion	5.0E+04	1.6E+02	3.8E+04
DICHLOROETHYLENE, 1,1-	3.9E+03	Aquatic Habitat Goal	1.5E+04	6.4E+03	3.9E+03
DICHLOROETHYLENE, Cis 1,2-	1.1E+03	Vapor Intrusion	5.0E+04	1.1E+03	1.2E+04
DICHLOROETHYLENE, Trans 1,2-	2.6E+03	Gross Contamination	2.6E+03	5.0E+03	1.2E+04
DICHLOROPHENOL, 2,4-	3.0E+00	Gross Contamination	3.0E+00		6.7E+02
DICHLOROPHENOXYACETIC ACID (2,4-D)	2.0E+02	Aquatic Habitat Goal	5.0E+04		2.0E+02
DICHLOROPROPANE, 1,2-	1.0E+02	Gross Contamination	1.0E+02	2.6E+02	3.4E+03
DICHLOROPROPENE, 1,3-	2.6E+02	Aquatic Habitat Goal	5.0E+04	5.5E+02	2.6E+02
DIELDRIN	7.1E-01	Aquatic Habitat Goal	1.3E+02		7.1E-01
DIETHYLPHTHALATE	9.4E+02	Aquatic Habitat Goal	5.0E+04		9.4E+02
DIMETHYLPHENOL, 2,4-	2.7E+02	Aquatic Habitat Goal	4.0E+03	1.5E+06	2.7E+02
DIMETHYLPHTHALATE	9.4E+02	Aquatic Habitat Goal	5.0E+04		9.4E+02
DINITROBENZENE, 1,3-	1.1E+02	Aquatic Habitat Goal	5.0E+04		1.1E+02
DINITROPHENOL, 2,4-	2.3E+02	Aquatic Habitat Goal	5.0E+04		2.3E+02
DINITROTOLUENE, 2,4- (2,4-DNT)	1.1E+02	Aquatic Habitat Goal	5.0E+04		1.1E+02
DINITROTOLUENE, 2,6- (2,6-DNT)	1.1E+02	Aquatic Habitat Goal	5.0E+04		1.1E+02
DIOXANE, 1,4-	5.0E+04	Gross Contamination	5.0E+04		3.4E+06
DIOXINS (TEQ)	3.0E-03	Aquatic Habitat Goal	6.0E-02		3.0E-03
DIURON	2.0E+02	Aquatic Habitat Goal	2.1E+04		2.0E+02
ENDOSULFAN	3.4E-02	Aquatic Habitat Goal	2.3E+02		3.4E-02
ENDRIN	3.7E-02	Aquatic Habitat Goal	1.3E+02		3.7E-02
ETHANOL	5.0E+04	Gross Contamination	5.0E+04		
ETHYLBENZENE	3.0E+02	Gross Contamination	3.0E+02	6.6E+04	4.3E+02
FLUORANTHENE	1.3E+02	Gross Contamination	1.3E+02		3.0E+02
FLUORENE	3.0E+02	Aquatic Habitat Goal	9.5E+02	1.9E+03	3.0E+02
GLYPHOSATE	6.0E+02	Aquatic Habitat Goal	5.0E+04		6.0E+02
HEPTACHLOR	5.3E-02	Aquatic Habitat Goal	9.0E+01		5.3E-02
HEPTACHLOR EPOXIDE	5.3E-02	Aquatic Habitat Goal	1.0E+02		5.3E-02
HEXACHLOROBENZENE	3.1E+00	Gross Contamination	3.1E+00		6.0E+00
HEXACHLOROBUTADIENE	1.1E+01	Aquatic Habitat Goal	6.0E+01		1.1E+01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	1.6E-01	Aquatic Habitat Goal	4.0E+03		1.6E-01
HEXACHLOROETHANE	1.0E+02	Gross Contamination	1.0E+02		3.1E+02
HEXAZINONE	5.0E+04	Aquatic Habitat Goal	5.0E+04		5.0E+04

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

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Odors, etc.) Table G-2	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (acute) Table D-4a
INDENO(1,2,3-cd)PYRENE	9.5E-02	Gross Contamination	9.5E-02		3.0E+02
ISOPHORONE	4.3E+03	Aquatic Habitat Goal	5.0E+04		4.3E+03
LEAD	2.9E+01	Aquatic Habitat Goal	5.0E+04		2.9E+01
MERCURY	2.1E+00	Aquatic Habitat Goal	3.0E+01	(Use soil gas)	2.1E+00
METHOXYCHLOR	3.0E-02	Aquatic Habitat Goal	5.0E+01		3.0E-02
METHYL ETHYL KETONE	1.4E+04	Aquatic Habitat Goal	5.0E+04	1.9E+08	1.4E+04
METHYL ISOBUTYL KETONE	1.7E+02	Aquatic Habitat Goal	1.3E+04	1.9E+07	1.7E+02
METHYL MERCURY	3.0E-03	Aquatic Habitat Goal	5.0E+04		3.0E-03
METHYL TERT BUTYL ETHER	1.8E+03	Gross Contamination	1.8E+03	2.6E+04	5.3E+04
METHYLENE CHLORIDE	3.9E+03	Vapor Intrusion	5.0E+04	3.9E+03	1.1E+04
METHYLNAPHTHALENE, 1-	1.0E+02	Gross Contamination	1.0E+02	2.5E+04	3.0E+02
METHYLNAPHTHALENE, 2-	1.0E+02	Gross Contamination	1.0E+02	2.5E+04	3.0E+02
MOLYBDENUM	2.4E+02	Aquatic Habitat Goal	5.0E+04		2.4E+02
NAPHTHALENE	2.1E+02	Gross Contamination	2.1E+02	2.8E+04	7.7E+02
NICKEL	5.0E+00	Aquatic Habitat Goal	5.0E+04		5.0E+00
NITROBENZENE	2.0E+03	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	2.0E+03
NITROGLYCERIN	1.4E+02	Aquatic Habitat Goal	5.0E+04		1.4E+02
NITROTOLUENE, 2-	7.5E+03	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	7.5E+03
NITROTOLUENE, 3-	3.8E+03	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	3.8E+03
NITROTOLUENE, 4-	3.3E+03	Aquatic Habitat Goal	5.0E+04		3.3E+03
PENTACHLOROPHENOL	1.3E+01	Aquatic Habitat Goal	5.9E+03		1.3E+01
PENTAERYTHRITOLTETRANITRATE (PETN)	2.2E+04	Gross Contamination	2.2E+04		4.3E+04
PERCHLORATE	6.0E+02	Aquatic Habitat Goal	5.0E+04		6.0E+02
PHENANTHRENE	3.0E+02	Aquatic Habitat Goal	4.1E+02	(Use soil gas)	3.0E+02
PHENOL	3.4E+03	Aquatic Habitat Goal	5.0E+04		3.4E+03
POLYCHLORINATED BIPHENYLS (PCBs)	2.0E+00	Aquatic Habitat Goal	1.6E+01		2.0E+00
PROPICONAZOLE	2.6E+02	Aquatic Habitat Goal	5.0E+04		2.6E+02
PYRENE	6.8E+01	Gross Contamination	6.8E+01	1.4E+02	3.0E+02
SELENIUM	2.0E+01	Aquatic Habitat Goal	5.0E+04		2.0E+01
SILVER	1.0E+00	Aquatic Habitat Goal	5.0E+04		1.0E+00
SIMAZINE	1.0E+01	Aquatic Habitat Goal	3.1E+03		1.0E+01
STYRENE	3.2E+01	Aquatic Habitat Goal	1.1E+02	3.1E+05	3.2E+01
TERBACIL	2.3E+04	Aquatic Habitat Goal	5.0E+04		2.3E+04
tert-BUTYL ALCOHOL	5.0E+04	Gross Contamination	5.0E+04	(Use soil gas)	1.8E+05
TETRACHLOROETHANE, 1,1,1,2-	3.1E+03	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	3.1E+03
TETRACHLOROETHANE, 1,1,2,2-	2.0E+02	Vapor Intrusion	5.0E+03	2.0E+02	3.0E+03
TETRACHLOROETHYLENE	1.8E+02	Vapor Intrusion	3.0E+03	1.8E+02	1.8E+03
TETRACHLOROPHENOL, 2,3,4,6-	1.0E+01	Aquatic Habitat Goal	1.2E+04		1.0E+01
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	1.9E+03	Aquatic Habitat Goal	5.0E+04		1.9E+03
THALLIUM	4.7E+02	Aquatic Habitat Goal	5.0E+04		4.7E+02
TOLUENE	4.0E+02	Gross Contamination	4.0E+02	5.3E+05	5.8E+03
TOXAPHENE	2.1E-01	Aquatic Habitat Goal	1.4E+02		2.1E-01
TPH (gasolines)	5.0E+03	Aquatic Habitat Goal	5.0E+03	(Use soil gas)	5.0E+03
TPH (middle distillates)	2.5E+03	Aquatic Habitat Goal	2.5E+03	(Use soil gas)	2.5E+03
TPH (residual fuels)	2.5E+03	Aquatic Habitat Goal	2.5E+03		2.5E+03

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

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Odors, etc.) Table G-2	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (acute) Table D-4a
TRICHLOROBENZENE, 1,2,4-	1.6E+02	Aquatic Habitat Goal	2.5E+04	8.8E+02	1.6E+02
TRICHLOROETHANE, 1,1,1-	6.0E+03	Aquatic Habitat Goal	5.0E+04	3.4E+05	6.0E+03
TRICHLOROETHANE, 1,1,2-	1.0E+02	Vapor Intrusion	5.0E+04	1.0E+02	6.0E+03
TRICHLOROETHYLENE	6.1E+02	Vapor Intrusion	5.0E+04	6.1E+02	7.0E+02
TRICHLOROPHENOL, 2,4,5-	1.0E+02	Aquatic Habitat Goal	2.0E+03		1.0E+02
TRICHLOROPHENOL, 2,4,6-	4.9E+02	Aquatic Habitat Goal	1.0E+03		4.9E+02
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	6.9E+02	Aquatic Habitat Goal	5.0E+04		6.9E+02
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	3.0E+01	Aquatic Habitat Goal	5.0E+04		3.0E+01
TRICHLOROPROPANE, 1,2,3-	1.4E+02	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	1.4E+02
TRICHLOROPROPENE, 1,2,3-	6.2E-01	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	6.2E-01
TRIFLURALIN	2.0E+01	Aquatic Habitat Goal	9.2E+01		2.0E+01
TRINITROBENZENE, 1,3,5-	1.4E+02	Aquatic Habitat Goal	5.0E+04		1.4E+02
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	1.5E+02	Aquatic Habitat Goal	3.7E+04		1.5E+02
TRINITROTOLUENE, 2,4,6- (TNT)	5.7E+02	Aquatic Habitat Goal	5.0E+04		5.7E+02
VANADIUM	1.9E+01	Aquatic Habitat Goal	5.0E+04		1.9E+01
VINYL CHLORIDE	6.2E+01	Vapor Intrusion	3.4E+04	6.2E+01	7.8E+02
XYLENES	1.0E+03	Aquatic Habitat Goal	5.3E+03	1.5E+05	1.0E+03
ZINC	2.2E+01	Aquatic Habitat Goal	5.0E+04		2.2E+01

Notes:

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

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

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

Vapor Intrusion: Addresses potential emission of volatile chemicals from groundwater into buildings and subsequent impact on indoor air. Assumes moderately permeable, sandy soil or fill material immediately beneath building slab and unrestricted ("residential") land use (refer to Chapter 5).

Aquatic Habitat Impacts: Addresses potential discharge of groundwater to estuarine aquatic habitat and subsequent impact on aquatic life; dilution of groundwater upon discharge to surface water not considered, in order to take into account potential impacts to benthic organisms (see Chapter 5).

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

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

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

CHEMICAL PARAMETER	[1]Final Surface Water Action Level	Basis	Gross Contamination (Taste & Odors, etc.) Table G-3	Drinking Water (Toxicity) Table D-3a	Fresh Water Aquatic Habitat Goal (Chronic Toxicity) Table D-4a	Bioaccumulation and Human Consumption Table D-4f
ACENAPHTHENE	2.0E+01	Ceiling Value	2.0E+01	3.7E+02	2.3E+01	9.9E+02
ACENAPHTHYLENE	3.0E+01	Aquatic Habitat Chronic Toxicity	2.0E+03	2.4E+02	3.0E+01	
ACETONE	1.5E+03	Aquatic Habitat Chronic Toxicity	2.0E+04	2.2E+04	1.5E+03	
ALDRIN	2.6E-05	Bioaccumulation/Human Consumption	8.5E+00	4.0E-03	3.0E-01	2.6E-05
AMETRYN	1.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	3.3E+02	1.5E+01	
AMINO,2- DINITROTOLUENE,4,6-	1.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	7.3E+01	1.5E+01	
AMINO,4- DINITROTOLUENE,2,6-	1.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	7.3E+01	1.5E+01	
ANTHRACENE	7.3E-01	Aquatic Habitat Chronic Toxicity	2.2E+01	1.8E+03	7.3E-01	4.0E+04
ANTIMONY	6.0E+00	Drinking Water Toxicity	5.0E+04	6.0E+00	3.0E+01	1.5E+04
ARSENIC	1.4E-01	Bioaccumulation/Human Consumption	5.0E+04	1.0E+01	1.9E+02	1.4E-01
ATRAZINE	3.0E+00	Drinking Water Toxicity	2.0E+01	3.0E+00	1.2E+01	
BARIUM	2.0E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	2.0E+03	2.0E+02	
BENZENE	5.0E+00	Drinking Water Toxicity	1.7E+02	5.0E+00	4.6E+01	1.3E+01
BENZO(a)ANTHRACENE	1.8E-02	Bioaccumulation/Human Consumption	4.7E+00	9.2E-02	2.7E-02	1.8E-02
BENZO(a)PYRENE	1.4E-02	Aquatic Habitat Chronic Toxicity	8.1E-01	2.0E-01	1.4E-02	1.8E-02
BENZO(b)FLUORANTHENE	1.8E-02	Bioaccumulation/Human Consumption	7.5E-01	9.2E-02	9.1E+00	1.8E-02
BENZO(g,h,i)PERYLENE	1.0E-01	Aquatic Habitat Chronic Toxicity	1.3E-01	1.5E+03	1.0E-01	
BENZO(k)FLUORANTHENE	1.8E-02	Bioaccumulation/Human Consumption	4.0E-01	9.2E-01	3.7E+00	1.8E-02
BERYLLIUM	3.8E-02	Bioaccumulation/Human Consumption	5.0E+04	4.0E+00	2.7E+00	3.8E-02
BIPHENYL, 1,1-	5.0E-01	Ceiling Value	5.0E-01	8.3E-01	1.4E+01	
BIS(2-CHLOROETHYL)ETHER	1.2E-02	Drinking Water Toxicity	3.6E+02	1.2E-02	6.1E+01	4.4E-01
BIS(2-CHLOROISOPROPYL)ETHER	3.2E-01	Drinking Water Toxicity	3.2E+02	3.2E-01	6.1E+01	1.4E+03
BIS(2-ETHYLHEXYL)PHTHALATE	2.2E+00	Bioaccumulation/Human Consumption	1.4E+02	6.0E+00	3.2E+01	2.2E+00
BORON	7.3E+03	Drinking Water Toxicity	5.0E+04	7.3E+03	7.3E+03	
BROMODICHLOROMETHANE	1.2E-01	Drinking Water Toxicity	5.0E+04	1.2E-01	3.2E+03	
BROMOFORM	8.0E+01	Drinking Water Toxicity	5.1E+02	8.0E+01	3.2E+03	1.4E+02
BROMOMETHANE	8.7E+00	Drinking Water Toxicity	5.0E+04	8.7E+00	1.6E+02	1.5E+03
CADMIUM	3.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	5.0E+00	3.0E+00	
CARBON TETRACHLORIDE	2.3E+00	Bioaccumulation/Human Consumption	5.2E+02	5.0E+00	9.8E+00	2.3E+00
CHLORDANE (TECHNICAL)	1.6E-05	Bioaccumulation/Human Consumption	2.5E+00	2.0E+00	4.3E-03	1.6E-05
CHLOROANILINE, p-	3.4E-01	Drinking Water Toxicity	5.0E+04	3.4E-01	5.0E+00	
CHLOROBENZENE	2.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+01	1.0E+02	2.5E+01	2.1E+04
CHLOROETHANE	1.6E+01	Ceiling Value	1.6E+01	2.1E+04	2.1E+04	
CHLOROFORM	5.1E+00	Bioaccumulation/Human Consumption	2.4E+03	7.0E+01	6.2E+02	5.1E+00
CHLOROMETHANE	1.8E+00	Drinking Water Toxicity	5.0E+04	1.8E+00	3.2E+03	
CHLOROPHENOL, 2-	1.8E-01	Ceiling Value	1.8E-01	3.0E+01	1.4E+02	1.5E+02
CHROMIUM (Total)	7.4E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.0E+02	7.4E+01	
CHROMIUM III	7.4E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	5.5E+04	7.4E+01	
CHROMIUM VI	1.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.3E+01	1.1E+01	
CHRYSENE	1.8E-02	Bioaccumulation/Human Consumption	1.0E+00	9.2E+00	3.5E-01	1.8E-02
COBALT	3.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	1.1E+01	3.0E+00	
COPPER	6.0E+00	Aquatic Habitat Chronic Toxicity	1.0E+03	1.3E+03	6.0E+00	
CYANIDE (Free)	5.2E+00	Aquatic Habitat Chronic Toxicity	1.7E+02	2.0E+02	5.2E+00	2.2E+05

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

CHEMICAL PARAMETER	[1]Final Surface Water Action Level	Basis	Gross Contamination (Taste & Odors, etc.) Table G-3	Drinking Water (Toxicity) Table D-3a	Fresh Water Aquatic Habitat Goal (Chronic Toxicity) Table D-4a	Bioaccumulation and Human Consumption Table D-4f
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	6.1E-01	Drinking Water Toxicity	3.0E+04	6.1E-01	1.9E+02	
DALAPON	2.0E+02	Drinking Water Toxicity	5.0E+04	2.0E+02	3.0E+02	
DIBENZO(a,h)ANTHTRACENE	9.2E-03	Drinking Water Toxicity	5.2E-01	9.2E-03	7.5E+00	1.8E-02
DIBROMO,1,2- CHLOROPROPANE,3-	4.0E-02	Drinking Water Toxicity	1.0E+01	4.0E-02	4.0E-02	
DIBROMOCHLOROMETHANE	1.6E-01	Drinking Water Toxicity	5.0E+04	1.6E-01	3.2E+03	1.3E+01
DIBROMOETHANE, 1,2-	4.0E-02	Drinking Water Toxicity	5.0E+04	4.0E-02	1.4E+03	
DICHLOROBENZENE, 1,2-	1.0E+01	Ceiling Value	1.0E+01	6.0E+02	1.4E+01	8.5E+02
DICHLOROBENZENE, 1,3-	7.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.8E+02	7.1E+01	8.5E+02
DICHLOROBENZENE, 1,4-	5.0E+00	Ceiling Value	5.0E+00	7.5E+01	1.5E+01	8.5E+02
DICHLOROBENZIDINE, 3,3-	7.0E-03	Bioaccumulation/Human Consumption	1.6E+03	1.5E-01	2.5E+02	7.0E-03
DICHLORODIPHENYLDICHLOROETHANE (DDD)	3.1E-04	Bioaccumulation/Human Consumption	4.5E+01	2.8E-01	1.0E-03	3.1E-04
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.2E-04	Bioaccumulation/Human Consumption	2.0E+01	2.0E-01	1.0E-03	2.2E-04
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	8.0E-06	Bioaccumulation/Human Consumption	2.8E+00	2.0E-01	1.0E-03	8.0E-06
DICHLOROETHANE, 1,1-	2.4E+00	Drinking Water Toxicity	5.0E+04	2.4E+00	4.7E+01	
DICHLOROETHANE, 1,2-	1.5E-01	Drinking Water Toxicity	7.0E+03	1.5E-01	1.0E+04	7.9E+01
DICHLOROETHYLENE, 1,1-	6.0E-01	Bioaccumulation/Human Consumption	1.5E+03	7.0E+00	2.5E+01	6.0E-01
DICHLOROETHYLENE, Cis 1,2-	7.0E+01	Drinking Water Toxicity	5.0E+04	7.0E+01	5.9E+02	
DICHLOROETHYLENE, Trans 1,2-	1.0E+02	Drinking Water Toxicity	2.6E+02	1.0E+02	5.9E+02	140000
DICHLOROPHENOL, 2,4-	3.0E-01	Ceiling Value	3.0E-01	1.1E+02	1.8E+02	2.9E+02
DICHLOROPHENOXYACETIC ACID (2,4-D)	7.0E+01	Drinking Water Toxicity	5.0E+04	7.0E+01	2.2E+02	
DICHLOROPROPANE, 1,2-	5.0E+00	Drinking Water Toxicity	1.0E+01	5.0E+00	2.9E+03	1.5E+01
DICHLOROPROPENE, 1,3-	4.3E-01	Drinking Water Toxicity	5.0E+04	4.3E-01	1.2E+02	4.6E+00
DIELDRIN	2.5E-05	Bioaccumulation/Human Consumption	4.1E+01	4.2E-03	1.9E-03	2.5E-05
DIETHYLPHTHALATE	1.5E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	2.9E+04	1.5E+00	4.4E+04
DIMETHYLPHENOL, 2,4-	1.2E+02	Drinking Water Toxicity	4.0E+02	1.2E+02	5.3E+02	8.5E+02
DIMETHYLPHTHALATE	1.5E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	3.7E+05	1.5E+00	1.1E+06
DINITROBENZENE, 1,3-	3.7E+00	Drinking Water Toxicity	5.0E+04	3.7E+00	3.0E+01	
DINITROPHENOL, 2,4-	7.3E+01	Drinking Water Toxicity	5.0E+04	7.3E+01	7.5E+01	5.3E+03
DINITROTOLUENE, 2,4- (2,4-DNT)	2.2E-01	Drinking Water Toxicity	5.0E+04	2.2E-01	4.4E+01	3.0E+00
DINITROTOLUENE, 2,6- (2,6-DNT)	3.7E+01	Drinking Water Toxicity	5.0E+04	3.7E+01	4.4E+01	
DIOXANE, 1,4-	6.7E-01	Drinking Water Toxicity	5.0E+04	6.7E-01	3.4E+05	
DIOXINS (TEQ)	5.0E-09	Bioaccumulation/Human Consumption	6.0E-02	3.0E-05	5.0E-06	5.0E-09
DIURON	6.0E+01	Aquatic Habitat Chronic Toxicity	2.1E+04	7.3E+01	6.0E+01	
ENDOSULFAN	5.6E-02	Aquatic Habitat Chronic Toxicity	2.3E+02	2.2E+02	5.6E-02	5.2E+01
ENDRIN	2.3E-03	Aquatic Habitat Chronic Toxicity	4.1E+01	2.0E+00	2.3E-03	8.1E-01
ETHANOL	5.0E+04	Ceiling Value	5.0E+04			
ETHYLBENZENE	3.0E+01	Ceiling Value	3.0E+01	7.0E+02	2.9E+02	1.1E+03
FLUORANTHENE	8.1E+00	Aquatic Habitat Chronic Toxicity	1.3E+02	1.5E+03	8.1E+00	1.8E+01
FLUORENE	3.9E+00	Aquatic Habitat Chronic Toxicity	9.5E+02	2.4E+02	3.9E+00	5.3E+03
GLYPHOSATE	6.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	7.0E+02	6.5E+01	
HEPTACHLOR	9.0E-05	Bioaccumulation/Human Consumption	2.0E+01	4.0E-01	3.8E-03	9.0E-05
HEPTACHLOR EPOXIDE	3.9E-05	Bioaccumulation/Human Consumption	1.0E+02	2.0E-01	3.8E-03	3.9E-05
HEXACHLOROBENZENE	2.4E-04	Bioaccumulation/Human Consumption	3.1E+00	1.0E+00	3.7E+00	2.4E-04

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

CHEMICAL PARAMETER	[1]Final Surface Water Action Level	Basis	Gross Contamination (Taste & Odors, etc.) Table G-3	Drinking Water (Toxicity) Table D-3a	Fresh Water Aquatic Habitat Goal (Chronic Toxicity) Table D-4a	Bioaccumulation and Human Consumption Table D-4f
HEXACHLOROBUTADIENE	8.6E-01	Drinking Water Toxicity	6.0E+00	8.6E-01	4.7E+00	1.6E+01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	2.0E-02	Bioaccumulation/Human Consumption	4.0E+03	2.0E-01	8.0E-02	2.0E-02
HEXACHLOROETHANE	2.9E+00	Bioaccumulation/Human Consumption	1.0E+01	4.8E+00	1.2E+01	2.9E+00
HEXAZINONE	1.2E+03	Drinking Water Toxicity	5.0E+04	1.2E+03	5.0E+03	
INDENO(1,2,3-cd)PYRENE	1.8E-02	Bioaccumulation/Human Consumption	9.5E-02	9.2E-02	4.3E+00	1.8E-02
ISOPHORONE	7.1E+01	Drinking Water Toxicity	5.0E+04	7.1E+01	1.2E+03	1.7E+05
LEAD	1.5E+01	Drinking Water Toxicity	5.0E+04	1.5E+01	2.9E+01	
MERCURY	4.7E-02	Bioaccumulation/Human Consumption	3.0E+01	2.0E+00	5.5E-01	4.7E-02
METHOXYCHLOR	3.0E-02	Aquatic Habitat Chronic Toxicity	5.0E+01	4.0E+01	3.0E-02	
METHYL ETHYL KETONE	7.1E+03	Drinking Water Toxicity	8.4E+03	7.1E+03	1.4E+04	
METHYL ISOBUTYL KETONE	1.7E+02	Aquatic Habitat Chronic Toxicity	1.3E+03	2.0E+03	1.7E+02	
METHYL MERCURY	3.0E-03	Aquatic Habitat Chronic Toxicity	5.0E+04	3.7E+00	3.0E-03	
METHYL TERT BUTYL ETHER	5.0E+00	Ceiling Value	5.0E+00	1.2E+01	5.1E+04	
METHYLENE CHLORIDE	4.8E+00	Drinking Water Toxicity	9.1E+03	4.8E+00	2.2E+03	5.9E+02
METHYLNAPHTHALENE, 1-	2.1E+00	Aquatic Habitat Chronic Toxicity	1.0E+01	4.7E+00	2.1E+00	
METHYLNAPHTHALENE, 2-	2.1E+00	Aquatic Habitat Chronic Toxicity	1.0E+01	2.4E+01	2.1E+00	
MOLYBDENUM	1.8E+02	Drinking Water Toxicity	5.0E+04	1.8E+02	2.4E+02	
NAPHTHALENE	1.7E+01	Drinking Water Toxicity	2.1E+01	1.7E+01	2.4E+01	
NICKEL	5.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	1.8E+03	5.0E+00	3.3E+01
NITROBENZENE	1.2E-01	Drinking Water Toxicity	5.0E+04	1.2E-01	2.2E+02	
NITROGLYCERIN	3.7E+00	Drinking Water Toxicity	5.0E+04	3.7E+00	1.4E+02	
NITROTOLUENE, 2-	6.2E-02	Drinking Water Toxicity	5.0E+04	6.2E-02	1.0E+03	
NITROTOLUENE, 3-	1.2E+02	Drinking Water Toxicity	5.0E+04	1.2E+02	3.8E+02	
NITROTOLUENE, 4-	4.2E+00	Drinking Water Toxicity	5.0E+04	4.2E+00	1.6E+03	
PENTACHLOROPHENOL	1.0E+00	Drinking Water Toxicity	3.0E+01	1.0E+00	1.3E+01	3.0E+00
PENTAERYTHRITOLTETRANITRATE (PETN)	1.7E+01	Drinking Water Toxicity	2.2E+04	1.7E+01	8.5E+04	
PERCHLORATE	2.6E+01	Drinking Water Toxicity	5.0E+04	2.6E+01	6.0E+02	
PHENANTHRENE	6.3E+00	Aquatic Habitat Chronic Toxicity	4.1E+02	2.4E+02	6.3E+00	
PHENOL	5.0E+00	Ceiling Value	5.0E+00	1.1E+04	1.3E+03	1.7E+06
POLYCHLORINATED BIPHENYLS (PCBs)	7.9E-05	Bioaccumulation/Human Consumption	1.6E+01	5.0E-01	1.4E-02	7.9E-05
PROPICONAZOLE	4.2E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	4.7E+02	4.2E+01	
PYRENE	2.0E+00	Aquatic Habitat Chronic Toxicity	6.8E+01	1.8E+02	2.0E+00	4.0E+03
SELENIUM	5.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	5.0E+01	5.0E+00	
SILVER	1.0E+00	Aquatic Habitat Chronic Toxicity	1.0E+02	1.8E+02	1.0E+00	
SIMAZINE	4.0E+00	Drinking Water Toxicity	3.1E+03	4.0E+00	1.7E+01	
STYRENE	1.0E+01	Ceiling Value	1.0E+01	1.0E+02	3.2E+01	
TERBACIL	4.7E+02	Drinking Water Toxicity	5.0E+04	4.7E+02	2.3E+03	
tert-BUTYL ALCOHOL	4.5E+00	Drinking Water Toxicity	5.0E+04	4.5E+00	1.8E+04	
TETRACHLOROETHANE, 1,1,1,2-	5.2E-01	Drinking Water Toxicity	5.0E+04	5.2E-01	3.1E+02	
TETRACHLOROETHANE, 1,1,2,2-	6.7E-02	Drinking Water Toxicity	5.0E+02	6.7E-02	4.2E+02	3.5E+00
TETRACHLOROETHYLENE	2.9E+00	Bioaccumulation/Human Consumption	1.7E+02	5.0E+00	1.2E+02	2.9E+00
TETRACHLOROPHENOL, 2,3,4,6-	1.2E+00	Aquatic Habitat Chronic Toxicity	1.2E+04	1.1E+03	1.2E+00	
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	3.3E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	1.8E+03	3.3E+02	

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

CHEMICAL PARAMETER	[1]Final Surface Water Action Level	Basis	Gross Contamination (Taste & Odors, etc.) Table G-3	Drinking Water (Toxicity) Table D-3a	Fresh Water Aquatic Habitat Goal (Chronic Toxicity) Table D-4a	Bioaccumulation and Human Consumption Table D-4f
THALLIUM	2.0E+00	Drinking Water Toxicity	5.0E+04	2.0E+00	2.0E+01	1.6E+01
TOLUENE	4.0E+01	Ceiling Value	4.0E+01	1.0E+03	1.3E+02	1.4E+05
TOXAPHENE	2.0E-04	Aquatic Habitat Chronic Toxicity	1.4E+02	3.0E+00	2.0E-04	2.4E-04
TPH (gasolines)	1.0E+02	Ceiling Value	1.0E+02	1.0E+02	5.0E+02	
TPH (middle distillates)	1.0E+02	Ceiling Value	1.0E+02	1.9E+02	6.4E+02	
TPH (residual fuels)	1.0E+02	Ceiling Value	1.0E+02	4.4E+03	6.4E+02	
TRICHLOROBENZENE, 1,2,4-	2.5E+01	Aquatic Habitat Chronic Toxicity	3.0E+03	7.0E+01	2.5E+01	
TRICHLOROETHANE, 1,1,1-	6.2E+01	Aquatic Habitat Chronic Toxicity	9.7E+02	2.0E+02	6.2E+01	3.4E+05
TRICHLOROETHANE, 1,1,2-	5.0E+00	Drinking Water Toxicity	5.0E+04	5.0E+00	4.7E+03	1.4E+01
TRICHLOROETHYLENE	5.0E+00	Drinking Water Toxicity	3.1E+02	5.0E+00	3.6E+02	2.6E+01
TRICHLOROPHENOL, 2,4,5-	6.3E+01	Aquatic Habitat Chronic Toxicity	2.0E+02	3.7E+03	6.3E+01	3.6E+03
TRICHLOROPHENOL, 2,4,6-	1.2E+00	Bioaccumulation/Human Consumption	1.0E+02	6.1E+00	4.9E+02	1.2E+00
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	3.7E+02	Drinking Water Toxicity	5.0E+04	3.7E+02	6.9E+02	-
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	3.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	5.0E+01	3.0E+01	
TRICHLOROPROPANE, 1,2,3-	6.0E-01	Drinking Water Toxicity	5.0E+04	6.0E-01	1.4E+01	
TRICHLOROPROPENE, 1,2,3-	6.2E-01	Drinking Water Toxicity	5.0E+04	6.2E-01	6.2E-01	
TRIFLURALIN	8.7E+00	Drinking Water Toxicity	9.2E+01	8.7E+00	2.0E+01	
TRINITROBENZENE, 1,3,5-	3.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.1E+03	3.0E+01	
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	1.5E+02	Drinking Water Toxicity	3.7E+04	1.5E+02	1.5E+02	
TRINITROTOLUENE, 2,4,6- (TNT)	2.2E+00	Drinking Water Toxicity	5.0E+04	2.2E+00	1.3E+02	
VANADIUM	1.9E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.8E+02	1.9E+01	
VINYL CHLORIDE	2.0E+00	Drinking Water Toxicity	3.4E+03	2.0E+00	7.8E+02	1.7E+02
XYLENES	2.0E+01	Ceiling Value	2.0E+01	1.0E+04	1.0E+02	
ZINC	2.2E+01	Aquatic Habitat Chronic Toxicity	5.0E+03	1.1E+04	2.2E+01	

Notes:

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

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

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

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

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

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

CHEMICAL PARAMETER	[1]Final Surface Water Action Level	Basis	Gross Contamination (Odors, etc.) Table G-4	Marine Aquatic Habitat Goal (Chronic Toxicity) Table D-4a	Bioaccumulation and Human Consumption Table D-4F
ACENAPHTHENE	2.0E+01	Ceiling Level	2.0E+01	4.0E+01	9.9E+02
ACENAPHTHYLENE	3.0E+01	Aquatic Habitat Chronic Toxicity	2.0E+03	3.0E+01	
ACETONE	1.5E+03	Aquatic Habitat Chronic Toxicity	2.0E+04	1.5E+03	
ALDRIN	2.6E-05	Bioaccumulation/Human Consumption	8.5E+00	1.3E-01	2.6E-05
AMETRYN	1.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.5E+01	
AMINO,2- DINITROTOLUENE,4,6-	1.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.5E+01	
AMINO,4- DINITROTOLUENE,2,6-	1.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.5E+01	
ANTHRACENE	7.3E-01	Aquatic Habitat Chronic Toxicity	2.2E+01	7.3E-01	4.0E+04
ANTIMONY	5.0E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	5.0E+02	1.5E+04
ARSENIC	1.4E-01	Bioaccumulation/Human Consumption	5.0E+04	3.6E+01	1.4E-01
ATRAZINE	2.6E+01	Aquatic Habitat Chronic Toxicity	1.7E+04	2.6E+01	
BARIUM	2.0E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	2.0E+02	
BENZENE	1.3E+01	Bioaccumulation/Human Consumption	2.0E+03	3.5E+02	1.3E+01
BENZO(a)ANTHRACENE	1.8E-02	Bioaccumulation/Human Consumption	4.7E+00	2.7E-02	1.8E-02
BENZO(a)PYRENE	1.4E-02	Aquatic Habitat Chronic Toxicity	8.1E-01	1.4E-02	1.8E-02
BENZO(b)FLUORANTHENE	1.8E-02	Bioaccumulation/Human Consumption	7.5E-01	9.1E+00	1.8E-02
BENZO(g,h,i)PERYLENE	1.0E-01	Aquatic Habitat Chronic Toxicity	1.3E-01	1.0E-01	
BENZO(k)FLUORANTHENE	1.8E-02	Bioaccumulation/Human Consumption	4.0E-01	3.7E+00	1.8E-02
BERYLLIUM	3.8E-02	Bioaccumulation/Human Consumption	5.0E+04	2.7E+00	3.8E-02
BIPHENYL, 1,1-	5.0E-01	Ceiling Level	5.0E-01	1.4E+01	
BIS(2-CHLOROETHYL)ETHER	4.4E-01	Bioaccumulation/Human Consumption	3.6E+02	6.1E+01	4.4E-01
BIS(2-CHLOROISOPROPYL)ETHER	6.1E+01	Aquatic Habitat Chronic Toxicity	3.2E+02	6.1E+01	1.4E+03
BIS(2-ETHYLHEXYL)PHTHALATE	2.2E+00	Bioaccumulation/Human Consumption	1.4E+02	3.2E+01	2.2E+00
BORON	7.3E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	7.3E+03	
BROMODICHLOROMETHANE	3.2E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	3.2E+03	
BROMOFORM	1.4E+02	Bioaccumulation/Human Consumption	5.1E+02	3.2E+03	1.4E+02
BROMOMETHANE	1.5E+03	Bioaccumulation/Human Consumption	5.0E+04	3.2E+03	1.5E+03
CADMIUM	9.3E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	9.3E+00	
CARBON TETRACHLORIDE	2.3E+00	Bioaccumulation/Human Consumption	5.2E+02	3.2E+03	2.3E+00
CHLORDANE (TECHNICAL)	1.6E-05	Bioaccumulation/Human Consumption	2.5E+00	4.0E-03	1.6E-05
CHLOROANILINE, p-	5.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	5.0E+00	
CHLOROBENZENE	5.0E+01	Ceiling Level	5.0E+01	6.5E+01	2.1E+04
CHLOROETHANE	1.6E+01	Ceiling Level	1.6E+01	2.1E+04	
CHLOROFORM	5.1E+00	Bioaccumulation/Human Consumption	2.4E+03	3.2E+03	5.1E+00
CHLOROMETHANE	3.2E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	3.2E+03	
CHLOROPHENOL, 2-	1.8E-01	Ceiling Level	1.8E-01	1.4E+02	1.5E+02
CHROMIUM (Total)	1.0E+04	Aquatic Habitat Chronic Toxicity	5.0E+04	1.0E+04	
CHROMIUM III	7.4E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	7.4E+01	
CHROMIUM VI	5.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	5.0E+01	
CHRYSENE	1.8E-02	Bioaccumulation/Human Consumption	1.0E+00	3.5E-01	1.8E-02
COBALT	3.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	3.0E+00	
COPPER	2.9E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	2.9E+00	
CYANIDE (Free)	1.0E+00	Aquatic Habitat Chronic Toxicity	1.7E+02	1.0E+00	2.2E+05
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	1.9E+02	Aquatic Habitat Chronic Toxicity	3.0E+04	1.9E+02	

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

CHEMICAL PARAMETER	[1]Final Surface Water Action Level	Basis	Gross Contamination (Odors, etc.) Table G-4	Marine Aquatic Habitat Goal (Chronic Toxicity) Table D-4a	Bioaccumulation and Human Consumption Table D-4F
DALAPON	3.0E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	3.0E+02	
DIBENZO(a,h)ANTHTRACENE	1.8E-02	Bioaccumulation/Human Consumption	5.2E-01	7.5E+00	1.8E-02
DIBROMO,1,2- CHLOROPROPANE,3-	4.0E-02	Aquatic Habitat Chronic Toxicity	1.0E+01	4.0E-02	
DIBROMOCHLOROMETHANE	1.3E+01	Bioaccumulation/Human Consumption	5.0E+04	3.2E+03	1.3E+01
DIBROMOETHANE, 1,2-	1.4E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	1.4E+03	
DICHLOROBENZENE, 1,2-	1.0E+01	Ceiling Level	1.0E+01	6.5E+01	8.5E+02
DICHLOROBENZENE, 1,3-	6.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	6.5E+01	8.5E+02
DICHLOROBENZENE, 1,4-	1.1E+01	Ceiling Level	1.1E+01	6.5E+01	8.5E+02
DICHLOROBENZIDINE, 3,3-	7.0E-03	Bioaccumulation/Human Consumption	1.6E+03	2.5E+02	7.0E-03
DICHLORODIPHENYLDICHLOROETHANE (DDD)	3.1E-04	Bioaccumulation/Human Consumption	4.5E+01	1.0E-03	3.1E-04
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.2E-04	Bioaccumulation/Human Consumption	2.0E+01	1.0E-03	2.2E-04
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	8.0E-06	Bioaccumulation/Human Consumption	2.8E+00	1.0E-03	8.0E-06
DICHLOROETHANE, 1,1-	4.7E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	4.7E+01	
DICHLOROETHANE, 1,2-	7.9E+01	Bioaccumulation/Human Consumption	2.0E+04	1.0E+04	7.9E+01
DICHLOROETHYLENE, 1,1-	6.0E-01	Bioaccumulation/Human Consumption	1.5E+03	2.5E+01	6.0E-01
DICHLOROETHYLENE, Cis 1,2-	5.9E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	5.9E+02	
DICHLOROETHYLENE, Trans 1,2-	2.6E+02	Ceiling Level	2.6E+02	5.9E+02	140000
DICHLOROPHENOL, 2,4-	3.0E-01	Ceiling Level	3.0E-01	1.8E+02	2.9E+02
DICHLOROPHENOXYACETIC ACID (2,4-D)	4.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	4.0E+01	
DICHLOROPROPANE, 1,2-	1.0E+01	Ceiling Level	1.0E+01	1.5E+03	1.5E+01
DICHLOROPROPENE, 1,3-	4.6E+00	Bioaccumulation/Human Consumption	5.0E+04	1.2E+02	4.6E+00
DIELDRIN	2.5E-05	Bioaccumulation/Human Consumption	4.1E+01	1.9E-03	2.5E-05
DIETHYLPHTHALATE	1.7E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	1.7E+00	4.4E+04
DIMETHYLPHENOL, 2,4-	1.1E+02	Aquatic Habitat Chronic Toxicity	4.0E+02	1.1E+02	8.5E+02
DIMETHYLPHTHALATE	1.7E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	1.7E+00	1.1E+06
DINITROBENZENE, 1,3-	3.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	3.0E+01	
DINITROPHENOL, 2,4-	7.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	7.5E+01	5.3E+03
DINITROTOLUENE, 2,4- (2,4-DNT)	3.0E+00	Bioaccumulation/Human Consumption	5.0E+04	6.7E+01	3.0E+00
DINITROTOLUENE, 2,6- (2,6-DNT)	6.7E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	6.7E+01	
DIOXANE, 1,4-	5.0E+04	Ceiling Level	5.0E+04	5.0E+05	
DIOXINS (TEQ)	5.0E-09	Bioaccumulation/Human Consumption	6.0E-02	5.0E-06	5.0E-09
DIURON	6.0E+01	Aquatic Habitat Chronic Toxicity	2.1E+04	6.0E+01	
ENDOSULFAN	8.7E-03	Aquatic Habitat Chronic Toxicity	2.3E+02	8.7E-03	5.2E+01
ENDRIN	2.3E-03	Aquatic Habitat Chronic Toxicity	4.1E+01	2.3E-03	8.1E-01
ETHANOL	5.0E+04	Ceiling Level	5.0E+04		
ETHYLBENZENE	3.0E+01	Ceiling Level	3.0E+01	2.9E+02	1.1E+03
FLUORANTHENE	8.0E+00	Aquatic Habitat Chronic Toxicity	1.3E+02	8.0E+00	1.8E+01
FLUORENE	3.9E+00	Aquatic Habitat Chronic Toxicity	9.5E+02	3.9E+00	5.3E+03
GLYPHOSATE	6.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	6.5E+01	
HEPTACHLOR	9.0E-05	Bioaccumulation/Human Consumption	2.0E+01	3.6E-03	9.0E-05
HEPTACHLOR EPOXIDE	3.9E-05	Bioaccumulation/Human Consumption	1.0E+02	3.6E-03	3.9E-05
HEXACHLOROBENZENE	2.4E-04	Bioaccumulation/Human Consumption	3.1E+00	6.5E+01	2.4E-04
HEXACHLOROBUTADIENE	4.7E+00	Aquatic Habitat Chronic Toxicity	6.0E+00	4.7E+00	1.6E+01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	2.0E-02	Bioaccumulation/Human Consumption	4.0E+03	8.0E-02	2.0E-02

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

CHEMICAL PARAMETER	[1]Final Surface Water Action Level	Basis	Gross Contamination (Odors, etc.) Table G-4	Marine Aquatic Habitat Goal (Chronic Toxicity) Table D-4a	Bioaccumulation and Human Consumption Table D-4F
HEXACHLOROETHANE	2.9E+00	Bioaccumulation/Human Consumption	1.0E+01	1.2E+01	2.9E+00
HEXAZINONE	5.0E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	5.0E+03	
INDENO(1,2,3-cd)PYRENE	1.8E-02	Bioaccumulation/Human Consumption	9.5E-02	4.3E+00	1.8E-02
ISOPHORONE	1.3E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	1.3E+02	1.7E+05
LEAD	5.6E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	5.6E+00	
MERCURY	2.5E-02	Aquatic Habitat Chronic Toxicity	3.0E+01	2.5E-02	4.7E-02
METHOXYCHLOR	3.0E-02	Aquatic Habitat Chronic Toxicity	5.0E+01	3.0E-02	
METHYL ETHYL KETONE	8.4E+03	Ceiling Level	8.4E+03	1.4E+04	
METHYL ISOBUTYL KETONE	1.7E+02	Aquatic Habitat Chronic Toxicity	1.3E+03	1.7E+02	
METHYL MERCURY	3.0E-03	Aquatic Habitat Chronic Toxicity	5.0E+04	3.0E-03	
METHYL TERT BUTYL ETHER	1.8E+02	Ceiling Level	1.8E+02	1.8E+04	
METHYLENE CHLORIDE	5.9E+02	Bioaccumulation/Human Consumption	9.1E+03	3.2E+03	5.9E+02
METHYLNAPHTHALENE, 1-	2.1E+00	Aquatic Habitat Chronic Toxicity	1.0E+01	2.1E+00	
METHYLNAPHTHALENE, 2-	2.1E+00	Aquatic Habitat Chronic Toxicity	1.0E+01	2.1E+00	
MOLYBDENUM	2.4E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	2.4E+02	
NAPHTHALENE	2.1E+01	Ceiling Level	2.1E+01	2.4E+01	
NICKEL	8.3E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	8.3E+00	3.3E+01
NITROBENZENE	6.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	6.0E+01	
NITROGLYCERIN	1.4E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	1.4E+02	
NITROTOLUENE, 2-	1.0E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	1.0E+03	
NITROTOLUENE, 3-	3.8E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	3.8E+02	
NITROTOLUENE, 4-	1.6E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	1.6E+03	
PENTACHLOROPHENOL	3.0E+00	Bioaccumulation/Human Consumption	5.9E+02	7.9E+00	3.0E+00
PENTAERYTHRITOLTETRANITRATE (PETN)	2.2E+04	Ceiling Level	2.2E+04	8.5E+04	
PERCHLORATE	6.0E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	6.0E+02	
PHENANTHRENE	4.6E+00	Aquatic Habitat Chronic Toxicity	4.1E+02	4.6E+00	
PHENOL	1.3E+03	Aquatic Habitat Chronic Toxicity	7.9E+03	1.3E+03	1.7E+06
POLYCHLORINATED BIPHENYLS (PCBs)	7.9E-05	Bioaccumulation/Human Consumption	1.6E+01	3.0E-02	7.9E-05
PROPICONAZOLE	2.6E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	2.6E+01	
PYRENE	2.0E+00	Aquatic Habitat Chronic Toxicity	6.8E+01	2.0E+00	4.0E+03
SELENIUM	7.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	7.1E+01	
SILVER	1.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	1.0E+00	
SIMAZINE	2.0E+00	Aquatic Habitat Chronic Toxicity	3.1E+03	2.0E+00	
STYRENE	1.1E+01	Ceiling Level	1.1E+01	3.2E+01	
TERBACIL	2.3E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	2.3E+03	
tert-BUTYL ALCOHOL	1.8E+04	Aquatic Habitat Chronic Toxicity	5.0E+04	1.8E+04	
TETRACHLOROETHANE, 1,1,1,2-	3.1E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	3.1E+02	
TETRACHLOROETHANE, 1,1,2,2-	3.5E+00	Bioaccumulation/Human Consumption	5.0E+02	4.2E+02	3.5E+00
TETRACHLOROETHYLENE	2.9E+00	Bioaccumulation/Human Consumption	3.0E+02	1.5E+02	2.9E+00
TETRACHLOROPHENOL, 2,3,4,6-	4.0E+00	Aquatic Habitat Chronic Toxicity	1.2E+04	4.0E+00	
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	3.3E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	3.3E+02	
THALLIUM	1.6E+01	Bioaccumulation/Human Consumption	5.0E+04	2.0E+01	1.6E+01
TOLUENE	4.0E+01	Ceiling Level	4.0E+01	2.5E+03	1.4E+05
TOXAPHENE	2.0E-04	Aquatic Habitat Chronic Toxicity	1.4E+02	2.0E-04	2.4E-04

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

CHEMICAL PARAMETER	[1]Final Surface Water Action Level	Basis	Gross Contamination (Odors, etc.) Table G-4	Marine Aquatic Habitat Goal (Chronic Toxicity) Table D-4a	Bioaccumulation and Human Consumption Table D-4F
TPH (gasolines)	3.7E+03	Aquatic Habitat Chronic Toxicity	5.0E+03	3.7E+03	
TPH (middle distillates)	6.4E+02	Aquatic Habitat Chronic Toxicity	2.5E+03	6.4E+02	
TPH (residual fuels)	6.4E+02	Aquatic Habitat Chronic Toxicity	2.5E+03	6.4E+02	
TRICHLOROBENZENE, 1,2,4-	6.5E+01	Aquatic Habitat Chronic Toxicity	3.0E+03	6.5E+01	
TRICHLOROETHANE, 1,1,1-	6.2E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	6.2E+01	3.4E+05
TRICHLOROETHANE, 1,1,2-	1.4E+01	Bioaccumulation/Human Consumption	5.0E+04	4.7E+03	1.4E+01
TRICHLOROETHYLENE	2.6E+01	Bioaccumulation/Human Consumption	1.0E+04	3.6E+02	2.6E+01
TRICHLOROPHENOL, 2,4,5-	1.1E+01	Aquatic Habitat Chronic Toxicity	2.0E+02	1.1E+01	3.6E+03
TRICHLOROPHENOL, 2,4,6-	1.2E+00	Bioaccumulation/Human Consumption	1.0E+02	4.9E+02	1.2E+00
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	6.9E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	6.9E+02	
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	3.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	3.0E+01	
TRICHLOROPROPANE, 1,2,3-	1.4E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.4E+01	
TRICHLOROPROPENE, 1,2,3-	6.2E-01	Aquatic Habitat Chronic Toxicity	5.0E+04	6.2E-01	
TRIFLURALIN	2.0E+01	Aquatic Habitat Chronic Toxicity	9.2E+01	2.0E+01	
TRINITROBENZENE, 1,3,5-	3.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	3.0E+01	
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	1.5E+02	Aquatic Habitat Chronic Toxicity	3.7E+04	1.5E+02	
TRINITROTOLUENE, 2,4,6- (TNT)	2.0E+01	Ceiling Level	2.0E+01	1.3E+02	
VANADIUM	1.9E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.9E+01	
VINYL CHLORIDE	1.7E+02	Bioaccumulation/Human Consumption	3.4E+03	7.8E+02	1.7E+02
XYLENES	1.0E+02	Aquatic Habitat Chronic Toxicity	5.3E+02	1.0E+02	
ZINC	8.6E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	8.6E+01	

Notes:

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

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

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

CHEMICAL PARAMETER	[1]Final Surface Water Action Level	Basis	Gross Contamination (Odors, etc.) Table G-4	Estuary Aquatic Habitat Goal (Chronic Toxicity) Table D-4a	Bioaccumulation and Human Consumption Table D-4f
ACENAPHTHENE	2.0E+01	Ceiling Level	2.0E+01	2.3E+01	9.9E+02
ACENAPHTHYLENE	3.0E+01	Aquatic Habitat Chronic Toxicity	2.0E+03	3.0E+01	
ACETONE	1.5E+03	Aquatic Habitat Chronic Toxicity	2.0E+04	1.5E+03	
ALDRIN	2.6E-05	Bioaccumulation/Human Consumption	8.5E+00	1.3E-01	2.6E-05
AMETRYN	1.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.5E+01	
AMINO,2- DINITROTOLUENE,4,6-	1.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.5E+01	
AMINO,4- DINITROTOLUENE,2,6-	1.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.5E+01	
ANTHRACENE	7.3E-01	Aquatic Habitat Chronic Toxicity	2.2E+01	7.3E-01	4.0E+04
ANTIMONY	3.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	3.0E+01	1.5E+04
ARSENIC	1.4E-01	Bioaccumulation/Human Consumption	5.0E+04	3.6E+01	1.4E-01
ATRAZINE	1.2E+01	Aquatic Habitat Chronic Toxicity	1.7E+04	1.2E+01	
BARIUM	2.0E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	2.0E+02	
BENZENE	1.3E+01	Bioaccumulation/Human Consumption	2.0E+03	4.6E+01	1.3E+01
BENZO(a)ANTHRACENE	1.8E-02	Bioaccumulation/Human Consumption	4.7E+00	2.7E-02	1.8E-02
BENZO(a)PYRENE	1.4E-02	Aquatic Habitat Chronic Toxicity	8.1E-01	1.4E-02	1.8E-02
BENZO(b)FLUORANTHENE	1.8E-02	Bioaccumulation/Human Consumption	7.5E-01	9.1E+00	1.8E-02
BENZO(g,h,i)PERYLENE	1.0E-01	Aquatic Habitat Chronic Toxicity	1.3E-01	1.0E-01	
BENZO(k)FLUORANTHENE	1.8E-02	Bioaccumulation/Human Consumption	4.0E-01	3.7E+00	1.8E-02
BERYLLIUM	3.8E-02	Bioaccumulation/Human Consumption	5.0E+04	2.7E+00	3.8E-02
BIPHENYL, 1,1-	5.0E-01	Ceiling Level	5.0E-01	1.4E+01	
BIS(2-CHLOROETHYL)ETHER	4.4E-01	Bioaccumulation/Human Consumption	3.6E+02	6.1E+01	4.4E-01
BIS(2-CHLOROISOPROPYL)ETHER	6.1E+01	Aquatic Habitat Chronic Toxicity	3.2E+02	6.1E+01	1.4E+03
BIS(2-ETHYLHEXYL)PHTHALATE	2.2E+00	Bioaccumulation/Human Consumption	1.4E+02	3.2E+01	2.2E+00
BORON	7.3E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	7.3E+03	
BROMODICHLOROMETHANE	3.2E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	3.2E+03	
BROMOFORM	1.4E+02	Bioaccumulation/Human Consumption	5.1E+02	3.2E+03	1.4E+02
BROMOMETHANE	1.6E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	1.6E+02	1.5E+03
CADMIUM	3.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	3.0E+00	
CARBON TETRACHLORIDE	2.3E+00	Bioaccumulation/Human Consumption	5.2E+02	9.8E+00	2.3E+00
CHLORDANE (TECHNICAL)	1.6E-05	Bioaccumulation/Human Consumption	2.5E+00	4.0E-03	1.6E-05
CHLOROANILINE, p-	5.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	5.0E+00	
CHLOROBENZENE	2.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+01	2.5E+01	2.1E+04
CHLOROETHANE	1.6E+01	Ceiling Level	1.6E+01	2.1E+04	
CHLOROFORM	5.1E+00	Bioaccumulation/Human Consumption	2.4E+03	6.2E+02	5.1E+00
CHLOROMETHANE	3.2E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	3.2E+03	
CHLOROPHENOL, 2-	1.8E-01	Ceiling Level	1.8E-01	1.4E+02	1.5E+02
CHROMIUM (Total)	7.4E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	7.4E+01	
CHROMIUM III	7.4E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	7.4E+01	
CHROMIUM VI	1.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.1E+01	
CHRYSENE	1.8E-02	Bioaccumulation/Human Consumption	1.0E+00	3.5E-01	1.8E-02
COBALT	3.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	3.0E+00	
COPPER	2.9E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	2.9E+00	
CYANIDE (Free)	1.0E+00	Aquatic Habitat Chronic Toxicity	1.7E+02	1.0E+00	2.2E+05
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	1.9E+02	Aquatic Habitat Chronic Toxicity	3.0E+04	1.9E+02	

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

CHEMICAL PARAMETER	[1]Final Surface Water Action Level	Basis	Gross Contamination (Odors, etc.) Table G-4	Estuary Aquatic Habitat Goal (Chronic Toxicity) Table D-4a	Bioaccumulation and Human Consumption Table D-4f
DALAPON	3.0E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	3.0E+02	
DIBENZO(a,h)ANTHTRACENE	1.8E-02	Bioaccumulation/Human Consumption	5.2E-01	7.5E+00	1.8E-02
DIBROMO,1,2- CHLOROPROPANE,3-	4.0E-02	Aquatic Habitat Chronic Toxicity	1.0E+01	4.0E-02	
DIBROMOCHLOROMETHANE	1.3E+01	Bioaccumulation/Human Consumption	5.0E+04	3.2E+03	1.3E+01
DIBROMOETHANE, 1,2-	1.4E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	1.4E+03	
DICHLOROBENZENE, 1,2-	1.0E+01	Ceiling Level	1.0E+01	1.4E+01	8.5E+02
DICHLOROBENZENE, 1,3-	6.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	6.5E+01	8.5E+02
DICHLOROBENZENE, 1,4-	1.1E+01	Ceiling Level	1.1E+01	1.5E+01	8.5E+02
DICHLOROBENZIDINE, 3,3-	7.0E-03	Bioaccumulation/Human Consumption	1.6E+03	2.5E+02	7.0E-03
DICHLORODIPHENYLDICHLOROETHANE (DDD)	3.1E-04	Bioaccumulation/Human Consumption	4.5E+01	1.0E-03	3.1E-04
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.2E-04	Bioaccumulation/Human Consumption	2.0E+01	1.0E-03	2.2E-04
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	8.0E-06	Bioaccumulation/Human Consumption	2.8E+00	1.0E-03	8.0E-06
DICHLOROETHANE, 1,1-	4.7E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	4.7E+01	
DICHLOROETHANE, 1,2-	7.9E+01	Bioaccumulation/Human Consumption	2.0E+04	1.0E+04	7.9E+01
DICHLOROETHYLENE, 1,1-	6.0E-01	Bioaccumulation/Human Consumption	1.5E+03	2.5E+01	6.0E-01
DICHLOROETHYLENE, Cis 1,2-	5.9E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	5.9E+02	
DICHLOROETHYLENE, Trans 1,2-	2.6E+02	Ceiling Level	2.6E+02	5.9E+02	140000
DICHLOROPHENOL, 2,4-	3.0E-01	Ceiling Level	3.0E-01	1.8E+02	2.9E+02
DICHLOROPHENOXYACETIC ACID (2,4-D)	4.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	4.0E+01	
DICHLOROPROPANE, 1,2-	1.0E+01	Ceiling Level	1.0E+01	1.5E+03	1.5E+01
DICHLOROPROPENE, 1,3-	4.6E+00	Bioaccumulation/Human Consumption	5.0E+04	1.2E+02	4.6E+00
DIELDRIN	2.5E-05	Bioaccumulation/Human Consumption	4.1E+01	1.9E-03	2.5E-05
DIETHYLPHTHALATE	1.5E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	1.5E+00	4.4E+04
DIMETHYLPHENOL, 2,4-	1.1E+02	Aquatic Habitat Chronic Toxicity	4.0E+02	1.1E+02	8.5E+02
DIMETHYLPHTHALATE	1.5E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	1.5E+00	1.1E+06
DINITROBENZENE, 1,3-	3.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	3.0E+01	
DINITROPHENOL, 2,4-	7.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	7.5E+01	5.3E+03
DINITROTOLUENE, 2,4- (2,4-DNT)	3.0E+00	Bioaccumulation/Human Consumption	5.0E+04	4.4E+01	3.0E+00
DINITROTOLUENE, 2,6- (2,6-DNT)	4.4E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	4.4E+01	
DIOXANE, 1,4-	5.0E+04	Ceiling Level	5.0E+04	3.4E+05	
DIOXINS (TEQ)	5.0E-09	Bioaccumulation/Human Consumption	6.0E-02	5.0E-06	5.0E-09
DIURON	6.0E+01	Aquatic Habitat Chronic Toxicity	2.1E+04	6.0E+01	
ENDOSULFAN	8.7E-03	Aquatic Habitat Chronic Toxicity	2.3E+02	8.7E-03	5.2E+01
ENDRIN	2.3E-03	Aquatic Habitat Chronic Toxicity	4.1E+01	2.3E-03	8.1E-01
ETHANOL	5.0E+04	Ceiling Level	5.0E+04		
ETHYLBENZENE	3.0E+01	Ceiling Level	3.0E+01	2.9E+02	1.1E+03
FLUORANTHENE	8.0E+00	Aquatic Habitat Chronic Toxicity	1.3E+02	8.0E+00	1.8E+01
FLUORENE	3.9E+00	Aquatic Habitat Chronic Toxicity	9.5E+02	3.9E+00	5.3E+03
GLYPHOSATE	6.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	6.5E+01	
HEPTACHLOR	9.0E-05	Bioaccumulation/Human Consumption	2.0E+01	3.6E-03	9.0E-05
HEPTACHLOR EPOXIDE	3.9E-05	Bioaccumulation/Human Consumption	1.0E+02	3.6E-03	3.9E-05
HEXACHLOROBENZENE	2.4E-04	Bioaccumulation/Human Consumption	3.1E+00	3.7E+00	2.4E-04
HEXACHLOROBUTADIENE	4.7E+00	Aquatic Habitat Chronic Toxicity	6.0E+00	4.7E+00	1.6E+01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	2.0E-02	Bioaccumulation/Human Consumption	4.0E+03	8.0E-02	2.0E-02

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

CHEMICAL PARAMETER	[1]Final Surface Water Action Level	Basis	Gross Contamination (Odors, etc.) Table G-4	Estuary Aquatic Habitat Goal (Chronic Toxicity) Table D-4a	Bioaccumulation and Human Consumption Table D-4f
HEXACHLOROETHANE	2.9E+00	Bioaccumulation/Human Consumption	1.0E+01	1.2E+01	2.9E+00
HEXAZINONE	5.0E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	5.0E+03	
INDENO(1,2,3-cd)PYRENE	1.8E-02	Bioaccumulation/Human Consumption	9.5E-02	4.3E+00	1.8E-02
ISOPHORONE	1.3E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	1.3E+02	1.7E+05
LEAD	5.6E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	5.6E+00	
MERCURY	2.5E-02	Aquatic Habitat Chronic Toxicity	3.0E+01	2.5E-02	4.7E-02
METHOXYCHLOR	3.0E-02	Aquatic Habitat Chronic Toxicity	5.0E+01	3.0E-02	
METHYL ETHYL KETONE	8.4E+03	Ceiling Level	8.4E+03	1.4E+04	
METHYL ISOBUTYL KETONE	1.7E+02	Aquatic Habitat Chronic Toxicity	1.3E+03	1.7E+02	
METHYL MERCURY	3.0E-03	Aquatic Habitat Chronic Toxicity	5.0E+04	3.0E-03	
METHYL TERT BUTYL ETHER	1.8E+02	Ceiling Level	1.8E+02	1.8E+04	
METHYLENE CHLORIDE	5.9E+02	Bioaccumulation/Human Consumption	9.1E+03	2.2E+03	5.9E+02
METHYLNAPHTHALENE, 1-	2.1E+00	Aquatic Habitat Chronic Toxicity	1.0E+01	2.1E+00	
METHYLNAPHTHALENE, 2-	2.1E+00	Aquatic Habitat Chronic Toxicity	1.0E+01	2.1E+00	
MOLYBDENUM	2.4E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	2.4E+02	
NAPHTHALENE	2.1E+01	Ceiling Level	2.1E+01	2.4E+01	
NICKEL	5.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	5.0E+00	3.3E+01
NITROBENZENE	6.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	6.0E+01	
NITROGLYCERIN	1.4E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	1.4E+02	
NITROTOLUENE, 2-	1.0E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	1.0E+03	
NITROTOLUENE, 3-	3.8E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	3.8E+02	
NITROTOLUENE, 4-	1.6E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	1.6E+03	
PENTACHLOROPHENOL	3.0E+00	Bioaccumulation/Human Consumption	5.9E+02	7.9E+00	3.0E+00
PENTAERYTHRITOLTETRANITRATE (PETN)	2.2E+04	Ceiling Level	2.2E+04	8.5E+04	
PERCHLORATE	6.0E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	6.0E+02	
PHENANTHRENE	4.6E+00	Aquatic Habitat Chronic Toxicity	4.1E+02	4.6E+00	
PHENOL	1.3E+03	Aquatic Habitat Chronic Toxicity	7.9E+03	1.3E+03	1.7E+06
POLYCHLORINATED BIPHENYLS (PCBs)	7.9E-05	Bioaccumulation/Human Consumption	1.6E+01	1.4E-02	7.9E-05
PROPICONAZOLE	2.6E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	2.6E+01	
PYRENE	2.0E+00	Aquatic Habitat Chronic Toxicity	6.8E+01	2.0E+00	4.0E+03
SELENIUM	5.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	5.0E+00	
SILVER	1.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	1.0E+00	
SIMAZINE	2.0E+00	Aquatic Habitat Chronic Toxicity	3.1E+03	2.0E+00	
STYRENE	1.1E+01	Ceiling Level	1.1E+01	3.2E+01	
TERBACIL	2.3E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	2.3E+03	
tert-BUTYL ALCOHOL	1.8E+04	Aquatic Habitat Chronic Toxicity	5.0E+04	1.8E+04	
TETRACHLOROETHANE, 1,1,1,2-	3.1E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	3.1E+02	
TETRACHLOROETHANE, 1,1,2,2-	3.5E+00	Bioaccumulation/Human Consumption	5.0E+02	4.2E+02	3.5E+00
TETRACHLOROETHYLENE	2.9E+00	Bioaccumulation/Human Consumption	3.0E+02	1.2E+02	2.9E+00
TETRACHLOROPHENOL, 2,3,4,6-	1.2E+00	Aquatic Habitat Chronic Toxicity	1.2E+04	1.2E+00	
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	3.3E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	3.3E+02	
THALLIUM	1.6E+01	Bioaccumulation/Human Consumption	5.0E+04	2.0E+01	1.6E+01
TOLUENE	4.0E+01	Ceiling Level	4.0E+01	1.3E+02	1.4E+05
TOXAPHENE	2.0E-04	Aquatic Habitat Chronic Toxicity	1.4E+02	2.0E-04	2.4E-04

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

CHEMICAL PARAMETER	[1]Final Surface Water Action Level	Basis	Gross Contamination (Odors, etc.) Table G-4	Estuary Aquatic Habitat Goal (Chronic Toxicity) Table D-4a	Bioaccumulation and Human Consumption Table D-4f
TPH (gasolines)	5.0E+02	Aquatic Habitat Chronic Toxicity	5.0E+03	5.0E+02	
TPH (middle distillates)	6.4E+02	Aquatic Habitat Chronic Toxicity	2.5E+03	6.4E+02	
TPH (residual fuels)	6.4E+02	Aquatic Habitat Chronic Toxicity	2.5E+03	6.4E+02	
TRICHLOROBENZENE, 1,2,4-	2.5E+01	Aquatic Habitat Chronic Toxicity	3.0E+03	2.5E+01	
TRICHLOROETHANE, 1,1,1-	6.2E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	6.2E+01	3.4E+05
TRICHLOROETHANE, 1,1,2-	1.4E+01	Bioaccumulation/Human Consumption	5.0E+04	4.7E+03	1.4E+01
TRICHLOROETHYLENE	2.6E+01	Bioaccumulation/Human Consumption	1.0E+04	3.6E+02	2.6E+01
TRICHLOROPHENOL, 2,4,5-	1.1E+01	Aquatic Habitat Chronic Toxicity	2.0E+02	1.1E+01	3.6E+03
TRICHLOROPHENOL, 2,4,6-	1.2E+00	Bioaccumulation/Human Consumption	1.0E+02	4.9E+02	1.2E+00
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	6.9E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	6.9E+02	
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	3.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	3.0E+01	
TRICHLOROPROPANE, 1,2,3-	1.4E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.4E+01	
TRICHLOROPROPENE, 1,2,3-	6.2E-01	Aquatic Habitat Chronic Toxicity	5.0E+04	6.2E-01	
TRIFLURALIN	2.0E+01	Aquatic Habitat Chronic Toxicity	9.2E+01	2.0E+01	
TRINITROBENZENE, 1,3,5-	3.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	3.0E+01	
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	1.5E+02	Aquatic Habitat Chronic Toxicity	3.7E+04	1.5E+02	
TRINITROTOLUENE, 2,4,6- (TNT)	2.0E+01	Ceiling Level	2.0E+01	1.3E+02	
VANADIUM	1.9E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.9E+01	
VINYL CHLORIDE	1.7E+02	Bioaccumulation/Human Consumption	3.4E+03	7.8E+02	1.7E+02
XYLENES	1.0E+02	Aquatic Habitat Chronic Toxicity	5.3E+02	1.0E+02	
ZINC	2.2E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	2.2E+01	

Notes:

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

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

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

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

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

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

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

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

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

CHEMICAL PARAMETER	Final Action Level	Basis	HDOH Primary MCL	Other Criteria	Reference	Risk-Based Action Level (Table D-3b)	Basis
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	6.1E-01	carcinogenic effects				6.1E-01	carcinogenic effects
DALAPON	2.0E+02	HDOH Primary MCL	2.0E+02			1.1E+03	noncarcinogenic effects
DIBENZO(a,h)ANTHTRACENE	9.2E-03	carcinogenic effects				9.2E-03	carcinogenic effects
DIBROMO,1,2- CHLOROPROPANE,3-	4.0E-02	HDOH Primary MCL	4.0E-02			8.0E-04	carcinogenic effects
DIBROMOCHLOROMETHANE	1.6E-01	carcinogenic effects				1.6E-01	carcinogenic effects
DIBROMOETHANE, 1,2-	4.0E-02	HDOH Primary MCL	4.0E-02			6.5E-03	carcinogenic effects
DICHLOROBENZENE, 1,2-	6.0E+02	HDOH Primary MCL	6.0E+02			3.7E+02	noncarcinogenic effects
DICHLOROBENZENE, 1,3-	1.8E+02	noncarcinogenic effects				1.8E+02	noncarcinogenic effects
DICHLOROBENZENE, 1,4-	7.5E+01	HDOH Primary MCL	7.5E+01			4.3E-01	carcinogenic effects
DICHLOROBENZIDINE, 3,3-	1.5E-01	carcinogenic effects				1.5E-01	carcinogenic effects
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.8E-01	carcinogenic effects				2.8E-01	carcinogenic effects
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.0E-01	carcinogenic effects				2.0E-01	carcinogenic effects
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	2.0E-01	carcinogenic effects				2.0E-01	carcinogenic effects
DICHLOROETHANE, 1,1-	2.4E+00	carcinogenic effects				2.4E+00	carcinogenic effects
DICHLOROETHANE, 1,2-	1.5E-01	carcinogenic effects				1.5E-01	carcinogenic effects
DICHLOROETHYLENE, 1,1-	7.0E+00	HDOH Primary MCL	7.0E+00			3.4E+02	noncarcinogenic effects
DICHLOROETHYLENE, Cis 1,2-	7.0E+01	HDOH Primary MCL	7.0E+01			1.2E+01	noncarcinogenic effects
DICHLOROETHYLENE, Trans 1,2-	1.0E+02	HDOH Primary MCL	1.0E+02			1.1E+02	noncarcinogenic effects
DICHLOROPHENOL, 2,4-	1.1E+02	noncarcinogenic effects				1.1E+02	noncarcinogenic effects
DICHLOROPHENOXYACETIC ACID (2,4-D)	7.0E+01	HDOH Primary MCL	7.0E+01			3.7E+02	noncarcinogenic effects
DICHLOROPROPANE, 1,2-	5.0E+00	HDOH Primary MCL	5.0E+00			3.9E-01	carcinogenic effects
DICHLOROPROPENE, 1,3-	4.3E-01	carcinogenic effects				4.3E-01	carcinogenic effects
DIELDRIN	4.2E-03	carcinogenic effects				4.2E-03	carcinogenic effects
DIETHYLPHTHALATE	2.9E+04	noncarcinogenic effects				2.9E+04	noncarcinogenic effects
DIMETHYLPHENOL, 2,4-	1.2E+02	noncarcinogenic effects				1.2E+02	noncarcinogenic effects
DIMETHYLPHTHALATE	3.7E+05	noncarcinogenic effects				3.7E+05	noncarcinogenic effects
DINITROBENZENE, 1,3-	3.7E+00	noncarcinogenic effects				3.7E+00	noncarcinogenic effects
DINITROPHENOL, 2,4-	7.3E+01	noncarcinogenic effects				7.3E+01	noncarcinogenic effects
DINITROTOLUENE, 2,4- (2,4-DNT)	2.2E-01	carcinogenic effects				2.2E-01	carcinogenic effects
DINITROTOLUENE, 2,6- (2,6-DNT)	3.7E+01	noncarcinogenic effects				3.7E+01	noncarcinogenic effects
DIOXANE, 1,4-	6.7E-01	carcinogenic effects				6.7E-01	carcinogenic effects
DIOXINS (TEQ)	3.0E-05	HDOH Primary MCL	3.0E-05			1.2E-04	noncarcinogenic effects
DIURON	7.3E+01	noncarcinogenic effects				7.3E+01	noncarcinogenic effects
ENDOSULFAN	2.2E+02	noncarcinogenic effects				2.2E+02	noncarcinogenic effects
ENDRIN	2.0E+00	HDOH Primary MCL	2.0E+00			1.1E+01	noncarcinogenic effects
ETHANOL							
ETHYLBENZENE	7.0E+02	HDOH Primary MCL	7.0E+02			1.5E+00	carcinogenic effects
FLUORANTHENE	1.5E+03	noncarcinogenic effects				1.5E+03	noncarcinogenic effects
FLUORENE	2.4E+02	noncarcinogenic effects				2.4E+02	noncarcinogenic effects
GLYPHOSATE	7.0E+02	HDOH Primary MCL	7.0E+02			3.7E+03	noncarcinogenic effects
HEPTACHLOR	4.0E-01	HDOH Primary MCL	4.0E-01			1.5E-02	carcinogenic effects
HEPTACHLOR EPOXIDE	2.0E-01	HDOH Primary MCL	2.0E-01			7.4E-03	carcinogenic effects
HEXACHLOROBENZENE	1.0E+00	HDOH Primary MCL	1.0E+00			4.2E-02	carcinogenic effects

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

CHEMICAL PARAMETER	Final Action Level	Basis	HDOH Primary MCL	Other Criteria	Reference	Risk-Based Action Level (Table D-3b)	Basis
HEXACHLOROBUTADIENE	8.6E-01	carcinogenic effects				8.6E-01	carcinogenic effects
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	2.0E-01	HDOH Primary MCL	2.0E-01			6.1E-02	carcinogenic effects
HEXACHLOROETHANE	4.8E+00	carcinogenic effects				4.8E+00	carcinogenic effects
HEXAZINONE	1.2E+03	noncarcinogenic effects				1.2E+03	noncarcinogenic effects
INDENO(1,2,3-cd)PYRENE	9.2E-02	carcinogenic effects				9.2E-02	carcinogenic effects
ISOPHORONE	7.1E+01	carcinogenic effects				7.1E+01	carcinogenic effects
LEAD	1.5E+01	HDOH Primary MCL	1.5E+01				
MERCURY	2.0E+00	HDOH Primary MCL	2.0E+00			6.2E-02	noncarcinogenic effects
METHOXYCHLOR	4.0E+01	HDOH Primary MCL	4.0E+01			1.8E+02	noncarcinogenic effects
METHYL ETHYL KETONE	7.1E+03	noncarcinogenic effects				7.1E+03	noncarcinogenic effects
METHYL ISOBUTYL KETONE	2.0E+03	noncarcinogenic effects				2.0E+03	noncarcinogenic effects
METHYL MERCURY	3.7E+00	noncarcinogenic effects				3.7E+00	noncarcinogenic effects
METHYL TERT BUTYL ETHER	1.2E+01	carcinogenic effects				1.2E+01	carcinogenic effects
METHYLENE CHLORIDE	4.8E+00	carcinogenic effects				4.8E+00	carcinogenic effects
METHYLNAPHTHALENE, 1-	4.7E+00	carcinogenic effects				4.7E+00	carcinogenic effects
METHYLNAPHTHALENE, 2-	2.4E+01	noncarcinogenic effects				2.4E+01	noncarcinogenic effects
MOLYBDENUM	1.8E+02	noncarcinogenic effects				1.8E+02	noncarcinogenic effects
NAPHTHALENE	1.7E+01	CDPH notification level		1.7E+01	CDPH notification level	1.4E-01	carcinogenic effects
NICKEL	1.8E+03	noncarcinogenic effects				1.8E+03	noncarcinogenic effects
NITROBENZENE	1.2E-01	carcinogenic effects				1.2E-01	carcinogenic effects
NITROGLYCERIN	3.7E+00	noncarcinogenic effects				3.7E+00	noncarcinogenic effects
NITROTOLUENE, 2-	6.2E-02	carcinogenic effects				6.2E-02	carcinogenic effects
NITROTOLUENE, 3-	1.2E+02	noncarcinogenic effects				1.2E+02	noncarcinogenic effects
NITROTOLUENE, 4-	4.2E+00	carcinogenic effects				4.2E+00	carcinogenic effects
PENTACHLOROPHENOL	1.0E+00	HDOH Primary MCL	1.0E+00			1.7E-01	carcinogenic effects
PENTAERYTHRITOLTETRANITRATE (PETN)	1.7E+01	carcinogenic effects				1.7E+01	carcinogenic effects
PERCHLORATE	2.6E+01	noncarcinogenic effects				2.6E+01	noncarcinogenic effects
PHENANTHRENE	2.4E+02	noncarcinogenic effects				2.4E+02	noncarcinogenic effects
PHENOL	1.1E+04	noncarcinogenic effects				1.1E+04	noncarcinogenic effects
POLYCHLORINATED BIPHENYLS (PCBs)	5.0E-01	HDOH Primary MCL	5.0E-01			3.4E-02	carcinogenic effects
PROPICONAZOLE	4.7E+02	noncarcinogenic effects				4.7E+02	noncarcinogenic effects
PYRENE	1.8E+02	noncarcinogenic effects				1.8E+02	noncarcinogenic effects
SELENIUM	5.0E+01	HDOH Primary MCL	5.0E+01			1.8E+02	noncarcinogenic effects
SILVER	1.8E+02	noncarcinogenic effects				1.8E+02	noncarcinogenic effects
SIMAZINE	4.0E+00	HDOH Primary MCL	4.0E+00			5.6E-01	carcinogenic effects
STYRENE	1.0E+02	HDOH Primary MCL	1.0E+02			1.6E+03	noncarcinogenic effects
TERBACIL	4.7E+02	noncarcinogenic effects				4.7E+02	noncarcinogenic effects
tert-BUTYL ALCOHOL	4.5E+00	carcinogenic effects				4.5E+00	carcinogenic effects
TETRACHLOROETHANE, 1,1,1,2-	5.2E-01	carcinogenic effects				5.2E-01	carcinogenic effects
TETRACHLOROETHANE, 1,1,2,2-	6.7E-02	carcinogenic effects				6.7E-02	carcinogenic effects
TETRACHLOROETHYLENE	5.0E+00	HDOH Primary MCL	5.0E+00			1.1E-01	carcinogenic effects
TETRACHLOROPHENOL, 2,3,4,6-	1.1E+03	noncarcinogenic effects				1.1E+03	noncarcinogenic effects
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	1.8E+03	noncarcinogenic effects				1.8E+03	noncarcinogenic effects

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

CHEMICAL PARAMETER	Final Action Level	Basis	HDOH Primary MCL	Other Criteria	Reference	Risk-Based Action Level (Table D-3b)	Basis
THALLIUM	2.0E+00	HDOH Primary MCL	2.0E+00			3.7E-01	noncarcinogenic effects
TOLUENE	1.0E+03	HDOH Primary MCL	1.0E+03			2.3E+03	noncarcinogenic effects
TOXAPHENE	3.0E+00	HDOH Primary MCL	3.0E+00			6.1E-02	carcinogenic effects
TPH (gasolines)	1.0E+02	noncarcinogenic effects				1.0E+02	noncarcinogenic effects
TPH (middle distillates)	1.9E+02	noncarcinogenic effects				1.9E+02	noncarcinogenic effects
TPH (residual fuels)	4.4E+03	noncarcinogenic effects				4.4E+03	noncarcinogenic effects
TRICHLOROBENZENE, 1,2,4-	7.0E+01	HDOH Primary MCL	7.0E+01			4.7E-01	carcinogenic effects
TRICHLOROETHANE, 1,1,1-	2.0E+02	HDOH Primary MCL	2.0E+02			9.1E+03	noncarcinogenic effects
TRICHLOROETHANE, 1,1,2-	5.0E+00	HDOH Primary MCL	5.0E+00			2.4E-01	carcinogenic effects
TRICHLOROETHYLENE	5.0E+00	HDOH Primary MCL	5.0E+00			2.0E+00	carcinogenic effects
TRICHLOROPHENOL, 2,4,5-	3.7E+03	noncarcinogenic effects				3.7E+03	noncarcinogenic effects
TRICHLOROPHENOL, 2,4,6-	6.1E+00	carcinogenic effects				6.1E+00	carcinogenic effects
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	3.7E+02	noncarcinogenic effects				3.7E+02	noncarcinogenic effects
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	5.0E+01	HDOH Primary MCL	5.0E+01			2.9E+02	noncarcinogenic effects
TRICHLOROPROPANE, 1,2,3-	6.0E-01	HDOH Primary MCL	6.0E-01			4.5E-04	carcinogenic effects
TRICHLOROPROPENE, 1,2,3-	6.2E-01	noncarcinogenic effects				6.2E-01	noncarcinogenic effects
TRIFLURALIN	8.7E+00	carcinogenic effects				8.7E+00	carcinogenic effects
TRINITROBENZENE, 1,3,5-	1.1E+03	noncarcinogenic effects				1.1E+03	noncarcinogenic effects
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	1.5E+02	noncarcinogenic effects				1.5E+02	noncarcinogenic effects
TRINITROTOLUENE, 2,4,6- (TNT)	2.2E+00	carcinogenic effects				2.2E+00	carcinogenic effects
VANADIUM	1.8E+02	noncarcinogenic effects				1.8E+02	noncarcinogenic effects
VINYL CHLORIDE	2.0E+00	HDOH Primary MCL	2.0E+00			1.6E-02	carcinogenic effects
XYLENES	1.0E+04	HDOH Primary MCL	1.0E+04			2.1E+02	noncarcinogenic effects
ZINC	1.1E+04	noncarcinogenic effects				1.1E+04	noncarcinogenic effects

Source (unless otherwise noted):

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

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

Notes:

Used for development of groundwater and soil screening levels.

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

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

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

CHEMICAL PARAMETER	Lowest Tapwater Goal (ug/L	Basis	Carcinogenic Effects	Mutagenic Effects	Noncancer Effects
ACENAPHTHENE	3.7E+02	noncarcinogenic effects			3.7E+02
ACENAPHTHYLENE	2.4E+02	noncarcinogenic effects			2.4E+02
ACETONE	2.2E+04	noncarcinogenic effects			2.2E+04
ALDRIN	4.0E-03	carcinogenic effects	4.0E-03		1.1E+00
AMETRYN	3.3E+02	noncarcinogenic effects			3.3E+02
AMINO,2- DINITROTOLUENE,4,6-	7.3E+01	noncarcinogenic effects			7.3E+01
AMINO,4- DINITROTOLUENE,2,6-	7.3E+01	noncarcinogenic effects			7.3E+01
ANTHRACENE	1.8E+03	noncarcinogenic effects			1.8E+03
ANTIMONY	1.5E+01	noncarcinogenic effects			1.5E+01
ARSENIC	4.5E-02	carcinogenic effects	4.5E-02		1.1E+01
ATRAZINE	2.9E-01	carcinogenic effects	2.9E-01		1.3E+03
BARIUM	7.3E+03	noncarcinogenic effects			7.3E+03
BENZENE	4.1E-01	carcinogenic effects	4.1E-01		4.4E+01
BENZO(a)ANTHRACENE	9.2E-02	carcinogenic effects	9.2E-02	2.9E-02	
BENZO(a)PYRENE	9.2E-03	carcinogenic effects	9.2E-03	2.9E-03	
BENZO(b)FLUORANTHENE	9.2E-02	carcinogenic effects	9.2E-02	2.9E-02	
BENZO(g,h,i)PERYLENE	1.5E+03	noncarcinogenic effects			1.5E+03
BENZO(k)FLUORANTHENE	9.2E-01	carcinogenic effects	9.2E-01	2.9E-01	
BERYLLIUM	7.3E+01	noncarcinogenic effects			7.3E+01
BIPHENYL, 1,1-	8.3E-01	noncarcinogenic effects	1.7E+00		8.3E-01
BIS(2-CHLOROETHYL)ETHER	1.2E-02	carcinogenic effects	1.2E-02		
BIS(2-CHLOROISOPROPYL)ETHER	3.2E-01	carcinogenic effects	3.2E-01		2.4E+02
BIS(2-ETHYLHEXYL)PHTHALATE	4.8E+00	carcinogenic effects	4.8E+00		7.3E+02
BORON	7.3E+03	noncarcinogenic effects			7.3E+03
BROMODICHLOROMETHANE	1.2E-01	carcinogenic effects	1.2E-01		1.2E+02
BROMOFORM	8.5E+00	carcinogenic effects	8.5E+00		7.3E+02
BROMOMETHANE	8.7E+00	noncarcinogenic effects			8.7E+00
CADMIUM	3.7E+01	noncarcinogenic effects			3.7E+01
CARBON TETRACHLORIDE	4.4E-01	carcinogenic effects	4.4E-01		8.6E+01
CHLORDANE (TECHNICAL)	1.9E-01	carcinogenic effects	1.9E-01		1.8E+01
CHLOROANILINE, p-	3.4E-01	carcinogenic effects	3.4E-01		1.5E+02
CHLOROBENZENE	9.1E+01	noncarcinogenic effects			9.1E+01
CHLOROETHANE	2.1E+04	noncarcinogenic effects			2.1E+04
CHLOROFORM	1.9E-01	carcinogenic effects	1.9E-01		1.3E+02
CHLOROMETHANE	1.8E+00	carcinogenic effects	1.8E+00		1.9E+02
CHLOROPHENOL, 2-	3.0E+01	noncarcinogenic effects			3.0E+01
CHROMIUM (Total)					
CHROMIUM III	5.5E+04	noncarcinogenic effects			5.5E+04
CHROMIUM VI	1.3E+01	carcinogenic effects	1.3E+01	4.3E+00	1.1E+02
CHRYSENE	9.2E+00	carcinogenic effects	9.2E+00	2.9E+00	
COBALT	1.1E+01	noncarcinogenic effects			1.1E+01
COPPER	1.5E+03	noncarcinogenic effects			1.5E+03
CYANIDE (Free)	7.3E+02	noncarcinogenic effects			7.3E+02
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	6.1E-01	carcinogenic effects	6.1E-01		1.1E+02
DALAPON	1.1E+03	noncarcinogenic effects			1.1E+03
DIBENZO(a,h)ANTHTRACENE	9.2E-03	carcinogenic effects	9.2E-03	2.9E-03	
DIBROMO,1,2- CHLOROPROPANE,3-	8.0E-04	carcinogenic effects	8.0E-04	3.2E-04	3.9E-01
DIBROMOCHLOROMETHANE	1.6E-01	carcinogenic effects	1.6E-01		1.2E+02
DIBROMOETHANE, 1,2-	6.5E-03	carcinogenic effects	6.5E-03		1.8E+01
DICHLOROBENZENE, 1,2-	3.7E+02	noncarcinogenic effects			3.7E+02
DICHLOROBENZENE, 1,3-	1.8E+02	noncarcinogenic effects			1.8E+02
DICHLOROBENZENE, 1,4-	4.3E-01	carcinogenic effects	4.3E-01		1.0E+03
DICHLOROBENZIDINE, 3,3-	1.5E-01	carcinogenic effects	1.5E-01		
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.8E-01	carcinogenic effects	2.8E-01		
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.0E-01	carcinogenic effects	2.0E-01		
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	2.0E-01	carcinogenic effects	2.0E-01		1.8E+01
DICHLOROETHANE, 1,1-	2.4E+00	carcinogenic effects	2.4E+00		1.2E+03
DICHLOROETHANE, 1,2-	1.5E-01	carcinogenic effects	1.5E-01		1.4E+01
DICHLOROETHYLENE, 1,1-	3.4E+02	noncarcinogenic effects			3.4E+02
DICHLOROETHYLENE, Cis 1,2-	1.2E+01	noncarcinogenic effects			1.2E+01
DICHLOROETHYLENE, Trans 1,2-	1.1E+02	noncarcinogenic effects			1.1E+02
DICHLOROPHENOL, 2,4-	1.1E+02	noncarcinogenic effects			1.1E+02
DICHLOROPHENOXYACETIC ACID (2,4-D)	3.7E+02	noncarcinogenic effects			3.7E+02
DICHLOROPROPANE, 1,2-	3.9E-01	carcinogenic effects	3.9E-01		8.3E+00
DICHLOROPROPENE, 1,3-	4.3E-01	carcinogenic effects	4.3E-01		4.0E+01
DIELDRIN	4.2E-03	carcinogenic effects	4.2E-03		1.8E+00
DIETHYLPHTHALATE	2.9E+04	noncarcinogenic effects			2.9E+04
DIMETHYLPHENOL, 2,4-	1.2E+02	noncarcinogenic effects			1.2E+02
DIMETHYLPHTHALATE	3.7E+05	noncarcinogenic effects			3.7E+05
DINITROBENZENE, 1,3-	3.7E+00	noncarcinogenic effects			3.7E+00
DINITROPHENOL, 2,4-	7.3E+01	noncarcinogenic effects			7.3E+01
DINITROTOLUENE, 2,4- (2,4-DNT)	2.2E-01	carcinogenic effects	2.2E-01		7.3E+01
DINITROTOLUENE, 2,6- (2,6-DNT)	3.7E+01	noncarcinogenic effects			3.7E+01
DIOXANE, 1,4-	6.7E-01	carcinogenic effects	6.7E-01		1.1E+03

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

CHEMICAL PARAMETER	Lowest Tapwater Goal (ug/L	Basis	Carcinogenic Effects	Mutagenic Effects	Noncancer Effects
DIOXINS (TEQ)	1.2E-04	noncarcinogenic effects			1.2E-04
DIURON	7.3E+01	noncarcinogenic effects			7.3E+01
ENDOSULFAN	2.2E+02	noncarcinogenic effects			2.2E+02
ENDRIN	1.1E+01	noncarcinogenic effects			1.1E+01
ETHANOL					
ETHYLBENZENE	1.5E+00	carcinogenic effects	1.5E+00		1.3E+03
FLUORANTHENE	1.5E+03	noncarcinogenic effects			1.5E+03
FLUORENE	2.4E+02	noncarcinogenic effects			2.4E+02
GLYPHOSATE	3.7E+03	noncarcinogenic effects			3.7E+03
HEPTACHLOR	1.5E-02	carcinogenic effects	1.5E-02		1.8E+01
HEPTACHLOR EPOXIDE	7.4E-03	carcinogenic effects	7.4E-03		4.7E-01
HEXACHLOROBENZENE	4.2E-02	carcinogenic effects	4.2E-02		2.9E+01
HEXACHLOROBUTADIENE	8.6E-01	carcinogenic effects	8.6E-01		3.7E+01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	6.1E-02	carcinogenic effects	6.1E-02		1.1E+01
HEXACHLOROETHANE	4.8E+00	carcinogenic effects	4.8E+00		3.7E+01
HEXAZINONE	1.2E+03	noncarcinogenic effects			1.2E+03
INDENO(1,2,3-cd)PYRENE	9.2E-02	carcinogenic effects	9.2E-02	2.9E-02	
ISOPHORONE	7.1E+01	carcinogenic effects	7.1E+01		7.3E+03
LEAD					
MERCURY	6.2E-02	noncarcinogenic effects			6.2E-02
METHOXYCHLOR	1.8E+02	noncarcinogenic effects			1.8E+02
METHYL ETHYL KETONE	7.1E+03	noncarcinogenic effects			7.1E+03
METHYL ISOBUTYL KETONE	2.0E+03	noncarcinogenic effects			2.0E+03
METHYL MERCURY	3.7E+00	noncarcinogenic effects			3.7E+00
METHYL TERT BUTYL ETHER	1.2E+01	carcinogenic effects	1.2E+01		6.3E+03
METHYLENE CHLORIDE	4.8E+00	carcinogenic effects	4.8E+00		1.1E+03
METHYLNAPHTHALENE, 1-	4.7E+00	carcinogenic effects	4.7E+00		4.3E+02
METHYLNAPHTHALENE, 2-	2.4E+01	noncarcinogenic effects			2.4E+01
MOLYBDENUM	1.8E+02	noncarcinogenic effects			1.8E+02
NAPHTHALENE	1.4E-01	carcinogenic effects	1.4E-01		6.2E+00
NICKEL	1.8E+03	noncarcinogenic effects			1.8E+03
NITROBENZENE	1.2E-01	carcinogenic effects	1.2E-01		9.3E+00
NITROGLYCERIN	3.7E+00	noncarcinogenic effects	4.0E+00		3.7E+00
NITROTOLUENE, 2-	6.2E-02	carcinogenic effects	6.2E-02		5.5E+00
NITROTOLUENE, 3-	1.2E+02	noncarcinogenic effects			1.2E+02
NITROTOLUENE, 4-	4.2E+00	carcinogenic effects	4.2E+00		1.5E+02
PENTACHLOROPHENOL	1.7E-01	carcinogenic effects	1.7E-01		1.8E+02
PENTAERYTHRITOLTETRANITRATE (PETN)	1.7E+01	carcinogenic effects	1.7E+01		7.3E+01
PERCHLORATE	2.6E+01	noncarcinogenic effects			2.6E+01
PHENANTHRENE	2.4E+02	noncarcinogenic effects			2.4E+02
PHENOL	1.1E+04	noncarcinogenic effects			1.1E+04
POLYCHLORINATED BIPHENYLS (PCBs)	3.4E-02	carcinogenic effects	3.4E-02		7.3E-01
PROPICONAZOLE	4.7E+02	noncarcinogenic effects			4.7E+02
PYRENE	1.8E+02	noncarcinogenic effects			1.8E+02
SELENIUM	1.8E+02	noncarcinogenic effects			1.8E+02
SILVER	1.8E+02	noncarcinogenic effects			1.8E+02
SIMAZINE	5.6E-01	carcinogenic effects	5.6E-01		1.8E+02
STYRENE	1.6E+03	noncarcinogenic effects			1.6E+03
TERBACIL	4.7E+02	noncarcinogenic effects			4.7E+02
tert-BUTYL ALCOHOL	4.5E+00	carcinogenic effects	4.5E+00		
TETRACHLOROETHANE, 1,1,1,2-	5.2E-01	carcinogenic effects	5.2E-01		1.8E+02
TETRACHLOROETHANE, 1,1,2,2-	6.7E-02	carcinogenic effects	6.7E-02		7.3E+02
TETRACHLOROETHYLENE	1.1E-01	carcinogenic effects	1.1E-01		2.2E+02
TETRACHLOROPHENOL, 2,3,4,6-	1.1E+03	noncarcinogenic effects			1.1E+03
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	1.8E+03	noncarcinogenic effects			1.8E+03
THALLIUM	3.7E-01	noncarcinogenic effects			3.7E-01
TOLUENE	2.3E+03	noncarcinogenic effects			2.3E+03
TOXAPHENE	6.1E-02	carcinogenic effects	6.1E-02		
TPH (gasolines)	1.0E+02	noncarcinogenic effects			1.0E+02
TPH (middle distillates)	1.9E+02	noncarcinogenic effects			1.9E+02
TPH (residual fuels)	4.4E+03	noncarcinogenic effects			4.4E+03
TRICHLOROBENZENE, 1,2,4-	4.7E-01	carcinogenic effects	4.7E-01		4.1E+00
TRICHLOROETHANE, 1,1,1-	9.1E+03	noncarcinogenic effects			9.1E+03
TRICHLOROETHANE, 1,1,2-	2.4E-01	carcinogenic effects	2.4E-01		4.2E-01
TRICHLOROETHYLENE	2.0E+00	carcinogenic effects	2.0E+00		9.7E+00
TRICHLOROPHENOL, 2,4,5-	3.7E+03	noncarcinogenic effects			3.7E+03
TRICHLOROPHENOL, 2,4,6-	6.1E+00	carcinogenic effects	6.1E+00		3.7E+01
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	3.7E+02	noncarcinogenic effects			3.7E+02
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	2.9E+02	noncarcinogenic effects			2.9E+02
TRICHLOROPROPANE, 1,2,3-	4.5E-04	carcinogenic effects	4.5E-04	1.7E-04	6.2E-01
TRICHLOROPROPENE, 1,2,3-	6.2E-01	noncarcinogenic effects			6.2E-01
TRIFLURALIN	8.7E+00	carcinogenic effects	8.7E+00		2.7E+02
TRINITROBENZENE, 1,3,5-	1.1E+03	noncarcinogenic effects			1.1E+03
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	1.5E+02	noncarcinogenic effects			1.5E+02

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

CHEMICAL PARAMETER	Lowest Tapwater Goal (ug/L	Basis	Carcinogenic Effects	Mutagenic Effects	Noncancer Effects
TRINITROTOLUENE, 2,4,6- (TNT)	2.2E+00	carcinogenic effects	2.2E+00		1.8E+01
VANADIUM	1.8E+02	noncarcinogenic effects			1.8E+02
VINYL CHLORIDE	1.6E-02	carcinogenic effects	1.6E-02	2.8E-02	7.2E+01
XYLENES	2.1E+02	noncarcinogenic effects			2.1E+02
ZINC	1.1E+04	noncarcinogenic effects			1.1E+04

References:

Calculated using Tap Water equations in USEPA Regional Screening Levels guidance (USEPA 2011a).

Notes:

Addresses use of water for drinking water and inhalation of volatile chemicals during showering.

Target risk = 10^{-6}. Target HQ = 1.0. See Appendix 2 for equations

TPH (gasolines) action level rounded from 95 ug/L to 100 ug/L.

TABLE D-4a. SUMMARY OF AQUATIC HABITAT GOALS

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

TABLE D-4a. SUMMARY OF AQUATIC HABITAT GOALS

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

TABLE D-4a. SUMMARY OF AQUATIC HABITAT GOALS

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

TABLE D-4a. SUMMARY OF AQUATIC HABITAT GOALS

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

Notes:

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

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

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

	[1]Aquatic Habitat Goals					
CHEMICAL PARAMETER	[1]Estuarine Aquatic Habitat Goal (ug/L)	Basis	Lowest Freshwater Aquatic Habitat Goal (ug/L)	Basis	Lowest Marine Aquatic Habitat Goal (ug/L)	Basis
ACENAPHTHENE	2.3E+01	USEPA Ecotox FW Chronic	2.3E+01	USEPA Ecotox FW Chronic	4.0E+01	USEPA Ecotox SW Chronic
ACENAPHTHYLENE	3.0E+01	10% USEPA SW Acute LOEL	3.0E+01	10% USEPA SW Acute LOEL	3.0E+01	10% USEPA SW Acute LOEL
ACETONE	1.5E+03	USDOE FW Chronic PRG	1.5E+03	USDOE FW Chronic PRG	1.5E+03	USDOE FW Chronic PRG
ALDRIN	1.3E-01	10% USEPA SW CMC	3.0E-01	10% USEPA FW CMC	1.3E-01	10% USEPA SW CMC
AMETRYN	1.5E+01	5% FW Acute LC50	1.5E+01	5% FW Acute LC50	1.5E+01	5% FW Acute LC50
AMINO,2- DINITROTOLUENE,4,6-	1.5E+01	5% FW Acute LC50	1.5E+01	5% FW Acute LC50	1.5E+01	5% FW Acute LC50
AMINO,4- DINITROTOLUENE,2,6-	1.5E+01	5% FW Acute LC50	1.5E+01	5% FW Acute LC50	1.5E+01	5% FW Acute LC50
ANTHRACENE	7.3E-01	USDOE FW Chronic PRG	7.3E-01	USDOE FW Chronic PRG	7.3E-01	USDOE FW Chronic PRG
ANTIMONY	3.0E+01	USEPA FW CCC	3.0E+01	USEPA FW CCC	5.0E+02	USEPA SW CCC
ARSENIC	3.6E+01	Hawai'i Chronic SW WQS	1.9E+02	Hawai'i Chronic FW WQS	3.6E+01	Hawai'i Chronic SW WQS
ATRAZINE	1.2E+01	USEPA FW CCC	1.2E+01	USEPA FW CCC	2.6E+01	USEPA SW CCC
BARIUM	2.0E+02	BC SW Chronic	2.0E+02	BC SW Chronic	2.0E+02	BC SW Chronic
BENZENE	4.6E+01	USEPA Ecotox FW Chronic	4.6E+01	USEPA Ecotox FW Chronic	3.5E+02	50% USEPA SW Chronic LOEL
BENZO(a)ANTHRACENE	2.7E-02	USDOE FW Chronic PRG	2.7E-02	USDOE FW Chronic PRG	2.7E-02	USDOE FW Chronic PRG
BENZO(a)PYRENE	1.4E-02	USEPA Ecotox FW Chronic	1.4E-02	USEPA Ecotox FW Chronic	1.4E-02	USEPA Ecotox FW Chronic
BENZO(b)FLUORANTHENE	9.1E+00	USEPA Reg. V FW Chronic	9.1E+00	USEPA Reg. V FW Chronic	9.1E+00	USEPA Reg. V FW Chronic
BENZO(g,h,i)PERYLENE	1.0E-01	50% MOEE FW Chronic LOEL	1.0E-01	50% MOEE FW Chronic LOEL	1.0E-01	50% MOEE FW Chronic LOEL
BENZO(k)FLUORANTHENE	3.7E+00	50% MOEE FW Chronic LOEL	3.7E+00	50% MOEE FW Chronic LOEL	3.7E+00	50% MOEE FW Chronic LOEL
BERYLLIUM	2.7E+00	50% USEPA FW Chronic LOEL	2.7E+00	50% USEPA FW Chronic LOEL	2.7E+00	50% USEPA FW Chronic LOEL
BIPHENYL, 1,1-	1.4E+01	USEPA Ecotox FW Chronic	1.4E+01	USEPA Ecotox FW Chronic	1.4E+01	USEPA Ecotox FW Chronic
BIS(2-CHLOROETHYL)ETHER	6.1E+01	50% USEPA FW Chronic LOEL	6.1E+01	50% USEPA FW Chronic LOEL	6.1E+01	50% USEPA FW Chronic LOEL
BIS(2-CHLOROISOPROPYL)ETHER	6.1E+01	50% USEPA FW Chronic LOEL	6.1E+01	50% USEPA FW Chronic LOEL	6.1E+01	50% USEPA FW Chronic LOEL
BIS(2-ETHYLHEXYL)PHTHALATE	3.2E+01	USEPA Ecotox FW Chronic	3.2E+01	USEPA Ecotox FW Chronic	3.2E+01	USEPA Ecotox FW Chronic
BORON	7.3E+03	=Drinking Water (Table D-3a)	7.3E+03	=Drinking Water (Table D-3a)	7.3E+03	=Drinking Water (Table D-3a)
BROMODICHLOROMETHANE	3.2E+03	50% USEPA SW Chronic LOEL	3.2E+03	50% USEPA SW Chronic LOEL	3.2E+03	50% USEPA SW Chronic LOEL
BROMOFORM	3.2E+03	50% USEPA SW Chronic LOEL	3.2E+03	50% USEPA SW Chronic LOEL	3.2E+03	50% USEPA SW Chronic LOEL
BROMOMETHANE	1.6E+02	50% MOEE FW Chronic LOEL	1.6E+02	50% MOEE FW Chronic LOEL	3.2E+03	50% USEPA SW Chronic LOEL
CADMIUM	3.0E+00	Hawai'i Chronic FW WQS	3.0E+00	Hawai'i Chronic FW WQS	9.3E+00	Hawai'i Chronic SW WQS
CARBON TETRACHLORIDE	9.8E+00	USDOE FW Chronic PRG	9.8E+00	USDOE FW Chronic PRG	3.2E+03	50% USEPA SW Chronic LOEL
CHLORDANE (TECHNICAL)	4.0E-03	Hawai'i Chronic SW WQS	4.3E-03	Hawai'i Chronic FW WQS	4.0E-03	Hawai'i Chronic SW WQS
CHLOROANILINE, p-	5.0E+00	50% MOEE FW Chronic LOEL	5.0E+00	50% MOEE FW Chronic LOEL	5.0E+00	50% MOEE FW Chronic LOEL
CHLOROBENZENE	2.5E+01	50% USEPA FW Chronic LOEL	2.5E+01	50% USEPA FW Chronic LOEL	6.5E+01	50% USEPA SW Chronic LOEL
CHLOROETHANE	2.1E+04	=Drinking Water (Table D-3a)	2.1E+04	=Drinking Water (Table D-3a)	2.1E+04	=Drinking Water (Table D-3a)
CHLOROFORM	6.2E+02	50% USEPA FW Chronic LOEL	6.2E+02	50% USEPA FW Chronic LOEL	3.2E+03	50% USEPA SW Chronic LOEL
CHLOROMETHANE	3.2E+03	50% USEPA SW Chronic LOEL	3.2E+03	50% USEPA SW Chronic LOEL	3.2E+03	50% USEPA SW Chronic LOEL
CHLOROPHENOL, 2-	1.4E+02	10% HI DOH FW Acute	1.4E+02	10% HI DOH FW Acute	1.4E+02	10% HI DOH FW Acute
CHROMIUM (Total)	7.4E+01	=Cr III	7.4E+01	=Cr III	1.0E+04	=Cr III
CHROMIUM III	7.4E+01	USEPA FW CCC	7.4E+01	USEPA FW CCC	7.4E+01	USEPA FW CCC
CHROMIUM VI	1.1E+01	Hawai'i Chronic FW WQS	1.1E+01	Hawai'i Chronic FW WQS	5.0E+01	Hawai'i Chronic SW WQS
CHRYSENE	3.5E-01	50% MOEE FW Chronic LOEL	3.5E-01	50% MOEE FW Chronic LOEL	3.5E-01	50% MOEE FW Chronic LOEL
COBALT	3.0E+00	USEPA Ecotox FW Chronic	3.0E+00	USEPA Ecotox FW Chronic	3.0E+00	USEPA Ecotox FW Chronic

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

	[1]Aquatic Habitat Goals					
CHEMICAL PARAMETER	[1]Estuarine Aquatic Habitat Goal (ug/L)	Basis	Lowest Freshwater Aquatic Habitat Goal (ug/L)	Basis	Lowest Marine Aquatic Habitat Goal (ug/L)	Basis
COPPER	2.9E+00	Hawai'i Chronic SW WQS	6.0E+00	Hawai'i Chronic FW WQS	2.9E+00	Hawai'i Chronic SW WQS
CYANIDE (Free)	1.0E+00	Hawai'i Chronic SW WQS	5.2E+00	Hawai'i Chronic FW WQS	1.0E+00	Hawai'i Chronic SW WQS
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	1.9E+02	ORNL FW SCV	1.9E+02	ORNL FW SCV	1.9E+02	ORNL FW SCV
DALAPON	3.0E+02	5% FW Acute LC50	3.0E+02	5% FW Acute LC50	3.0E+02	5% FW Acute LC50
DIBENZO(a,h)ANTHTRACENE	7.5E+00	50% MOEE FW Chronic LOEL	7.5E+00	50% MOEE FW Chronic LOEL	7.5E+00	50% MOEE FW Chronic LOEL
DIBROMO,1,2- CHLOROPROPANE,3-	4.0E-02	=Drinking Water (Table D-3a)	4.0E-02	=Drinking Water (Table D-3a)	4.0E-02	=Drinking Water (Table D-3a)
DIBROMOCHLOROMETHANE	3.2E+03	50% USEPA SW Chronic LOEL	3.2E+03	50% USEPA SW Chronic LOEL	3.2E+03	50% USEPA SW Chronic LOEL
DIBROMOETHANE, 1,2-	1.4E+03	50% MOEE FW Chronic AWQC	1.4E+03	50% MOEE FW Chronic AWQC	1.4E+03	50% MOEE FW Chronic AWQC
DICHLOROBENZENE, 1,2-	1.4E+01	USEPA Ecotox FW Chronic	1.4E+01	USEPA Ecotox FW Chronic	6.5E+01	50% USEPA SW Chronic LOEL
DICHLOROBENZENE, 1,3-	6.5E+01	50% USEPA SW Chronic LOEL	7.1E+01	USEPA Ecotox FW Chronic	6.5E+01	50% USEPA SW Chronic LOEL
DICHLOROBENZENE, 1,4-	1.5E+01	USEPA Ecotox FW Chronic	1.5E+01	USEPA Ecotox FW Chronic	6.5E+01	50% USEPA SW Chronic LOEL
DICHLOROBENZIDINE, 3,3-	2.5E+02	50% MOEE FW Chronic LOEL	2.5E+02	50% MOEE FW Chronic LOEL	2.5E+02	50% MOEE FW Chronic LOEL
DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.0E-03	=DDT	1.0E-03	=DDT	1.0E-03	=DDT
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.0E-03	=DDT	1.0E-03	=DDT	1.0E-03	=DDT
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.0E-03	Hawai'i Chronic FW WQS	1.0E-03	Hawai'i Chronic FW WQS	1.0E-03	Hawai'i Chronic SW WQS
DICHLOROETHANE, 1,1-	4.7E+01	USEPA Ecotox FW Chronic	4.7E+01	USEPA Ecotox FW Chronic	4.7E+01	USEPA Ecotox FW Chronic
DICHLOROETHANE, 1,2-	1.0E+04	50% USEPA FW Chronic LOEL	1.0E+04	50% USEPA FW Chronic LOEL	1.0E+04	50% USEPA FW Chronic LOEL
DICHLOROETHYLENE, 1,1-	2.5E+01	USDOE FW Chronic PRG	2.5E+01	USDOE FW Chronic PRG	2.5E+01	USDOE FW Chronic PRG
DICHLOROETHYLENE, Cis 1,2-	5.9E+02	USDOE FW Chronic PRG	5.9E+02	USDOE FW Chronic PRG	5.9E+02	USDOE FW Chronic PRG
DICHLOROETHYLENE, Trans 1,2-	5.9E+02	USDOE FW Chronic PRG	5.9E+02	USDOE FW Chronic PRG	5.9E+02	USDOE FW Chronic PRG
DICHLOROPHENOL, 2,4-	1.8E+02	50% USEPA FW Chronic LOEL	1.8E+02	50% USEPA FW Chronic LOEL	1.8E+02	50% USEPA FW Chronic LOEL
DICHLOROPHENOXYACETIC ACID (2,4-D)	4.0E+01	UK SW WQS	2.2E+02	MDEQ FW FCV	4.0E+01	UK SW WQS
DICHLOROPROPANE, 1,2-	1.5E+03	50% USEPA SW Chronic LOEL	2.9E+03	50% USEPA FW Chronic LOEL	1.5E+03	50% USEPA SW Chronic LOEL
DICHLOROPROPENE, 1,3-	1.2E+02	50% USEPA FW Chronic LOEL	1.2E+02	50% USEPA FW Chronic LOEL	1.2E+02	50% USEPA FW Chronic LOEL
DIELDRIN	1.9E-03	Hawai'i Chronic FW WQS	1.9E-03	Hawai'i Chronic FW WQS	1.9E-03	Hawai'i Chronic SW WQS
DIETHYLPHTHALATE	1.5E+00	50% USEPA FW Chronic LOEL	1.5E+00	50% USEPA FW Chronic LOEL	1.7E+00	50% USEPA SW Chronic LOEL
DIMETHYLPHENOL, 2,4-	1.1E+02	USEPA SW CCC	5.3E+02	USEPA FW CCC	1.1E+02	USEPA SW CCC
DIMETHYLPHTHALATE	1.5E+00	50% USEPA FW Chronic LOEL	1.5E+00	50% USEPA FW Chronic LOEL	1.7E+00	50% USEPA SW Chronic LOEL
DINITROBENZENE, 1,3-	3.0E+01	ORNL FW SCV	3.0E+01	ORNL FW SCV	3.0E+01	ORNL FW SCV
DINITROPHENOL, 2,4-	7.5E+01	50% USEPA FW Chronic LOEL	7.5E+01	50% USEPA FW Chronic LOEL	7.5E+01	50% USEPA FW Chronic LOEL
DINITROTOLUENE, 2,4- (2,4-DNT)	4.4E+01	USEPA Reg. V FW Chronic	4.4E+01	USEPA Reg. V FW Chronic	6.7E+01	USEPA Region IV
DINITROTOLUENE, 2,6- (2,6-DNT)	4.4E+01	=2,4 DNT	4.4E+01	=2,4 DNT	6.7E+01	=2,4 DNT
DIOXANE, 1,4-	3.4E+05	5% Acute FW LC 50	3.4E+05	5% Acute FW LC 50	5.0E+05	5% Acute SW LC 50
DIOXINS (TEQ)	5.0E-06	50% USEPA FW Chronic LOEL	5.0E-06	50% USEPA FW Chronic LOEL	5.0E-06	50% USEPA FW Chronic LOEL
DIURON	6.0E+01	50% FW EC50	6.0E+01	50% FW EC50	6.0E+01	50% FW EC50
ENDOSULFAN	8.7E-03	Hawai'i Chronic SW WQS	5.6E-02	Hawai'i Chronic FW WQS	8.7E-03	Hawai'i Chronic SW WQS
ENDRIN	2.3E-03	Hawai'i Chronic FW WQS	2.3E-03	Hawai'i Chronic FW WQS	2.3E-03	Hawai'i Chronic SW WQS
ETHANOL						
ETHYLBENZENE	2.9E+02	USEPA Ecotox FW Chronic	2.9E+02	USEPA Ecotox FW Chronic	2.9E+02	USEPA Ecotox FW Chronic
FLUORANTHENE	8.0E+00	50% USEPA SW Chronic LOEL	8.1E+00	USEPA Ecotox FW Chronic	8.0E+00	50% USEPA SW Chronic LOEL
FLUORENE	3.9E+00	USEPA Ecotox FW Chronic	3.9E+00	USEPA Ecotox FW Chronic	3.9E+00	USEPA Ecotox FW Chronic

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

	[1]Aquatic Habitat Goals					
CHEMICAL PARAMETER	[1]Estuarine Aquatic Habitat Goal (ug/L)	Basis	Lowest Freshwater Aquatic Habitat Goal (ug/L)	Basis	Lowest Marine Aquatic Habitat Goal (ug/L)	Basis
GLYPHOSATE	6.5E+01	CCME EQG	6.5E+01	CCME EQG	6.5E+01	CCME EQG
HEPTACHLOR	3.6E-03	Hawai'i Chronic SW WQS	3.8E-03	Hawai'i Chronic FW WQS	3.6E-03	Hawai'i Chronic SW WQS
HEPTACHLOR EPOXIDE	3.6E-03	USEPA SW CCC	3.8E-03	USEPA FW CCC	3.6E-03	USEPA SW CCC
HEXACHLOROBENZENE	3.7E+00	USEPA FW CCC	3.7E+00	USEPA FW CCC	6.5E+01	50% USEPA SW Chronic LOEL
HEXACHLOROBUTADIENE	4.7E+00	50% USEPA FW Chronic LOEL	4.7E+00	50% USEPA FW Chronic LOEL	4.7E+00	50% USEPA FW Chronic LOEL
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	8.0E-02	Hawai'i Chronic FW WQS	8.0E-02	Hawai'i Chronic FW WQS	8.0E-02	USEPA Ecotox FW Chronic
HEXACHLOROETHANE	1.2E+01	USEPA Ecotox FW Chronic	1.2E+01	USEPA Ecotox FW Chronic	1.2E+01	USEPA Ecotox FW Chronic
HEXAZINONE	5.0E+03	5% FW Acute LC50	5.0E+03	5% FW Acute LC50	5.0E+03	5% FW Acute LC50
INDENO(1,2,3-cd)PYRENE	4.3E+00	USEPA Reg. V FW Chronic	4.3E+00	USEPA Reg. V FW Chronic	4.3E+00	USEPA Reg. V FW Chronic
ISOPHORONE	1.3E+02	USEPA Reg. IV SW Chronic	1.2E+03	USEPA Reg. IV FW Chronic	1.3E+02	USEPA Reg. IV SW Chronic
LEAD	5.6E+00	Hawai'i Chronic SW WQS	2.9E+01	Hawai'i Chronic FW WQS	5.6E+00	Hawai'i Chronic SW WQS
MERCURY	2.5E-02	Hawai'i Chronic SW WQS	5.5E-01	Hawai'i Chronic FW WQS	2.5E-02	Hawai'i Chronic SW WQS
METHOXYCHLOR	3.0E-02	Hawai'i Chronic FW WQS	3.0E-02	Hawai'i Chronic FW WQS	3.0E-02	Hawai'i Chronic SW WQS
METHYL ETHYL KETONE	1.4E+04	USDOE FW Chronic PRG	1.4E+04	USDOE FW Chronic PRG	1.4E+04	USDOE FW Chronic PRG
METHYL ISOBUTYL KETONE	1.7E+02	USDOE FW Chronic PRG	1.7E+02	USDOE FW Chronic PRG	1.7E+02	USDOE FW Chronic PRG
METHYL MERCURY	3.0E-03	USEPA Ecotox FW Chronic	3.0E-03	USEPA Ecotox FW Chronic	3.0E-03	USEPA Ecotox FW Chronic
METHYL TERT BUTYL ETHER	1.8E+04	USEPA SW CCC	5.1E+04	USEPA FW CCC	1.8E+04	USEPA SW CCC
METHYLENE CHLORIDE	2.2E+03	USDOE FW Chronic PRG	2.2E+03	USDOE FW Chronic PRG	3.2E+03	50% USEPA SW Chronic LOEL
METHYLNAPHTHALENE, 1-	2.1E+00	USDOE FW Chronic PRG	2.1E+00	USDOE FW Chronic PRG	2.1E+00	USDOE FW Chronic PRG
METHYLNAPHTHALENE, 2-	2.1E+00	USDOE FW Chronic PRG	2.1E+00	USDOE FW Chronic PRG	2.1E+00	USDOE FW Chronic PRG
MOLYBDENUM	2.4E+02	USEPA Ecotox FW Chronic	2.4E+02	USEPA Ecotox FW Chronic	2.4E+02	USEPA Ecotox FW Chronic
NAPHTHALENE	2.4E+01	USEPA Ecotox FW Chronic	2.4E+01	USEPA Ecotox FW Chronic	2.4E+01	USEPA Ecotox FW Chronic
NICKEL	5.0E+00	Hawai'i Chronic FW WQS	5.0E+00	Hawai'i Chronic FW WQS	8.3E+00	Hawai'i Chronic SW WQS
NITROBENZENE	6.0E+01	USEPA Reg. IV FW Chronic	2.2E+02	MDEQ FW FCV	6.0E+01	USEPA Reg. IV FW Chronic
NITROGLYCERIN	1.4E+02	USEPA Reg. VI FW Chronic	1.4E+02	USEPA Reg. VI FW Chronic	1.4E+02	USEPA Reg. VI FW Chronic
NITROTOLUENE, 2-	1.0E+03	=3 NT	1.0E+03	=3 NT	1.0E+03	=3 NT
NITROTOLUENE, 3-	3.8E+02	5% FW Acute LC50	3.8E+02	5% FW Acute LC50	3.8E+02	5% FW Acute LC50
NITROTOLUENE, 4-	1.6E+03	50% FW EC50	1.6E+03	50% FW EC50	1.6E+03	50% FW EC50
PENTACHLOROPHENOL	7.9E+00	USEPA SW CCC	1.3E+01	Hawai'i Chronic FW WQS	7.9E+00	USEPA SW CCC
PENTAERYTHRITOLTETRANITRATE (PETN)	8.5E+04	USEPA Reg. VI FW Chronic	8.5E+04	USEPA Reg. VI FW Chronic	8.5E+04	USEPA Reg. VI FW Chronic
PERCHLORATE	6.0E+02	USEPA Ecotox FW Chronic	6.0E+02	USEPA Ecotox FW Chronic	6.0E+02	USEPA Ecotox FW Chronic
PHENANTHRENE	4.6E+00	USEPA SW CCC	6.3E+00	USEPA FW CCC	4.6E+00	USEPA SW CCC
PHENOL	1.3E+03	50% USEPA FW Chronic LOEL	1.3E+03	50% USEPA FW Chronic LOEL	1.3E+03	50% USEPA FW Chronic LOEL
POLYCHLORINATED BIPHENYLS (PCBs)	1.4E-02	Hawai'i Chronic FW WQS	1.4E-02	Hawai'i Chronic FW WQS	3.0E-02	Hawai'i Chronic SW WQS
PROPICONAZOLE	2.6E+01	5% SW LC50	4.2E+01	5% FW Acute LC50	2.6E+01	5% SW LC50
PYRENE	2.0E+00	50% MOEE FW Chronic LOEL	2.0E+00	50% MOEE FW Chronic LOEL	2.0E+00	50% MOEE FW Chronic LOEL
SELENIUM	5.0E+00	Hawai'i Chronic FW WQS	5.0E+00	Hawai'i Chronic FW WQS	7.1E+01	Hawai'i Chronic SW WQS
SILVER	1.0E+00	Hawai'i Chronic FW WQS	1.0E+00	Hawai'i Chronic FW WQS	1.0E+00	HI DOH FW Chronic
SIMAZINE	2.0E+00	UK SW WQS	1.7E+01	MDEQ FW FCV	2.0E+00	UK SW WQS
STYRENE	3.2E+01	USEPA Reg. VI FW Chronic	3.2E+01	USEPA Reg. VI FW Chronic	3.2E+01	USEPA Reg. VI FW Chronic
TERBACIL	2.3E+03	5% FW Acute LC50	2.3E+03	5% FW Acute LC50	2.3E+03	5% FW Acute LC50

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

	[1]Aquatic Habitat Goals					
CHEMICAL PARAMETER	[1]Estuarine Aquatic Habitat Goal (ug/L)	Basis	Lowest Freshwater Aquatic Habitat Goal (ug/L)	Basis	Lowest Marine Aquatic Habitat Goal (ug/L)	Basis
tert-BUTYL ALCOHOL	1.8E+04	10% Acute FW LC0	1.8E+04	10% Acute FW LC0	1.8E+04	10% Acute FW LC0
TETRACHLOROETHANE, 1,1,1,2-	3.1E+02	10% HI DOH FW Acute	3.1E+02	10% HI DOH FW Acute	3.1E+02	10% HI DOH FW Acute
TETRACHLOROETHANE, 1,1,2,2-	4.2E+02	USEPA Ecotox FW Chronic	4.2E+02	USEPA Ecotox FW Chronic	4.2E+02	USEPA Ecotox FW Chronic
TETRACHLOROETHYLENE	1.2E+02	USEPA Ecotox FW Chronic	1.2E+02	USEPA Ecotox FW Chronic	1.5E+02	Hawai'i Chronic SW WQS
TETRACHLOROPHENOL, 2,3,4,6-	1.2E+00	MDEQ FW FCV	1.2E+00	MDEQ FW FCV	4.0E+00	CA Daily SW Max
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	3.3E+02	ORNL FW SCV	3.3E+02	ORNL FW SCV	3.3E+02	ORNL FW SCV
THALLIUM	2.0E+01	50% USEPA FW Chronic LOEL	2.0E+01	50% USEPA FW Chronic LOEL	2.0E+01	50% USEPA FW Chronic LOEL
TOLUENE	1.3E+02	USEPA Ecotox FW Chronic	1.3E+02	USEPA Ecotox FW Chronic	2.5E+03	50% USEPA SW Chronic LOEL
TOXAPHENE	2.0E-04	Hawai'i Chronic FW WQS	2.0E-04	Hawai'i Chronic FW WQS	2.0E-04	Hawai'i Chronic SW WQS
TPH (gasolines)	5.0E+02	CA FW Chronic	5.0E+02	CA FW Chronic	3.7E+03	CA SW Chronic
TPH (middle distillates)	6.4E+02	CA FW Chronic	6.4E+02	CA FW Chronic	6.4E+02	CA FW Chronic
TPH (residual fuels)	6.4E+02	CA FW Chronic	6.4E+02	CA FW Chronic	6.4E+02	CA FW Chronic
TRICHLOROBENZENE, 1,2,4-	2.5E+01	50% USEPA FW Chronic LOEL	2.5E+01	50% USEPA FW Chronic LOEL	6.5E+01	50% USEPA SW Chronic LOEL
TRICHLOROETHANE, 1,1,1-	6.2E+01	USEPA Ecotox FW Chronic	6.2E+01	USEPA Ecotox FW Chronic	6.2E+01	USEPA Ecotox FW Chronic
TRICHLOROETHANE, 1,1,2-	4.7E+03	50% USEPA FW Chronic LOEL	4.7E+03	50% USEPA FW Chronic LOEL	4.7E+03	50% USEPA FW Chronic LOEL
TRICHLOROETHYLENE	3.6E+02	USEPA Ecotox FW Chronic	3.6E+02	USEPA Ecotox FW Chronic	3.6E+02	USEPA Ecotox FW Chronic
TRICHLOROPHENOL, 2,4,5-	1.1E+01	USEPA SW CCC	6.3E+01	USEPA FW CCC	1.1E+01	USEPA SW CCC
TRICHLOROPHENOL, 2,4,6-	4.9E+02	50% USEPA FW Chronic LOEL	4.9E+02	50% USEPA FW Chronic LOEL	4.9E+02	50% USEPA FW Chronic LOEL
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	6.9E+02	USEPA Reg. V FW Chronic	6.9E+02	USEPA Reg. V FW Chronic	6.9E+02	USEPA Reg. V FW Chronic
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	3.0E+01	USEPA Reg. V FW Chronic	3.0E+01	USEPA Reg. V FW Chronic	3.0E+01	USEPA Reg. V FW Chronic
TRICHLOROPROPANE, 1,2,3-	1.4E+01	50% FW EC50	1.4E+01	50% FW EC50	1.4E+01	50% FW EC50
TRICHLOROPROPENE, 1,2,3-	6.2E-01	=Drinking Water (Table D-3a)	6.2E-01	=Drinking Water (Table D-3a)	6.2E-01	=Drinking Water (Table D-3a)
TRIFLURALIN	2.0E+01	CCME FW EQG	2.0E+01	CCME FW EQG	2.0E+01	CCME FW EQG
TRINITROBENZENE, 1,3,5-	3.0E+01	ORNL FW SCV	3.0E+01	ORNL FW SCV	3.0E+01	ORNL FW SCV
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	1.5E+02	=Drinking Water (Table D-3a)	1.5E+02	=Drinking Water (Table D-3a)	1.5E+02	=Drinking Water (Table D-3a)
TRINITROTOLUENE, 2,4,6- (TNT)	1.3E+02	ORNL FW SCV	1.3E+02	ORNL FW SCV	1.3E+02	ORNL FW SCV
VANADIUM	1.9E+01	USEPA Ecotox FW Chronic	1.9E+01	USEPA Ecotox FW Chronic	1.9E+01	USEPA Ecotox FW Chronic

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

	[1]Aquatic Habitat Goals					
CHEMICAL PARAMETER	**[1]Estuarine Aquatic Habitat Goal (ug/L)**	**Basis**	**Lowest Freshwater Aquatic Habitat Goal (ug/L)**	**Basis**	**Lowest Marine Aquatic Habitat Goal (ug/L)**	**Basis**
VINYL CHLORIDE	7.8E+02	USDOE FW Chronic PRG	7.8E+02	USDOE FW Chronic PRG	7.8E+02	USDOE FW Chronic PRG
XYLENES	1.0E+02	5% Acute SW LC 50	1.0E+02	5% Acute SW LC 50	1.0E+02	5% Acute SW LC 50
ZINC	2.2E+01	Hawai'i Chronic FW WQS	2.2E+01	Hawai'i Chronic FW WQS	8.6E+01	Hawai'i Chronic SW WQS

Notes:

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

See text for prioritization and selection of surface water quality screening levels. USEPA HH criteria for potential bioaccumulation of chemicals in aquatic life considered in surface water screening levels only (refer to main text). Drinking water goal substituted as aquatic habitat goal if latter was not available (see text).

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

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

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

AWQC: Aquatic Water Quality Criteria

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

CCC: Criterion for Continuous Concentration

CMC: Criterion for Maximum Concentration

FCV: Final Chronic Value

FW: Freshwater

LOEL: Lowest Observed Effects Level

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

PRG: USDOE Preliminary Remediation Goal for ecological concerns.

SW: Saltwater

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

USDOE: U. S. Department of Energy

USEPA: U.S. Environmental Protection Agency

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

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

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

CONTAMINANT	[1]Aquatic Habitat Goals					
	[1]Estuarine Acute Aquatic Habitat Goal (ug/L)	Basis	Freshwater Acute Aquatic Habitat Goal (ug/L)	Basis	Saltwater Acute Aquatic Habitat Goal (ug/L)	Basis
DIBROMO-3-CHLOROPROPANE, 1,2-	4.0E-02	=Drinking Water (Table D-3a)	4.0E-02	=Drinking Water (Table D-3a)	4.0E-02	=Drinking Water (Table D-3a)
DIBROMOCHLOROMETHANE	1.1E+04	USEPA FW Acute LOEL	1.1E+04	USEPA FW Acute LOEL	1.2E+04	USEPA SW Acute LOEL
DIBROMOETHANE, 1,2-	1.4E+03	FW Chronic goal	1.4E+03	FW Chronic goal	1.4E+03	SW Chronic goal
DICHLOROBENZENE, 1,2-	3.7E+02	Hawai'i Acute FW WQS	3.7E+02	Hawai'i Acute FW WQS	6.6E+02	Hawai'i Acute SW WQS
DICHLOROBENZENE, 1,3-	3.7E+02	Hawai'i Acute FW WQS	3.7E+02	Hawai'i Acute FW WQS	6.6E+02	Hawai'i Acute SW WQS
DICHLOROBENZENE, 1,4-	3.7E+02	Hawai'i Acute FW WQS	3.7E+02	Hawai'i Acute FW WQS	6.6E+02	Hawai'i Acute SW WQS
DICHLOROBENZIDINE, 3,3-	2.5E+02	FW Chronic goal	2.5E+02	FW Chronic goal	2.5E+02	SW Chronic goal
DICHLORODIPHENYLDICHLOROETHANE (DDD)	6.0E-01	USEPA FW Acute LOEL	6.0E-01	USEPA FW Acute LOEL	3.6E+00	USEPA SW Acute LOEL
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.1E+00	USEPA FW Acute LOEL	1.1E+00	USEPA FW Acute LOEL	1.4E+01	USEPA SW Acute LOEL
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.3E-02	Hawai'i Acute SW WQS	1.1E+00	Hawai'i Acute FW WQS	1.3E-02	Hawai'i Acute SW WQS
DICHLOROETHANE, 1,1-	4.7E+01	FW Chronic goal	4.7E+01	FW Chronic goal	4.7E+01	SW Chronic goal
DICHLOROETHANE, 1,2-	3.8E+04	Hawai'i Acute SW WQS	3.9E+04	Hawai'i Acute FW WQS	3.8E+04	Hawai'i Acute SW WQS
DICHLOROETHYLENE, 1,1-	3.9E+03	Hawai'i Acute FW WQS	3.9E+03	Hawai'i Acute FW WQS	7.5E+04	Hawai'i Acute SW WQS
DICHLOROETHYLENE, Cis 1,2-	1.2E+04	USEPA FW Acute LOEL	1.2E+04	USEPA FW Acute LOEL	2.2E+05	USEPA SW Acute LOEL
DICHLOROETHYLENE, Trans 1,2-	1.2E+04	USEPA FW Acute LOEL	1.2E+04	USEPA FW Acute LOEL	2.2E+05	USEPA SW Acute LOEL
DICHLOROPHENOL, 2,4-	6.7E+02	Hawai'i Acute FW WQS	6.7E+02	Hawai'i Acute FW WQS	6.7E+02	Hawai'i Acute FW WQS
DICHLOROPHENOXYACETIC ACID (2,4-D)	2.0E+02	UK SW WQS	2.9E+03	MDEQ FW FAV	2.0E+02	UK SW WQS
DICHLOROPROPANE, 1,2-	3.4E+03	Hawai'i Acute SW WQS	7.7E+03	Hawai'i Acute FW WQS	3.4E+03	Hawai'i Acute SW WQS
DICHLOROPROPENE, 1,3-	2.6E+02	Hawai'i Acute SW WQS	2.0E+03	Hawai'i Acute FW WQS	2.6E+02	Hawai'i Acute SW WQS
DIELDRIN	7.1E-01	Hawai'i Acute SW WQS	2.5E+00	Hawai'i Acute FW WQS	7.1E-01	Hawai'i Acute SW WQS
DIETHYLPHTHALATE	9.4E+02	USEPA FW Acute LOEL	9.4E+02	USEPA FW Acute LOEL	2.9E+03	USEPA SW Acute LOEL
DIMETHYLPHENOL, 2,4-	2.7E+02	USEPA SW CMC	7.0E+02	Hawai'i Acute FW WQS	2.7E+02	USEPA SW CMC
DIMETHYLPHTHALATE	9.4E+02	USEPA FW Acute LOEL	9.4E+02	USEPA FW Acute LOEL	2.9E+03	USEPA SW Acute LOEL
DINITROBENZENE, 1,3-	1.1E+02	ORNL FW SAV	1.1E+02	ORNL FW SAV	1.1E+02	ORNL FW SAV
DINITROPHENOL, 2,4-	2.3E+02	USEPA FW Acute LOEL	2.3E+02	USEPA FW Acute LOEL	4.9E+03	USEPA SW Acute LOEL
DINITROTOLUENE, 2,4- (2,4-DNT)	1.1E+02	Hawai'i Acute FW WQS	1.1E+02	Hawai'i Acute FW WQS	2.0E+02	Hawai'i Acute SW WQS
DINITROTOLUENE, 2,6- (2,6-DNT)	1.1E+02	Hawai'i Acute FW WQS	1.1E+02	Hawai'i Acute FW WQS	2.0E+02	Hawai'i Acute SW WQS
DIOXANE, 1,4-	3.4E+06	50% FW LC50	3.4E+06	50% FW LC50	5.0E+06	50% SW LC50
DIOXINS (TEQ)	3.0E-03	Hawai'i Acute FW WQS	3.0E-03	Hawai'i Acute FW WQS	3.0E-03	Hawai'i Acute FW WQS
DIURON	2.0E+02	50% FW LC50	2.0E+02	50% FW LC50	5.5E+02	50% SW LC50
ENDOSULFAN	3.4E-02	Hawai'i Acute SW WQS	2.2E-01	Hawai'i Acute FW WQS	3.4E-02	Hawai'i Acute SW WQS
ENDRIN	3.7E-02	Hawai'i Acute SW WQS	1.8E-01	Hawai'i Acute FW WQS	3.7E-02	Hawai'i Acute SW WQS
ETHANOL						
ETHYLBENZENE	4.3E+02	USEPA SW Acute LOEL	1.1E+04	Hawai'i Acute FW WQS	4.3E+02	USEPA SW Acute LOEL
FLUORANTHENE	3.0E+02	USEPA SW Acute LOEL	3.0E+02	USEPA SW Acute LOEL	3.0E+02	USEPA SW Acute LOEL
FLUORENE	3.0E+02	USEPA SW Acute LOEL	3.0E+02	USEPA SW Acute LOEL	3.0E+02	USEPA SW Acute LOEL
GLYPHOSATE	6.0E+02	50% FW LC50	6.0E+02	50% FW LC50	6.0E+02	50% FW LC50
HEPTACHLOR	5.3E-02	Hawai'i Acute SW WQS	5.2E-01	Hawai'i Acute FW WQS	5.3E-02	Hawai'i Acute SW WQS
HEPTACHLOR EPOXIDE	5.3E-02	USEPA SW CMC	5.2E-01	USEPA FW CMC	5.3E-02	USEPA SW CMC
HEXACHLOROBENZENE	6.0E+00	USEPA FW CMC	6.0E+00	USEPA FW CMC	6.2E+00	solubility
HEXACHLOROBUTADIENE	1.1E+01	Hawai'i Acute SW WQS	3.0E+01	Hawai'i Acute FW WQS	1.1E+01	Hawai'i Acute SW WQS
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	1.6E-01	Hawai'i Acute SW WQS	2.0E+00	Hawai'i Acute FW WQS	1.6E-01	Hawai'i Acute SW WQS
HEXACHLOROETHANE	3.1E+02	Hawai'i Acute SW WQS	3.3E+02	Hawai'i Acute FW WQS	3.1E+02	Hawai'i Acute SW WQS
HEXAZINONE	5.0E+04	50% FW LC50	5.0E+04	50% FW LC50	5.0E+04	50% FW LC50
INDENO(1,2,3-cd)PYRENE	3.0E+02	USEPA SW Acute LOEL	3.0E+02	USEPA SW Acute LOEL	3.0E+02	USEPA SW Acute LOEL
ISOPHORONE	4.3E+03	Hawai'i Acute SW WQS	3.9E+04	Hawai'i Acute FW WQS	4.3E+03	Hawai'i Acute SW WQS

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

CONTAMINANT	[1]Aquatic Habitat Goals					
	[1]Estuarine Acute Aquatic Habitat Goal (ug/L)	Basis	Freshwater Acute Aquatic Habitat Goal (ug/L)	Basis	Saltwater Acute Aquatic Habitat Goal (ug/L)	Basis
LEAD	2.9E+01	Hawai'i Acute FW WQS	2.9E+01	Hawai'i Acute FW WQS	1.4E+02	Hawai'i Acute SW WQS
MERCURY	2.1E+00	Hawai'i Acute SW WQS	2.4E+00	Hawai'i Acute FW WQS	2.1E+00	Hawai'i Acute SW WQS
METHOXYCHLOR	3.0E-02	USEPA FW CMC	3.0E-02	USEPA FW CMC	3.0E-02	USEPA SW CMC
METHYL ETHYL KETONE	1.4E+04	FW Chronic goal	1.4E+04	FW Chronic goal	1.4E+04	SW Chronic goal
METHYL ISOBUTYL KETONE	1.7E+02	FW Chronic goal	1.7E+02	FW Chronic goal	1.7E+02	SW Chronic goal
METHYL MERCURY	3.0E-03	FW Chronic goal	3.0E-03	FW Chronic goal	3.0E-03	SW Chronic goal
METHYL TERT BUTYL ETHER	5.3E+04	USEPA SW CMC	1.5E+05	USEPA FW CMC	5.3E+04	USEPA SW CMC
METHYLENE CHLORIDE	1.1E+04	USEPA FW Acute LOEL	1.1E+04	USEPA FW Acute LOEL	1.2E+04	USEPA SW Acute LOEL
METHYLNAPHTHALENE, 1-	3.0E+02	USEPA SW Acute LOEL	3.0E+02	USEPA SW Acute LOEL	3.0E+02	USEPA SW Acute LOEL
METHYLNAPHTHALENE, 2-	3.0E+02	USEPA SW Acute LOEL	3.0E+02	USEPA SW Acute LOEL	3.0E+02	USEPA SW Acute LOEL
MOLYBDENUM	2.4E+02	FW Chronic goal	2.4E+02	FW Chronic goal	2.4E+02	SW Chronic goal
NAPHTHALENE	7.7E+02	Hawai'i Acute FW WQS	7.7E+02	Hawai'i Acute FW WQS	7.8E+02	Hawai'i Acute SW WQS
NICKEL	5.0E+00	Hawai'i Acute FW WQS	5.0E+00	Hawai'i Acute FW WQS	7.5E+01	Hawai'i Acute SW WQS
NITROBENZENE	2.0E+03	Hawai'i Acute SW WQS	9.0E+03	Hawai'i Acute FW WQS	2.0E+03	Hawai'i Acute SW WQS
NITROGLYCERIN	1.4E+02	FW Chronic goal	1.4E+02	FW Chronic goal	1.4E+02	SW Chronic goal
NITROTOLUENE, 2-	7.5E+03	=3 NT	7.5E+03	=3 NT	7.5E+03	=3 NT
NITROTOLUENE, 3-	3.8E+03	50% FW LC50	3.8E+03	50% FW LC50	3.8E+03	50% FW LC50
NITROTOLUENE, 4-	3.3E+03	50% SW LC50	1.7E+04	50% FW LC50	3.3E+03	50% SW LC50
PENTACHLOROPHENOL	1.3E+01	Hawai'i Acute SW WQS	2.0E+01	Hawai'i Acute FW WQS	1.3E+01	Hawai'i Acute SW WQS
PENTAERYTHRITOLTETRANITRATE (PETN)	4.3E+04	solubility	4.3E+04	solubility	4.3E+04	solubility
PERCHLORATE	6.0E+02	FW Chronic goal	6.0E+02	FW Chronic goal	6.0E+02	SW Chronic goal
PHENANTHRENE	3.0E+02	USEPA SW Acute LOEL	3.0E+02	USEPA SW Acute LOEL	3.0E+02	USEPA SW Acute LOEL
PHENOL	3.4E+03	Hawai'i Acute FW WQS	3.4E+03	Hawai'i Acute FW WQS	5.8E+03	USEPA SW Acute LOEL
POLYCHLORINATED BIPHENYLS (PCBs)	2.0E+00	Hawai'i Acute FW WQS	2.0E+00	Hawai'i Acute FW WQS	1.0E+01	Hawai'i Acute SW WQS
PROPICONAZOLE	2.6E+02	50% SW LC50	4.2E+02	50% FW LC50	2.6E+02	50% SW LC50
PYRENE	3.0E+02	USEPA SW Acute LOEL	3.0E+02	USEPA SW Acute LOEL	3.0E+02	USEPA SW Acute LOEL
SELENIUM	2.0E+01	Hawai'i Acute FW WQS	2.0E+01	Hawai'i Acute FW WQS	3.0E+02	Hawai'i Acute SW WQS
SILVER	1.0E+00	Hawai'i Acute FW WQS	1.0E+00	Hawai'i Acute FW WQS	2.3E+00	Hawai'i Acute SW WQS
SIMAZINE	1.0E+01	UK SW WQS	3.1E+02	MDEQ FW FAV	1.0E+01	UK SW WQS
STYRENE	3.2E+01	FW Chronic goal	3.2E+01	FW Chronic goal	3.2E+01	SW Chronic goal
TERBACIL	2.3E+04	50% FW LC50	2.3E+04	50% FW LC50	2.3E+04	50% FW LC50
tert-BUTYL ALCOHOL	1.8E+05	FW LC0	1.8E+05	FW LC0	1.8E+05	FW LC0
TETRACHLOROETHANE, 1,1,1,2-	3.1E+03	Hawai'i Acute FW WQS	3.1E+03	Hawai'i Acute FW WQS	3.1E+03	Hawai'i Acute FW WQS
TETRACHLOROETHANE, 1,1,2,2-	3.0E+03	Hawai'i Acute SW WQS	9.3E+03	USEPA FW Acute LOEL	3.0E+03	Hawai'i Acute SW WQS
TETRACHLOROETHYLENE	1.8E+03	Hawai'i Acute FW WQS	1.8E+03	Hawai'i Acute FW WQS	3.4E+03	Hawai'i Acute SW WQS
TETRACHLOROPHENOL, 2,3,4,6-	1.0E+01	CA Instant. SW Max	2.2E+01	MDEQ FW FAV	1.0E+01	CA Instant. SW Max
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	1.9E+03	ORNL FW SAV	1.9E+03	ORNL FW SAV	1.9E+03	ORNL FW SAV
THALLIUM	4.7E+02	Hawai'i Acute FW WQS	4.7E+02	Hawai'i Acute FW WQS	7.1E+02	Hawai'i Acute SW WQS
TOLUENE	5.8E+03	Hawai'i Acute FW WQS	5.8E+03	Hawai'i Acute FW WQS	6.3E+03	USEPA SW Acute LOEL
TOXAPHENE	2.1E-01	Hawai'i Acute SW WQS	7.3E-01	Hawai'i Acute FW WQS	2.1E-01	Hawai'i Acute SW WQS
TPH (gasolines)	5.0E+03	Ceiling Level	5.0E+03	Ceiling Level	5.0E+03	Ceiling Level
TPH (middle distillates)	2.5E+03	Ceiling Level	2.5E+03	Ceiling Level	2.5E+03	Ceiling Level
TPH (residual fuels)	2.5E+03	Ceiling Level	2.5E+03	Ceiling Level	2.5E+03	Ceiling Level
TRICHLOROBENZENE, 1,2,4-	1.6E+02	USEPA SW Acute LOEL	2.5E+02	USEPA FW Acute LOEL	1.6E+02	USEPA SW Acute LOEL
TRICHLOROETHANE, 1,1,1-	6.0E+03	Hawai'i Acute FW WQS	6.0E+03	Hawai'i Acute FW WQS	1.0E+04	Hawai'i Acute SW WQS
TRICHLOROETHANE, 1,1,2-	6.0E+03	Hawai'i Acute FW WQS	6.0E+03	Hawai'i Acute FW WQS	6.0E+03	Hawai'i Acute FW WQS

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

CONTAMINANT	[1]Aquatic Habitat Goals					
	[1]Estuarine Acute Aquatic Habitat Goal (ug/L)	Basis	Freshwater Acute Aquatic Habitat Goal (ug/L)	Basis	Saltwater Acute Aquatic Habitat Goal (ug/L)	Basis
TRICHLOROETHYLENE	7.0E+02	Hawai'i Acute SW WQS	1.5E+04	Hawai'i Acute FW WQS	7.0E+02	Hawai'i Acute SW WQS
TRICHLOROPHENOL, 2,4,5-	1.0E+02	USEPA FW CMC	1.0E+02	USEPA FW CMC	2.4E+02	USEPA SW CMC
TRICHLOROPHENOL, 2,4,6-	4.9E+02	FW Chronic goal	4.9E+02	FW Chronic goal	4.9E+02	SW Chronic goal
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	6.9E+02	FW Chronic goal	6.9E+02	FW Chronic goal	6.9E+02	SW Chronic goal
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	3.0E+01	FW Chronic goal	3.0E+01	FW Chronic goal	3.0E+01	SW Chronic goal
TRICHLOROPROPANE, 1,2,3-	1.4E+02	5xFW EC50	1.4E+02	5xFW EC50	1.4E+02	5xFW EC50
TRICHLOROPROPENE, 1,2,3-	6.2E-01	=Drinking Water (Table D-3a)	6.2E-01	=Drinking Water (Table D-3a)	6.2E-01	=Drinking Water (Table D-3a)
TRIFLURALIN	2.0E+01	FW Chronic goal	2.0E+01	FW Chronic goal	2.0E+01	SW Chronic goal
TRINITROBENZENE, 1,3,5-	1.4E+02	ORNL FW SAV	1.4E+02	ORNL FW SAV	1.4E+02	ORNL FW SAV
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	1.5E+02	=Drinking Water (Table D-3a)	1.5E+02	=Drinking Water (Table D-3a)	1.5E+02	=Drinking Water (Table D-3a)
TRINITROTOLUENE, 2,4,6- (TNT)	5.7E+02	ORNL FW SAV	5.7E+02	ORNL FW SAV	5.7E+02	ORNL FW SAV
VANADIUM	1.9E+01	FW Chronic goal	1.9E+01	FW Chronic goal	1.9E+01	SW Chronic goal
VINYL CHLORIDE	7.8E+02	FW Chronic goal	7.8E+02	FW Chronic goal	7.8E+02	SW Chronic goal
XYLENES	1.0E+03	50% SW LC50	1.0E+03	50% SW LC50	1.0E+03	50% SW LC50
ZINC	2.2E+01	Hawai'i Acute FW WQS	2.2E+01	Hawai'i Acute FW WQS	9.5E+01	Hawai'i Acute SW WQS

Notes:

1. Estuarine Goal = Lowest of Freshwater vs Saltwater chronic goals.
See text for prioritization and selection of surface water quality goals.
Chronic surface water goal referred to if no acute goal available (see Table D-4b (chronic)). Drinking water action level referred to if aquatic habitat goals not available.
AWQC: Aquatic Water Quality Criteria
BC: British Columbia Water Quality Guidelines (NOAA 2008).
CCC: Criterion for Continuous Concentration
CMC: Criterion for Maximum Concentration
FCV: Final Chronic Value
FW: Freshwater
LOEL: Lowest Observed Effects Level
MOEE: Ontario Ministry of Environment and Energy (MOEE 1996)
PRG: USDOE Preliminary Remediation Goal for ecological concerns.
SW: Saltwater
TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.
USDOE: U. S. Department of Energy
USEPA: U.S. Environmental Protection Agency

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

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

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

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

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

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

Primary Reference:

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

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

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

	Freshwater									Marine								
CONTAMINANT	CCC	USEPA Chronic LOEL	CMC	USEPA Acute LOEL	Ecotox Chronic Threshold (AWQC, FCV Or Tier II)	Other Acute	Basis	Other Chronic	Basis	CCC	USEPA Chronic LOEL	CMC	USEPA Acute LOEL	Ecotox Chronic Threshold (AWQC, FCV Or Tier II)	Other Acute	Basis	Other Chronic	Basis
ACENAPHTHENE		5.2E+02		1.7E+03	2.3E+01						7.1E+02		9.7E+02	4.0E+01				
ACENAPHTHYLENE															3.0E+02	CCME 2002		
ACETONE								1.5E+03	USDOE FW Chronic PRG									
ALDRIN			3.0E+00									1.3E+00						
AMETRYN						1.5E+02	50% FW LC50	1.5E+01	5% FW Acute LC50									
AMINO,2- DINITROTOLUENE,4,6-						1.5E+02	50% FW LC50	1.5E+01	5% FW Acute LC50									
AMINO,4- DINITROTOLUENE,2,6-						1.5E+02	50% FW LC50	1.5E+01	5% FW Acute LC50									
ANTHRACENE								7.3E-01	USDOE FW Chronic PRG						3.0E+02	CCME 2002		
ANTIMONY	3.0E+01		8.8E+01							5.0E+02		1.5E+03						
ARSENIC	1.5E+02		3.4E+02		1.9E+02					3.6E+01		6.9E+01		3.6E+01				
ATRAZINE	1.2E+01		3.5E+02							2.6E+01		7.6E+02						
BARIUM															1.0E+03	BC SW Acute	2.0E+02	BC SW Chronic
BENZENE				5.3E+03	4.6E+01						7.0E+02		5.1E+03					
BENZO(a)ANTHRACENE								2.7E-02	USDOE FW Chronic PRG						3.0E+02	CCME 2002		
BENZO(a)PYRENE					1.4E-02										3.0E+02	CCME 2002		
BENZO(b)FLUORANTHENE								9.1E+00	USEPA Reg. IV FW Chronic						3.0E+02	CCME 2002		
BENZO(g,h,i)PERYLENE								1.0E-01	50% MOEE FW Chronic LOEL						3.0E+02	CCME 2002		
BENZO(k)FLUORANTHENE								3.7E+00	50% MOEE FW Chronic LOEL						3.0E+02	CCME 2002		
BERYLLIUM		5.3E+00		1.3E+02	5.1E+00													
BIPHENYL, 1,1-					1.4E+01													
BIS(2-CHLOROETHYL)ETHER		1.2E+02		2.4E+05														
BIS(2-CHLOROISOPROPYL)ETHER		1.2E+02		2.4E+05														
BIS(2-ETHYLHEXYL)PHTHALATE					3.2E+01													
BORON																		
BROMODICHLOROMETHANE				1.1E+04							6.4E+03		1.2E+04					
BROMOFORM				1.1E+04							6.4E+03		1.2E+04					
BROMOMETHANE				1.1E+04				1.6E+02	50% MOEE FW Chronic LOEL		6.4E+03		1.2E+04					
CADMIUM	2.5E-01		2.0E+00		1.0E+00					8.8E+00		4.0E+01		9.3E+00				
CARBON TETRACHLORIDE				3.5E+04				9.8E+00	USDOE FW Chronic PRG		6.4E+03		5.0E+04					
CHLORDANE (TECHNICAL)	4.3E-03		2.4E+00							4.0E-03		9.0E-02						
CHLOROANILINE, p-								5.0E+00	50% MOEE FW Chronic LOEL									
CHLOROBENZENE		5.0E+01		2.5E+02	1.3E+02						1.3E+02		1.6E+02					
CHLOROETHANE																		
CHLOROFORM		1.2E+03		2.9E+04				2.8E+01	USDOE FW Chronic PRG		6.4E+03		1.2E+04					
CHLOROMETHANE				1.1E+04							6.4E+03		1.2E+04					
CHLOROPHENOL, 2-				4.4E+03														
CHROMIUM (Total)								7.4E+01	=Cr III								1.0E+04	=Cr III
CHROMIUM III	7.4E+01		5.7E+02		1.8E+02								1.03E+04					
CHROMIUM VI	1.1E+01		1.6E+01		1.0E+01					5.0E+01		1.1E+03						
CHRYSENE								3.5E-01	50% MOEE FW Chronic LOEL						3.0E+02	CCME 2002		
COBALT					3.0E+00													
COPPER	9.0E+00		1.3E+01		1.1E+01					3.1E+00		4.8E+00		2.4E+00				
CYANIDE (Free)	5.2E+00		2.2E+01		5.2E+00							1.0E+00		1.0E+00				
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)						1.4E+03	ORNL FW SAV	1.9E+02	ORNL FW SCV									
DALAPON						3.0E+03	50% FW LC50	3.0E+02	5% FW Acute LC50									
DIBENZO(a,h)ANTHTRACENE								7.5E+00	50% MOEE FW Chronic LOEL						3.0E+02	CCME 2002		
DIBROMO-3-CHLOROPROPANE, 1,2-																		
DIBROMOCHLOROMETHANE				1.1E+04							6.4E+03		1.2E+04					
DIBROMOETHANE, 1,2-								1.4E+03	50% MOEE FW Chronic AWQC									
DICHLOROBENZENE, 1,2-		7.6E+02		1.1E+03	1.4E+01						1.3E+02		1.97E+03					
DICHLOROBENZENE, 1,3-		7.6E+02		1.1E+03	7.1E+01						1.3E+02		1.97E+03					
DICHLOROBENZENE, 1,4-		7.6E+02		1.1E+03	1.5E+01						1.3E+02		1.97E+03					
DICHLOROBENZIDINE, 3,3-								2.5E+02	50% MOEE FW Chronic LOEL									
DICHLORODIPHENYLDICHLOROETHANE (DDD)				6.0E-01				1.0E-03	=DDT				3.6E+00				1.0E-03	=DDT
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)				1.1E+00				1.0E-03	=DDT				1.4E+01				1.0E-03	=DDT
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.0E-03		1.1E+00		1.3E-02					1.0E-03		1.3E-01						
DICHLOROETHANE, 1,1-					4.7E+01													
DICHLOROETHANE, 1,2-		2.0E+04		1.2E+05				9.1E+02	USDOE FW Chronic PRG				1.13E+05					
DICHLOROETHYLENE, 1,1-				1.2E+04				2.5E+01	USDOE FW Chronic PRG				2.24E+05					
DICHLOROETHYLENE, Cis 1,2-				1.2E+04				5.9E+02	USDOE FW Chronic PRG				2.24E+05					
DICHLOROETHYLENE, Trans 1,2-				1.2E+04				5.9E+02	USDOE FW Chronic PRG				2.24E+05					
DICHLOROPHENOL, 2,4-		3.7E+02		2.0E+03														
DICHLOROPHENOXYACETIC ACID (2,4-D)						2.9E+03	MDEQ FW FAV	2.2E+02	MDEQ FW FCV						2.0E+02	UK SW WQS	4.0E+01	UK SW WQS
DICHLOROPROPANE, 1,2-		5.7E+03		2.3E+04							3.0E+03		1.03E+04					
DICHLOROPROPENE, 1,3-		2.4E+02		6.1E+03									7.9E+02					
DIELDRIN	5.6E-02		2.4E-01		6.2E-02					1.9E-03		7.1E-01		1.1E-01				

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

	Freshwater									Marine								
CONTAMINANT	**CCC**	**USEPA Chronic LOEL**	**CMC**	**USEPA Acute LOEL**	**Ecotox Chronic Threshold (AWQC, FCV Or Tier II)**	**Other Acute**	**Basis**	**Other Chronic**	**Basis**	**CCC**	**USEPA Chronic LOEL**	**CMC**	**USEPA Acute LOEL**	**Ecotox Chronic Threshold (AWQC, FCV Or Tier II)**	**Other Acute**	**Basis**	**Other Chronic**	**Basis**
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					
DINITROBENZENE, 1,3-						1.1E+02	ORNL FW SAV	3.0E+01	ORNL FW SCV									
DINITROPHENOL, 2,4-		1.5E+02		2.3E+02									4.85E+03					
DINITROTOLUENE, 2,4- (2,4-DNT)								4.4E+01	USEPA Reg. V FW Chronic								6.7E+01	USEPA Region IV
DINITROTOLUENE, 2,6- (2,6-DNT)								4.4E+01	=2,4 DNT								6.7E+01	=2,4 DNT
DIOXANE, 1,4-						3.4E+06	50% FW LC50	3.4E+05	5% Acute FW LC 50						5.0E+06	50% SW LC50	5.0E+05	5% Acute SW LC 50
DIOXINS (TEQ)		1.0E-05		1.0E-02														
DIURON						2.0E+02	50% FW LC50	6.0E+01	50% FW EC50						5.5E+02	50% SW LC50		
ENDOSULFAN	5.6E-02		2.2E-01		5.6E-02					8.7E-03		3.4E-02						
ENDRIN	3.6E-02		8.6E-02		6.1E-02					2.3E-03		3.7E-02		1.0E-02				
ETHANOL																		
ETHYLBENZENE				3.2E+04	2.9E+02								4.3E+02					
FLUORANTHENE				3.98E+03	8.1E+00						1.6E+01				3.0E+02	CCME 2002		
FLUORENE					3.9E+00										3.0E+02	CCME 2002		
GLYPHOSATE						6.0E+02	50% FW LC50	6.5E+01	CCME EQG									
HEPTACHLOR	3.8E-03		5.2E-01		6.9E-03					3.6E-03		5.3E-02						
HEPTACHLOR EPOXIDE	3.8E-03		5.2E-01							3.6E-03		5.3E-02						
HEXACHLOROBENZENE	3.7E+00		6.0E+00								1.3E+02		1.6E+02					
HEXACHLOROBUTADIENE		9.3E+00		9.0E+01									3.2E+01					
HEXACHLOROCYCLOHEXANE (gamma) LINDANE			9.5E-01		8.0E-02							1.6E-01						
HEXACHLOROETHANE		5.4E+02		9.8E+02	1.2E+01								9.4E+02					
HEXAZINONE						5.0E+04	50% FW LC50	5.0E+03	5% FW Acute LC50									
INDENO(1,2,3-cd)PYRENE								4.3E+00	USEPA Reg. IV FW Chronic						3.0E+02	CCME 2002		
ISOPHORONE						1.2E+04	SW Acute	1.2E+03	USEPA Reg. IV FW Chronic				1.3E+04		1.3E+03	Acute	1.3E+02	Chronic
LEAD	2.5E+00		6.5E+01		2.5E+00					8.1E+00		2.1E+02		8.1E+00				
MERCURY	7.7E-01		1.4E+00		1.3E+00					9.4E-01		1.8E+00		1.1E+00				
METHOXYCHLOR			3.0E-02		1.9E-02							3.0E-02						
METHYL ETHYL KETONE								1.4E+04	USDOE FW Chronic PRG									
METHYL ISOBUTYL KETONE								1.7E+02	USDOE FW Chronic PRG									
METHYL MERCURY					3.0E-03													
METHYL TERT BUTYL ETHER	5.1E+04		1.5E+05							1.8E+04		5.3E+04					8.0E+03	CalEPA SW Chronic
METHYLENE CHLORIDE				1.1E+04				2.2E+03	USDOE FW Chronic PRG		6.4E+03		1.2E+04					
METHYLNAPHTHALENE, 1-								2.1E+00	USDOE FW Chronic PRG				3.0E+02					
METHYLNAPHTHALENE, 2-								2.1E+00	USDOE FW Chronic PRG				3.0E+02					
MOLYBDENUM					2.4E+02													
NAPHTHALENE		6.2E+02		2.3E+03	2.4E+01								2.4E+03					
NICKEL	5.2E+01		4.7E+02		1.6E+02					8.2E+00		7.4E+01		8.2E+00				
NITROBENZENE						2.1E+03	MDEQ FW FAV	2.2E+02	MDEQ FW FCV								6.0E+01	Chronic
NITROGLYCERIN								1.4E+02	USEPA Reg. VI FW Chronic									
NITROTOLUENE, 2-						7.5E+03	=3 NT	1.0E+03	=3 NT									
NITROTOLUENE, 3-						3.8E+03	50% FW LC50	3.8E+02	5% FW Acute LC50									
NITROTOLUENE, 4-						1.7E+04	50% FW LC50	1.6E+03	50% FW EC50						3.3E+03	50% SW LC50		
PENTACHLOROPHENOL	1.5E+01		1.9E+01		1.3E+01					7.9E+00		1.3E+01		7.9E+00				
PENTAERYTHRITOLTETRANITRATE (PETN)								8.5E+04	USEPA Reg. VI FW Chronic									
PERCHLORATE					6.0E+02													
PHENANTHRENE	6.3E+00		3.0E+01		6.3E+00					4.6E+00				8.3E+00	3.0E+02	CCME 2002		
PHENOL		2.56E+03		1.02E+04									5.8E+03					
POLYCHLORINATED BIPHENYLS (PCBs)	1.4E-02				1.9E-01					3.0E-02								
PROPICONAZOLE						4.2E+02	50% FW LC50	4.2E+01	5% FW Acute LC50						2.6E+02	50% SW LC50	2.6E+01	5% SW LC50
PYRENE								2.0E+00	50% MOEE FW Chronic LOEL						3.0E+02	CCME 2002		
SELENIUM	5.0E+00				5.0E+00					7.1E+01		2.9E+02		7.1E+01				
SILVER			3.2E+00									1.9E+00						
SIMAZINE						3.1E+02	MDEQ FW FAV	1.7E+01	MDEQ FW FCV						1.0E+01	UK SW WQS	2.0E+00	UK SW WQS
STYRENE								3.2E+01	USEPA Reg. IV FW Chronic									
TERBACIL						2.3E+04	50% FW LC50	2.3E+03	5% FW Acute LC50									
tert-BUTYL ALCOHOL						1.8E+05	FW LC0	1.8E+04	10% Acute FW LC0									
TETRACHLOROETHANE, 1,1,1,2-				9.32E+03														
TETRACHLOROETHANE, 1,1,2,2-		2.4E+03		9.32E+03	4.2E+02								9.02E+03					
TETRACHLOROETHYLENE		8.4E+02		5.28E+03	1.2E+02						4.5E+02		1.02E+04					
TETRACHLOROPHENOL, 2,3,4,6-						2.2E+01	MDEQ FW FAV	1.2E+00	MDEQ FW FCV						1.0E+01	Max	4.0E+00	CA Daily SW Max
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)						1.9E+03	ORNL FW SAV	3.3E+02	ORNL FW SCV									
THALLIUM		4.0E+01		1.4E+03									2.13E+03					
TOLUENE				1.75E+04	1.3E+02						5.0E+03		6.3E+03					
TOXAPHENE	2.0E-04		7.3E-01		1.1E-02					2.0E-04		2.1E-01		2.1E-01				

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

	Freshwater									Marine								
CONTAMINANT	**CCC**	**USEPA Chronic LOEL**	**CMC**	**USEPA Acute LOEL**	**Ecotox Chronic Threshold (AWQC, FCV Or Tier II)**	**Other Acute**	**Basis**	**Other Chronic**	**Basis**	**CCC**	**USEPA Chronic LOEL**	**CMC**	**USEPA Acute LOEL**	**Ecotox Chronic Threshold (AWQC, FCV Or Tier II)**	**Other Acute**	**Basis**	**Other Chronic**	**Basis**
TPH (gasolines)						5.0E+03	Ceiling Level	5.0E+02	CA FW Chronic						5.0E+03	Ceiling Level	3.7E+03	CA SW Chronic
TPH (middle distillates)						2.5E+03	Ceiling Level	6.4E+02	CA FW Chronic						2.5E+03	Ceiling Level		
TPH (residual fuels)						2.5E+03	Ceiling Level	6.4E+02	CA FW Chronic						2.5E+03	Ceiling Level		
TRICHLOROBENZENE, 1,2,4-		5.0E+01		2.5E+02	1.1E+02						1.29E+02		1.6E+02					
TRICHLOROETHANE, 1,1,1-				1.8E+04	6.2E+01								3.12E+04					
TRICHLOROETHANE, 1,1,2-		9.4E+03		1.8E+04														
TRICHLOROETHYLENE		2.19E+04		4.5E+04	3.6E+02								2.0E+03					
TRICHLOROPHENOL, 2,4,5-	6.3E+01		1.0E+02							1.1E+01		2.4E+02						
TRICHLOROPHENOL, 2,4,6-		9.7E+02																
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)								6.9E+02	USEPA Reg. V FW Chronic									
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)								3.0E+01	USEPA Reg. V FW Chronic									
TRICHLOROPROPANE, 1,2,3-						1.4E+02	5xFW EC50	1.4E+01	50% FW EC50									
TRICHLOROPROPENE, 1,2,3-																		
TRIFLURALIN								2.0E+01	CCME FW EQG									
TRINITROBENZENE, 1,3,5-						1.4E+02	ORNL FW SAV	3.0E+01	ORNL FW SCV									
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)																		
TRINITROTOLUENE, 2,4,6- (TNT)						5.7E+02	ORNL FW SAV	1.3E+02	ORNL FW SCV									
VANADIUM					1.9E+01													
VINYL CHLORIDE								7.8E+02	USDOE FW Chronic PRG									
XYLENES															1.0E+03	50% SW LC50	1.0E+02	5% Acute SW LC 50
ZINC	1.2E+02		1.2E+02		1.0E+02					8.1E+01		9.0E+01		8.1E+01				

References:

Primary sources USEPA (2006, 1996b), MOEE (1996), USDOE (1997, 2008). USEPA standards and goals presented in *A Compilation of Water Quality Goals* , CalEPA RWQCB Central Valley Region (RWQCBCV 2007).

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

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

Notes:

Used for development of groundwater and soil action levels.

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

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

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

2-amino-4,6-dinitrotoluene aquatic toxicity data not available; assumed equal to 4-amino-2,6-dinitrotoluene. (Note that goals are coincidentally equal to ametryn, directly above.)

Barium marine aquatic toxicity screening noted (NOAA 2008, from British Columbia Water Quality guidance); published freshwater aquatic habitat screening levels not considered due to low confidence and natural background concentrations of barium in groundwater in Hawai'i.

MTBE aquatic goals from USEPA *Ambient Water Quality Criteria Update for MTBE* (March 2006), http://www.epa.gov/waterscience/criteria/mtbe-fs.html

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

Trinitrobenzene Tier II Secondary Acute and Chronic Values as reported on UDOE RAIS database (USDOE 2008)

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

AWQC: Aquatic Water Quality Criteria

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

CCC: Criterion for Continuous Concentration

CCME: Canadian Council of Ministers of the Environment (CCME 2002)

CMC: Criterion for Maximum Concentration

FCV: Final Chronic Value

FW: Freshwater

LOEL: Lowest Observed Effects Level

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

ORNL: Oak Ridge National Laboratories

PRG: USDOE Preliminary Remediation Goal for ecological concerns.

SW: Saltwater

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

USDOE: U. S. Department of Energy

USEPA: U.S. Environmental Protection Agency

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

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

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

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

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

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

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

CONTAMINANT	Selected Criteria	Basis	[1]HI DOH WQS	[2]USEPA NWQC
TETRACHLOROETHYLENE	2.9E+00	HI DOH Fish Consumption	2.90E+00	3.3E+00
TETRACHLOROPHENOL, 2,3,4,6-				
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)				
THALLIUM	1.6E+01	HI DOH Fish Consumption	1.6E+01	6.3E+00
TOLUENE	1.4E+05	HI DOH Fish Consumption	1.4E+05	2.0E+05
TOXAPHENE	2.4E-04	HI DOH Fish Consumption	2.4E-04	2.8E-04
TPH (gasolines)				
TPH (middle distillates)				
TPH (residual fuels)				
TRICHLOROBENZENE, 1,2,4-				
TRICHLOROETHANE, 1,1,1-	3.4E+05	HI DOH Fish Consumption	3.4E+05	
TRICHLOROETHANE, 1,1,2-	1.4E+01	HI DOH Fish Consumption	1.4E+01	1.6E+01
TRICHLOROETHYLENE	2.6E+01	HI DOH Fish Consumption	2.6E+01	3.0E+01
TRICHLOROPHENOL, 2,4,5-	3.6E+03	USEPA Aquatic Organism Consumption		3.6E+03
TRICHLOROPHENOL, 2,4,6-	1.2E+00	HI DOH Fish Consumption	1.2E+00	
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)				
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)				
TRICHLOROPROPANE, 1,2,3-				
TRICHLOROPROPENE, 1,2,3-				
TRIFLURALIN				
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)				
TRINITROTOLUENE, 1,3,5-				
TRINITROTOLUENE, 2,4,6- (TNT)				
VANADIUM				
VINYL CHLORIDE	1.7E+02	HI DOH Fish Consumption	1.70E+02	5.30E+02
XYLENES				
ZINC				

References:

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

Notes:

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

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

CHEMICAL PARAMETER	Agricultural Water Quality Goals
ACENAPHTHENE	-
ACENAPHTHYLENE	-
ACETONE	-
ALDRIN	-
AMETRYN	-
AMINO,2- DINITROTOLUENE,4,6-	-
AMINO,4- DINITROTOLUENE,2,6-	-
ANTHRACENE	-
ANTIMONY	-
ARSENIC	1.0E+02
ATRAZINE	-
BARIUM	-
BENZENE	-
BENZO(a)ANTHRACENE	-
BENZO(a)PYRENE	-
BENZO(b)FLUORANTHENE	-
BENZO(g,h,i)PERYLENE	-
BENZO(k)FLUORANTHENE	-
BERYLLIUM	1.0E+02
BIPHENYL, 1,1-	-
BIS(2-CHLOROETHYL)ETHER	-
BIS(2-CHLOROISOPROPYL)ETHER	-
BIS(2-ETHYLHEXYL)PHTHALATE	-
BORON	7.0E+02
BROMODICHLOROMETHANE	-
BROMOFORM	-
BROMOMETHANE	-
CADMIUM	1.0E+01
CARBON TETRACHLORIDE	-
CHLORDANE (TECHNICAL)	-
CHLOROANILINE, p-	-
CHLOROBENZENE	-
CHLOROETHANE	-
CHLOROFORM	-
CHLOROMETHANE	-
CHLOROPHENOL, 2-	-
CHROMIUM (Total)	-
CHROMIUM III	-
CHROMIUM VI	1.0E+02
CHRYSENE	-
COBALT	5.0E+01
COPPER	2.0E+02
CYANIDE (Free)	-
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	-
DALAPON	-
DIBENZO(a,h)ANTHTRACENE	-
DIBROMO,1,2- CHLOROPROPANE,3-	-
DIBROMOCHLOROMETHANE	-
DIBROMOETHANE, 1,2-	-
DICHLOROBENZENE, 1,2-	-
DICHLOROBENZENE, 1,3-	-
DICHLOROBENZENE, 1,4-	-
DICHLOROBENZIDINE, 3,3-	-
DICHLORODIPHENYLDICHLOROETHANE (DDD)	-

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

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

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

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

References:

A Compiliation of Water Quality Goals (RWQCBCV 2007).

Notes:

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

TABLE E. SOIL ACTION LEVELS FOR LEACHING CONCERNS

					Target Groundwater Concentrations				Soil Leaching Action Levels			
					Drinking Water IS Threatened		Drinking Water NOT Threatened		Drinking Water IS Threatened		Drinking Water NOT Threatened	
CONTAMINANT	Organic Carbon Coefficient (Koc) (cm^3/g)	Henry's Law Constant (H) ($atm\text{-}m^3/mol$)	Dilution/ Atenuation Factor (DAF)	Saturation Limit (mg/kg)	Target Groundwater Concentration (Surface Water Within 150m; Table D-1a) (ug/L)	Target Groundwater Concentration (Surface Water NOT Within 150m; Table D-1b) (ug/L)	Target Groundwater Concentration (Surface Water Within 150m; Table D-1c) (ug/L)	Target Groundwater Concentration (Surface Water NOT Within 150m; Table D-1d) (ug/L)	Soil Leaching Action Level (Surface Water Within 150m) (mg/kg)	Soil Leaching Action Level (Surface Water NOT Within 150m) (mg/kg)	Soil Leaching Action Level (Surface Water Within 150m) (mg/kg)	Soil Leaching Action Level (Surface Water NOT Within 150m) (mg/kg)
#ACENAPHTHENE	5.03E+03	1.80E-04	8.36E+02	1.2E+02	2.0E+01	2.0E+01	2.3E+01	2.0E+02	1.2E+02	1.2E+02	1.2E+02	1.7E+02
ACENAPHTHYLENE	2.50E+03	1.45E-03	4.24E+02	5.9E+01	3.0E+01	2.4E+02	3.0E+01	3.0E+02	1.3E+01	1.0E+02	1.3E+01	1.3E+02
ACETONE	2.60E+00	3.90E-05	6.74E-01	1.2E+05	1.5E+03	1.5E+03	1.5E+03	1.5E+03	1.0E+00	1.0E+00	1.0E+00	1.0E+00
#ALDRIN	8.20E+04	4.39E-05	1.36E+04	8.4E+00	4.0E-03	4.0E-03	1.3E-01	1.3E+00	8.4E+00	8.4E+00	8.4E+00	1.8E+01
AMETRYN	4.28E+02	2.39E-09	7.10E+01	5.6E+02	1.5E+01	1.5E+02	1.5E+01	1.5E+02	1.1E+00	1.1E+01	1.1E+00	1.1E+01
AMINO,2- DINITROTOLUENE,4,6-	2.83E+02	1.61E-10	4.70E+01	2.2E+03	1.5E+01	7.3E+01	1.5E+01	1.5E+02	7.0E-01	3.4E+00	7.0E-01	7.0E+00
AMINO,4- DINITROTOLUENE,2,6-	2.83E+02	1.61E-10	4.70E+01	2.2E+03	1.5E+01	7.3E+01	1.5E+01	1.5E+02	7.0E-01	3.4E+00	7.0E-01	7.0E+00
#ANTHRACENE	1.64E+04	5.61E-05	2.72E+03	4.3E+00	7.3E-01	2.2E+01	7.3E-01	2.2E+01	4.3E+00	5.9E+01	4.3E+00	5.9E+01
ANTIMONY					6.0E+00	6.0E+00	3.0E+01	1.5E+03	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
ARSENIC					1.0E+01	1.0E+01	3.6E+01	6.9E+01	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
ATRAZINE	2.25E+02	2.34E-09	3.74E+01	5.0E+01	3.0E+00	3.0E+00	1.2E+01	3.5E+02	1.1E-01	1.1E-01	4.5E-01	1.3E+01
BARIUM					2.0E+02	1.0E+03	2.0E+02	1.0E+03	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
BENZENE	1.46E+02	5.61E-03	5.91E+01	1.8E+03	5.0E+00	5.0E+00	4.6E+01	1.7E+03	3.0E-01	3.0E-01	2.7E+00	1.0E+02
#BENZO(a)ANTHRACENE	1.77E+05	1.20E-05	2.94E+04	1.0E+01	2.7E-02	9.2E-02	2.7E-02	4.7E+00	1.0E+01	1.0E+01	1.0E+01	1.4E+02
#BENZO(a)PYRENE	5.87E+05	4.63E-07	9.75E+04	5.7E+00	1.4E-02	2.0E-01	1.4E-02	8.1E-01	5.7E+00	2.0E+01	5.7E+00	7.9E+01
#BENZO(b)FLUORANTHENE	5.99E+05	6.59E-07	9.95E+04	5.4E+00	9.2E-02	9.2E-02	7.5E-01	7.5E-01	9.2E+00	9.2E+00	7.5E+01	7.5E+01
#BENZO(g,h,i)PERYLENE	1.60E+06	1.44E-07	2.66E+05	2.5E+00	1.0E-01	1.3E-01	1.0E-01	1.3E-01	2.7E+01	3.5E+01	2.7E+01	3.5E+01
#BENZO(k)FLUORANTHENE	5.87E+05	5.85E-07	9.75E+04	2.8E+00	4.0E-01	4.0E-01	4.0E-01	4.0E-01	3.9E+01	3.9E+01	3.9E+01	3.9E+01
BERYLLIUM					2.7E+00	4.0E+00	2.7E+00	4.3E+01	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
#BIPHENYL, 1,1-	5.13E+03	3.17E-04	8.53E+02	2.1E+02	5.0E-01	5.0E-01	5.0E+00	5.0E+00	2.1E+02	2.1E+02	2.1E+02	2.1E+02
BIS(2-CHLOROETHYL)ETHER	3.20E+01	1.71E-05	5.42E+00	5.0E+03	1.2E-02	1.2E-02	6.1E+01	1.3E+02	6.4E-05	6.4E-05	3.3E-01	7.2E-01
BIS(2-CHLOROISOPROPYL)ETHER	6.10E+01	1.13E-04	1.08E+01	7.9E+02	3.2E-01	3.2E-01	6.1E+01	3.2E+03	3.5E-03	3.5E-03	6.6E-01	3.5E+01
BIS(2-ETHYLHEXYL)PHTHALATE	1.20E+05	2.68E-07	1.99E+04	1.9E+02	6.0E+00	6.0E+00	3.2E+01	3.2E+01	1.9E+02	1.9E+02	6.4E+02	6.4E+02
BORON					7.3E+03	7.3E+03	7.3E+03	7.3E+03	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
BROMODICHLOROMETHANE	3.18E+01	2.12E-03	1.84E+01	9.3E+02	1.2E-01	1.2E-01	9.8E+01	9.8E+01	2.2E-03	2.2E-03	1.8E+00	1.8E+00
BROMOFORM	3.18E+01	5.37E-04	8.61E+00	9.1E+02	8.0E+01	8.0E+01	3.2E+03	5.1E+03	6.9E-01	6.9E-01	2.8E+01	4.4E+01
BROMOMETHANE	1.32E+01	6.34E-03	4.16E+01	3.5E+03	8.7E+00	8.7E+00	1.6E+02	4.6E+02	3.6E-01	3.6E-01	6.6E+00	1.9E+01
CADMIUM					3.0E+00	3.0E+00	3.0E+00	3.0E+00	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
CARBON TETRACHLORIDE	4.39E+01	2.68E-02	1.74E+02	4.5E+02	5.0E+00	5.0E+00	9.8E+00	9.8E+01	8.7E-01	8.7E-01	1.7E+00	1.7E+01
#CHLORDANE (TECHNICAL)	8.67E+04	4.88E-05	1.44E+04	2.9E+01	4.0E-03	9.0E-02	4.0E-03	9.0E-02	2.9E+01	2.9E+01	2.9E+01	2.9E+01
CHLOROANILINE, p-	1.13E+02	1.15E-06	1.87E+01	3.0E+03	3.4E-01	3.4E-01	5.0E+00	5.0E+00	6.3E-03	6.3E-03	9.4E-02	9.4E-02
CHLOROBENZENE	2.34E+02	3.17E-03	5.85E+01	7.6E+02	2.5E+01	5.0E+01	2.5E+01	1.6E+02	1.5E+00	2.9E+00	1.5E+00	9.4E+00
CHLOROETHANE	2.18E+01	1.10E-02	7.17E+01	2.1E+03	1.6E+01	1.6E+01	1.6E+02	1.6E+02	1.1E+00	1.1E+00	1.1E+01	1.1E+01
CHLOROFORM	3.18E+01	3.66E-03	2.80E+01	2.5E+03	7.0E+01	7.0E+01	9.4E+01	9.4E+01	2.0E+00	2.0E+00	2.6E+00	2.6E+00
CHLOROMETHANE	1.32E+01	8.78E-03	5.67E+01	1.3E+03	1.8E+00	1.8E+00	3.7E+02	3.7E+02	1.0E-01	1.0E-01	2.1E+01	2.1E+01
CHLOROPHENOL, 2-	3.06E+02	1.12E-05	5.09E+01	5.5E+04	1.8E-01	1.8E-01	1.8E+00	1.8E+00	9.2E-03	9.2E-03	9.2E-02	9.2E-02
CHROMIUM (Total)					7.4E+01	1.0E+02	7.4E+01	5.7E+02	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
CHROMIUM III					7.4E+01	5.7E+02	7.4E+01	5.7E+02	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
CHROMIUM VI					1.1E+01	1.3E+01	1.1E+01	1.6E+01	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
#CHRYSENE	1.81E+05	5.12E-06	3.00E+04	2.2E+00	3.5E-01	1.0E+00	3.5E-01	1.0E+00	1.0E+01	3.0E+01	1.0E+01	3.0E+01
COBALT					3.0E+00	3.0E+00	3.0E+00	3.0E+00	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
COPPER					2.9E+00	2.9E+00	2.9E+00	2.9E+00	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
CYANIDE (Free)					1.0E+00	1.0E+00	1.0E+00	1.0E+00	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	8.91E+01	6.34E-08	1.48E+01	3.8E+01	6.1E-01	6.1E-01	1.9E+02	1.4E+03	9.0E-03	9.0E-03	2.8E+00	2.1E+01
DALAPON	3.20E+00	9.02E-08	5.32E-01	6.0E+04	2.0E+02	2.0E+02	3.0E+02	3.0E+03	1.1E-01	1.1E-01	1.6E-01	1.6E+00
#DIBENZO(a,h)ANTHTRACENE	1.91E+06	1.22E-07	3.17E+05	1.2E+01	9.2E-03	9.2E-03	5.2E-01	5.2E-01	1.2E+01	1.2E+01	1.6E+02	1.6E+02
DIBROMO,1,2- CHLOROPROPANE,3-	1.31E+02	1.46E-04	2.26E+01	1.1E+03	4.0E-02	4.0E-02	4.0E-02	4.0E-02	9.0E-04	9.0E-04	9.0E-04	9.0E-04
DIBROMOCHLOROMETHANE	3.18E+01	7.80E-04	1.01E+01	8.0E+02	1.6E-01	1.6E-01	3.4E+02	3.4E+02	1.6E-03	1.6E-03	3.4E+00	3.4E+00
DIBROMOETHANE, 1,2-	3.18E+01	6.59E-04	9.37E+00	1.2E+03	4.0E-02	4.0E-02	1.6E+01	1.6E+01	3.7E-04	3.7E-04	1.5E-01	1.5E-01
DICHLOROBENZENE, 1,2-	3.83E+02	1.90E-03	7.54E+01	1.9E+02	1.0E+01	1.0E+01	1.4E+01	1.0E+02	7.5E-01	7.5E-01	1.1E+00	7.5E+00
DICHLOROBENZENE, 1,3-	6.17E+02	1.90E-03	1.14E+02	6.0E+02	5.0E+00	5.0E+00	6.5E+01	3.7E+02	5.7E-01	5.7E-01	7.4E+00	4.2E+01
DICHLOROBENZENE, 1,4-	3.75E+02	2.41E-03	7.72E+01	1.9E+02	5.0E+00	5.0E+00	1.5E+01	1.1E+02	3.9E-01	3.9E-01	1.2E+00	8.5E+00
DICHLOROBENZIDINE, 3,3-	3.19E+03	5.12E-11	5.30E+02	6.0E+01	1.5E-01	1.5E-01	2.5E+02	2.5E+02	7.9E-02	7.9E-02	1.3E+02	1.3E+02
#DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.18E+05	6.59E-06	1.95E+04	6.3E+01	1.0E-03	2.8E-01	1.0E-03	6.0E-01	6.3E+01	6.3E+01	6.3E+01	6.3E+01
#DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.18E+05	4.15E-05	1.95E+04	2.8E+01	1.0E-03	2.0E-01	1.0E-03	1.1E+00	2.8E+01	2.8E+01	2.8E+01	2.8E+01
#DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.69E+05	8.29E-06	2.80E+04	5.6E+00	1.0E-03	1.3E-02	1.0E-03	1.3E-02	5.6E+00	5.6E+00	5.6E+00	5.6E+00
DICHLOROETHANE, 1,1-	3.18E+01	5.61E-03	4.01E+01	1.7E+03	2.4E+00	2.4E+00	4.7E+01	4.7E+01	9.7E-02	9.7E-02	1.9E+00	1.9E+00

TABLE E. SOIL ACTION LEVELS FOR LEACHING CONCERNS

					Target Groundwater Concentrations				Soil Leaching Action Levels			
					Drinking Water IS Threatened		Drinking Water NOT Threatened		Drinking Water IS Threatened		Drinking Water NOT Threatened	
CONTAMINANT	Organic Carbon Coefficient (Koc) (cm^3/g)	Henry's Law Constant (H) (atm-m^3/mol)	Dilution/ Atenuation Factor (DAF)	Saturation Limit (mg/kg)	Target Groundwater Concentration (Surface Water Within 150m; Table D-1a) (ug/L)	Target Groundwater Concentration (Surface Water NOT Within 150m; Table D-1b) (ug/L)	Target Groundwater Concentration (Surface Water Within 150m; Table D-1c) (ug/L)	Target Groundwater Concentration (Surface Water NOT Within 150m; Table D-1d) (ug/L)	Soil Leaching Action Level (Surface Water Within 150m) (mg/kg)	Soil Leaching Action Level (Surface Water NOT Within 150m) (mg/kg)	Soil Leaching Action Level (Surface Water Within 150m) (mg/kg)	Soil Leaching Action Level (Surface Water NOT Within 150m) (mg/kg)
DICHLOROETHANE, 1,2-	3.96E+01	1.17E-03	1.38E+01	1.8E+03	1.5E-01	1.5E-01	1.6E+02	1.6E+02	2.1E-03	2.1E-03	2.2E+00	2.2E+00
DICHLOROETHYLENE, 1,1-	3.18E+01	2.68E-02	1.72E+02	1.2E+03	7.0E+00	7.0E+00	2.5E+01	3.9E+03	1.2E+00	1.2E+00	4.3E+00	6.7E+02
DICHLOROETHYLENE, Cis 1,2-	3.96E+01	4.15E-03	3.23E+01	1.3E+03	7.0E+01	7.0E+01	5.9E+02	1.1E+03	2.3E+00	2.3E+00	1.9E+01	3.5E+01
DICHLOROETHYLENE, Trans 1,2-	3.96E+01	9.27E-03	6.41E+01	1.4E+03	1.0E+02	1.0E+02	5.9E+02	2.6E+03	6.4E+00	6.4E+00	3.8E+01	1.7E+02
DICHLOROPHENOL, 2,4-	4.92E+02	2.20E-06	8.17E+01	1.4E+04	3.0E-01	3.0E-01	3.0E+00	3.0E+00	2.5E-02	2.5E-02	2.5E-01	2.5E-01
DICHLOROPHENOXYACETIC ACID (2,4-D)	2.96E+01	3.41E-08	4.91E+00	1.9E+02	4.0E+01	7.0E+01	4.0E+01	2.0E+02	2.0E-01	3.4E-01	2.0E-01	9.8E-01
DICHLOROPROPANE, 1,2-	6.07E+01	2.93E-03	2.82E+01	1.4E+03	5.0E+00	5.0E+00	1.0E+02	1.0E+02	1.4E-01	1.4E-01	2.8E+00	2.8E+00
DICHLOROPROPENE, 1,3-	7.22E+01	3.66E-03	3.47E+01	1.6E+03	4.3E-01	4.3E-01	1.2E+02	2.6E+02	1.5E-02	1.5E-02	4.2E+00	9.0E+00
#DIELDRIN	2.01E+04	1.00E-05	3.34E+03	3.0E+01	1.9E-03	4.2E-03	1.9E-03	7.1E-01	3.0E+01	3.0E+01	3.0E+01	3.0E+01
DIETHYLPHTHALATE	1.05E+02	6.10E-07	1.74E+01	7.9E+02	1.5E+00	9.4E+02	1.5E+00	9.4E+02	2.6E-02	1.6E+01	2.6E-02	1.6E+01
DIMETHYLPHENOL, 2,4-	4.92E+02	9.51E-07	8.17E+01	2.4E+04	1.1E+02	1.2E+02	1.1E+02	2.7E+02	9.0E+00	9.9E+00	9.0E+00	2.2E+01
DIMETHYLPHTHALATE	1.40E+02	1.05E-07	2.32E+01	4.7E+03	1.5E+00	9.4E+02	1.5E+00	9.4E+02	3.5E-02	2.2E+01	3.5E-02	2.2E+01
DINITROBENZENE, 1,3-	3.52E+02	4.88E-08	5.84E+01	1.2E+03	3.7E+00	3.7E+00	3.0E+01	1.1E+02	2.1E-01	2.1E-01	1.8E+00	6.4E+00
DINITROPHENOL, 2,4-	4.61E+02	8.54E-08	7.65E+01	8.0E+03	7.3E+01	7.3E+01	7.5E+01	2.3E+02	5.6E+00	5.6E+00	5.7E+00	1.8E+01
DINITROTOLUENE, 2,4- (2,4-DNT)	5.87E+02	5.37E-08	9.74E+01	9.8E+02	2.2E-01	2.2E-01	4.4E+01	1.1E+02	2.1E-02	2.1E-02	4.3E+00	1.1E+01
DINITROTOLUENE, 2,6- (2,6-DNT)	5.87E+02	7.56E-07	9.74E+01	1.3E+03	3.7E+01	3.7E+01	4.4E+01	1.1E+02	3.6E+00	3.6E+00	4.3E+00	1.1E+01
DIOXANE, 1,4-	2.60E+00	4.88E-06	4.62E-01	1.2E+05	6.7E-01	6.7E-01	5.0E+04	5.0E+04	3.1E-04	3.1E-04	2.3E+01	2.3E+01
#DIOXINS (TEQ)	2.49E+05	2.20E-06	4.14E+04	1.8E-01	5.0E-06	3.0E-05	5.0E-06	3.0E-03	1.8E-01	1.8E-01	1.8E-01	1.8E-01
DIURON	1.09E+02	5.12E-10	1.81E+01	3.2E+01	6.0E+01	7.3E+01	6.0E+01	2.0E+02	1.1E+00	1.3E+00	1.1E+00	3.6E+00
#ENDOSULFAN	6.76E+03	6.59E-05	1.12E+03	1.8E+01	8.7E-03	3.4E-02	8.7E-03	3.4E-02	1.8E+01	1.8E+01	1.8E+01	1.8E+01
#ENDRIN	2.01E+04	6.34E-06	3.33E+03	3.0E+01	2.3E-03	3.7E-02	2.3E-03	3.7E-02	3.0E+01	3.0E+01	3.0E+01	3.0E+01
ETHANOL	3.09E-01	6.29E-06	9.03E-02	1.0E+05	5.0E+04	5.0E+04	5.0E+04	5.0E+04	4.5E+00	4.5E+00	4.5E+00	4.5E+00
ETHYLBENZENE	4.46E+02	7.80E-03	1.22E+02	4.8E+02	3.0E+01	3.0E+01	2.9E+02	3.0E+02	3.7E+00	3.7E+00	3.6E+01	3.7E+01
#FLUORANTHENE	5.55E+04	8.78E-06	9.20E+03	8.7E+01	8.0E+00	1.3E+02	8.0E+00	1.3E+02	8.7E+01	1.2E+03	8.7E+01	1.2E+03
#FLUORENE	9.16E+03	9.51E-05	1.52E+03	1.0E+02	3.9E+00	2.4E+02	3.9E+00	3.0E+02	1.0E+02	3.7E+02	1.0E+02	4.6E+02
GLYPHOSATE	1.00E+00	4.15E-19	1.66E-01	1.3E+03	6.5E+01	6.0E+02	6.5E+01	6.0E+02	1.1E-02	1.0E-01	1.1E-02	1.0E-01
#HEPTACHLOR	4.13E+04	2.93E-04	6.85E+03	4.5E+01	3.6E-03	5.3E-02	3.6E-03	5.3E-02	4.5E+01	4.5E+01	4.5E+01	4.5E+01
#HEPTACHLOR EPOXIDE	1.01E+04	2.10E-05	1.68E+03	1.2E+01	3.6E-03	5.3E-02	3.6E-03	5.3E-02	1.2E+01	1.2E+01	1.2E+01	1.2E+01
#HEXACHLOROBENZENE	6.20E+03	1.71E-03	1.04E+03	2.3E-01	1.0E+00	1.0E+00	3.1E+00	3.1E+00	1.0E+00	1.0E+00	3.2E+00	3.2E+00
HEXACHLOROBUTADIENE	8.45E+02	1.02E-02	2.04E+02	1.7E+01	8.6E-01	8.6E-01	4.7E+00	1.1E+01	1.8E-01	1.8E-01	9.5E-01	2.2E+00
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	2.81E+03	5.12E-06	4.66E+02	1.4E+02	8.0E-02	1.6E-01	8.0E-02	1.6E-01	3.7E-02	7.5E-02	3.7E-02	7.5E-02
HEXACHLOROETHANE	1.97E+02	3.90E-03	5.69E+01	6.6E+01	4.8E+00	4.8E+00	1.2E+01	1.0E+02	2.7E-01	2.7E-01	6.8E-01	5.7E+00
HEXAZINONE	1.29E+02	2.24E-12	2.14E+01	2.9E+04	1.2E+03	1.2E+03	5.0E+03	5.0E+04	2.6E+01	2.6E+01	1.1E+02	1.1E+03
#INDENO(1,2,3-cd)PYRENE	1.95E+06	3.41E-07	3.24E+05	2.2E+00	9.2E-02	9.2E-02	9.5E-02	9.5E-02	3.0E+01	3.0E+01	3.1E+01	3.1E+01
ISOPHORONE	6.52E+01	6.59E-06	1.09E+01	5.9E+03	7.1E+01	7.1E+01	1.3E+02	4.3E+03	7.7E-01	7.7E-01	1.4E+00	4.7E+01
LEAD					5.6E+00	1.5E+01	5.6E+00	2.9E+01	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
MERCURY					2.5E-02	2.0E+00	2.5E-02	2.1E+00	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
#METHOXYCHLOR	2.69E+04	2.02E-07	4.46E+03	1.6E+01	3.0E-02	3.0E-02	3.0E-02	3.0E-02	1.6E+01	1.6E+01	1.6E+01	1.6E+01
METHYL ETHYL KETONE	4.51E+00	5.61E-05	1.10E+00	2.8E+04	7.1E+03	7.1E+03	1.4E+04	1.4E+04	7.7E+00	7.7E+00	1.5E+01	1.5E+01
METHYL ISOBUTYL KETONE	1.26E+01	1.37E-04	2.94E+00	3.4E+03	1.7E+02	1.7E+02	1.7E+02	1.7E+02	5.0E-01	5.0E-01	5.0E-01	5.0E-01
METHYL MERCURY					3.0E-03	3.0E-03	3.0E-03	3.0E-03	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
METHYL TERT BUTYL ETHER	1.16E+01	5.85E-04	5.56E+00	8.9E+03	5.0E+00	5.0E+00	1.8E+03	1.8E+03	2.8E-02	2.8E-02	1.0E+01	1.0E+01
METHYLENE CHLORIDE	2.17E+01	3.17E-03	2.33E+01	3.3E+03	4.8E+00	4.8E+00	2.2E+03	3.9E+03	1.1E-01	1.1E-01	5.1E+01	9.2E+01
METHYLNAPHTHALENE, 1-	2.26E+03	5.12E-04	3.78E+02	3.4E+02	2.1E+00	4.7E+00	2.1E+00	1.0E+02	7.9E-01	1.8E+00	7.9E-01	3.8E+01
METHYLNAPHTHALENE, 2-	2.48E+03	5.12E-04	4.15E+02	3.7E+02	2.1E+00	1.0E+01	2.1E+00	1.0E+02	8.7E-01	4.1E+00	8.7E-01	4.1E+01
MOLYBDENUM					1.8E+02	1.8E+02	2.4E+02	2.4E+02	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
NAPHTHALENE	1.54E+03	4.39E-04	2.59E+02	2.9E+02	1.7E+01	1.7E+01	2.4E+01	2.1E+02	4.4E+00	4.4E+00	6.2E+00	5.4E+01
NICKEL					5.0E+00	5.0E+00	5.0E+00	5.0E+00	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
NITROBENZENE	2.26E+02	2.39E-05	3.77E+01	3.0E+03	1.2E-01	1.2E-01	6.0E+01	2.0E+03	4.6E-03	4.6E-03	2.3E+00	7.5E+01
NITROGLYCERIN	1.16E+02	9.76E-08	1.93E+01	1.1E+03	3.7E+00	3.7E+00	1.4E+02	1.4E+02	7.0E-02	7.0E-02	2.7E+00	2.7E+00
NITROTOLUENE, 2-	3.71E+02	1.24E-05	6.17E+01	1.5E+03	6.2E-02	6.2E-02	1.0E+03	7.5E+03	3.8E-03	3.8E-03	6.2E+01	4.6E+02
NITROTOLUENE, 3-	3.63E+02	2.39E-05	6.04E+01	9.5E+02	1.2E+02	1.2E+02	3.8E+02	3.8E+03	7.3E+00	7.3E+00	2.3E+01	2.3E+02
NITROTOLUENE, 4-	3.63E+02	5.61E-06	6.03E+01	1.0E+03	4.2E+00	4.2E+00	1.6E+03	3.3E+03	2.5E-01	2.5E-01	9.6E+01	2.0E+02
PENTACHLOROPHENOL	4.96E+03	2.44E-08	8.23E+02	4.2E+02	1.0E+00	1.0E+00	7.9E+00	1.3E+01	8.2E-01	8.2E-01	6.5E+00	1.1E+01
PENTAERYTHRITOLTETRANITRATE (PETN)	1.51E+02	1.20E-11	2.51E+01	4.3E+01	1.7E+01	1.7E+01	2.2E+04	2.2E+04	4.2E-01	4.2E-01	5.4E+02	5.4E+02
PERCHLORATE					2.6E+01	2.6E+01	6.0E+02	6.0E+02	7.0E-03	7.0E-03	1.2E+00	1.2E+00
#PHENANTHRENE	1.40E+04	3.93E-05	2.32E+03	6.9E+01	4.6E+00	2.4E+02	4.6E+00	3.0E+02	6.9E+01	5.7E+02	6.9E+01	7.0E+02

TABLE E. SOIL ACTION LEVELS FOR LEACHING CONCERNS

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

TABLE E. SOIL ACTION LEVELS FOR LEACHING CONCERNS

					Target Groundwater Concentrations				Soil Leaching Action Levels			
					Drinking Water IS Threatened		Drinking Water NOT Threatened		Drinking Water IS Threatened		Drinking Water NOT Threatened	
CONTAMINANT	Organic Carbon Coefficient (Koc) (cm^3/g)	Henry's Law Constant (H) ($atm\text{-}m^3/mol$)	Dilution/ Atenuation Factor (DAF)	Saturation Limit (mg/kg)	Target Groundwater Concentration (Surface Water Within 150m; Table D-1a) (ug/L)	Target Groundwater Concentration (Surface Water NOT Within 150m; Table D-1b) (ug/L)	Target Groundwater Concentration (Surface Water Within 150m; Table D-1c) (ug/L)	Target Groundwater Concentration (Surface Water NOT Within 150m; Table D-1d) (ug/L)	Soil Leaching Action Level (Surface Water Within 150m) (mg/kg)	Soil Leaching Action Level (Surface Water NOT Within 150m) (mg/kg)	Soil Leaching Action Level (Surface Water Within 150m) (mg/kg)	Soil Leaching Action Level (Surface Water NOT Within 150m) (mg/kg)
VINYL CHLORIDE	2.17E+01	2.68E-02	1.70E+02	3.9E+03	2.0E+00	2.0E+00	6.2E+01	6.2E+01	3.4E-01	3.4E-01	1.1E+01	1.1E+01
XYLENES	3.75E+02	7.07E-03	1.06E+02	3.9E+02	2.0E+01	2.0E+01	1.0E+02	1.0E+03	2.1E+00	2.1E+00	1.1E+01	1.1E+02
ZINC					2.2E+01	2.2E+01	2.2E+01	2.2E+01	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)

Notes:

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

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

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

#: Leaching model used considered to be excessively conservative for highly sorptive chemicals. For chemicals with koc values greater than 5,000 cm3/g, theoretical soil saturation level ("sat") used in place of leaching model action level if higher (see text). Soil saturation levels calculated using equation presented in USEPA Regional action levels guidance (USEPA 2011, see Appendix 2).

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

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

Physio-Chemical constants for TPH (gasolines and middle distillates) based on constants developed for C11 to C22 aromatic carbon range fraction by Massachusetts DEP

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

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

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

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

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

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

Soil Category	Criteria	Gross Contamination Action Level (mg/kg)
Surface Soils		
Unrestricted Land Use (includes Residential, Schools, Parkland, etc.)	Odor Index $\geq$ 100 OR no Odor Index and Vapor Pressure $\geq$ 1 Torr OR no data	100
	0.1 $\leq$ Odor Index < 100 OR no Odor Index and Vapor Pressure < 1 Torr	500
	Odor Index < 0.1 OR non-odorous chemical	1000
Industrial/Commercial Land Use Only	Odor Index $\geq$ 100 OR no Odor Index and Vapor Pressure $\geq$ 1 Torr OR no data	500
	0.1 $\leq$ Odor Index < 100 OR no Odor Index and Vapor Pressure < 1 Torr	1000
	Odor Index < 0.1 OR non-odorous chemical	2500
Subsurface Soils		
Unrestricted Land Use (includes Residential, Schools, Parkland, etc.)	Odor Index $\geq$ 100 OR no Odor Index and Vapor Pressure $\geq$ 1 Torr OR no data	500
	0.1 $\leq$ Odor Index < 100 OR no Odor Index and Vapor Pressure < 1 Torr	1000
	Odor Index < 0.1 OR non-odorous chemical	2500
Industrial/Commercial Land Use Only	Odor Index $\geq$ 100 OR no Odor Index and Vapor Pressure $\geq$ 1 Torr OR no data	1000
	0.1 $\leq$ Odor Index < 100 OR no Odor Index and Vapor Pressure < 1 Torr	2500
	Odor Index < 0.1 OR non-odorous chemical	5000

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

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

CONTAMINANT	[2]Final Unrestricted Land Use Action Level	Final Industrial/ Commercial Land Use Action Level	[2]Raw Unrestricted Action Level	Raw Industrial/ Commercial Action Level	Soil Saturation Limit (mg/kg)	Vapor Pressure (VP) (Torr @ 20-30 °C)	50 Percentile Odor Recognition Threshold (ORT) (ug/m^3)	50 Percentile Odor Recognition Threshold (ORT) (ppm-v)	Odor Index
ACENAPHTHENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	4.5E-03	5.13E+02	8.00E-02	5.63E-02
ACENAPHTHYLENE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	2.9E-02	-	-	-
ACETONE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	1.2E+05	2.70E+02	3.09E+04	1.30E+01	2.08E+01
ALDRIN	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.3E-05	2.63E+02	1.70E-02	1.35E-03
AMETRYN	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	2.74E-06	-	-	-
AMINO,2- DINITROTOLUENE,4,6-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.07E-04	-	-	-
AMINO,4- DINITROTOLUENE,2,6-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.07E-04	-	-	-
ANTHRACENE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.7E-05	-	-	-
ANTIMONY	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-
ARSENIC	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-
ATRAZINE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	2.89E-07	-	-	-
BARIUM	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-
BENZENE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	1.8E+03	9.50E+01	4.89E+03	1.50E+00	6.33E+01
BENZO(a)ANTHRACENE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	2.2E-08	-	-	-
BENZO(a)PYRENE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	5.6E-09	-	-	-
BENZO(b)FLUORANTHENE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	5.0E-07	-	-	-
BENZO(g,h,i)PERYLENE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.1E-10	-	-	-
BENZO(k)FLUORANTHENE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	9.6E-11	-	-	-
BERYLLIUM	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-
BIPHENYL, 1,1-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	5.00E-03	6.00E+01	9.50E-03	5.26E-01
BIS(2-CHLOROETHYL)ETHER	5.0E+02	1.0E+03	5.0E+02	1.0E+03	5.0E+03	7.1E-01	2.87E+02	4.9E-02	1.45E+01
BIS(2-CHLOROISOPROPYL)ETHER	5.0E+02	7.9E+02	5.0E+02	1.0E+03	7.9E+02	8.5E-01	2.24E+03	3.20E-01	2.66E+00
BIS(2-ETHYLHEXYL)PHTHALATE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	6.2E-08	-	-	-
BORON	1.0E+02	5.0E+02	1.0E+02	5.0E+02	NA	-	-	-	-
BROMODICHLOROMETHANE	9.3E+02	9.3E+02	1.0E+03	2.5E+03	9.3E+02	5.00E+01	1.10E+07	1.68E+03	2.98E-02
BROMOFORM	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	5.60E+00	1.35E+04	1.30E+00	4.31E+00
BROMOMETHANE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	3.5E+03	1.42E+03	8.00E+04	2.00E+01	7.10E+01
CADMIUM	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-
CARBON TETRACHLORIDE	4.5E+02	4.5E+02	5.0E+02	1.0E+03	4.5E+02	1.13E+02	6.30E+04	1.00E+01	1.13E+01
CHLORDANE (TECHNICAL)	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.0E-05	8.40E+00	4.92E-04	2.03E-02
CHLOROANILINE, p-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.0E-05	-	-	-
CHLOROBENZENE	5.0E+02	7.6E+02	5.0E+02	1.0E+03	7.6E+02	1.18E+01	1.00E+03	2.20E-01	5.36E+01
CHLOROETHANE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	2.1E+03	1.01E+03	3.80E+05	1.40E+02	7.20E+00
CHLOROFORM	5.0E+02	1.0E+03	5.0E+02	1.0E+03	2.5E+03	1.60E+02	4.22E+05	8.50E+01	1.88E+00
CHLOROMETHANE	1.0E+02	5.0E+02	1.0E+02	5.0E+02	1.3E+03	4.30E+03	-	-	-
CHLOROPHENOL, 2-	1.0E+02	5.0E+02	1.0E+02	5.0E+02	5.5E+04	1.42E+00	1.90E+01	3.60E-03	3.94E+02
CHROMIUM (Total)	-	-	-	-	-	-	-	-	-
CHROMIUM III	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-
CHROMIUM VI	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-
CHRYSENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	6.3E-07	-	-	-
COBALT	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-
COPPER	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-
CYANIDE (Free)	1.0E+02	5.0E+02	1.0E+02	5.0E+02	NA	6.20E+02	6.52E+02	5.80E-01	1.07E+03
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	4.10E-09	-	-	-
DALAPON	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	6.70E-01	-	-	-
DIBENZO(a,h)ANTHTRACENE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.0E-10	-	-	-
DIBROMO-3-CHLOROPROPANE, 1,2-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	1.1E+03	8.00E-01	-	-	-

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

CONTAMINANT	[2]Final Unrestricted Land Use Action Level	Final Industrial/ Commercial Land Use Action Level	[2]Raw Unrestricted Action Level	Raw Industrial/ Commercial Action Level	Soil Saturation Limit (mg/kg)	Vapor Pressure (VP) (Torr @ 20-30 °C)	50 Percentile Odor Recognition Threshold (ORT) (ug/m^3)	50 Percentile Odor Recognition Threshold (ORT) (ppm-v)	Odor Index
DIBROMOCHLOROMETHANE	1.0E+02	5.0E+02	1.0E+02	5.0E+02	NA	7.60E+01	-	-	-
DIBROMOETHANE, 1,2-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.20E+01	2.00E+05	2.60E+01	4.62E-01
DICHLOROBENZENE, 1,2-	1.9E+02	1.9E+02	1.0E+03	2.5E+03	1.9E+02	1.50E+00	3.05E+05	5.00E+01	3.00E-02
DICHLOROBENZENE, 1,3-	1.0E+02	5.0E+02	1.0E+02	5.0E+02	6.0E+02	2.30E+00	-	-	-
DICHLOROBENZENE, 1,4-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.80E+00	1.10E+03	1.80E-01	1.00E+01
DICHLOROBENZIDINE, 3,3-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	4.5E-09	-	-	-
DICHLORODIPHENYLDICHLOROETHANE (DDD)	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.0E-06	-	-	-
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	6.5E-06	-	-	-
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	5.5E-06	-	-	-
DICHLOROETHANE, 1,1-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	1.7E+03	2.34E+02	1.25E+05	3.00E+01	7.80E+00
DICHLOROETHANE, 1,2-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	1.8E+03	7.90E+01	2.42E+03	5.90E-01	1.34E+02
DICHLOROETHYLENE, 1,1-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	1.2E+03	5.91E+02	2.00E+06	5.00E+02	1.18E+00
DICHLOROETHYLENE, Cis 1,2-	1.0E+02	5.0E+02	1.0E+02	5.0E+02	1.3E+03	2.15E+02	-	-	-
DICHLOROETHYLENE, Trans 1,2-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	1.4E+03	3.31E+02	6.73E+04	1.70E+01	1.95E+01
DICHLOROPHENOL, 2,4-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	6.7E-02	1.40E+03	2.10E-01	3.19E-01
DICHLOROPHENOXYACETIC ACID (2,4-D)	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	8.25E-05	-	-	-
DICHLOROPROPANE, 1,2-	1.0E+02	5.0E+02	1.0E+02	5.0E+02	1.4E+03	4.20E+01	1.19E+03	2.50E-01	1.68E+02
DICHLOROPROPENE, 1,3-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	1.6E+03	4.30E+01	4.16E+03	1.00E+00	4.30E+01
DIELDRIN	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.8E-08	-	-	-
DIETHYLPHTHALATE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	3.5E-04	-	-	-
DIMETHYLPHENOL, 2,4-	1.0E+02	5.0E+02	1.0E+02	5.0E+02	NA	9.8E-02	1.00E+00	1.97E-04	4.97E+02
DIMETHYLPHTHALATE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.7E-03	-	-	-
DINITROBENZENE, 1,3-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	9.00E-04	-	-	-
DINITROPHENOL, 2,4-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.5E-05	-	-	-
DINITROTOLUENE, 2,4- (2,4-DNT)	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.47E-04	-	-	-
DINITROTOLUENE, 2,6- (2,6-DNT)	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	5.67E-04	-	-	-
DIOXANE, 1,4-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	3.70E+01	6.12E+05	1.70E+02	2.18E-01
DIOXINS (TEQ)	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.50E-09	-	-	-
DIURON	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	6.90E-08	-	-	-
ENDOSULFAN	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.0E-05	-	-	-
ENDRIN	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	2.0E-07	-	-	-
ETHANOL	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	5.65E+01	1.92E+04	1.00E+01	5.65E+00
ETHYLBENZENE	4.8E+02	4.8E+02	5.0E+02	1.0E+03	4.8E+02	1.00E+01	2.00E+03	4.50E-01	2.22E+01
FLUORANTHENE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	5.0E-06	-	-	-
FLUORENE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	3.2E-04	-	-	-
GLYPHOSATE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	4.30E-10	-	-	-
HEPTACHLOR	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	3.0E-04	3.00E+02	2.00E-02	1.50E-02
HEPTACHLOR EPOXIDE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.6E-06	3.00E+02	1.90E-02	1.37E-04
HEXACHLOROBENZENE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.1E-05	-	-	-
HEXACHLOROBUTADIENE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.50E-01	1.20E+04	1.10E+00	1.36E-01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	9.4E-06	-	-	-
HEXACHLOROETHANE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	2.1E-01	-	-	-
HEXAZINONE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	2.25E-07	-	-	-
INDENO(1,2,3-cd)PYRENE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.0E-06	-	-	-
ISOPHORONE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	4.38E-01	-	-	-
LEAD	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-
MERCURY	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	2.0E-03	-	-	-

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

CONTAMINANT	[2]Final Unrestricted Land Use Action Level	Final Industrial/ Commercial Land Use Action Level	[2]Raw Unrestricted Action Level	Raw Industrial/ Commercial Action Level	Soil Saturation Limit (mg/kg)	Vapor Pressure (VP) (Torr @ 20-30 °C)	50 Percentile Odor Recognition Threshold (ORT) (ug/m^3)	50 Percentile Odor Recognition Threshold (ORT) (ppm-v)	Odor Index
METHOXYCHLOR	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.4E-06	-	-	-
METHYL ETHYL KETONE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	2.8E+04	1.00E+02	3.20E+04	1.10E+01	9.09E+00
METHYL ISOBUTYL KETONE	1.0E+02	5.0E+02	1.0E+02	5.0E+02	3.4E+03	1.00E+01	4.20E+02	1.00E-01	1.00E+02
METHYL MERCURY	1.0E+02	5.0E+02	1.0E+02	5.0E+02	NA	-	-	-	-
METHYL TERT BUTYL ETHER	1.0E+02	5.0E+02	1.0E+02	5.0E+02	8.9E+03	2.45E+02	5.30E+02	1.30E-01	1.88E+03
METHYLENE CHLORIDE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	3.3E+03	4.29E+02	5.60E+05	1.60E+02	2.68E+00
METHYLNAPHTHALENE, 1-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	6.8E-02	6.80E+01	1.15E-02	5.91E+00
METHYLNAPHTHALENE, 2-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	6.8E-02	6.80E+01	1.15E-02	5.91E+00
MOLYBDENUM	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-
NAPHTHALENE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	8.2E-02	4.40E+02	8.40E-02	9.76E-01
NICKEL	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-
NITROBENZENE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	3.0E+03	2.45E-01	-	-	-
NITROGLYCERIN	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	4.00E-02	-	-	-
NITROTOLUENE, 2-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	2.09E-01	-	-	-
NITROTOLUENE, 3-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	2.04E-01	-	-	-
NITROTOLUENE, 4-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	4.90E-03	-	-	-
PENTACHLOROPHENOL	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.1E-04	-	-	-
PENTAERYTHRITOLTETRANITRATE (PETN)	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	8.38E-04	-	-	-
PERCHLORATE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-
PHENANTHRENE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	9.6E-04	5.50E+01	7.42E-03	1.29E-01
PHENOL	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	3.50E-01	1.56E+02	4.00E-02	8.75E+00
POLYCHLORINATED BIPHENYLS (PCBs)	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	4.9E-04 to 6.7E-03	-	-	-
PROPICONAZOLE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.00E-06	-	-	-
PYRENE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	2.5E-06	-	-	-
SELENIUM	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-
SILVER	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-
SIMAZINE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	2.21E-08	-	-	-
STYRENE	5.0E+02	8.7E+02	5.0E+02	1.0E+03	8.7E+02	5.00E+00	1.36E+03	3.00E-01	1.67E+01
TERBACIL	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	2.76E-07	-	-	-
tert-BUTYL ALCOHOL	1.0E+02	5.0E+02	1.0E+02	5.0E+02	3.2E+05	4.20E+01	-	-	-
TETRACHLOROETHANE, 1,1,1,2-	1.0E+02	5.0E+02	1.0E+02	5.0E+02	6.8E+02	1.20E+01	-	-	-
TETRACHLOROETHANE, 1,1,2,2-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	1.9E+03	4.00E+00	1.05E+04	1.50E+00	2.67E+00
TETRACHLOROETHYLENE	1.7E+02	1.7E+02	5.0E+02	1.0E+03	1.7E+02	1.90E+01	3.17E+04	4.68E+00	4.06E+00
TETRACHLOROPHENOL, 2,3,4,6-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	6.66E-04	-	-	-
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	2.41E-08	-	-	-
THALLIUM	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-
TOLUENE	5.0E+02	8.2E+02	5.0E+02	1.0E+03	8.2E+02	2.80E+01	3.00E+04	8.00E+00	3.50E+00
TOXAPHENE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	4.00E-01	-	-	-
TPH (gasolines)	1.0E+02	5.0E+02	1.0E+02	5.0E+02	5.4E+03	3.00E+02	1.00E+03	2.00E-01	1.50E+03
TPH (middle distillates)	5.0E+02	5.0E+02	5.0E+02	1.0E+03	5.0E+02	5.00E+00	1.00E+03	1.41E-01	3.55E+01
TPH (residual fuels)	5.0E+02	2.5E+03	5.0E+02	2.5E+03	NA	-	-	-	-
TRICHLOROBENZENE, 1,2,4-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	2.9E-01	2.20E+04	2.96E+00	9.80E-02
TRICHLOROETHANE, 1,1,1-	5.0E+02	6.4E+02	5.0E+02	1.0E+03	6.4E+02	1.00E+02	6.51E+04	1.20E+01	8.33E+00
TRICHLOROETHANE, 1,1,2-	1.0E+02	5.0E+02	1.0E+02	5.0E+02	5.2E+02	2.25E+01	-	-	-
TRICHLOROETHYLENE	5.0E+02	6.9E+02	5.0E+02	2.5E+03	6.9E+02	7.70E+01	1.36E+06	2.49E+02	3.09E-01
TRICHLOROPHENOL, 2,4,5-	1.0E+02	5.0E+02	1.0E+02	5.0E+02	NA	-	-	-	-
TRICHLOROPHENOL, 2,4,6-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.2E-02	3.00E-01	3.60E-05	3.33E+02

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

CONTAMINANT	[2]Final Unrestricted Land Use Action Level	Final Industrial/ Commercial Land Use Action Level	[2]Raw Unrestricted Action Level	Raw Industrial/ Commercial Action Level	Soil Saturation Limit (mg/kg)	Vapor Pressure (VP) (Torr @ 20-30 °C)	50 Percentile Odor Recognition Threshold (ORT) (ug/m^3)	50 Percentile Odor Recognition Threshold (ORT) (ppm-v)	Odor Index
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	3.75E-05	-	-	-
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	2.58E-06	-	-	-
TRICHLOROPROPANE, 1,2,3-	1.0E+02	5.0E+02	1.0E+02	5.0E+02	1.2E+03	3.69E+00	-	-	-
TRICHLOROPROPENE, 1,2,3-	1.0E+02	5.0E+02	1.0E+02	5.0E+02	2.7E+03	4.40E+00	-	-	-
TRIFLURALIN	1.0E+02	5.0E+02	1.0E+02	5.0E+02	NA	4.58E-05	-	-	-
TRINITROBENZENE, 1,3,5-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	6.40E-06	-	-	-
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.17E-07	-	-	-
TRINITROTOLUENE, 2,4,6- (TNT)	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	8.02E-06	-	-	-
VANADIUM	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-
VINYL CHLORIDE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	3.9E+03	2.58E+03	7.71E+05	2.94E+02	8.78E+00
XYLENES	3.9E+02	3.9E+02	5.0E+02	1.0E+03	3.9E+02	6.00E+00	4.41E+02	1.00E-01	6.00E+01
ZINC	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	-	-	-	-

Notes:

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

Odor Index = VP/ORT in ppm-v

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

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

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

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

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

Saturation limits calculated using equation in USEPA RSL guidance (USEPA 2011) for chemicals that are liquid at ambient temperatures and pressures (refer to Appendix 2).

50% ORT of 0.13 ppm-v for MTBE from information in CaEPA Public Health Goal for MTBE (CalEPA 1999).

TPH VP values from NIOSH (2002); TPHd ORT value from ATSDR (2001a). TPHg ORT based on threshold of 0.2ppm (AHC 2004; worst-case gasoline with TAME) and assumed MW of 108 (refer to Table H); ORT in ug/m^3 = 200 ppbv x (104/24)= 900; rounded to 1,000 ug/m^3.

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

1. Ontario Ministry of Environment and Energy (MOEE 1996).
2. Massachusetts Department of Environmental Protection (MADEP 1994).
3. Agency for Toxic Substances and Disease Registry (ATSDR 2001).
4. Vapor Pressure for 1,4 Dioxane from "Solvent Stabilizers - White Paper" (Mohr 2001). Odor Threshold from US Department of Health and Human Services, National Toxicology Program (USDHHS, 2001).
5. Military range Database (ARAMS), U.S. Army Corps of Engineers, Engineer Research and Development Center, http://el.erdc.usace.army.mil/arams/databases.html (used for explosive-related contaminants

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

CONTAMINANT	[2]Final Unrestricted Land Use Action Level	Final Industrial/ Commercial Land Use Action Level	[2]Raw Unrestricted Action Level	Raw Industrial/ Commercial Action Level	Soil Saturation Limit (mg/kg)	Vapor Pressure (VP) (Torr @ 20-30 °C)	50 Percentile Odor Recognition Threshold (ORT) (ug/m^3)	50 Percentile Odor Recognition Threshold (ORT) (ppm-v)	Odor Index
ACENAPHTHENE	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	4.50E-03	5.13E+02	8.00E-02	5.63E-02
ACENAPHTHYLENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.90E-02	-	-	-
ACETONE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	1.2E+05	2.70E+02	3.09E+04	1.30E+01	2.08E+01
ALDRIN	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	2.30E-05	2.63E+02	1.70E-02	1.35E-03
AMETRYN	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.74E-06	-	-	-
AMINO,2- DINITROTOLUENE,4,6-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.07E-04	-	-	-
AMINO,4- DINITROTOLUENE,2,6-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.07E-04	-	-	-
ANTHRACENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.70E-05	-	-	-
ANTIMONY	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
ARSENIC	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
ATRAZINE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.89E-07	-	-	-
BARIUM	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
BENZENE	1.0E+03	1.8E+03	1.0E+03	2.5E+03	1.8E+03	9.50E+01	4.89E+03	1.50E+00	6.33E+01
BENZO(a)ANTHRACENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.20E-08	-	-	-
BENZO(a)PYRENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	5.60E-09	-	-	-
BENZO(b)FLUORANTHENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	5.00E-07	-	-	-
BENZO(g,h,i)PERYLENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.10E-10	-	-	-
BENZO(k)FLUORANTHENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	9.60E-11	-	-	-
BERYLLIUM	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
BIPHENYL, 1,1-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	5.00E-03	6.00E+01	9.50E-03	5.26E-01
BIS(2-CHLOROETHYL)ETHER	1.0E+03	2.5E+03	1.0E+03	2.5E+03	5.0E+03	7.10E-01	2.87E+02	4.9E-02	1.45E+01
BIS(2-CHLOROISOPROPYL)ETHER	7.9E+02	7.9E+02	1.0E+03	2.5E+03	7.9E+02	8.50E-01	2.24E+03	3.20E-01	2.66E+00
BIS(2-ETHYLHEXYL)PHTHALATE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	6.20E-08	-	-	-
BORON	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	-	-	-	-
BROMODICHLOROMETHANE	9.3E+02	9.3E+02	2.5E+03	5.0E+03	9.3E+02	5.00E+01	1.10E+07	1.68E+03	2.98E-02
BROMOFORM	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	5.60E+00	1.35E+04	1.30E+00	4.31E+00
BROMOMETHANE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	3.5E+03	1.42E+03	8.00E+04	2.00E+01	7.10E+01
CADMIUM	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
CARBON TETRACHLORIDE	4.5E+02	4.5E+02	1.0E+03	2.5E+03	4.5E+02	1.13E+02	6.30E+04	1.00E+01	1.13E+01
CHLORDANE (TECHNICAL)	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	1.00E-05	8.40E+00	4.92E-04	2.03E-02
CHLOROANILINE, p-	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	1.00E-05	-	-	-
CHLOROBENZENE	7.6E+02	7.6E+02	1.0E+03	2.5E+03	7.6E+02	1.18E+01	1.00E+03	2.20E-01	5.36E+01
CHLOROETHANE	1.0E+03	2.1E+03	1.0E+03	2.5E+03	2.1E+03	1.01E+03	3.80E+05	1.40E+02	7.20E+00
CHLOROFORM	1.0E+03	2.5E+03	1.0E+03	2.5E+03	2.5E+03	1.60E+02	4.22E+05	8.50E+01	1.88E+00
CHLOROMETHANE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	1.3E+03	4.30E+03	-	-	-
CHLOROPHENOL, 2-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	5.5E+04	1.42E+00	1.90E+01	3.60E-03	3.94E+02
CHROMIUM (Total)	-	-	-	-	-	-	-	-	-
CHROMIUM III	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
CHROMIUM VI	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
CHRYSENE	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	6.30E-07	-	-	-
COBALT	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
COPPER	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
CYANIDE (Free)	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	6.20E+02	6.52E+02	5.80E-01	1.07E+03
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	4.10E-09	-	-	-
DALAPON	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	6.70E-01	-	-	-
DIBENZO(a,h)ANTHTRACENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.00E-10	-	-	-
DIBROMO-3-CHLOROPROPANE, 1,2-	1.0E+03	1.1E+03	1.0E+03	2.5E+03	1.1E+03	8.00E-01	-	-	-

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

CONTAMINANT	[2]Final Unrestricted Land Use Action Level	Final Industrial/ Commercial Land Use Action Level	[2]Raw Unrestricted Action Level	Raw Industrial/ Commercial Action Level	Soil Saturation Limit (mg/kg)	Vapor Pressure (VP) (Torr @ 20-30 °C)	50 Percentile Odor Recognition Threshold (ORT) (ug/m^3)	50 Percentile Odor Recognition Threshold (ORT) (ppm-v)	Odor Index
DIBROMOCHLOROMETHANE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	7.60E+01	-	-	-
DIBROMOETHANE, 1,2-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.20E+01	2.00E+05	2.60E+01	4.62E-01
DICHLOROBENZENE, 1,2-	1.9E+02	1.9E+02	2.5E+03	5.0E+03	1.9E+02	1.50E+00	3.05E+05	5.00E+01	3.00E-02
DICHLOROBENZENE, 1,3-	5.0E+02	6.0E+02	5.0E+02	1.0E+03	6.0E+02	2.30E+00	-	-	-
DICHLOROBENZENE, 1,4-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.80E+00	1.10E+03	1.80E-01	1.00E+01
DICHLOROBENZIDINE, 3,3-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	4.50E-09	-	-	-
DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.00E-06	-	-	-
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	6.50E-06	-	-	-
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	5.50E-06	-	-	-
DICHLOROETHANE, 1,1-	1.0E+03	1.7E+03	1.0E+03	2.5E+03	1.7E+03	2.34E+02	1.25E+05	3.00E+01	7.80E+00
DICHLOROETHANE, 1,2-	1.0E+03	1.8E+03	1.0E+03	2.5E+03	1.8E+03	7.90E+01	2.42E+03	5.90E-01	1.34E+02
DICHLOROETHYLENE, 1,1-	1.0E+03	1.2E+03	1.0E+03	2.5E+03	1.2E+03	5.91E+02	2.00E+06	5.00E+02	1.18E+00
DICHLOROETHYLENE, Cis 1,2-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	1.3E+03	2.15E+02	-	-	-
DICHLOROETHYLENE, Trans 1,2-	1.0E+03	1.4E+03	1.0E+03	2.5E+03	1.4E+03	3.31E+02	6.73E+04	1.70E+01	1.95E+01
DICHLOROPHENOL, 2,4-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	6.70E-02	1.40E+03	2.10E-01	3.19E-01
DICHLOROPHENOXYACETIC ACID (2,4-D)	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	8.25E-05	-	-	-
DICHLOROPROPANE, 1,2-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	1.4E+03	4.20E+01	1.19E+03	2.50E-01	1.68E+02
DICHLOROPROPENE, 1,3-	1.0E+03	1.6E+03	1.0E+03	2.5E+03	1.6E+03	4.30E+01	4.16E+03	1.00E+00	4.30E+01
DIELDRIN	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	1.80E-08	-	-	-
DIETHYLPHTHALATE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	3.50E-04	-	-	-
DIMETHYLPHENOL, 2,4-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	9.80E-02	1.00E+00	1.97E-04	4.97E+02
DIMETHYLPHTHALATE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.70E-03	-	-	-
DINITROBENZENE, 1,3-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	9.00E-04	-	-	-
DINITROPHENOL, 2,4-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.50E-05	-	-	-
DINITROTOLUENE, 2,4- (2,4-DNT)	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.47E-04	-	-	-
DINITROTOLUENE, 2,6- (2,6-DNT)	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	5.67E-04	-	-	-
DIOXANE, 1,4-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	3.70E+01	6.12E+05	1.70E+02	2.18E-01
DIOXINS (TEQ)	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	1.50E-09	-	-	-
DIURON	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	6.90E-08	-	-	-
ENDOSULFAN	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.00E-05	-	-	-
ENDRIN	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.00E-07	-	-	-
ETHANOL	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	5.65E+01	1.92E+04	1.00E+01	5.65E+00
ETHYLBENZENE	4.8E+02	4.8E+02	1.0E+03	2.5E+03	4.8E+02	1.00E+01	2.00E+03	4.50E-01	2.22E+01
FLUORANTHENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	5.00E-06	-	-	-
FLUORENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	3.20E-04	-	-	-
GLYPHOSATE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	4.30E-10	-	-	-
HEPTACHLOR	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	3.00E-04	3.00E+02	2.00E-02	1.50E-02
HEPTACHLOR EPOXIDE	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	2.60E-06	3.00E+02	1.90E-02	1.37E-04
HEXACHLOROBENZENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.10E-05	-	-	-
HEXACHLOROBUTADIENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.50E-01	1.20E+04	1.10E+00	1.36E-01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	9.40E-06	-	-	-
HEXACHLOROETHANE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.10E-01	-	-	-
HEXAZINONE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.25E-07	-	-	-
INDENO(1,2,3-cd)PYRENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.00E-06	-	-	-
ISOPHORONE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	4.38E-01	-	-	-
LEAD	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
MERCURY	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.00E-03	-	-	-

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

CONTAMINANT	[2]Final Unrestricted Land Use Action Level	Final Industrial/ Commercial Land Use Action Level	[2]Raw Unrestricted Action Level	Raw Industrial/ Commercial Action Level	Soil Saturation Limit (mg/kg)	Vapor Pressure (VP) (Torr @ 20-30 °C)	50 Percentile Odor Recognition Threshold (ORT) (ug/m^3)	50 Percentile Odor Recognition Threshold (ORT) (ppm-v)	Odor Index
METHOXYCHLOR	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.40E-06	-	-	-
METHYL ETHYL KETONE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	2.8E+04	1.00E+02	3.20E+04	1.10E+01	9.09E+00
METHYL ISOBUTYL KETONE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	3.4E+03	1.00E+01	4.20E+02	1.00E-01	1.00E+02
METHYL MERCURY	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	-	-	-	-
METHYL TERT BUTYL ETHER	5.0E+02	1.0E+03	5.0E+02	1.0E+03	8.9E+03	2.45E+02	5.30E+02	1.30E-01	1.88E+03
METHYLENE CHLORIDE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	3.3E+03	4.29E+02	5.60E+05	1.60E+02	2.68E+00
METHYLNAPHTHALENE, 1-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	6.80E-02	6.80E+01	1.15E-02	5.91E+00
METHYLNAPHTHALENE, 2-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	6.80E-02	6.80E+01	1.15E-02	5.91E+00
MOLYBDENUM	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
NAPHTHALENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	8.20E-02	4.40E+02	8.40E-02	9.76E-01
NICKEL	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
NITROBENZENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	3.0E+03	2.45E-01	-	-	-
NITROGLYCERIN	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	4.00E-02	-	-	-
NITROTOLUENE, 2-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.09E-01	-	-	-
NITROTOLUENE, 3-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.04E-01	-	-	-
NITROTOLUENE, 4-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	4.90E-03	-	-	-
PENTACHLOROPHENOL	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.10E-04	-	-	-
PENTAERYTHRITOLTETRANITRATE (PETN)	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	8.38E-04	-	-	-
PERCHLORATE	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
PHENANTHRENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	9.60E-04	5.50E+01	7.42E-03	1.29E-01
PHENOL	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	3.50E-01	1.56E+02	4.00E-02	8.75E+00
POLYCHLORINATED BIPHENYLS (PCBs)	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	6.70E-03	-	-	-
PROPICONAZOLE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.00E-06	-	-	-
PYRENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.50E-06	-	-	-
SELENIUM	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
SILVER	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
SIMAZINE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.21E-08	-	-	-
STYRENE	8.7E+02	8.7E+02	1.0E+03	2.5E+03	8.7E+02	5.00E+00	1.36E+03	3.00E-01	1.67E+01
TERBACIL	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.76E-07	-	-	-
tert-BUTYL ALCOHOL	5.0E+02	1.0E+03	5.0E+02	1.0E+03	3.2E+05	4.20E+01	-	-	-
TETRACHLOROETHANE, 1,1,1,2-	5.0E+02	6.8E+02	5.0E+02	1.0E+03	6.8E+02	1.20E+01	-	-	-
TETRACHLOROETHANE, 1,1,2,2-	1.0E+03	1.9E+03	1.0E+03	2.5E+03	1.9E+03	4.00E+00	1.05E+04	1.50E+00	2.67E+00
TETRACHLOROETHYLENE	1.7E+02	1.7E+02	1.0E+03	2.5E+03	1.7E+02	1.90E+01	3.17E+04	4.68E+00	4.06E+00
TETRACHLOROPHENOL, 2,3,4,6-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	6.66E-04	-	-	-
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.41E-08	-	-	-
THALLIUM	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
TOLUENE	8.2E+02	8.2E+02	1.0E+03	2.5E+03	8.2E+02	2.80E+01	3.00E+04	8.00E+00	3.50E+00
TOXAPHENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	4.00E-01	-	-	-
TPH (gasolines)	5.0E+03	5.0E+03	5.0E+03	5.0E+03	5.4E+03	3.00E+02	1.00E+03	2.00E-01	1.50E+03
TPH (middle distillates)	5.0E+03	5.0E+03	5.0E+03	5.0E+03	NA	5.00E+00	1.00E+03	1.41E-01	3.55E+01
TPH (residual fuels)	5.0E+03	5.0E+03	5.0E+03	5.0E+03	NA	-	-	-	-
TRICHLOROBENZENE, 1,2,4-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.90E-01	2.20E+04	2.96E+00	9.80E-02
TRICHLOROETHANE, 1,1,1-	6.4E+02	6.4E+02	1.0E+03	2.5E+03	6.4E+02	1.00E+02	6.51E+04	1.20E+01	8.33E+00
TRICHLOROETHANE, 1,1,2-	5.0E+02	5.2E+02	5.0E+02	1.0E+03	5.2E+02	2.25E+01	-	-	-
TRICHLOROETHYLENE	6.9E+02	6.9E+02	2.5E+03	5.0E+03	6.9E+02	7.70E+01	1.36E+06	2.49E+02	3.09E-01
TRICHLOROPHENOL, 2,4,5-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	-	-	-	-
TRICHLOROPHENOL, 2,4,6-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.20E-02	3.00E-01	3.60E-05	3.33E+02

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

CONTAMINANT	[2]Final Unrestricted Land Use Action Level	Final Industrial/ Commercial Land Use Action Level	[2]Raw Unrestricted Action Level	Raw Industrial/ Commercial Action Level	Soil Saturation Limit (mg/kg)	Vapor Pressure (VP) (Torr @ 20-30 °C)	50 Percentile Odor Recognition Threshold (ORT) (ug/m^3)	50 Percentile Odor Recognition Threshold (ORT) (ppm-v)	Odor Index
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	3.75E-05	-	-	-
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.58E-06	-	-	-
TRICHLOROPROPANE, 1,2,3-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	1.2E+03	3.69E+00	-	-	-
TRICHLOROPROPENE, 1,2,3-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	2.7E+03	4.40E+00	-	-	-
TRIFLURALIN	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	4.58E-05	-	-	-
TRINITROBENZENE, 1,3,5-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	6.40E-06	-	-	-
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.17E-07	-	-	-
TRINITROTOLUENE, 2,4,6- (TNT)	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	8.02E-06	-	-	-
VANADIUM	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
VINYL CHLORIDE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	3.9E+03	2.58E+03	7.71E+05	2.94E+02	8.78E+00
XYLENES	3.9E+02	3.9E+02	1.0E+03	2.5E+03	3.9E+02	6.00E+00	4.41E+02	1.00E-01	6.00E+01
ZINC	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-

Notes:

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

Odor Index = VP/ORT in ppm-v

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

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

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

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

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

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

Ceiling Levels for TPH after guidance from Massachusetts Department of Environmental Protection (MADEP 1997a).

50% ORT of 0.13 ppm-v for MTBE from information in CaEPA Public Health Goal for MTBE (CalEPA 1999).

TPH VP values from NIOSH (2002); TPHd ORT value from ATSDR (2001a). TPHg ORT based on threshold of 0.2ppm (AHC 2004; worst-case gasoline with TAME) and assumed MW of 108 (refer to Table H); ORT in ug/l^3 = 200 ppbv x (104/24)= 900; rounded to 1,000 ug/m^3.

TPH(middle distillate fuels) gross contamination action level for isolated soils at commercial/industrial sites set at 5,000 mg/kg, based on profession judgement.

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

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

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

CHEMICAL PARAMETER	Final Action Level	Basis	Solubility (1/2)	Taste And Odor Threshold	Basis	Upper Limit
ACENAPHTHENE	2.0E+01	Taste & Odors	2.0E+03	2.0E+01	Ontario MOEE	5.0E+04
ACENAPHTHYLENE	2.0E+03	Solubility	2.0E+03	-	-	5.0E+04
ACETONE	2.0E+04	Taste & Odors	5.0E+08	2.0E+04	Amoore & Hautala	5.0E+04
ALDRIN	8.5E+00	Solubility	8.5E+00	1.7E+01	Ontario MOEE	5.0E+04
AMETRYN	5.0E+04	Upper Limit	1.0E+05	-	-	5.0E+04
AMINO,2- DINITROTOLUENE,4,6-	5.0E+04	Upper Limit	6.1E+05	-	-	5.0E+04
AMINO,4- DINITROTOLUENE,2,6-	5.0E+04	Upper Limit	6.1E+05	-	-	5.0E+04
ANTHRACENE	2.2E+01	Solubility	2.2E+01	-	-	5.0E+04
ANTIMONY	5.0E+04	Upper Limit		-	-	5.0E+04
ARSENIC	5.0E+04	Upper Limit		-	-	5.0E+04
ATRAZINE	2.0E+01	Taste & Odors	1.7E+04	2.0E+01	Young et al	5.0E+04
BARIUM	5.0E+04	Upper Limit		-	-	5.0E+04
BENZENE	1.7E+02	Taste & Odors	9.0E+05	1.7E+02	Amoore & Hautala	5.0E+04
BENZO(a)ANTHRACENE	4.7E+00	Solubility	4.7E+00	-	-	5.0E+04
BENZO(a)PYRENE	8.1E-01	Solubility	8.1E-01	-	-	5.0E+04
BENZO(b)FLUORANTHENE	7.5E-01	Solubility	7.5E-01	-	-	5.0E+04
BENZO(g,h,i)PERYLENE	1.3E-01	Solubility	1.3E-01	-	-	5.0E+04
BENZO(k)FLUORANTHENE	4.0E-01	Solubility	4.0E-01	-	-	5.0E+04
BERYLLIUM	5.0E+04	Upper Limit		-	-	5.0E+04
BIPHENYL, 1,1-	5.0E-01	Taste & Odors	3.5E+03	5.0E-01	Amoore & Hautala	5.0E+04
BIS(2-CHLOROETHYL)ETHER	3.6E+02	Taste & Odors	8.6E+06	3.6E+02	Amoore & Hautala	5.0E+04
BIS(2-CHLOROISOPROPYL)ETHER	3.2E+02	Taste & Odors	8.5E+05	3.2E+02	Ontario MOEE	5.0E+04
BIS(2-ETHYLHEXYL)PHTHALATE	1.4E+02	Solubility	1.4E+02	-	-	5.0E+04
BORON	5.0E+04	Upper Limit		-	-	5.0E+04
BROMODICHLOROMETHANE	5.0E+04	Upper Limit	1.5E+06	-	-	5.0E+04
BROMOFORM	5.1E+02	Taste & Odors	1.6E+06	5.1E+02	Amoore & Hautala	5.0E+04
BROMOMETHANE	5.0E+04	Upper Limit	7.6E+06	-	-	5.0E+04
CADMIUM	5.0E+04	Upper Limit		-	-	5.0E+04
CARBON TETRACHLORIDE	5.2E+02	Taste & Odors	4.0E+05	5.2E+02	Amoore & Hautala	5.0E+04
CHLORDANE (TECHNICAL)	2.5E+00	Taste & Odors	2.8E+01	2.5E+00	Ontario MOEE	5.0E+04
CHLOROANILINE, p-	5.0E+04	Upper Limit	2.0E+06	-	-	5.0E+04
CHLOROBENZENE	5.0E+01	Taste & Odors	2.5E+05	5.0E+01	Amoore & Hautala	5.0E+04
CHLOROETHANE	1.6E+01	Taste & Odors	3.4E+06	1.6E+01	Amoore & Hautala	5.0E+04
CHLOROFORM	2.4E+03	Taste & Odors	4.0E+06	2.4E+03	Amoore & Hautala	5.0E+04
CHLOROMETHANE	5.0E+04	Upper Limit	2.7E+06		-	5.0E+04
CHLOROPHENOL, 2-	1.8E-01	Taste & Odors	1.4E+07	1.8E-01	Ontario MOEE	5.0E+04
CHROMIUM (Total)	5.0E+04	Upper Limit		-	-	5.0E+04
CHROMIUM III	5.0E+04	Upper Limit		-	-	5.0E+04
CHROMIUM VI	5.0E+04	Upper Limit	8.5E+08	-	-	5.0E+04
CHRYSENE	1.0E+00	Solubility	1.0E+00	-	-	5.0E+04
COBALT	5.0E+04	Upper Limit		-	-	5.0E+04
COPPER	1.0E+03	Taste & Odors		1.0E+03	CalDHS 2nd MCL	5.0E+04
CYANIDE (Free)	1.7E+02	Taste & Odors		1.7E+02	Amoore & Hautala	5.0E+04
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	3.0E+04	Solubility	3.0E+04	-	-	5.0E+04

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

CHEMICAL PARAMETER	Final Action Level	Basis	Solubility (1/2)	Taste And Odor Threshold	Basis	Upper Limit
DALAPON	5.0E+04	Upper Limit	2.5E+08	-	-	5.0E+04
DIBENZO(a,h)ANTHTRACENE	5.2E-01	Solubility	5.2E-01	-	-	5.0E+04
DIBROMO,1,2- CHLOROPROPANE,3-	1.0E+01	Taste & Odors	6.2E+05	1.0E+01	Amoore & Hautala	5.0E+04
DIBROMOCHLOROMETHANE	5.0E+04	Upper Limit	1.4E+06	-	-	5.0E+04
DIBROMOETHANE, 1,2-	5.0E+04	Upper Limit	2.0E+06	-	-	5.0E+04
DICHLOROBENZENE, 1,2-	1.0E+01	Taste & Odors	4.0E+04	1.0E+01	USEPA 2nd MCL	5.0E+04
DICHLOROBENZENE, 1,3-	5.0E+00	Taste & Odors	7.8E+04	5.0E+00	1,4 DCB	5.0E+04
DICHLOROBENZENE, 1,4-	5.0E+00	Taste & Odors	4.1E+04	5.0E+00	USEPA 2nd MCL	5.0E+04
DICHLOROBENZIDINE, 3,3-	1.6E+03	Solubility	1.6E+03	-	-	5.0E+04
DICHLORODIPHENYLDICHLOROETHANE (DDD)	4.5E+01	Solubility	4.5E+01	-	-	5.0E+04
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.0E+01	Solubility	2.0E+01	-	-	5.0E+04
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	2.8E+00	Solubility	2.8E+00	3.5E+02	Ontario MOEE	5.0E+04
DICHLOROETHANE, 1,1-	5.0E+04	Upper Limit	2.5E+06	-	-	5.0E+04
DICHLOROETHANE, 1,2-	7.0E+03	Taste & Odors	2.6E+06	7.0E+03	Amoore & Hautala	5.0E+04
DICHLOROETHYLENE, 1,1-	1.5E+03	Taste & Odors	1.2E+06	1.5E+03	Amoore & Hautala	5.0E+04
DICHLOROETHYLENE, Cis 1,2-	5.0E+04	Upper Limit	1.8E+06	-	-	5.0E+04
DICHLOROETHYLENE, Trans 1,2-	2.6E+02	Taste & Odors	1.8E+06	2.6E+02	Amoore & Hautala	5.0E+04
DICHLOROPHENOL, 2,4-	3.0E-01	Taste & Odors	2.3E+06	3.0E-01	Ontario MOEE	5.0E+04
DICHLOROPHENOXYACETIC ACID (2,4-D)	5.0E+04	Upper Limit	3.4E+05	-	-	5.0E+04
DICHLOROPROPANE, 1,2-	1.0E+01	Taste & Odors	1.4E+06	1.0E+01	Ontario MOEE	5.0E+04
DICHLOROPROPENE, 1,3-	5.0E+04	Upper Limit	1.4E+06	-	-	5.0E+04
DIELDRIN	4.1E+01	Taste & Odors	1.3E+02	4.1E+01	Ontario MOEE	5.0E+04
DIETHYLPHTHALATE	5.0E+04	Upper Limit	5.4E+05	-	-	5.0E+04
DIMETHYLPHENOL, 2,4-	4.0E+02	Taste & Odors	3.9E+06	4.0E+02	Cal DHS AL	5.0E+04
DIMETHYLPHTHALATE	5.0E+04	Upper Limit	2.5E+06	-	-	5.0E+04
DINITROBENZENE, 1,3-	5.0E+04	Upper Limit	2.7E+05	-	-	5.0E+04
DINITROPHENOL, 2,4-	5.0E+04	Upper Limit	1.4E+06	-	-	5.0E+04
DINITROTOLUENE, 2,4- (2,4-DNT)	5.0E+04	Upper Limit	1.4E+05	-	-	5.0E+04
DINITROTOLUENE, 2,6- (2,6-DNT)	5.0E+04	Upper Limit	1.8E+05	-	-	5.0E+04
DIOXANE, 1,4-	5.0E+04	Upper Limit	5.0E+08	2.3E+05	Amoore & Hautala	5.0E+04
DIOXINS (TEQ)	6.0E-02	Solubility	6.0E-02	-	-	5.0E+04
DIURON	2.1E+04	Solubility	2.1E+04	-	-	5.0E+04
ENDOSULFAN	2.3E+02	Solubility	2.3E+02	-	-	5.0E+04
ENDRIN	4.1E+01	Taste & Odors	1.3E+02	4.1E+01	Ontario MOEE	5.0E+04
ETHANOL	5.0E+04	Upper Limit	5.0E+08	7.6E+05	Amoore & Hautala	5.0E+04
ETHYLBENZENE	3.0E+01	Taste & Odors	8.5E+04	3.0E+01	USEPA 2nd MCL	5.0E+04
FLUORANTHENE	1.3E+02	Solubility	1.3E+02	-	-	5.0E+04
FLUORENE	9.5E+02	Solubility	9.5E+02	-	-	5.0E+04
GLYPHOSATE	5.0E+04	Upper Limit	6.0E+06	-	-	5.0E+04
HEPTACHLOR	2.0E+01	Taste & Odors	9.0E+01	2.0E+01	Ontario MOEE	5.0E+04
HEPTACHLOR EPOXIDE	1.0E+02	Solubility	1.0E+02	-	-	5.0E+04
HEXACHLOROBENZENE	3.1E+00	Solubility	3.1E+00	3.0E+03	Ontario MOEE	5.0E+04
HEXACHLOROBUTADIENE	6.0E+00	Taste & Odors	1.6E+03	6.0E+00	Ontario MOEE	5.0E+04
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	4.0E+03	Solubility	4.0E+03	1.2E+04	Ontario MOEE	5.0E+04

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

CHEMICAL PARAMETER	Final Action Level	Basis	Solubility (1/2)	Taste And Odor Threshold	Basis	Upper Limit
HEXACHLOROETHANE	1.0E+01	Taste & Odors	2.5E+04	1.0E+01	Amoore & Hautala	5.0E+04
HEXAZINONE	5.0E+04	Upper Limit	1.7E+07	-	-	5.0E+04
INDENO(1,2,3-cd)PYRENE	9.5E-02	Solubility	9.5E-02	-	-	5.0E+04
ISOPHORONE	5.0E+04	Upper Limit	6.0E+06	-	-	5.0E+04
LEAD	5.0E+04	Upper Limit		-	-	5.0E+04
MERCURY	3.0E+01	Solubility	3.0E+01	-	-	5.0E+04
METHOXYCHLOR	5.0E+01	Solubility	5.0E+01	4.7E+03	Amoore & Hautala	5.0E+04
METHYL ETHYL KETONE	8.4E+03	Taste & Odors	1.1E+08	8.4E+03	Amoore & Hautala	5.0E+04
METHYL ISOBUTYL KETONE	1.3E+03	Taste & Odors	9.5E+06	1.3E+03	Amoore & Hautala	5.0E+04
METHYL MERCURY	5.0E+04	Upper Limit		-	-	5.0E+04
METHYL TERT BUTYL ETHER	5.0E+00	Taste & Odors	2.6E+07	5.0E+00	Cal DHS 2nd MCL	5.0E+04
METHYLENE CHLORIDE	9.1E+03	Taste & Odors	6.5E+06	9.1E+03	Ontario MOEE	5.0E+04
METHYLNAPHTHALENE, 1-	1.0E+01	Taste & Odors	1.3E+04	1.0E+01	Ontario MOEE	5.0E+04
METHYLNAPHTHALENE, 2-	1.0E+01	Taste & Odors	1.3E+04	1.0E+01	Ontario MOEE	5.0E+04
MOLYBDENUM	5.0E+04	Upper Limit		-	-	5.0E+04
NAPHTHALENE	2.1E+01	Taste & Odors	1.6E+04	2.1E+01	Amoore & Hautala	5.0E+04
NICKEL	5.0E+04	Upper Limit		-	-	5.0E+04
NITROBENZENE	5.0E+04	Upper Limit	1.0E+06	-	-	5.0E+04
NITROGLYCERIN	5.0E+04	Upper Limit	6.9E+05	-	-	5.0E+04
NITROTOLUENE, 2-	5.0E+04	Upper Limit	3.3E+05	-	-	5.0E+04
NITROTOLUENE, 3-	5.0E+04	Upper Limit	2.1E+05	-	-	5.0E+04
NITROTOLUENE, 4-	5.0E+04	Upper Limit	2.2E+05	-	-	5.0E+04
PENTACHLOROPHENOL	3.0E+01	Taste & Odors	7.0E+03	3.0E+01	Amoore & Hautala	5.0E+04
PENTAERYTHRITOLTETRANITRATE (PETN)	2.2E+04	Solubility	2.2E+04	-	-	5.0E+04
PERCHLORATE	5.0E+04	Upper Limit	1.2E+08	-	-	5.0E+04
PHENANTHRENE	4.1E+02	Solubility	4.1E+02	1.0E+03	Ontario MOEE	5.0E+04
PHENOL	5.0E+00	Taste & Odors	4.1E+07	5.0E+00	Cal DHS AL	5.0E+04
POLYCHLORINATED BIPHENYLS (PCBs)	1.6E+01	Solubility	1.6E+01	-	-	5.0E+04
PROPICONAZOLE	5.0E+04	Upper Limit	5.5E+04	-	-	5.0E+04
PYRENE	6.8E+01	Solubility	6.8E+01	-	-	5.0E+04
SELENIUM	5.0E+04	Upper Limit		-	-	5.0E+04
SILVER	1.0E+02	Taste & Odors		1.0E+02	Cal DHS 2nd MCL	5.0E+04
SIMAZINE	3.1E+03	Solubility	3.1E+03	-	-	5.0E+04
STYRENE	1.0E+01	Taste & Odors	1.6E+05	1.0E+01	USEPA 2nd MCL	5.0E+04
TERBACIL	5.0E+04	Upper Limit	3.6E+05	-	-	5.0E+04
tert-BUTYL ALCOHOL	5.0E+04	Upper Limit	5.0E+08	-	-	5.0E+04
TETRACHLOROETHANE, 1,1,1,2-	5.0E+04	Upper Limit	5.4E+05	-	-	5.0E+04
TETRACHLOROETHANE, 1,1,2,2-	5.0E+02	Taste & Odors	1.4E+06	5.0E+02	Amoore & Hautala	5.0E+04
TETRACHLOROETHYLENE	1.7E+02	Taste & Odors	1.0E+05	1.7E+02	Amoore & Hautala	5.0E+04
TETRACHLOROPHENOL, 2,3,4,6-	1.2E+04	Solubility	1.2E+04	-	-	5.0E+04
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	5.0E+04	Upper Limit	4.7E+06	-	-	5.0E+04
THALLIUM	5.0E+04	Upper Limit		-	-	5.0E+04
TOLUENE	4.0E+01	Taste & Odors	2.6E+05	4.0E+01	USEPA 2nd MCL	5.0E+04
TOXAPHENE	1.4E+02	Taste & Odors	2.8E+02	1.4E+02	USEPA 2nd MCL	5.0E+04

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

CHEMICAL PARAMETER	Final Action Level	Basis	Solubility (1/2)	Taste And Odor Threshold	Basis	Upper Limit
TPH (gasolines)	1.0E+02	Taste & Odors	7.5E+04	1.0E+02	USEPA SNARL	5.0E+04
TPH (middle distillates)	1.0E+02	Taste & Odors	2.5E+03	1.0E+02	USEPA SNARL	5.0E+04
TPH (residual fuels)	1.0E+02	Taste & Odors	2.5E+03	1.0E+02	USEPA SNARL	5.0E+04
TRICHLOROBENZENE, 1,2,4-	3.0E+03	Taste & Odors	2.5E+04	3.0E+03	USEPA (1995)	5.0E+04
TRICHLOROETHANE, 1,1,1-	9.7E+02	Taste & Odors	6.5E+05	9.7E+02	Amoore & Hautala	5.0E+04
TRICHLOROETHANE, 1,1,2-	5.0E+04	Upper Limit	5.5E+05	-	-	5.0E+04
TRICHLOROETHYLENE	3.1E+02	Taste & Odors	6.4E+05	3.1E+02	Amoore & Hautala	5.0E+04
TRICHLOROPHENOL, 2,4,5-	2.0E+02	Taste & Odors	6.0E+05	2.0E+02	Ontario MOEE	5.0E+04
TRICHLOROPHENOL, 2,4,6-	1.0E+02	Taste & Odors	4.0E+05	1.0E+02	Ontario MOEE	5.0E+04
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	5.0E+04	Upper Limit	1.4E+05	-	-	5.0E+04
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	5.0E+04	Upper Limit	1.0E+05	-	-	5.0E+04
TRICHLOROPROPANE, 1,2,3-	5.0E+04	Upper Limit	8.8E+05	-	-	5.0E+04
TRICHLOROPROPENE, 1,2,3-	5.0E+04	Upper Limit	1.4E+06	-	-	5.0E+04
TRIFLURALIN	9.2E+01	Solubility	9.2E+01	-	-	5.0E+04
TRINITROBENZENE, 1,3,5-	5.0E+04	Upper Limit	1.4E+05	-	-	5.0E+04
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	3.7E+04	Solubility	3.7E+04	-	-	5.0E+04
TRINITROTOLUENE, 2,4,6- (TNT)	5.0E+04	Upper Limit	6.5E+04	-	-	5.0E+04
VANADIUM	5.0E+04	Upper Limit		-	-	5.0E+04
VINYL CHLORIDE	3.4E+03	Taste & Odors	4.4E+06	3.4E+03	Amoore & Hautala	5.0E+04
XYLENES	2.0E+01	Taste & Odors	8.1E+04	2.0E+01	USEPA 2nd MCL	5.0E+04
ZINC	5.0E+03	Taste & Odors		5.0E+03	Cal DHS 2nd MCL	5.0E+04

References:

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

Other references (see Appendix 1 text): Ontario Ministry of Energy and Environment (MOEE 1996); Young et al (1996).

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

1/2 solubility based on solubility constants in USEPA RSL guidance (USEPA 2008a) or Ontario MOEE (MOEE 1996) if not available.

Notes:

Ceiling Level: lowest of 1/2 solubility, taste and odor threshold and 50000 ug/L maximum level

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

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

TPH Taste and Odor Thresholds based on USEPA Suggested-No-Adverse-reaction (SNARL) level for TPH diesel.

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

CHEMICAL PARAMETER	Final Action Level	Basis	Solubility (1/2)	Nuisance Odor Threshold	Basis	Upper Limit
ACENAPHTHENE	2.0E+02	Nuisance Odors	2.0E+03	2.0E+02	Ontario MOEE	5.0E+04
ACENAPHTHYLENE	2.0E+03	Solubility	2.0E+03	-	-	5.0E+04
ACETONE	5.0E+04	Upper Limit	5.0E+08	200000	Ontario MOEE	5.0E+04
ALDRIN	8.5E+00	Solubility	8.5E+00	170	Ontario MOEE	5.0E+04
AMETRYN	5.0E+04	Upper Limit	1.0E+05	-	-	5.0E+04
AMINO,2- DINITROTOLUENE,4,6-	5.0E+04	Upper Limit	6.1E+05	-	-	5.0E+04
AMINO,4- DINITROTOLUENE,2,6-	5.0E+04	Upper Limit	6.1E+05	-	-	5.0E+04
ANTHRACENE	2.2E+01	Solubility	2.2E+01	-	-	5.0E+04
ANTIMONY	5.0E+04	Upper Limit			-	5.0E+04
ARSENIC	5.0E+04	Upper Limit		-	-	5.0E+04
ATRAZINE	1.7E+04	Solubility	1.7E+04	-	-	5.0E+04
BARIUM	5.0E+04	Upper Limit		-	-	5.0E+04
BENZENE	2.0E+04	Nuisance Odors	9.0E+05	2.0E+04	Ontario MOEE	5.0E+04
BENZO(a)ANTHRACENE	4.7E+00	Solubility	4.7E+00	-	-	5.0E+04
BENZO(a)PYRENE	8.1E-01	Solubility	8.1E-01	-	-	5.0E+04
BENZO(b)FLUORANTHENE	7.5E-01	Solubility	7.5E-01	-	-	5.0E+04
BENZO(g,h,i)PERYLENE	1.3E-01	Solubility	1.3E-01	-	-	5.0E+04
BENZO(k)FLUORANTHENE	4.0E-01	Solubility	4.0E-01	-	-	5.0E+04
BERYLLIUM	5.0E+04	Upper Limit		-	-	5.0E+04
BIPHENYL, 1,1-	5.0E+00	Nuisance Odors	3.5E+03	5.0E+00	Amoore & Hautala	5.0E+04
BIS(2-CHLOROETHYL)ETHER	3.6E+03	Nuisance Odors	8.6E+06	3.6E+03	Amoore & Hautala	5.0E+04
BIS(2-CHLOROISOPROPYL)ETHER	3.2E+03	Nuisance Odors	8.5E+05	3.2E+03	Ontario MOEE	5.0E+04
BIS(2-ETHYLHEXYL)PHTHALATE	1.4E+02	Solubility	1.4E+02	-	-	5.0E+04
BORON	5.0E+04	Upper Limit		-	-	5.0E+04
BROMODICHLOROMETHANE	5.0E+04	Upper Limit	1.5E+06	-	-	5.0E+04
BROMOFORM	5.1E+03	Nuisance Odors	1.6E+06	5.1E+03	Ontario MOEE	5.0E+04
BROMOMETHANE	5.0E+04	Upper Limit	7.6E+06	-	-	5.0E+04
CADMIUM	5.0E+04	Upper Limit		-	-	5.0E+04
CARBON TETRACHLORIDE	5.2E+03	Nuisance Odors	4.0E+05	5.2E+03	Ontario MOEE	5.0E+04
CHLORDANE (TECHNICAL)	2.5E+01	Nuisance Odors	2.8E+01	2.5E+01	Ontario MOEE	5.0E+04
CHLOROANILINE, p-	5.0E+04	Upper Limit	2.0E+06	-	-	5.0E+04
CHLOROBENZENE	5.0E+02	Nuisance Odors	2.5E+05	5.0E+02	Ontario MOEE	5.0E+04
CHLOROETHANE	1.6E+02	Nuisance Odors	3.4E+06	1.6E+02	Amoore & Hautala	5.0E+04
CHLOROFORM	2.4E+04	Nuisance Odors	4.0E+06	2.4E+04	Ontario MOEE	5.0E+04
CHLOROMETHANE	5.0E+04	Upper Limit	2.7E+06	-	-	5.0E+04
CHLOROPHENOL, 2-	1.8E+00	Nuisance Odors	1.4E+07	1.8E+00	Ontario MOEE	5.0E+04
CHROMIUM (Total)	5.0E+04	Upper Limit		-	-	5.0E+04
CHROMIUM III	5.0E+04	Upper Limit		-	-	5.0E+04
CHROMIUM VI	5.0E+04	Upper Limit	8.5E+08	-	-	5.0E+04
CHRYSENE	1.0E+00	Solubility	1.0E+00	-	-	5.0E+04
COBALT	5.0E+04	Upper Limit		-	-	5.0E+04
COPPER	5.0E+04	Upper Limit		-	-	5.0E+04
CYANIDE (Free)	1.7E+03	Nuisance Odors		1.7E+03	Ontario MOEE	5.0E+04
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	3.0E+04	Solubility	3.0E+04	-	-	5.0E+04

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

CHEMICAL PARAMETER	Final Action Level	Basis	Solubility (1/2)	Nuisance Odor Threshold	Basis	Upper Limit
DALAPON	5.0E+04	Upper Limit	2.5E+08	-	-	5.0E+04
DIBENZO(a,h)ANTHTRACENE	5.2E-01	Solubility	5.2E-01	-	-	5.0E+04
DIBROMO,1,2- CHLOROPROPANE,3-	1.0E+02	Nuisance Odors	6.2E+05	1.0E+02	Amoore & Hautala	5.0E+04
DIBROMOCHLOROMETHANE	5.0E+04	Upper Limit	1.4E+06	-	-	5.0E+04
DIBROMOETHANE, 1,2-	5.0E+04	Upper Limit	2.0E+06	-	-	5.0E+04
DICHLOROBENZENE, 1,2-	1.0E+02	Nuisance Odors	4.0E+04	1.0E+02	Ontario MOEE	5.0E+04
DICHLOROBENZENE, 1,3-	5.0E+04	Upper Limit	7.8E+04	-	-	5.0E+04
DICHLOROBENZENE, 1,4-	1.1E+02	Nuisance Odors	4.1E+04	1.1E+02	Ontario MOEE	5.0E+04
DICHLOROBENZIDINE, 3,3-	1.6E+03	Solubility	1.6E+03	-	-	5.0E+04
DICHLORODIPHENYLDICHLOROETHANE (DDD)	4.5E+01	Solubility	4.5E+01	-	-	5.0E+04
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.0E+01	Solubility	2.0E+01	-	-	5.0E+04
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	2.8E+00	Solubility	2.8E+00	3.5E+03	Ontario MOEE	5.0E+04
DICHLOROETHANE, 1,1-	5.0E+04	Upper Limit	2.5E+06	-	-	5.0E+04
DICHLOROETHANE, 1,2-	5.0E+04	Upper Limit	2.6E+06	2.0E+05	Ontario MOEE	5.0E+04
DICHLOROETHYLENE, 1,1-	1.5E+04	Nuisance Odors	1.2E+06	1.5E+04	Amoore & Hautala	5.0E+04
DICHLOROETHYLENE, Cis 1,2-	5.0E+04	Upper Limit	1.8E+06	-	-	5.0E+04
DICHLOROETHYLENE, Trans 1,2-	2.6E+03	Nuisance Odors	1.8E+06	2.6E+03	Ontario MOEE	5.0E+04
DICHLOROPHENOL, 2,4-	3.0E+00	Nuisance Odors	2.3E+06	3.0E+00	Ontario MOEE	5.0E+04
DICHLOROPHENOXYACETIC ACID (2,4-D)	5.0E+04	Upper Limit	3.4E+05	-	-	5.0E+04
DICHLOROPROPANE, 1,2-	1.0E+02	Nuisance Odors	1.4E+06	1.0E+02	Ontario MOEE	5.0E+04
DICHLOROPROPENE, 1,3-	5.0E+04	Upper Limit	1.4E+06	-	-	5.0E+04
DIELDRIN	1.3E+02	Solubility	1.3E+02	4.1E+02	Ontario MOEE	5.0E+04
DIETHYLPHTHALATE	5.0E+04	Upper Limit	5.4E+05	-	-	5.0E+04
DIMETHYLPHENOL, 2,4-	4.0E+03	Nuisance Odors	3.9E+06	4.0E+03	Ontario MOEE	5.0E+04
DIMETHYLPHTHALATE	5.0E+04	Upper Limit	2.5E+06	-	-	5.0E+04
DINITROBENZENE, 1,3-	5.0E+04	Upper Limit	2.7E+05	-	-	5.0E+04
DINITROPHENOL, 2,4-	5.0E+04	Upper Limit	1.4E+06	-	-	5.0E+04
DINITROTOLUENE, 2,4- (2,4-DNT)	5.0E+04	Upper Limit	1.4E+05	-	-	5.0E+04
DINITROTOLUENE, 2,6- (2,6-DNT)	5.0E+04	Upper Limit	1.8E+05	-	-	5.0E+04
DIOXANE, 1,4-	5.0E+04	Upper Limit	5.0E+08	-	-	5.0E+04
DIOXINS (TEQ)	6.0E-02	Solubility	6.0E-02	-	-	5.0E+04
DIURON	2.1E+04	Solubility	2.1E+04	-	-	5.0E+04
ENDOSULFAN	2.3E+02	Solubility	2.3E+02	-	-	5.0E+04
ENDRIN	1.3E+02	Solubility	1.3E+02	4.1E+02	Ontario MOEE	5.0E+04
ETHANOL	5.0E+04	Upper Limit	5.0E+08	7.6E+05	Amoore & Hautala	5.0E+04
ETHYLBENZENE	3.0E+02	Nuisance Odors	8.5E+04	3.0E+02	USEPA 2nd MCL	5.0E+04
FLUORANTHENE	1.3E+02	Solubility	1.3E+02	-	-	5.0E+04
FLUORENE	9.5E+02	Solubility	9.5E+02	-	-	5.0E+04
GLYPHOSATE	5.0E+04	Upper Limit	6.0E+06	-	-	5.0E+04
HEPTACHLOR	9.0E+01	Solubility	9.0E+01	2.0E+02	Ontario MOEE	5.0E+04
HEPTACHLOR EPOXIDE	1.0E+02	Solubility	1.0E+02	-	-	5.0E+04
HEXACHLOROBENZENE	3.1E+00	Solubility	3.1E+00	3.0E+04	Ontario MOEE	5.0E+04
HEXACHLOROBUTADIENE	6.0E+01	Nuisance Odors	1.6E+03	6.0E+01	Ontario MOEE	5.0E+04
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	4.0E+03	Solubility	4.0E+03	1.2E+05	Ontario MOEE	5.0E+04

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

CHEMICAL PARAMETER	Final Action Level	Basis	Solubility (1/2)	Nuisance Odor Threshold	Basis	Upper Limit
HEXACHLOROETHANE	1.0E+02	Nuisance Odors	2.5E+04	1.0E+02	Ontario MOEE	5.0E+04
HEXAZINONE	5.0E+04	Upper Limit	1.7E+07	-	-	5.0E+04
INDENO(1,2,3-cd)PYRENE	9.5E-02	Solubility	9.5E-02	-	-	5.0E+04
ISOPHORONE	5.0E+04	Upper Limit	6.0E+06	-	-	5.0E+04
LEAD	5.0E+04	Upper Limit		-	-	5.0E+04
MERCURY	3.0E+01	Solubility	3.0E+01	-	-	5.0E+04
METHOXYCHLOR	5.0E+01	Solubility	5.0E+01	4.7E+04	Ontario MOEE	5.0E+04
METHYL ETHYL KETONE	5.0E+04	Upper Limit	1.1E+08	8.4E+04	Amoore & Hautala	5.0E+04
METHYL ISOBUTYL KETONE	1.3E+04	Nuisance Odors	9.5E+06	1.3E+04	Amoore & Hautala	5.0E+04
METHYL MERCURY	5.0E+04	Upper Limit		-	-	5.0E+04
METHYL TERT BUTYL ETHER	1.8E+03	Nuisance Odors	2.6E+07	1.8E+03	CalDHS	5.0E+04
METHYLENE CHLORIDE	5.0E+04	Upper Limit	6.5E+06	9.1E+04	Ontario MOEE	5.0E+04
METHYLNAPHTHALENE, 1-	1.0E+02	Nuisance Odors	1.3E+04	1.0E+02	Ontario MOEE	5.0E+04
METHYLNAPHTHALENE, 2-	1.0E+02	Nuisance Odors	1.3E+04	1.0E+02	Ontario MOEE	5.0E+04
MOLYBDENUM	5.0E+04	Upper Limit		-	-	5.0E+04
NAPHTHALENE	2.1E+02	Nuisance Odors	1.6E+04	2.1E+02	Ontario MOEE	5.0E+04
NICKEL	5.0E+04	Upper Limit		-	-	5.0E+04
NITROBENZENE	5.0E+04	Upper Limit	1.0E+06	-	-	5.0E+04
NITROGLYCERIN	5.0E+04	Upper Limit	6.9E+05	-	-	5.0E+04
NITROTOLUENE, 2-	5.0E+04	Upper Limit	3.3E+05	-	-	5.0E+04
NITROTOLUENE, 3-	5.0E+04	Upper Limit	2.1E+05	-	-	5.0E+04
NITROTOLUENE, 4-	5.0E+04	Upper Limit	2.2E+05	-	-	5.0E+04
PENTACHLOROPHENOL	5.9E+03	Nuisance Odors	7.0E+03	5.9E+03	Ontario MOEE	5.0E+04
PENTAERYTHRITOLTETRANITRATE (PETN)	2.2E+04	Solubility	2.2E+04	-	-	5.0E+04
PERCHLORATE	5.0E+04	Upper Limit	1.2E+08	-	-	5.0E+04
PHENANTHRENE	4.1E+02	Solubility	4.1E+02	1.0E+04	Ontario MOEE	5.0E+04
PHENOL	5.0E+04	Upper Limit	4.1E+07	7.9E+04	Ontario MOEE	5.0E+04
POLYCHLORINATED BIPHENYLS (PCBs)	1.6E+01	Solubility	1.6E+01	-	-	5.0E+04
PROPICONAZOLE	5.0E+04	Upper Limit	5.5E+04	-	-	5.0E+04
PYRENE	6.8E+01	Solubility	6.8E+01	-	-	5.0E+04
SELENIUM	5.0E+04	Upper Limit		-	-	5.0E+04
SILVER	5.0E+04	Upper Limit		-	-	5.0E+04
SIMAZINE	3.1E+03	Solubility	3.1E+03	-	-	5.0E+04
STYRENE	1.1E+02	Nuisance Odors	1.6E+05	1.1E+02	Ontario MOEE	5.0E+04
TERBACIL	5.0E+04	Upper Limit	3.6E+05	-	-	5.0E+04
tert-BUTYL ALCOHOL	5.0E+04	Upper Limit	5.0E+08	-	-	5.0E+04
TETRACHLOROETHANE, 1,1,1,2-	5.0E+04	Upper Limit	5.4E+05	-	-	5.0E+04
TETRACHLOROETHANE, 1,1,2,2-	5.0E+03	Nuisance Odors	1.4E+06	5.0E+03	Ontario MOEE	5.0E+04
TETRACHLOROETHYLENE	3.0E+03	Nuisance Odors	1.0E+05	3.0E+03	Ontario MOEE	5.0E+04
TETRACHLOROPHENOL, 2,3,4,6-	1.2E+04	Solubility	1.2E+04	-	-	5.0E+04
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	5.0E+04	Upper Limit	4.7E+06	-	-	5.0E+04
THALLIUM	5.0E+04	Upper Limit		-	-	5.0E+04
TOLUENE	4.0E+02	Nuisance Odors	2.6E+05	4.0E+02	Ontario MOEE	5.0E+04
TOXAPHENE	1.4E+02	Nuisance Odors	2.8E+02	1.4E+02	USEPA 2nd MCL	5.0E+04

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

CHEMICAL PARAMETER	Final Action Level	Basis	Solubility (1/2)	Nuisance Odor Threshold	Basis	Upper Limit
TPH (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-	2.5E+04	Solubility	2.5E+04	3.0E+04	USEPA (1995)	5.0E+04
TRICHLOROETHANE, 1,1,1-	5.0E+04	Upper Limit	6.5E+05	5.0E+05	Ontario MOEE	5.0E+04
TRICHLOROETHANE, 1,1,2-	5.0E+04	Upper Limit	5.5E+05	-	-	5.0E+04
TRICHLOROETHYLENE	5.0E+04	Upper Limit	6.4E+05	1.0E+05	Ontario MOEE	5.0E+04
TRICHLOROPHENOL, 2,4,5-	2.0E+03	Nuisance Odors	6.0E+05	2.0E+03	Ontario MOEE	5.0E+04
TRICHLOROPHENOL, 2,4,6-	1.0E+03	Nuisance Odors	4.0E+05	1.0E+03	Ontario MOEE	5.0E+04
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	5.0E+04	Upper Limit	1.4E+05	-	-	5.0E+04
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	5.0E+04	Upper Limit	1.0E+05	-	-	5.0E+04
TRICHLOROPROPANE, 1,2,3-	5.0E+04	Upper Limit	8.8E+05	-	-	5.0E+04
TRICHLOROPROPENE, 1,2,3-	5.0E+04	Upper Limit	1.4E+06	-	-	5.0E+04
TRIFLURALIN	9.2E+01	Solubility	9.2E+01	-	-	5.0E+04
TRINITROBENZENE, 1,3,5-	5.0E+04	Upper Limit	1.4E+05	-	-	5.0E+04
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	3.7E+04	Solubility	3.7E+04	-	-	5.0E+04
TRINITROTOLUENE, 2,4,6- (TNT)	5.0E+04	Upper Limit	6.5E+04	-	-	5.0E+04
VANADIUM	5.0E+04	Upper Limit		-	-	5.0E+04
VINYL CHLORIDE	3.4E+04	Nuisance Odors	4.4E+06	3.4E+04	Ontario MOEE	5.0E+04
XYLENES	5.3E+03	Nuisance Odors	8.1E+04	5.3E+03	Ontario MOEE	5.0E+04
ZINC	5.0E+04	Upper Limit		-	-	5.0E+04

References:

Unless otherwise noted, criteria for nuisance odor threshold from Ontario MOEE (MOEE 1996) OR data from Amoore and Hautala (1983) as presented in *A Compilation of Water Quality Goals* if not available *(RWQCBCV 2007).*

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

1/2 solubility based on solubility constants in USEPA RSL guidance (USEPA 2008a) or Ontario MOEE (MOEE 1996) if not available.

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

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

Notes:

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

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

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

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

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

CHEMICAL PARAMETER	Final Action Level	Basis	Solubility (1/2)	Taste And Odor Threshold	Basis	Upper Limit
ACENAPHTHENE	2.0E+01	Taste & Odors	2.0E+03	2.0E+01	Ontario MOEE	5.0E+04
ACENAPHTHYLENE	2.0E+03	Solubility	2.0E+03	-	-	5.0E+04
ACETONE	2.0E+04	Taste & Odors	5.0E+08	2.0E+04	Amoore & Hautala	5.0E+04
ALDRIN	8.5E+00	Solubility	8.5E+00	1.7E+01	Ontario MOEE	5.0E+04
AMETRYN	5.0E+04	Upper Limit	1.0E+05	-	-	5.0E+04
AMINO,2- DINITROTOLUENE,4,6-	5.0E+04	Upper Limit	6.1E+05	-	-	5.0E+04
AMINO,4- DINITROTOLUENE,2,6-	5.0E+04	Upper Limit	6.1E+05	-	-	5.0E+04
ANTHRACENE	2.2E+01	Solubility	2.2E+01	-	-	5.0E+04
ANTIMONY	5.0E+04	Upper Limit		-	-	5.0E+04
ARSENIC	5.0E+04	Upper Limit		-	-	5.0E+04
ATRAZINE	2.0E+01	Taste & Odors	1.7E+04	2.0E+01	Young et al	5.0E+04
BARIUM	5.0E+04	Upper Limit		-	-	5.0E+04
BENZENE	1.7E+02	Taste & Odors	9.0E+05	1.7E+02	Amoore & Hautala	5.0E+04
BENZO(a)ANTHRACENE	4.7E+00	Solubility	4.7E+00	-	-	5.0E+04
BENZO(a)PYRENE	8.1E-01	Solubility	8.1E-01	-	-	5.0E+04
BENZO(b)FLUORANTHENE	7.5E-01	Solubility	7.5E-01	-	-	5.0E+04
BENZO(g,h,i)PERYLENE	1.3E-01	Solubility	1.3E-01	-	-	5.0E+04
BENZO(k)FLUORANTHENE	4.0E-01	Solubility	4.0E-01	-	-	5.0E+04
BERYLLIUM	5.0E+04	Upper Limit		-	-	5.0E+04
BIPHENYL, 1,1-	5.0E-01	Taste & Odors	3.5E+03	5.0E-01	Amoore & Hautala	5.0E+04
BIS(2-CHLOROETHYL)ETHER	3.6E+02	Taste & Odors	8.6E+06	3.6E+02	Amoore & Hautala	5.0E+04
BIS(2-CHLOROISOPROPYL)ETHER	3.2E+02	Taste & Odors	8.5E+05	3.2E+02	Ontario MOEE	5.0E+04
BIS(2-ETHYLHEXYL)PHTHALATE	1.4E+02	Solubility	1.4E+02	-	-	5.0E+04
BORON	5.0E+04	Upper Limit		-	-	5.0E+04
BROMODICHLOROMETHANE	5.0E+04	Upper Limit	1.5E+06	-	-	5.0E+04
BROMOFORM	5.1E+02	Taste & Odors	1.6E+06	5.1E+02	Amoore & Hautala	5.0E+04
BROMOMETHANE	5.0E+04	Upper Limit	7.6E+06	-	-	5.0E+04
CADMIUM	5.0E+04	Upper Limit		-	-	5.0E+04
CARBON TETRACHLORIDE	5.2E+02	Taste & Odors	4.0E+05	5.2E+02	Amoore & Hautala	5.0E+04
CHLORDANE (TECHNICAL)	2.5E+00	Taste & Odors	2.8E+01	2.5E+00	Ontario MOEE	5.0E+04
CHLOROANILINE, p-	5.0E+04	Upper Limit	2.0E+06	-	-	5.0E+04
CHLOROBENZENE	5.0E+01	Taste & Odors	2.5E+05	5.0E+01	Amoore & Hautala	5.0E+04
CHLOROETHANE	1.6E+01	Taste & Odors	3.4E+06	1.6E+01	Amoore & Hautala	5.0E+04
CHLOROFORM	2.4E+03	Taste & Odors	4.0E+06	2.4E+03	Amoore & Hautala	5.0E+04
CHLOROMETHANE	5.0E+04	Upper Limit	2.7E+06		-	5.0E+04
CHLOROPHENOL, 2-	1.8E-01	Taste & Odors	1.4E+07	1.8E-01	Ontario MOEE	5.0E+04
CHROMIUM (Total)	5.0E+04	Upper Limit		-	-	5.0E+04
CHROMIUM III	5.0E+04	Upper Limit		-	-	5.0E+04
CHROMIUM VI	5.0E+04	Upper Limit	8.5E+08	-	-	5.0E+04
CHRYSENE	1.0E+00	Solubility	1.0E+00	-	-	5.0E+04
COBALT	5.0E+04	Upper Limit		-	-	5.0E+04
COPPER	1.0E+03	Taste & Odors		1.0E+03	CalDHS 2nd MCL	5.0E+04
CYANIDE (Free)	1.7E+02	Taste & Odors		1.7E+02	Amoore & Hautala	5.0E+04

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

CHEMICAL PARAMETER	Final Action Level	Basis	Solubility (1/2)	Taste And Odor Threshold	Basis	Upper Limit
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	3.0E+04	Solubility	3.0E+04	-	-	5.0E+04
DALAPON	5.0E+04	Upper Limit	2.5E+08	-	-	5.0E+04
DIBENZO(a,h)ANTHTRACENE	5.2E-01	Solubility	5.2E-01	-	-	5.0E+04
DIBROMO,1,2- CHLOROPROPANE,3-	1.0E+01	Taste & Odors	6.2E+05	1.0E+01	Amoore & Hautala	5.0E+04
DIBROMOCHLOROMETHANE	5.0E+04	Upper Limit	1.4E+06	-	-	5.0E+04
DIBROMOETHANE, 1,2-	5.0E+04	Upper Limit	2.0E+06	-	-	5.0E+04
DICHLOROBENZENE, 1,2-	1.0E+01	Taste & Odors	4.0E+04	1.0E+01	USEPA 2nd MCL	5.0E+04
DICHLOROBENZENE, 1,3-	5.0E+04	Upper Limit	7.8E+04	-	-	5.0E+04
DICHLOROBENZENE, 1,4-	5.0E+00	Taste & Odors	4.1E+04	5.0E+00	USEPA 2nd MCL	5.0E+04
DICHLOROBENZIDINE, 3,3-	1.6E+03	Solubility	1.6E+03	-	-	5.0E+04
DICHLORODIPHENYLDICHLOROETHANE (DDD)	4.5E+01	Solubility	4.5E+01	-	-	5.0E+04
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.0E+01	Solubility	2.0E+01	-	-	5.0E+04
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	2.8E+00	Solubility	2.8E+00	3.5E+02	Ontario MOEE	5.0E+04
DICHLOROETHANE, 1,1-	5.0E+04	Upper Limit	2.5E+06	-	-	5.0E+04
DICHLOROETHANE, 1,2-	7.0E+03	Taste & Odors	2.6E+06	7.0E+03	Amoore & Hautala	5.0E+04
DICHLOROETHYLENE, 1,1-	1.5E+03	Taste & Odors	1.2E+06	1.5E+03	Amoore & Hautala	5.0E+04
DICHLOROETHYLENE, Cis 1,2-	5.0E+04	Upper Limit	1.8E+06	-	-	5.0E+04
DICHLOROETHYLENE, Trans 1,2-	2.6E+02	Taste & Odors	1.8E+06	2.6E+02	Amoore & Hautala	5.0E+04
DICHLOROPHENOL, 2,4-	3.0E-01	Taste & Odors	2.3E+06	3.0E-01	Ontario MOEE	5.0E+04
DICHLOROPHENOXYACETIC ACID (2,4-D)	5.0E+04	Upper Limit	3.4E+05	-	-	5.0E+04
DICHLOROPROPANE, 1,2-	1.0E+01	Taste & Odors	1.4E+06	1.0E+01	Ontario MOEE	5.0E+04
DICHLOROPROPENE, 1,3-	5.0E+04	Upper Limit	1.4E+06	-	-	5.0E+04
DIELDRIN	4.1E+01	Taste & Odors	1.3E+02	4.1E+01	Ontario MOEE	5.0E+04
DIETHYLPHTHALATE	5.0E+04	Upper Limit	5.4E+05	-	-	5.0E+04
DIMETHYLPHENOL, 2,4-	4.0E+02	Taste & Odors	3.9E+06	4.0E+02	Cal DHS AL	5.0E+04
DIMETHYLPHTHALATE	5.0E+04	Upper Limit	2.5E+06	-	-	5.0E+04
DINITROBENZENE, 1,3-	5.0E+04	Upper Limit	2.7E+05	-	-	5.0E+04
DINITROPHENOL, 2,4-	5.0E+04	Upper Limit	1.4E+06	-	-	5.0E+04
DINITROTOLUENE, 2,4- (2,4-DNT)	5.0E+04	Upper Limit	1.4E+05	-	-	5.0E+04
DINITROTOLUENE, 2,6- (2,6-DNT)	5.0E+04	Upper Limit	1.8E+05	-	-	5.0E+04
DIOXANE, 1,4-	5.0E+04	Upper Limit	5.0E+08	2.3E+05	Amoore & Hautala	5.0E+04
DIOXINS (TEQ)	6.0E-02	Solubility	6.0E-02	-	-	5.0E+04
DIURON	2.1E+04	Solubility	2.1E+04	-	-	5.0E+04
ENDOSULFAN	2.3E+02	Solubility	2.3E+02	-	-	5.0E+04
ENDRIN	4.1E+01	Taste & Odors	1.3E+02	4.1E+01	Ontario MOEE	5.0E+04
ETHANOL	5.0E+04	Upper Limit	5.0E+08	7.6E+05	Amoore & Hautala	5.0E+04
ETHYLBENZENE	3.0E+01	Taste & Odors	8.5E+04	3.0E+01	USEPA 2nd MCL	5.0E+04
FLUORANTHENE	1.3E+02	Solubility	1.3E+02	-	-	5.0E+04
FLUORENE	9.5E+02	Solubility	9.5E+02	-	-	5.0E+04
GLYPHOSATE	5.0E+04	Upper Limit	6.0E+06	-	-	5.0E+04
HEPTACHLOR	2.0E+01	Taste & Odors	9.0E+01	2.0E+01	Ontario MOEE	5.0E+04
HEPTACHLOR EPOXIDE	1.0E+02	Solubility	1.0E+02	-	-	5.0E+04
HEXACHLOROBENZENE	3.1E+00	Solubility	3.1E+00	3.0E+03	Ontario MOEE	5.0E+04

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

CHEMICAL PARAMETER	Final Action Level	Basis	Solubility (1/2)	Taste And Odor Threshold	Basis	Upper Limit
HEXACHLOROBUTADIENE	6.0E+00	Taste & Odors	1.6E+03	6.0E+00	Ontario MOEE	5.0E+04
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	4.0E+03	Solubility	4.0E+03	1.2E+04	Ontario MOEE	5.0E+04
HEXACHLOROETHANE	1.0E+01	Taste & Odors	2.5E+04	1.0E+01	Amoore & Hautala	5.0E+04
HEXAZINONE	5.0E+04	Upper Limit	1.7E+07	-	-	5.0E+04
INDENO(1,2,3-cd)PYRENE	9.5E-02	Solubility	9.5E-02	-	-	5.0E+04
ISOPHORONE	5.0E+04	Upper Limit	6.0E+06	-	-	5.0E+04
LEAD	5.0E+04	Upper Limit		-	-	5.0E+04
MERCURY	3.0E+01	Solubility	3.0E+01	-	-	5.0E+04
METHOXYCHLOR	5.0E+01	Solubility	5.0E+01	4.7E+03	Amoore & Hautala	5.0E+04
METHYL ETHYL KETONE	8.4E+03	Taste & Odors	1.1E+08	8.4E+03	Amoore & Hautala	5.0E+04
METHYL ISOBUTYL KETONE	1.3E+03	Taste & Odors	9.5E+06	1.3E+03	Amoore & Hautala	5.0E+04
METHYL MERCURY	5.0E+04	Upper Limit		-	-	5.0E+04
METHYL TERT BUTYL ETHER	5.0E+00	Taste & Odors	2.6E+07	5.0E+00	Cal DHS 2nd MCL	5.0E+04
METHYLENE CHLORIDE	9.1E+03	Taste & Odors	6.5E+06	9.1E+03	Ontario MOEE	5.0E+04
METHYLNAPHTHALENE, 1-	1.0E+01	Taste & Odors	1.3E+04	1.0E+01	Ontario MOEE	5.0E+04
METHYLNAPHTHALENE, 2-	1.0E+01	Taste & Odors	1.3E+04	1.0E+01	Ontario MOEE	5.0E+04
MOLYBDENUM	5.0E+04	Upper Limit		-	-	5.0E+04
NAPHTHALENE	2.1E+01	Taste & Odors	1.6E+04	2.1E+01	Amoore & Hautala	5.0E+04
NICKEL	5.0E+04	Upper Limit		-	-	5.0E+04
NITROBENZENE	5.0E+04	Upper Limit	1.0E+06	-	-	5.0E+04
NITROGLYCERIN	5.0E+04	Upper Limit	6.9E+05	-	-	5.0E+04
NITROTOLUENE, 2-	5.0E+04	Upper Limit	3.3E+05	-	-	5.0E+04
NITROTOLUENE, 3-	5.0E+04	Upper Limit	2.1E+05	-	-	5.0E+04
NITROTOLUENE, 4-	5.0E+04	Upper Limit	2.2E+05	-	-	5.0E+04
PENTACHLOROPHENOL	3.0E+01	Taste & Odors	7.0E+03	3.0E+01	Amoore & Hautala	5.0E+04
PENTAERYTHRITOLTETRANITRATE (PETN)	2.2E+04	Solubility	2.2E+04	-	-	5.0E+04
PERCHLORATE	5.0E+04	Upper Limit	1.2E+08	-	-	5.0E+04
PHENANTHRENE	4.1E+02	Solubility	4.1E+02	1.0E+03	Ontario MOEE	5.0E+04
PHENOL	5.0E+00	Taste & Odors	4.1E+07	5.0E+00	Cal DHS AL	5.0E+04
POLYCHLORINATED BIPHENYLS (PCBs)	1.6E+01	Solubility	1.6E+01	-	-	5.0E+04
PROPICONAZOLE	5.0E+04	Upper Limit	5.5E+04	-	-	5.0E+04
PYRENE	6.8E+01	Solubility	6.8E+01	-	-	5.0E+04
SELENIUM	5.0E+04	Upper Limit		-	-	5.0E+04
SILVER	1.0E+02	Taste & Odors		1.0E+02	Cal DHS 2nd MCL	5.0E+04
SIMAZINE	3.1E+03	Solubility	3.1E+03	-	-	5.0E+04
STYRENE	1.0E+01	Taste & Odors	1.6E+05	1.0E+01	USEPA 2nd MCL	5.0E+04
TERBACIL	5.0E+04	Upper Limit	3.6E+05	-	-	5.0E+04
tert-BUTYL ALCOHOL	5.0E+04	Upper Limit	5.0E+08	-	-	5.0E+04
TETRACHLOROETHANE, 1,1,1,2-	5.0E+04	Upper Limit	5.4E+05	-	-	5.0E+04
TETRACHLOROETHANE, 1,1,2,2-	5.0E+02	Taste & Odors	1.4E+06	5.0E+02	Amoore & Hautala	5.0E+04
TETRACHLOROETHYLENE	1.7E+02	Taste & Odors	1.0E+05	1.7E+02	Amoore & Hautala	5.0E+04
TETRACHLOROPHENOL, 2,3,4,6-	1.2E+04	Solubility	1.2E+04	-	-	5.0E+04
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	5.0E+04	Upper Limit	4.7E+06	-	-	5.0E+04

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

CHEMICAL PARAMETER	Final Action Level	Basis	Solubility (1/2)	Taste And Odor Threshold	Basis	Upper Limit
THALLIUM	5.0E+04	Upper Limit		-	-	5.0E+04
TOLUENE	4.0E+01	Taste & Odors	2.6E+05	4.0E+01	USEPA 2nd MCL	5.0E+04
TOXAPHENE	1.4E+02	Taste & Odors	2.8E+02	1.4E+02	USEPA 2nd MCL	5.0E+04
TPH (gasolines)	1.0E+02	Taste & Odors	7.5E+04	1.0E+02	USEPA SNARL	5.0E+04
TPH (middle distillates)	1.0E+02	Taste & Odors	2.5E+03	1.0E+02	USEPA SNARL	5.0E+04
TPH (residual fuels)	1.0E+02	Taste & Odors	2.5E+03	1.0E+02	USEPA SNARL	5.0E+04
TRICHLOROBENZENE, 1,2,4-	3.0E+03	Taste & Odors	2.5E+04	3.0E+03	USEPA (1995)	5.0E+04
TRICHLOROETHANE, 1,1,1-	9.7E+02	Taste & Odors	6.5E+05	9.7E+02	Amoore & Hautala	5.0E+04
TRICHLOROETHANE, 1,1,2-	5.0E+04	Upper Limit	5.5E+05	-	-	5.0E+04
TRICHLOROETHYLENE	3.1E+02	Taste & Odors	6.4E+05	3.1E+02	Amoore & Hautala	5.0E+04
TRICHLOROPHENOL, 2,4,5-	2.0E+02	Taste & Odors	6.0E+05	2.0E+02	Ontario MOEE	5.0E+04
TRICHLOROPHENOL, 2,4,6-	1.0E+02	Taste & Odors	4.0E+05	1.0E+02	Ontario MOEE	5.0E+04
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	5.0E+04	Upper Limit	1.4E+05	-	-	5.0E+04
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	5.0E+04	Upper Limit	1.0E+05	-	-	5.0E+04
TRICHLOROPROPANE, 1,2,3-	5.0E+04	Upper Limit	8.8E+05	-	-	5.0E+04
TRICHLOROPROPENE, 1,2,3-	5.0E+04	Upper Limit	1.4E+06	-	-	5.0E+04
TRIFLURALIN	9.2E+01	Solubility	9.2E+01	-	-	5.0E+04
TRINITROBENZENE, 1,3,5-	5.0E+04	Upper Limit	1.4E+05	-	-	5.0E+04
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	3.7E+04	Solubility	3.7E+04	-	-	5.0E+04
TRINITROTOLUENE, 2,4,6- (TNT)	5.0E+04	Upper Limit	6.5E+04	-	-	5.0E+04
VANADIUM	5.0E+04	Upper Limit		-	-	5.0E+04
VINYL CHLORIDE	3.4E+03	Taste & Odors	4.4E+06	3.4E+03	Amoore & Hautala	5.0E+04
XYLENES	2.0E+01	Taste & Odors	8.1E+04	2.0E+01	USEPA 2nd MCL	5.0E+04
ZINC	5.0E+03	Taste & Odors		5.0E+03	Cal DHS 2nd MCL	5.0E+04

References:

Unless otherwise noted, criteria for drinking water taste and odor threshold from summary in *A Compilation of Water Quality Goals* (RWQCBCV 2007) or Ontario MOEE if not available (MOEE 1996).

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

1/2 solubility based on solubility constants in USEPA RSL guidance (USEPA 2008a) or Ontario MOEE (MOEE 1996) if not available.

Notes:

Ceiling Level: lowest of 1/2 solubility, taste and odor threshold and 50000 ug/L maximum level

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

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

TPH Taste and Odor Thresholds based on USEPA Suggested-No-Adverse-reaction (SNARL) level for TPH diesel.

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

CHEMICAL PARAMETER	Final Action Level	Basis	Solubility (1/2)	Nuisance Odor Threshold	Basis	Upper Limit
ACENAPHTHENE	2.0E+01	Nuisance Odors	2.0E+03	2.0E+01	Ontario MOEE	5.0E+04
ACENAPHTHYLENE	2.0E+03	Solubility	2.0E+03	-	-	5.0E+04
ACETONE	2.0E+04	Nuisance Odors	5.0E+08	2.0E+04	Ontario MOEE	5.0E+04
ALDRIN	8.5E+00	Solubility	8.5E+00	1.7E+01	Ontario MOEE	5.0E+04
AMETRYN	5.0E+04	Upper Limit	1.0E+05	-	-	5.0E+04
AMINO,2- DINITROTOLUENE,4,6-	5.0E+04	Upper Limit	6.1E+05	-	-	5.0E+04
AMINO,4- DINITROTOLUENE,2,6-	5.0E+04	Upper Limit	6.1E+05	-	-	5.0E+04
ANTHRACENE	2.2E+01	Solubility	2.2E+01	-	-	5.0E+04
ANTIMONY	5.0E+04	Upper Limit		-	-	5.0E+04
ARSENIC	5.0E+04	Upper Limit		-	-	5.0E+04
ATRAZINE	1.7E+04	Solubility	1.7E+04	-	-	5.0E+04
BARIUM	5.0E+04	Upper Limit		-	-	5.0E+04
BENZENE	2.0E+03	Nuisance Odors	9.0E+05	2.0E+03	Ontario MOEE	5.0E+04
BENZO(a)ANTHRACENE	4.7E+00	Solubility	4.7E+00	-	-	5.0E+04
BENZO(a)PYRENE	8.1E-01	Solubility	8.1E-01	-	-	5.0E+04
BENZO(b)FLUORANTHENE	7.5E-01	Solubility	7.5E-01	-	-	5.0E+04
BENZO(g,h,i)PERYLENE	1.3E-01	Solubility	1.3E-01	-	-	5.0E+04
BENZO(k)FLUORANTHENE	4.0E-01	Solubility	4.0E-01	-	-	5.0E+04
BERYLLIUM	5.0E+04	Upper Limit		-	-	5.0E+04
BIPHENYL, 1,1-	5.0E-01	Nuisance Odors	3.5E+03	5.0E-01	Amoore & Hautala	5.0E+04
BIS(2-CHLOROETHYL)ETHER	3.6E+02	Nuisance Odors	8.6E+06	3.6E+02	Amoore & Hautala	5.0E+04
BIS(2-CHLOROISOPROPYL)ETHER	3.2E+02	Nuisance Odors	8.5E+05	3.2E+02	Ontario MOEE	5.0E+04
BIS(2-ETHYLHEXYL)PHTHALATE	1.4E+02	Solubility	1.4E+02	-	-	5.0E+04
BORON	5.0E+04	Upper Limit		-	-	5.0E+04
BROMODICHLOROMETHANE	5.0E+04	Upper Limit	1.5E+06	-	-	5.0E+04
BROMOFORM	5.1E+02	Nuisance Odors	1.6E+06	5.1E+02	Ontario MOEE	5.0E+04
BROMOMETHANE	5.0E+04	Upper Limit	7.6E+06	-	-	5.0E+04
CADMIUM	5.0E+04	Upper Limit		-	-	5.0E+04
CARBON TETRACHLORIDE	5.2E+02	Nuisance Odors	4.0E+05	5.2E+02	Ontario MOEE	5.0E+04
CHLORDANE (TECHNICAL)	2.5E+00	Nuisance Odors	2.8E+01	2.5E+00	Ontario MOEE	5.0E+04
CHLOROANILINE, p-	5.0E+04	Upper Limit	2.0E+06	-	-	5.0E+04
CHLOROBENZENE	5.0E+01	Nuisance Odors	2.5E+05	5.0E+01	Ontario MOEE	5.0E+04
CHLOROETHANE	1.6E+01	Nuisance Odors	3.4E+06	1.6E+01	Amoore & Hautala	5.0E+04
CHLOROFORM	2.4E+03	Nuisance Odors	4.0E+06	2.4E+03	Ontario MOEE	5.0E+04
CHLOROMETHANE	5.0E+04	Upper Limit	2.7E+06	-	-	5.0E+04
CHLOROPHENOL, 2-	1.8E-01	Nuisance Odors	1.4E+07	1.8E-01	Ontario MOEE	5.0E+04
CHROMIUM (Total)	5.0E+04	Upper Limit		-	-	5.0E+04
CHROMIUM III	5.0E+04	Upper Limit		-	-	5.0E+04
CHROMIUM VI	5.0E+04	Upper Limit	8.5E+08	-	-	5.0E+04
CHRYSENE	1.0E+00	Solubility	1.0E+00	-	-	5.0E+04
COBALT	5.0E+04	Upper Limit		-	-	5.0E+04
COPPER	5.0E+04	Upper Limit		-	-	5.0E+04
CYANIDE (Free)	1.7E+02	Nuisance Odors		1.7E+02	Ontario MOEE	5.0E+04
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	3.0E+04	Solubility	3.0E+04	-	-	5.0E+04

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

CHEMICAL PARAMETER	Final Action Level	Basis	Solubility (1/2)	Nuisance Odor Threshold	Basis	Upper Limit
DALAPON	5.0E+04	Upper Limit	2.5E+08	-	-	5.0E+04
DIBENZO(a,h)ANTHTRACENE	5.2E-01	Solubility	5.2E-01	-	-	5.0E+04
DIBROMO,1,2- CHLOROPROPANE,3-	1.0E+01	Nuisance Odors	6.2E+05	1.0E+01	Amoore & Hautala	5.0E+04
DIBROMOCHLOROMETHANE	5.0E+04	Upper Limit	1.4E+06	-	-	5.0E+04
DIBROMOETHANE, 1,2-	5.0E+04	Upper Limit	2.0E+06	-	-	5.0E+04
DICHLOROBENZENE, 1,2-	1.0E+01	Nuisance Odors	4.0E+04	1.0E+01	Ontario MOEE	5.0E+04
DICHLOROBENZENE, 1,3-	5.0E+04	Upper Limit	7.8E+04	-	-	5.0E+04
DICHLOROBENZENE, 1,4-	1.1E+01	Nuisance Odors	4.1E+04	1.1E+01	Ontario MOEE	5.0E+04
DICHLOROBENZIDINE, 3,3-	1.6E+03	Solubility	1.6E+03	-	-	5.0E+04
DICHLORODIPHENYLDICHLOROETHANE (DDD)	4.5E+01	Solubility	4.5E+01	-	-	5.0E+04
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.0E+01	Solubility	2.0E+01	-	-	5.0E+04
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	2.8E+00	Solubility	2.8E+00	3.5E+02	Ontario MOEE	5.0E+04
DICHLOROETHANE, 1,1-	5.0E+04	Upper Limit	2.5E+06	-	-	5.0E+04
DICHLOROETHANE, 1,2-	2.0E+04	Nuisance Odors	2.6E+06	2.0E+04	Ontario MOEE	5.0E+04
DICHLOROETHYLENE, 1,1-	1.5E+03	Nuisance Odors	1.2E+06	1.5E+03	Amoore & Hautala	5.0E+04
DICHLOROETHYLENE, Cis 1,2-	5.0E+04	Upper Limit	1.8E+06	-	-	5.0E+04
DICHLOROETHYLENE, Trans 1,2-	2.6E+02	Nuisance Odors	1.8E+06	2.6E+02	Ontario MOEE	5.0E+04
DICHLOROPHENOL, 2,4-	3.0E-01	Nuisance Odors	2.3E+06	3.0E-01	Ontario MOEE	5.0E+04
DICHLOROPHENOXYACETIC ACID (2,4-D)	5.0E+04	Upper Limit	3.4E+05	-	-	5.0E+04
DICHLOROPROPANE, 1,2-	1.0E+01	Nuisance Odors	1.4E+06	1.0E+01	Ontario MOEE	5.0E+04
DICHLOROPROPENE, 1,3-	5.0E+04	Upper Limit	1.4E+06	-	-	5.0E+04
DIELDRIN	4.1E+01	Nuisance Odors	1.3E+02	4.1E+01	Ontario MOEE	5.0E+04
DIETHYLPHTHALATE	5.0E+04	Upper Limit	5.4E+05	-	-	5.0E+04
DIMETHYLPHENOL, 2,4-	4.0E+02	Nuisance Odors	3.9E+06	4.0E+02	Ontario MOEE	5.0E+04
DIMETHYLPHTHALATE	5.0E+04	Upper Limit	2.5E+06	-	-	5.0E+04
DINITROBENZENE, 1,3-	5.0E+04	Upper Limit	2.7E+05	-	-	5.0E+04
DINITROPHENOL, 2,4-	5.0E+04	Upper Limit	1.4E+06	-	-	5.0E+04
DINITROTOLUENE, 2,4- (2,4-DNT)	5.0E+04	Upper Limit	1.4E+05	-	-	5.0E+04
DINITROTOLUENE, 2,6- (2,6-DNT)	5.0E+04	Upper Limit	1.8E+05	-	-	5.0E+04
DIOXANE, 1,4-	5.0E+04	Upper Limit	5.0E+08	-	-	5.0E+04
DIOXINS (TEQ)	6.0E-02	Solubility	6.0E-02	-	-	5.0E+04
DIURON	2.1E+04	Solubility	2.1E+04	-	-	5.0E+04
ENDOSULFAN	2.3E+02	Solubility	2.3E+02	-	-	5.0E+04
ENDRIN	4.1E+01	Nuisance Odors	1.3E+02	4.1E+01	Ontario MOEE	5.0E+04
ETHANOL	5.0E+04	Upper Limit	5.0E+08	7.6E+05	Amoore & Hautala	5.0E+04
ETHYLBENZENE	3.0E+01	Nuisance Odors	8.5E+04	3.0E+01	USEPA 2nd MCL	5.0E+04
FLUORANTHENE	1.3E+02	Solubility	1.3E+02	-	-	5.0E+04
FLUORENE	9.5E+02	Solubility	9.5E+02	-	-	5.0E+04
GLYPHOSATE	5.0E+04	Upper Limit	6.0E+06	-	-	5.0E+04
HEPTACHLOR	2.0E+01	Nuisance Odors	9.0E+01	2.0E+01	Ontario MOEE	5.0E+04
HEPTACHLOR EPOXIDE	1.0E+02	Solubility	1.0E+02	-	-	5.0E+04
HEXACHLOROBENZENE	3.1E+00	Solubility	3.1E+00	3.0E+03	Ontario MOEE	5.0E+04
HEXACHLOROBUTADIENE	6.0E+00	Nuisance Odors	1.6E+03	6.0E+00	Ontario MOEE	5.0E+04
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	4.0E+03	Solubility	4.0E+03	1.2E+04	Ontario MOEE	5.0E+04

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

CHEMICAL PARAMETER	Final Action Level	Basis	Solubility (1/2)	Nuisance Odor Threshold	Basis	Upper Limit
HEXACHLOROETHANE	1.0E+01	Nuisance Odors	2.5E+04	1.0E+01	Ontario MOEE	5.0E+04
HEXAZINONE	5.0E+04	Upper Limit	1.7E+07	-	-	5.0E+04
INDENO(1,2,3-cd)PYRENE	9.5E-02	Solubility	9.5E-02	-	-	5.0E+04
ISOPHORONE	5.0E+04	Upper Limit	6.0E+06	-	-	5.0E+04
LEAD	5.0E+04	Upper Limit		-	-	5.0E+04
MERCURY	3.0E+01	Solubility	3.0E+01	-	-	5.0E+04
METHOXYCHLOR	5.0E+01	Solubility	5.0E+01	4.7E+03	Ontario MOEE	5.0E+04
METHYL ETHYL KETONE	8.4E+03	Nuisance Odors	1.1E+08	8.4E+03	Amoore & Hautala	5.0E+04
METHYL ISOBUTYL KETONE	1.3E+03	Nuisance Odors	9.5E+06	1.3E+03	Amoore & Hautala	5.0E+04
METHYL MERCURY	5.0E+04	Upper Limit		-	-	5.0E+04
METHYL TERT BUTYL ETHER	1.8E+02	Nuisance Odors	2.6E+07	1.8E+02	CalDHS	5.0E+04
METHYLENE CHLORIDE	9.1E+03	Nuisance Odors	6.5E+06	9.1E+03	Ontario MOEE	5.0E+04
METHYLNAPHTHALENE, 1-	1.0E+01	Nuisance Odors	1.3E+04	1.0E+01	Ontario MOEE	5.0E+04
METHYLNAPHTHALENE, 2-	1.0E+01	Nuisance Odors	1.3E+04	1.0E+01	Ontario MOEE	5.0E+04
MOLYBDENUM	5.0E+04	Upper Limit		-	-	5.0E+04
NAPHTHALENE	2.1E+01	Nuisance Odors	1.6E+04	2.1E+01	Ontario MOEE	5.0E+04
NICKEL	5.0E+04	Upper Limit		-	-	5.0E+04
NITROBENZENE	5.0E+04	Upper Limit	1.0E+06	-	-	5.0E+04
NITROGLYCERIN	5.0E+04	Upper Limit	6.9E+05	-	-	5.0E+04
NITROTOLUENE, 2-	5.0E+04	Upper Limit	3.3E+05	-	-	5.0E+04
NITROTOLUENE, 3-	5.0E+04	Upper Limit	2.1E+05	-	-	5.0E+04
NITROTOLUENE, 4-	5.0E+04	Upper Limit	2.2E+05	-	-	5.0E+04
PENTACHLOROPHENOL	5.9E+02	Nuisance Odors	7.0E+03	5.9E+02	Ontario MOEE	5.0E+04
PENTAERYTHRITOLTETRANITRATE (PETN)	2.2E+04	Solubility	2.2E+04	-	-	5.0E+04
PERCHLORATE	5.0E+04	Upper Limit	1.2E+08	-	-	5.0E+04
PHENANTHRENE	4.1E+02	Solubility	4.1E+02	1.0E+03	Ontario MOEE	5.0E+04
PHENOL	7.9E+03	Nuisance Odors	4.1E+07	7.9E+03	Ontario MOEE	5.0E+04
POLYCHLORINATED BIPHENYLS (PCBs)	1.6E+01	Solubility	1.6E+01	-	-	5.0E+04
PROPICONAZOLE	5.0E+04	Upper Limit	5.5E+04	-	-	5.0E+04
PYRENE	6.8E+01	Solubility	6.8E+01	-	-	5.0E+04
SELENIUM	5.0E+04	Upper Limit		-	-	5.0E+04
SILVER	5.0E+04	Upper Limit		-	-	5.0E+04
SIMAZINE	3.1E+03	Solubility	3.1E+03	-	-	5.0E+04
STYRENE	1.1E+01	Nuisance Odors	1.6E+05	1.1E+01	Ontario MOEE	5.0E+04
TERBACIL	5.0E+04	Upper Limit	3.6E+05	-	-	5.0E+04
tert-BUTYL ALCOHOL	5.0E+04	Upper Limit	5.0E+08	-	-	5.0E+04
TETRACHLOROETHANE, 1,1,1,2-	5.0E+04	Upper Limit	5.4E+05	-	-	5.0E+04
TETRACHLOROETHANE, 1,1,2,2-	5.0E+02	Nuisance Odors	1.4E+06	5.0E+02	Ontario MOEE	5.0E+04
TETRACHLOROETHYLENE	3.0E+02	Nuisance Odors	1.0E+05	3.0E+02	Ontario MOEE	5.0E+04
TETRACHLOROPHENOL, 2,3,4,6-	1.2E+04	Solubility	1.2E+04	-	-	5.0E+04
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	5.0E+04	Upper Limit	4.7E+06	-	-	5.0E+04
THALLIUM	5.0E+04	Upper Limit		-	-	5.0E+04
TOLUENE	4.0E+01	Nuisance Odors	2.6E+05	4.0E+01	Ontario MOEE	5.0E+04
TOXAPHENE	1.4E+02	Nuisance Odors	2.8E+02	1.4E+02	USEPA 2nd MCL	5.0E+04

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

CHEMICAL PARAMETER	Final Action Level	Basis	Solubility (1/2)	Nuisance Odor Threshold	Basis	Upper Limit
TPH (gasolines)	5.0E+03	Nuisance Odors	7.5E+04	5.0E+03	MADEP	5.0E+04
TPH (middle distillates)	2.5E+03	Solubility	2.5E+03	5.0E+03	MADEP	5.0E+04
TPH (residual fuels)	2.5E+03	Solubility	2.5E+03	5.0E+03	MADEP	5.0E+04
TRICHLOROBENZENE, 1,2,4-	3.0E+03	Nuisance Odors	2.5E+04	3.0E+03	USEPA (1995)	5.0E+04
TRICHLOROETHANE, 1,1,1-	5.0E+04	Nuisance Odors	6.5E+05	5.0E+04	Ontario MOEE	5.0E+04
TRICHLOROETHANE, 1,1,2-	5.0E+04	Upper Limit	5.5E+05	-	-	5.0E+04
TRICHLOROETHYLENE	1.0E+04	Nuisance Odors	6.4E+05	1.0E+04	Ontario MOEE	5.0E+04
TRICHLOROPHENOL, 2,4,5-	2.0E+02	Nuisance Odors	6.0E+05	2.0E+02	Ontario MOEE	5.0E+04
TRICHLOROPHENOL, 2,4,6-	1.0E+02	Nuisance Odors	4.0E+05	1.0E+02	Ontario MOEE	5.0E+04
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	5.0E+04	Upper Limit	1.4E+05	-	-	5.0E+04
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	5.0E+04	Upper Limit	1.0E+05	-	-	5.0E+04
TRICHLOROPROPANE, 1,2,3-	5.0E+04	Upper Limit	8.8E+05	-	-	5.0E+04
TRICHLOROPROPENE, 1,2,3-	5.0E+04	Upper Limit	1.4E+06	-	-	5.0E+04
TRIFLURALIN	9.2E+01	Solubility	9.2E+01	-	-	5.0E+04
TRINITROBENZENE, 1,3,5-	5.0E+04	Upper Limit	1.4E+05	-	-	5.0E+04
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	3.7E+04	Solubility	3.7E+04	-	-	5.0E+04
TRINITROTOLUENE, 2,4,6- (TNT)	2.0E+01	Nuisance Odors	6.5E+04	2.0E+01	Ontario MOEE	5.0E+04
VANADIUM	5.0E+04	Upper Limit		-	-	5.0E+04
VINYL CHLORIDE	3.4E+03	Nuisance Odors	4.4E+06	3.4E+03	Ontario MOEE	5.0E+04
XYLENES	5.3E+02	Nuisance Odors	8.1E+04	5.3E+02	Ontario MOEE	5.0E+04
ZINC	5.0E+04	Upper Limit		-	-	5.0E+04

References:

Unless otherwise noted, criteria for nuisance odor threshold from Ontario MOEE (MOEE 1996, minus groundwater-to-surface water dilution factor) OR data from Amoore and Hautala (1983) as presented in *A Compilation of Water Quality Goals* if not available (RWQCBCV 2007).

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

1/2 solubility based on solubility constants in USEPA RSL guidance (USEPA 2008a) or Ontario MOEE (MOEE 1996) if not available.

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

Notes:

Nuisance Odor Thresholds assume no attenuation/dilution of chemical in surface water.

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

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

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

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

CHEMICAL PARAMETER	Physical State		Molecular Weight	Organic carbon partition coefficient, K_{oc}	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'	GI Absorption Factor GIABS	Skin Absorption Factor ABS	Cancer Slope Factor Oral CSFo	Cancer Unit Risk Factor (Inhalation) IUR	Reference Dose Oral RfDo	Reference Concentration (Inhalation) RfC
				(cm^3/g)	(cm^2/s)	(cm^2/s)	(mg/L)	(atm-m^3/mol)	(unitless)	(unitless)	(unitless)	(mg/kg-d)$^{-1}$	(ug/m^3)$^{-1}$	(mg/kg-d)	(mg/m^3)
ACENAPHTHENE	V	S	154	5.03E+03	5.10E-02	8.30E-06	3.90E+00	1.80E-04	7.40E-03	1.0	0.13			6.0E-02	2.1E-01
ACENAPHTHYLENE	V	S	152	2.50E+03	6.08E-02	7.88E-06	3.93E+00	1.45E-03	5.95E-02	1.0	0.13			4.0E-02	1.4E-01
ACETONE	V	L	58	2.60E+00	1.10E-01	1.10E-05	1.00E+06	3.90E-05	1.60E-03	1.0				9.0E-01	3.1E+01
ALDRIN	NV	S	365	8.20E+04			1.70E-02	4.39E-05	1.80E-03	1.0	0.1	1.7E+01	4.9E-03	3.0E-05	
AMETRYN	NV	S	227	4.28E+02			2.09E+02	2.39E-09	9.80E-08	1.0	0.1			9.0E-03	
AMINO,2- DINITROTOLUENE,4,6-	NV	S	197	2.83E+02			1.22E+03	1.61E-10	6.60E-09	1.0	0.006			2.0E-03	
AMINO,4- DINITROTOLUENE,2,6-	NV	S	197	2.83E+02			1.22E+03	1.61E-10	6.60E-09	1.0	0.009			2.0E-03	
ANTHRACENE	V	S	178	1.64E+04	3.90E-02	7.90E-06	4.34E-02	5.61E-05	2.30E-03	1.0	0.13			3.0E-01	1.1E+00
ANTIMONY	NV	S	122							0.15	0.15			4.0E-04	
ARSENIC	NV	S	75							1.0	0.0004	1.5E+00	4.3E-03	3.0E-04	1.5E-05
ATRAZINE	NV	S	216	2.25E+02			3.47E+01	2.34E-09	9.60E-08	1.0	0.1	2.3E-01		3.5E-02	
BARIUM	NV	S	137							0.07				2.0E-01	5.0E-04
BENZENE	V	L	78	1.46E+02	9.00E-02	1.00E-05	1.79E+03	5.61E-03	2.30E-01	1.0		5.5E-02	7.8E-06	4.0E-03	3.0E-02
BENZO(a)ANTHRACENE	NV	S	228	1.77E+05			9.40E-03	1.20E-05	4.90E-04	1.0	0.13	7.3E-01	1.1E-04		
BENZO(a)PYRENE	NV	S	252	5.87E+05			1.62E-03	4.63E-07	1.90E-05	1.0	0.13	7.3E+00	1.1E-03		
BENZO(b)FLUORANTHENE	NV	S	252	5.99E+05			1.50E-03	6.59E-07	2.70E-05	1.0	0.13	7.3E-01	1.1E-04		
BENZO(g,h,i)PERYLENE	NV	S	276	1.60E+06			2.60E-04	1.44E-07	5.90E-06	1.0	0.13			4.0E-02	
BENZO(k)FLUORANTHENE	NV	S	252	5.87E+05			8.00E-04	5.85E-07	2.40E-05	1.0	0.13	7.3E-02	1.1E-04		
BERYLLIUM	NV	S	9							0.007			2.4E-03	2.0E-03	2.0E-05
BIPHENYL, 1,1-	V	S	154	5.13E+03	4.70E-02	7.60E-06	6.94E+00	3.17E-04	1.30E-02	1.0		8.0E-03	2.3E-06	5.0E-02	4.0E-04
BIS(2-CHLOROETHYL)ETHER	V	L	143	3.20E+01	5.70E-02	8.70E-06	1.72E+04	1.71E-05	7.00E-04	1.0		1.1E+00	3.3E-04		
BIS(2-CHLOROISOPROPYL)ETHER	V	L	171	6.10E+01	6.31E-02	6.40E-06	1.70E+03	1.13E-04	4.63E-03	1.0		7.0E-02	1.0E-05	4.00E-02	1.40E-01
BIS(2-ETHYLHEXYL)PHTHALATE	NV	S	391	1.20E+05			2.70E-01	2.68E-07	1.10E-05	1.0	0.1	1.4E-02	2.4E-06	2.0E-02	
BORON	NV	S	14							1.0				2.0E-01	2.0E-02
BROMODICHLOROMETHANE	V	L	164	3.18E+01	5.60E-02	1.10E-05	3.03E+03	2.12E-03	8.70E-02	1.0		6.2E-02	3.7E-05	2.0E-02	7.0E-02
BROMOFORM	NV	S	253	3.18E+01			3.10E+03	5.37E-04	2.20E-02	1.0	0.1	7.9E-03	1.1E-06	2.0E-02	
BROMOMETHANE	V	G	95	1.32E+01	1.00E-01	1.30E-05	1.52E+04	6.34E-03	2.60E-01	1.0				1.4E-03	5.0E-03
CADMIUM	NV	S	112							0.025	0.001		1.8E-03	1.0E-03	2.0E-05
CARBON TETRACHLORIDE	V	L	154	4.39E+01	5.70E-02	9.80E-06	7.93E+02	2.68E-02	1.10E+00	1.0		7.0E-02	6.0E-06	4.0E-03	1.0E-01
CHLORDANE (TECHNICAL)	NV	S	410	8.67E+04			5.60E-02	4.88E-05	2.00E-03	1.0	0.04	3.5E-01	1.0E-04	5.0E-04	7.0E-04
CHLOROANILINE, p-	NV	S	128	1.13E+02	7.00E-02	1.00E-05	3.90E+03	1.15E-06	4.70E-05	1.0	0.1	2.0E-01		4.0E-03	
CHLOROBENZENE	V	L	113	2.34E+02	7.20E-02	9.50E-06	4.98E+02	3.17E-03	1.30E-01	1.0				2.0E-02	5.0E-02
CHLOROETHANE	V	G	65	2.18E+01	1.10E-01	1.20E-05	6.71E+03	1.10E-02	4.50E-01	1.0					1.0E+01
CHLOROFORM	V	L	119	3.18E+01	7.70E-02	1.10E-05	7.95E+03	3.66E-03	1.50E-01	1.0		3.1E-02	2.3E-05	1.0E-02	9.8E-02
CHLOROMETHANE	V	G	50	1.32E+01	1.20E-01	1.40E-05	5.32E+03	8.78E-03	3.60E-01	1.0		1.3E-02	1.8E-06		9.0E-02
CHLOROPHENOL, 2-	V	L	129	3.06E+02	6.60E-02	9.50E-06	2.85E+04	1.12E-05	4.60E-04	1.0				5.0E-03	1.8E-02
CHROMIUM (Total)	NV	S	52							1.0					
CHROMIUM III	NV	S	52							0.013				1.5E+00	
CHROMIUM VI	NV	S	52				1.69E+06			0.025		5.0E-01	8.4E-02	3.0E-03	1.0E-04
CHRYSENE	NV	S	228	1.81E+05			2.00E-03	5.12E-06	2.10E-04	1.0	0.13	7.3E-03	1.1E-05		
COBALT	NV	S	59							1.0			9.0E-03	3.00E-04	6.00E-06
COPPER	NV	S	64							1.0				4.0E-02	
CYANIDE (Free)	V	S	27							1.0				2.0E-02	
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	NV	S	222	8.91E+01			5.97E+01	6.34E-08	2.60E-06	1.0	0.015	1.1E-01		3.0E-03	
DALAPON	NV	L	143	3.20E+00			5.02E+05	9.02E-08	3.70E-06	1.0	0.1			3.0E-02	
DIBENZO(a,h)ANTHTRACENE	NV	S	278	1.91E+06			1.03E-03	1.22E-07	5.00E-06	1.0	0.13	7.3E+00	1.2E-03		
DIBROMO,1,2- CHLOROPROPANE,3-	V	L	236	1.31E+02	3.20E-02	8.90E-06	1.23E+03	1.46E-04	6.00E-03	1.0		8.0E-01	6.0E-03	2.0E-04	2.0E-04
DIBROMOCHLOROMETHANE	V	S	208	3.18E+01	3.70E-02	1.10E-05	2.70E+03	7.80E-04	3.20E-02	1.0	0.1	8.4E-02	2.4E-05	2.0E-02	7.0E-02
DIBROMOETHANE, 1,2-	V	S	188	3.18E+01	4.30E-02	1.00E-05	3.91E+03	6.59E-04	2.70E-02	1.0		2.0E+00	6.0E-04	9.0E-03	9.0E-03
DICHLOROBENZENE, 1,2-	V	L	147	3.83E+02	5.60E-02	8.90E-06	8.00E+01	1.90E-03	7.80E-02	1.0				9.0E-02	2.0E-01
DICHLOROBENZENE, 1,3-	V	L	147	6.17E+02	6.90E-02	7.90E-06	1.56E+02	1.90E-03	7.79E-02	1.0				3.00E-02	1.1E-01
DICHLOROBENZENE, 1,4-	V	S	147	3.75E+02	5.50E-02	8.70E-06	8.13E+01	2.41E-03	9.90E-02	1.0		5.4E-03	1.1E-05	7.0E-02	8.0E-01
DICHLOROBENZIDINE, 3,3-	NV	S	253	3.19E+03			3.10E+00	5.12E-11	2.10E-09	1.0	0.1	4.5E-01	3.4E-04		

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

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

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

CHEMICAL PARAMETER	Physical State		Molecular Weight	Organic carbon partition coefficient, K_{oc}	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'	GI Absorption Factor GIABS	Skin Absorption Factor ABS	Cancer Slope Factor Oral CSFo	Cancer Unit Risk Factor (Inhalation) IUR	Reference Dose Oral RfDo	Reference Concentration (Inhalation) RfC
				(cm^3/g)	(cm^2/s)	(cm^2/s)	(mg/L)	(atm-m^3/mol)	(unitless)	(unitless)	(unitless)	$(mg/kg\text{-}d)^{-1}$	$(ug/m^3)^{-1}$	(mg/kg-d)	(mg/m^3)
NITROGLYCERIN	NV	L	227	1.16E+02			1.38E+03	9.76E-08	4.00E-06	1.0	0.1	1.7E-02		1.0E-04	
NITROTOLUENE, 2-	V	S	137	3.71E+02	5.90E-02	8.70E-06	6.50E+02	1.24E-05	5.10E-04	1.0		2.2E-01	6.3E-05	9.0E-04	3.2E-03
NITROTOLUENE, 3-	V	S	137	3.63E+02	7.60E-02	8.60E-06	4.19E+02	2.39E-05	9.80E-04	1.0				2.00E-02	7.0E-02
NITROTOLUENE, 4-	NV	S	137	3.63E+02	5.70E-02	8.40E-06	4.42E+02	5.61E-06	2.30E-04	1.0	0.1	1.6E-02	4.6E-06	4.0E-03	1.4E-02
PENTACHLOROPHENOL	NV	S	266	4.96E+03			1.40E+01	2.44E-08	1.00E-06	1.0	0.25	4.0E-01	5.1E-06	5.0E-03	
PENTAERYTHRITOLTETRANITRATE (PETN)	NV	S	316	1.51E+02			4.30E+01	1.20E-11	4.92E-10	1.0	0.1	4.0E-03		2.0E-03	
PERCHLORATE	NV	S	117				2.45E+05			1.0				7.0E-04	
PHENANTHRENE	V	S	178	1.40E+04	6.08E-02	7.88E-06	8.16E-01	3.93E-05	1.61E-03	1.0	0.13			4.0E-02	1.4E-01
PHENOL	NV	S	94	1.87E+02	8.30E-02	1.00E-05	8.28E+04	3.41E-07	1.40E-05	1.0	0.1			3.0E-01	2.0E-01
POLYCHLORINATED BIPHENYLS (PCBs)	NV	S	326	3.30E+04			3.20E-02	2.93E-04	1.20E-02	1.0	0.14	2.0E+00	5.7E-04	2.0E-05	
PROPICONAZOLE	NV	L	342	1.56E+03			1.10E+02	4.15E-09	1.70E-07	1.0	0.1			1.3E-02	
PYRENE	V	S	202	5.43E+04	2.80E-02	7.20E-06	1.35E-01	1.20E-05	4.90E-04	1.0	0.13			3.0E-02	1.1E-01
SELENIUM	NV	S	81							1.0				5.0E-03	2.0E-02
SILVER	NV	S	108							0.04				5.0E-03	
SIMAZINE	NV	S	202	1.47E+02			6.20E+00	9.51E-10	3.90E-08	1.0	0.1	1.2E-01		5.0E-03	
STYRENE	V	L	104	4.46E+02	7.10E-02	8.80E-06	3.10E+02	2.68E-03	1.10E-01	1.0				2.0E-01	1.0E+00
TERBACIL	NV	S	217	5.01E+01			7.10E+02	1.20E-10	4.90E-09	1.0	0.1			1.3E-02	
tert-BUTYL ALCOHOL	V	L	74	3.70E+01	9.00E-02	9.10E-06	1.00E+06	1.17E-05	4.80E-04	1.0		3.0E-03	8.6E-07		
TETRACHLOROETHANE, 1,1,1,2-	V	L	168	8.60E+01	4.80E-02	9.10E-06	1.07E+03	2.41E-03	9.90E-02	1.0		2.6E-02	7.4E-06	3.0E-02	1.1E-01
TETRACHLOROETHANE, 1,1,2,2-	V	L	168	9.49E+01	4.90E-02	9.30E-06	2.87E+03	3.66E-04	1.50E-02	1.0		2.0E-01	5.8E-05	2.0E-02	
TETRACHLOROETHYLENE	V	L	166	9.49E+01	5.00E-02	9.50E-06	2.06E+02	1.76E-02	7.20E-01	1.0		5.4E-01	5.9E-06	1.0E-02	2.7E-01
TETRACHLOROPHENOL, 2,3,4,6-	NV	S	232	2.97E+03	2.17E-02	7.10E-06	2.30E+01	8.78E-06	3.60E-04	1.0	0.1			3.0E-02	
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	NV	S	296	5.32E+02			9.44E+03	8.54E-10	3.50E-08	1.0	0.006			5.0E-02	
THALLIUM	NV	S	204							1.0				1.0E-05	
TOLUENE	V	L	92	2.34E+02	7.80E-02	9.20E-06	5.26E+02	6.59E-03	2.70E-01	1.0				8.0E-02	5.0E+00
TOXAPHENE	NV	S	414	7.72E+04			5.50E-01	6.10E-06	2.50E-04	1.0	0.1	1.1E+00	3.2E-04		
TPH (gasolines)	V	L	119	5.00E+03	7.00E-02	1.00E-05	1.50E+02	7.80E-01	3.20E+01	1.0	0.10			3.00E-02	1.26E-01
TPH (middle distillates)	V	L	201	5.00E+03	7.00E-02	1.00E-05	5.00E+00	1.00E+00	4.10E+01	1.0	0.10			2.00E-02	1.26E-01
TPH (residual fuels)	NV	L	236				5.00E+00			1.0				1.20E-01	1.26E-01
TRICHLOROBENZENE, 1,2,4-	V	S	181	1.36E+03	4.00E-02	8.40E-06	4.90E+01	1.41E-03	5.80E-02	1.0		2.9E-02	8.3E-06	1.0E-02	2.0E-03
TRICHLOROETHANE, 1,1,1-	V	L	133	4.34E+01	6.50E-02	9.60E-06	1.29E+03	1.71E-02	7.00E-01	1.0				2.0E+00	5.0E+00
TRICHLOROETHANE, 1,1,2-	V	L	133	6.07E+01	6.70E-02	1.00E-05	1.10E+03	8.29E-04	3.40E-02	1.0		5.7E-02	1.6E-05	4.0E-03	2.0E-04
TRICHLOROETHYLENE	V	L	131	6.07E+01	6.90E-02	1.00E-05	1.28E+03	9.76E-03	4.00E-01	1.0		5.9E-03	2.0E-06	5.0E-04	1.0E-02
TRICHLOROPHENOL, 2,4,5-	NV	S	198	1.78E+03	5.60E-02	6.50E-06	1.20E+03	1.61E-06	6.60E-05	1.0	0.1			1.0E-01	3.5E-01
TRICHLOROPHENOL, 2,4,6-	NV	S	198	1.78E+03	3.10E-02	8.10E-06	8.00E+02	2.68E-06	1.10E-04	1.0	0.1	1.1E-02	3.1E-06	1.0E-03	
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	NV	S	255	1.07E+02			2.78E+02	4.63E-08	1.90E-06	1.0	0.1			1.0E-02	
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	NV	S	270	1.75E+02			2.00E+02	9.02E-09	3.70E-07	1.0	0.1			8.0E-03	
TRICHLOROPROPANE, 1,2,3-	V	L	147	9.49E+01	5.70E-02	9.20E-06	1.75E+03	3.41E-04	1.40E-02	1.0		3.0E+01	8.6E-03	4.0E-03	3.0E-04
TRICHLOROPROPENE, 1,2,3-	V	L	145	1.16E+02	7.10E-02	7.90E-06	2.70E+03	2.80E-02	1.15E+00	1.0				3.00E-03	3.0E-04
TRIFLURALIN	NV	S	335	1.64E+04			1.84E-01	1.02E-04	4.20E-03	1.0	0.1	7.7E-03		7.5E-03	
TRINITROBENZENE, 1,3,5-	NV	S	213	1.68E+03			2.78E+02	3.17E-09	1.30E-07	1.0	0.019			3.0E-02	
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	NV	S	287	4.61E+03			7.40E+01	2.68E-09	1.10E-07	1.0	0.1			4.0E-03	
TRINITROTOLUENE, 2,4,6- (TNT)	NV	S	227	2.81E+03			1.30E+02	4.63E-07	1.90E-05	1.0	0.032	3.0E-02		5.0E-04	
VANADIUM	NV	S	51							0.026				5.0E-03	

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

CHEMICAL PARAMETER	Physical State		Molecular Weight	Organic carbon partition coefficient, K_{oc}	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'	GI Absorption Factor GIABS	Skin Absorption Factor ABS	Cancer Slope Factor Oral CSFo	Cancer Unit Risk Factor (Inhalation) IUR	Reference Dose Oral RfDo	Reference Concentration (Inhalation) RfC
				(cm^3/g)	(cm^2/s)	(cm^2/s)	(mg/L)	(atm-m^3/mol)	(unitless)	(unitless)	(unitless)	$(mg/kg\text{-}d)^{-1}$	$(ug/m^3)^{-1}$	(mg/kg-d)	(mg/m^3)
VINYL CHLORIDE	V	G	63	2.17E+01	1.10E-01	1.20E-05	8.80E+03	2.68E-02	1.10E+00	1.0		7.2E-01	4.4E-06	3.0E-03	1.0E-01
XYLENES	V	L	106	3.75E+02	6.80E-02	8.40E-06	1.61E+02	7.07E-03	2.90E-01	1.0				2.0E+00	1.0E-01
ZINC	NV	S	67							1.0				3.0E-01	

General Notes:

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

Physical state of chemical at ambient conditions (V - volatile, NV - nonvolatile, S - solid, L - liquid, G - gas).
Chemical considered to be **"volatile"** if Henry's number (atm m3/mole) >0.00001 and molecular weight <200.

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

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

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

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

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

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

Notes on Individual Chemicals

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

Antimony toxicity factors based on metallic forms.

Dibromochloromethane, dibromochloropropane and pyrene considered volatile for purposes of modeling (USEPA 2004). (Molecular weight adjusted to 199 in column E (hidden) to permit generation of volatilization factor in soil direct-exposure models.)

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

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

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

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

Mercury toxicity factors based on elemental mercury.

Nickel toxicity factors based on soluble salts.

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

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

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

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

Thallium toxicity factors based on soluble salts.

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

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

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

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

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

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

Vanadium toxicity factors based on metallic forms.

Zinc toxicity factors based on metallic forms.

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

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

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

CHEMICAL	Final Action Level (mg/kg)	Basis	[2]Carcinogens (Risk = 10^{-6}) (mg/kg)	[2]Mutagens (Risk = 10^{-6}) (mg/kg)	[3]Noncarcinogens (HQ = 0.2) (mg/kg)	[3]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
DIBROMO,1,2- CHLOROPROPANE,3-	5.7E-03	mutagenic effects	1.5E-02	5.7E-03	1.0E+00	5.1E+00	1.1E+03
DIBROMOCHLOROMETHANE	7.8E-01	carcinogenic effects	7.8E-01		8.3E+01	4.1E+02	NA
DIBROMOETHANE, 1,2-	3.2E-02	carcinogenic effects	3.2E-02		1.5E+01	7.3E+01	NA
DICHLOROBENZENE, 1,2-	1.9E+02	saturation limit			3.9E+02	1.9E+03	1.9E+02
DICHLOROBENZENE, 1,3-	1.9E+02	noncarcinogenic effects			1.9E+02	9.5E+02	6.0E+02
DICHLOROBENZENE, 1,4-	2.5E+00	carcinogenic effects	2.5E+00		6.9E+02	3.5E+03	NA
DICHLOROBENZIDINE, 3,3-	1.1E+00	carcinogenic effects	1.1E+00				NA
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.0E+00	carcinogenic effects	2.0E+00				NA
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.4E+00	carcinogenic effects	1.4E+00				NA
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.7E+00	carcinogenic effects	1.7E+00		7.2E+00	3.6E+01	NA
DICHLOROETHANE, 1,1-	3.3E+00	carcinogenic effects	3.3E+00		3.0E+02	1.5E+03	1.7E+03
DICHLOROETHANE, 1,2-	4.4E-01	carcinogenic effects	4.4E-01		6.7E+00	3.4E+01	1.8E+03
DICHLOROETHYLENE, 1,1-	4.9E+01	noncarcinogenic effects			4.9E+01	2.4E+02	1.2E+03
DICHLOROETHYLENE, Cis 1,2-	3.5E+00	noncarcinogenic effects			3.5E+00	1.7E+01	1.3E+03
DICHLOROETHYLENE, Trans 1,2-	2.2E+01	noncarcinogenic effects			2.2E+01	1.1E+02	1.4E+03
DICHLOROPHENOL, 2,4-	3.7E+01	noncarcinogenic effects			3.7E+01	1.8E+02	NA
DICHLOROPHENOXYACETIC ACID (2,4-D)	1.4E+02	noncarcinogenic effects			1.4E+02	6.9E+02	NA
DICHLOROPROPANE, 1,2-	8.9E-01	carcinogenic effects	8.9E-01		3.2E+00	1.6E+01	1.4E+03
DICHLOROPROPENE, 1,3-	1.7E+00	carcinogenic effects	1.7E+00		1.5E+01	7.4E+01	1.6E+03
DIELDRIN	1.5E+00	noncarcinogenic effects	3.0E+00		1.5E+00	3.1E+00	NA
DIETHYLPHTHALATE	9.8E+03	noncarcinogenic effects			9.8E+03	4.9E+04	NA
DIMETHYLPHENOL, 2,4-	2.4E+02	noncarcinogenic effects			2.4E+02	1.2E+03	NA
DIMETHYLPHTHALATE	1.2E+05	noncarcinogenic effects			1.2E+05	6.1E+05	NA
DINITROBENZENE, 1,3-	1.2E+00	noncarcinogenic effects			1.2E+00	6.1E+00	NA
DINITROPHENOL, 2,4-	2.4E+01	noncarcinogenic effects			2.4E+01	1.2E+02	NA
DINITROTOLUENE, 2,4- (2,4-DNT)	1.6E+00	carcinogenic effects	1.6E+00		2.4E+01	1.2E+02	NA
DINITROTOLUENE, 2,6- (2,6-DNT)	1.2E+01	noncarcinogenic effects			1.2E+01	6.1E+01	NA
DIOXANE, 1,4-	4.9E+00	carcinogenic effects	4.9E+00		3.7E+02	1.8E+03	NA
DIOXINS (TEQ)	2.4E-04	HDOH 2010a					
DIURON	2.4E+01	noncarcinogenic effects			2.4E+01	1.2E+02	NA
ENDOSULFAN	7.3E+01	noncarcinogenic effects			7.3E+01	3.7E+02	NA
ENDRIN	3.7E+00	noncarcinogenic effects			3.7E+00	1.8E+01	NA
ETHANOL		not available					
ETHYLBENZENE	5.5E+01	carcinogenic effects	5.5E+01		7.1E+02	3.5E+03	4.8E+02
FLUORANTHENE	4.6E+02	noncarcinogenic effects			4.6E+02	2.3E+03	NA
FLUORENE	4.4E+02	noncarcinogenic effects			4.4E+02	2.2E+03	NA
GLYPHOSATE	1.2E+03	noncarcinogenic effects			1.2E+03	6.1E+03	NA
HEPTACHLOR	1.1E-01	carcinogenic effects	1.1E-01		6.1E+00	3.1E+01	NA
HEPTACHLOR EPOXIDE	5.3E-02	carcinogenic effects	5.3E-02		1.6E-01	7.9E-01	NA
HEXACHLOROBENZENE	3.0E-01	carcinogenic effects	3.0E-01		9.8E+00	4.9E+01	NA
HEXACHLOROBUTADIENE	6.2E+00	carcinogenic effects	6.2E+00		1.2E+01	6.1E+01	NA
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	5.2E-01	carcinogenic effects	5.2E-01		4.2E+00	2.1E+01	NA
HEXACHLOROETHANE	1.2E+01	noncarcinogenic effects	3.5E+01		1.2E+01	6.1E+01	NA
HEXAZINONE	4.0E+02	noncarcinogenic effects			4.0E+02	2.0E+03	NA
INDENO(1,2,3-cd)PYRENE	1.5E+00	mutagenic effects	6.2E+00	1.5E+00			NA
ISOPHORONE	5.1E+02	carcinogenic effects	5.1E+02		2.4E+03	1.2E+04	NA

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

CHEMICAL	Final Action Level (mg/kg)	Basis	[2]Carcinogens (Risk = 10^{-6}) (mg/kg)	[2]Mutagens (Risk = 10^{-6}) (mg/kg)	[3]Noncarcinogens (HQ = 0.2) (mg/kg)	[3]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
LEAD	2.0E+02	noncarcinogenic effects			2.0E+02		NA
MERCURY	4.7E+00	noncarcinogenic effects			4.7E+00	2.3E+01	NA
METHOXYCHLOR	6.1E+01	noncarcinogenic effects			6.1E+01	3.1E+02	NA
METHYL ETHYL KETONE	5.6E+03	noncarcinogenic effects			5.6E+03	2.8E+04	2.8E+04
METHYL ISOBUTYL KETONE	1.1E+03	noncarcinogenic effects			1.1E+03	5.3E+03	3.4E+03
METHYL MERCURY	1.6E+00	noncarcinogenic effects			1.6E+00	7.8E+00	NA
METHYL TERT BUTYL ETHER	4.4E+01	carcinogenic effects	4.4E+01		3.3E+03	1.7E+04	8.9E+03
METHYLENE CHLORIDE	1.1E+01	carcinogenic effects	1.1E+01		3.5E+02	1.7E+03	3.3E+03
METHYLNAPHTHALENE, 1-	9.8E+01	carcinogenic effects	9.8E+01		8.1E+02	4.0E+03	NA
METHYLNAPHTHALENE, 2-	4.7E+01	noncarcinogenic effects			4.7E+01	2.3E+02	NA
MOLYBDENUM	7.8E+01	noncarcinogenic effects			7.8E+01	3.9E+02	NA
NAPHTHALENE	2.8E+01	noncarcinogenic effects	3.6E+01		2.8E+01	1.4E+02	NA
NICKEL	7.6E+02	noncarcinogenic effects			7.6E+02	3.8E+03	NA
NITROBENZENE	4.8E+00	carcinogenic effects	4.8E+00		7.4E+00	3.7E+01	3.0E+03
NITROGLYCERIN	1.2E+00	noncarcinogenic effects	2.9E+01		1.2E+00	6.1E+00	NA
NITROTOLUENE, 2-	1.9E+00	carcinogenic effects	1.9E+00		1.2E+01	6.2E+01	NA
NITROTOLUENE, 3-	2.5E+02	noncarcinogenic effects			2.5E+02	1.3E+03	NA
NITROTOLUENE, 4-	3.0E+01	carcinogenic effects	3.0E+01		4.9E+01	2.4E+02	NA
PENTACHLOROPHENOL	8.9E-01	carcinogenic effects	8.9E-01		4.6E+01	2.3E+02	NA
PENTAERYTHRITOLTETRANITRATE (PETN)	2.4E+01	noncarcinogenic effects	1.2E+02		2.4E+01	1.2E+02	NA
PERCHLORATE	1.1E+01	noncarcinogenic effects			1.1E+01	5.5E+01	NA
PHENANTHRENE	4.4E+02	noncarcinogenic effects			4.4E+02	2.2E+03	NA
PHENOL	3.7E+03	noncarcinogenic effects			3.7E+03	1.8E+04	NA
POLYCHLORINATED BIPHENYLS (PCBs)	1.1E+00	noncarcinogenic effects	2.2E+00		1.1E+00	1.1E+00	NA
PROPICONAZOLE	1.6E+02	noncarcinogenic effects			1.6E+02	7.9E+02	NA
PYRENE	3.4E+02	noncarcinogenic effects			3.4E+02	1.7E+03	NA
SELENIUM	7.8E+01	noncarcinogenic effects			7.8E+01	3.9E+02	NA
SILVER	7.8E+01	noncarcinogenic effects			7.8E+01	3.9E+02	NA
SIMAZINE	4.0E+00	carcinogenic effects	4.0E+00		6.1E+01	3.1E+02	NA
STYRENE	8.7E+02	saturation limit			1.3E+03	6.4E+03	8.7E+02
TERBACIL	1.6E+02	noncarcinogenic effects			1.6E+02	7.9E+02	NA
tert-BUTYL ALCOHOL	8.1E+01	carcinogenic effects	8.1E+01				3.2E+05
TETRACHLOROETHANE, 1,1,1,2-	1.9E+00	carcinogenic effects	1.9E+00		1.1E+02	5.3E+02	6.8E+02
TETRACHLOROETHANE, 1,1,2,2-	5.7E-01	carcinogenic effects	5.7E-01		3.1E+02	1.6E+03	1.9E+03
TETRACHLOROETHYLENE	5.6E-01	carcinogenic effects	5.6E-01		7.5E+01	3.8E+02	1.7E+02
TETRACHLOROPHENOL, 2,3,4,6-	3.7E+02	noncarcinogenic effects			3.7E+02	1.8E+03	NA
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	7.7E+02	noncarcinogenic effects			7.7E+02	3.8E+03	NA
THALLIUM	7.8E-01	noncarcinogenic effects			7.8E-01	7.8E-01	NA
TOLUENE	8.2E+02	saturation limit			1.0E+03	5.0E+03	8.2E+02
TOXAPHENE	4.4E-01	carcinogenic effects	4.4E-01				NA
TPH (gasolines)	5.0E+02	noncarcinogenic effects			5.0E+02	5.0E+02	5.4E+03
TPH (middle distillates)	5.0E+02	noncarcinogenic effects			5.0E+02	5.0E+02	5.0E+02
TPH (residual fuels)	9.4E+03	noncarcinogenic effects			9.4E+03	9.4E+03	NA
TRICHLOROBENZENE, 1,2,4-	6.6E+00	carcinogenic effects	6.6E+00		1.2E+01	6.2E+01	NA
TRICHLOROETHANE, 1,1,1-	6.4E+02	saturation limit			1.8E+03	8.8E+03	6.4E+02
TRICHLOROETHANE, 1,1,2-	3.2E-01	noncarcinogenic effects	1.1E+00		3.2E-01	1.6E+00	5.2E+02

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

CHEMICAL	Final Action Level (mg/kg)	Basis	[2]Carcinogens (Risk = 10^{-6}) (mg/kg)	[2]Mutagens (Risk = 10^{-6}) (mg/kg)	[3]Noncarcinogens (HQ = 0.2) (mg/kg)	[3]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
TRICHLOROETHYLENE	2.8E+00	carcinogenic effects	2.8E+00		3.1E+00	1.5E+01	6.9E+02
TRICHLOROPHENOL, 2,4,5-	1.2E+03	noncarcinogenic effects			1.2E+03	6.1E+03	NA
TRICHLOROPHENOL, 2,4,6-	1.2E+01	noncarcinogenic effects	4.4E+01		1.2E+01	6.1E+01	NA
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	1.2E+02	noncarcinogenic effects			1.2E+02	6.1E+02	NA
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	9.8E+01	noncarcinogenic effects			9.8E+01	4.9E+02	NA
TRICHLOROPROPANE, 1,2,3-	1.3E-03	mutagenic effects	3.7E-03	1.3E-03	9.7E-01	4.8E+00	1.2E+03
TRICHLOROPROPENE, 1,2,3-	1.2E-01	noncarcinogenic effects			1.2E-01	6.0E-01	2.7E+03
TRIFLURALIN	6.3E+01	carcinogenic effects	6.3E+01		9.2E+01	4.6E+02	NA
TRINITROBENZENE, 1,3,5-	4.5E+02	noncarcinogenic effects			4.5E+02	2.2E+03	NA
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.9E+01	noncarcinogenic effects			4.9E+01	2.4E+02	NA
TRINITROTOLUENE, 2,4,6- (TNT)	7.2E+00	noncarcinogenic effects	1.9E+01		7.2E+00	3.6E+01	NA
VANADIUM	7.8E+01	noncarcinogenic effects			7.8E+01	3.9E+02	NA
VINYL CHLORIDE	7.2E-02	carcinogenic effects	7.2E-02	1.1E-01	1.5E+01	7.4E+01	3.9E+03
XYLENES	1.2E+02	noncarcinogenic effects			1.2E+02	6.2E+02	3.9E+02
ZINC	4.7E+03	noncarcinogenic effects			4.7E+03	2.3E+04	NA

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

Notes:

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

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

3. Noncarcinogens: Default target hazard quotient = 0.2. TPH action levels based on HQ of 1.0 (see below footnote and Sections 3.2 and 6 .0 in text). Action levels for Technical Chlordane based on HQ of 1.0. Action levels for aldrin and dieldrin (breakdown product of aldrin) based on HQ of 0.5. All chemicals - Separate screening levels based on hazard quotient of 1.0 provided for reference.

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

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

See text for equations and assumptions used in models.

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

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

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

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

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

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

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

CHEMICAL	Final Action Level (mg/kg)	Basis	[1]Carcinogens (Risk = 10^{-6}) (mg/kg)	[2]Noncarcinogens (HQ = 0.2) (mg/kg)	[2]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
ACENAPHTHENE	5.3E+03	noncarcinogenic effects		5.3E+03	2.7E+04	NA
ACENAPHTHYLENE	2.2E+03	noncarcinogenic effects		2.2E+03	1.1E+04	NA
ACETONE	1.2E+05	saturation limit		1.2E+05	6.2E+05	1.2E+05
ALDRIN	9.2E+00	noncarcinogenic effects	1.0E+01	9.2E+00	1.8E+01	NA
AMETRYN	1.1E+03	noncarcinogenic effects		1.1E+03	5.5E+03	NA
AMINO,2- DINITROTOLUENE,4,6-	3.9E+02	noncarcinogenic effects		3.9E+02	2.0E+03	NA
AMINO,4- DINITROTOLUENE,2,6-	3.9E+02	noncarcinogenic effects		3.9E+02	1.9E+03	NA
ANTHRACENE	3.1E+04	noncarcinogenic effects		3.1E+04	1.6E+05	NA
ANTIMONY	1.1E+01	noncarcinogenic effects		1.1E+01	5.4E+01	NA
ARSENIC	9.5E+01	carcinogenic effects	9.5E+01	3.0E+02	3.0E+02	NA
ATRAZINE	7.5E+00	carcinogenic effects	7.5E+00	4.3E+03	2.2E+04	NA
BARIUM	4.3E+03	trench/construction worker		3.8E+04	1.9E+05	NA
BENZENE	5.4E+00	carcinogenic effects	5.4E+00	8.9E+01	4.5E+02	1.8E+03
BENZO(a)ANTHRACENE	2.1E+01	carcinogenic effects	2.1E+01			NA
BENZO(a)PYRENE	2.1E+00	carcinogenic effects	2.1E+00			NA
BENZO(b)FLUORANTHENE	2.1E+01	carcinogenic effects	2.1E+01			NA
BENZO(g,h,i)PERYLENE	4.4E+03	noncarcinogenic effects		4.4E+03	2.2E+04	NA
BENZO(k)FLUORANTHENE	2.1E+02	carcinogenic effects	2.1E+02			NA
BERYLLIUM	1.5E+02	trench/construction worker	6.9E+03	4.0E+02	2.0E+03	NA
BIPHENYL, 1,1-	4.3E+01	noncarcinogenic effects	2.3E+02	4.3E+01	2.1E+02	NA
BIS(2-CHLOROETHYL)ETHER	1.0E+00	carcinogenic effects	1.0E+00			5.0E+03
BIS(2-CHLOROISOPROPYL)ETHER	1.6E+01	carcinogenic effects	1.6E+01	2.0E+03	1.0E+04	7.9E+02
BIS(2-ETHYLHEXYL)PHTHALATE	1.2E+02	carcinogenic effects	1.2E+02	2.5E+03	1.2E+04	NA
BORON	4.1E+04	noncarcinogenic effects		4.1E+04	2.0E+05	NA
BROMODICHLOROMETHANE	1.4E+00	carcinogenic effects	1.4E+00	2.5E+02	1.2E+03	9.3E+02
BROMOFORM	2.2E+02	carcinogenic effects	2.2E+02	2.5E+03	1.2E+04	NA
BROMOMETHANE	6.9E+00	noncarcinogenic effects		6.9E+00	3.4E+01	3.5E+03
CADMIUM	1.2E+02	trench/construction worker	9.3E+03	1.6E+02	8.0E+02	NA
CARBON TETRACHLORIDE	3.1E+00	carcinogenic effects	3.1E+00	1.2E+02	6.1E+02	4.5E+02
CHLORDANE (TECHNICAL)	6.5E+01	carcinogenic effects	6.5E+01		4.0E+02	NA
CHLOROANILINE, p-	8.6E+00	carcinogenic effects	8.6E+00	4.9E+02	2.5E+03	NA
CHLOROBENZENE	2.8E+02	noncarcinogenic effects		2.8E+02	1.4E+03	7.6E+02
CHLOROETHANE	2.1E+03	saturation limit		1.2E+04	6.0E+04	2.1E+03
CHLOROFORM	1.5E+00	carcinogenic effects	1.5E+00	2.2E+02	1.1E+03	2.5E+03
CHLOROMETHANE	8.5E+00	carcinogenic effects	8.5E+00	1.0E+02	5.1E+02	1.3E+03
CHLOROPHENOL, 2-	6.8E+02	noncarcinogenic effects		6.8E+02	3.4E+03	5.5E+04
CHROMIUM (Total)		not available				
CHROMIUM III	3.1E+05	noncarcinogenic effects		3.1E+05	1.5E+06	NA
CHROMIUM VI	4.8E+02	trench/construction worker	5.6E+02	6.1E+02	3.1E+03	NA
CHRYSENE	2.1E+03	carcinogenic effects	2.1E+03			NA
COBALT	3.8E+01	trench/construction worker	1.9E+03	6.1E+01	3.0E+02	NA
COPPER	8.2E+03	noncarcinogenic effects		8.2E+03	4.1E+04	NA
CYANIDE (Free)	4.1E+03	noncarcinogenic effects		4.1E+03	2.0E+04	NA
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	2.4E+01	carcinogenic effects	2.4E+01	5.6E+02	2.8E+03	NA
DALAPON	3.7E+03	noncarcinogenic effects		3.7E+03	1.8E+04	NA

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

CHEMICAL	Final Action Level (mg/kg)	Basis	[1]Carcinogens (Risk = 10^{-6}) (mg/kg)	[2]Noncarcinogens (HQ = 0.2) (mg/kg)	[2]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
DIBENZO(a,h)ANTHTRACENE	2.1E+00	carcinogenic effects	2.1E+00			NA
DIBROMO,1,2- CHLOROPROPANE,3-	7.4E-02	carcinogenic effects	7.4E-02	5.6E+00	2.8E+01	1.1E+03
DIBROMOCHLOROMETHANE	3.6E+00	carcinogenic effects	3.6E+00	4.3E+02	2.2E+03	NA
DIBROMOETHANE, 1,2-	1.6E-01	carcinogenic effects	1.6E-01	6.6E+01	3.3E+02	NA
DICHLOROBENZENE, 1,2-	1.9E+02	saturation limit		2.0E+03	1.0E+04	1.9E+02
DICHLOROBENZENE, 1,3-	6.0E+02	saturation limit		1.1E+03	5.5E+03	6.0E+02
DICHLOROBENZENE, 1,4-	1.2E+01	carcinogenic effects	1.2E+01	5.1E+03	2.6E+04	NA
DICHLOROBENZIDINE, 3,3-	3.8E+00	carcinogenic effects	3.8E+00			NA
DICHLORODIPHENYLDICHLOROETHANE (DDD)	7.2E+00	carcinogenic effects	7.2E+00			NA
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	5.1E+00	carcinogenic effects	5.1E+00			NA
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	7.0E+00	carcinogenic effects	7.0E+00	8.5E+01	4.3E+02	NA
DICHLOROETHANE, 1,1-	1.7E+01	carcinogenic effects	1.7E+01	1.3E+03	6.7E+03	1.7E+03
DICHLOROETHANE, 1,2-	2.2E+00	carcinogenic effects	2.2E+00	3.0E+01	1.5E+02	1.8E+03
DICHLOROETHYLENE, 1,1-	2.1E+02	noncarcinogenic effects		2.1E+02	1.1E+03	1.2E+03
DICHLOROETHYLENE, Cis 1,2-	1.6E+01	noncarcinogenic effects		1.6E+01	8.0E+01	1.3E+03
DICHLOROETHYLENE, Trans 1,2-	9.7E+01	noncarcinogenic effects		9.7E+01	4.9E+02	1.4E+03
DICHLOROPHENOL, 2,4-	3.7E+02	noncarcinogenic effects		3.7E+02	1.8E+03	NA
DICHLOROPHENOXYACETIC ACID (2,4-D)	1.5E+03	noncarcinogenic effects		1.5E+03	7.7E+03	NA
DICHLOROPROPANE, 1,2-	4.4E+00	carcinogenic effects	4.4E+00	1.3E+01	6.7E+01	1.4E+03
DICHLOROPROPENE, 1,3-	8.1E+00	carcinogenic effects	8.1E+00	6.4E+01	3.2E+02	1.6E+03
DIELDRIN	1.1E+01	carcinogenic effects	1.1E+01	1.5E+01	3.1E+01	NA
DIETHYLPHTHALATE	9.9E+04	noncarcinogenic effects		9.9E+04	4.9E+05	NA
DIMETHYLPHENOL, 2,4-	2.5E+03	noncarcinogenic effects		2.5E+03	1.2E+04	NA
DIMETHYLPHTHALATE	1.0E+06	maximum		1.2E+06	6.2E+06	NA
DINITROBENZENE, 1,3-	1.2E+01	noncarcinogenic effects		1.2E+01	6.2E+01	NA
DINITROPHENOL, 2,4-	2.5E+02	noncarcinogenic effects		2.5E+02	1.2E+03	NA
DINITROTOLUENE, 2,4- (2,4-DNT)	5.6E+00	carcinogenic effects	5.6E+00	2.5E+02	1.2E+03	NA
DINITROTOLUENE, 2,6- (2,6-DNT)	1.2E+02	noncarcinogenic effects		1.2E+02	6.2E+02	NA
DIOXANE, 1,4-	1.7E+01	carcinogenic effects	1.7E+01	3.7E+03	1.8E+04	NA
DIOXINS (TEQ)	1.5E-03	HDOH 2010a				
DIURON	2.5E+02	noncarcinogenic effects		2.5E+02	1.2E+03	NA
ENDOSULFAN	7.4E+02	noncarcinogenic effects		7.4E+02	3.7E+03	NA
ENDRIN	3.7E+01	noncarcinogenic effects		3.7E+01	1.8E+02	NA
ETHANOL		not available				
ETHYLBENZENE	1.5E+02	trench/construction worker	2.7E+02	4.3E+03	2.1E+04	4.8E+02
FLUORANTHENE	4.4E+03	noncarcinogenic effects		4.4E+03	2.2E+04	NA
FLUORENE	3.9E+03	noncarcinogenic effects		3.9E+03	2.0E+04	NA
GLYPHOSATE	1.2E+04	noncarcinogenic effects		1.2E+04	6.2E+04	NA
HEPTACHLOR	3.8E-01	carcinogenic effects	3.8E-01	6.2E+01	3.1E+02	NA
HEPTACHLOR EPOXIDE	1.9E-01	carcinogenic effects	1.9E-01	1.6E+00	8.0E+00	NA
HEXACHLOROBENZENE	1.1E+00	carcinogenic effects	1.1E+00	9.9E+01	4.9E+02	NA
HEXACHLOROBUTADIENE	2.2E+01	carcinogenic effects	2.2E+01	1.2E+02	6.2E+02	NA
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	2.1E+00	carcinogenic effects	2.1E+00	4.9E+01	2.4E+02	NA
HEXACHLOROETHANE	1.2E+02	carcinogenic effects	1.2E+02	1.2E+02	6.2E+02	NA
HEXAZINONE	4.1E+03	noncarcinogenic effects		4.1E+03	2.0E+04	NA

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

CHEMICAL	Final Action Level (mg/kg)	Basis	[1]Carcinogens (Risk = 10^{-6}) (mg/kg)	[2]Noncarcinogens (HQ = 0.2) (mg/kg)	[2]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
INDENO(1,2,3-cd)PYRENE	2.1E+01	carcinogenic effects	2.1E+01			NA
ISOPHORONE	1.8E+03	carcinogenic effects	1.8E+03	2.5E+04	1.2E+05	NA
LEAD	8.0E+02	commercial/industrial exposure		8.0E+02		NA
MERCURY	6.1E+01	noncarcinogenic effects		6.1E+01	3.1E+02	NA
METHOXYCHLOR	6.2E+02	noncarcinogenic effects		6.2E+02	3.1E+03	NA
METHYL ETHYL KETONE	2.8E+04	saturation limit		4.0E+04	2.0E+05	2.8E+04
METHYL ISOBUTYL KETONE	3.4E+03	saturation limit		1.1E+04	5.3E+04	3.4E+03
METHYL MERCURY	2.0E+01	noncarcinogenic effects		2.0E+01	1.0E+02	NA
METHYL TERT BUTYL ETHER	2.2E+02	carcinogenic effects	2.2E+02	1.4E+04	7.0E+04	8.9E+03
METHYLENE CHLORIDE	5.4E+01	carcinogenic effects	5.4E+01	1.9E+03	9.7E+03	3.3E+03
METHYLNAPHTHALENE, 1-	2.9E+02	trench/construction worker	4.7E+02	6.8E+03	3.4E+04	NA
METHYLNAPHTHALENE, 2-	4.0E+02	noncarcinogenic effects		4.0E+02	2.0E+03	NA
MOLYBDENUM	1.0E+03	noncarcinogenic effects		1.0E+03	5.1E+03	NA
NAPHTHALENE	9.6E+01	trench/construction worker	1.8E+02	1.3E+02	6.3E+02	NA
NICKEL	8.7E+02	trench/construction worker		9.4E+03	4.7E+04	NA
NITROBENZENE	2.4E+01	carcinogenic effects	2.4E+01	8.8E+01	4.4E+02	3.0E+03
NITROGLYCERIN	1.2E+01	noncarcinogenic effects	1.0E+02	1.2E+01	6.2E+01	NA
NITROTOLUENE, 2-	9.0E+00	carcinogenic effects	9.0E+00	1.3E+02	6.3E+02	NA
NITROTOLUENE, 3-	2.4E+03	noncarcinogenic effects		2.4E+03	1.2E+04	NA
NITROTOLUENE, 4-	1.1E+02	carcinogenic effects	1.1E+02	4.9E+02	2.5E+03	NA
PENTACHLOROPHENOL	2.7E+00	carcinogenic effects	2.7E+00	3.9E+02	1.9E+03	NA
PENTAERYTHRITOLTETRANITRATE (PETN)	2.5E+02	noncarcinogenic effects	4.3E+02	2.5E+02	1.2E+03	NA
PERCHLORATE	1.4E+02	noncarcinogenic effects		1.4E+02	7.2E+02	NA
PHENANTHRENE	4.1E+03	noncarcinogenic effects		4.1E+03	2.1E+04	NA
PHENOL	3.7E+04	noncarcinogenic effects		3.7E+04	1.8E+05	NA
POLYCHLORINATED BIPHENYLS (PCBs)	7.4E+00	carcinogenic effects	7.4E+00	1.1E+01	1.1E+01	NA
PROPICONAZOLE	1.6E+03	noncarcinogenic effects		1.6E+03	8.0E+03	NA
PYRENE	3.3E+03	noncarcinogenic effects		3.3E+03	1.6E+04	NA
SELENIUM	1.0E+03	noncarcinogenic effects		1.0E+03	5.1E+03	NA
SILVER	1.0E+03	noncarcinogenic effects		1.0E+03	5.1E+03	NA
SIMAZINE	1.4E+01	carcinogenic effects	1.4E+01	6.2E+02	3.1E+03	NA
STYRENE	8.7E+02	saturation limit		7.4E+03	3.7E+04	8.7E+02
TERBACIL	1.6E+03	noncarcinogenic effects		1.6E+03	8.0E+03	NA
tert-BUTYL ALCOHOL	3.9E+02	carcinogenic effects	3.9E+02			3.2E+05
TETRACHLOROETHANE, 1,1,1,2-	9.5E+00	carcinogenic effects	9.5E+00	5.3E+02	2.6E+03	6.8E+02
TETRACHLOROETHANE, 1,1,2,2-	2.8E+00	carcinogenic effects	2.8E+00	4.1E+03	2.0E+04	1.9E+03
TETRACHLOROETHYLENE	2.7E+00	carcinogenic effects	2.7E+00	4.7E+02	2.3E+03	1.7E+02
TETRACHLOROPHENOL, 2,3,4,6-	3.7E+03	noncarcinogenic effects		3.7E+03	1.8E+04	NA
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	9.8E+03	noncarcinogenic effects		9.8E+03	4.9E+04	NA
THALLIUM	1.0E+01	noncarcinogenic effects		1.0E+01	1.0E+01	NA
TOLUENE	8.2E+02	saturation limit		9.1E+03	4.5E+04	8.2E+02
TOXAPHENE	1.6E+00	carcinogenic effects	1.6E+00			NA
TPH (gasolines)	1.1E+03	noncarcinogenic effects		1.1E+03	1.1E+03	5.4E+03
TPH (middle distillates)	5.0E+02	saturation limit		1.0E+03	1.0E+03	5.0E+02
TPH (residual fuels)	1.2E+05	noncarcinogenic effects		1.2E+05	1.2E+05	NA

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

CHEMICAL	Final Action Level (mg/kg)	Basis	[1]Carcinogens (Risk = 10^{-6}) (mg/kg)	[2]Noncarcinogens (HQ = 0.2) (mg/kg)	[2]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
TRICHLOROBENZENE, 1,2,4-	3.2E+01	carcinogenic effects	3.2E+01	5.5E+01	2.8E+02	NA
TRICHLOROETHANE, 1,1,1-	6.4E+02	saturation limit		7.7E+03	3.8E+04	6.4E+02
TRICHLOROETHANE, 1,1,2-	1.4E+00	noncarcinogenic effects	5.3E+00	1.4E+00	6.8E+00	5.2E+02
TRICHLOROETHYLENE	1.4E+01	carcinogenic effects	1.4E+01	1.7E+01	8.7E+01	6.9E+02
TRICHLOROPHENOL, 2,4,5-	1.2E+04	noncarcinogenic effects		1.2E+04	6.2E+04	NA
TRICHLOROPHENOL, 2,4,6-	1.2E+02	noncarcinogenic effects	1.6E+02	1.2E+02	6.2E+02	NA
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	1.2E+03	noncarcinogenic effects		1.2E+03	6.2E+03	NA
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	9.9E+02	noncarcinogenic effects		9.9E+02	4.9E+03	NA
TRICHLOROPROPANE, 1,2,3-	1.8E-02	carcinogenic effects	1.8E-02	4.1E+00	2.1E+01	1.2E+03
TRICHLOROPROPENE, 1,2,3-	5.0E-01	noncarcinogenic effects		5.0E-01	2.5E+00	2.7E+03
TRIFLURALIN	2.2E+02	carcinogenic effects	2.2E+02	9.2E+02	4.6E+03	NA
TRINITROBENZENE, 1,3,5-	5.4E+03	noncarcinogenic effects		5.4E+03	2.7E+04	NA
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.9E+02	noncarcinogenic effects		4.9E+02	2.5E+03	NA
TRINITROTOLUENE, 2,4,6- (TNT)	7.9E+01	carcinogenic effects	7.9E+01	8.4E+01	4.2E+02	NA
VANADIUM	1.0E+03	noncarcinogenic effects		1.0E+03	5.1E+03	NA
VINYL CHLORIDE	1.7E+00	carcinogenic effects	1.7E+00	7.9E+01	3.9E+02	3.9E+03
XYLENES	3.9E+02	saturation limit		5.2E+02	2.6E+03	3.9E+02
ZINC	6.1E+04	noncarcinogenic effects		6.1E+04	3.1E+05	NA

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

Notes:

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

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

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

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

See text for equations and assumptions used in models.

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

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

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

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

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

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

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

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

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

CHEMICAL	Final Action Level (mg/kg)	Basis	[1]Carcinogens (Risk = 10^{-5}) (mg/kg)	[2]Noncarcinogens (HQ = 0.2) (mg/kg)	[2]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
DIBROMO,1,2- CHLOROPROPANE,3-	3.9E-01	carcinogenic effects	3.9E-01	8.6E+00	4.3E+01	1.1E+03
DIBROMOCHLOROMETHANE	2.0E+01	carcinogenic effects	2.0E+01	6.9E+02	3.4E+03	NA
DIBROMOETHANE, 1,2-	8.6E-01	carcinogenic effects	8.6E-01	9.9E+01	4.9E+02	NA
DICHLOROBENZENE, 1,2-	1.9E+02	saturation limit		3.1E+03	1.5E+04	1.9E+02
DICHLOROBENZENE, 1,3-	6.0E+02	saturation limit		1.7E+03	8.6E+03	6.0E+02
DICHLOROBENZENE, 1,4-	6.6E+01	carcinogenic effects	6.6E+01	8.5E+03	4.3E+04	NA
DICHLOROBENZIDINE, 3,3-	3.1E+02	carcinogenic effects	3.1E+02			NA
DICHLORODIPHENYLDICHLOROETHANE (DDD)	6.0E+02	carcinogenic effects	6.0E+02			NA
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	4.2E+02	carcinogenic effects	4.2E+02			NA
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.9E+02	noncarcinogenic effects	5.6E+02	1.9E+02	9.5E+02	NA
DICHLOROETHANE, 1,1-	9.0E+01	carcinogenic effects	9.0E+01	2.0E+03	1.0E+04	1.7E+03
DICHLOROETHANE, 1,2-	1.2E+01	carcinogenic effects	1.2E+01	4.5E+01	2.2E+02	1.8E+03
DICHLOROETHYLENE, 1,1-	3.2E+02	noncarcinogenic effects		3.2E+02	1.6E+03	1.2E+03
DICHLOROETHYLENE, Cis 1,2-	2.4E+01	noncarcinogenic effects		2.4E+01	1.2E+02	1.3E+03
DICHLOROETHYLENE, Trans 1,2-	1.5E+02	noncarcinogenic effects		1.5E+02	7.3E+02	1.4E+03
DICHLOROPHENOL, 2,4-	8.7E+02	noncarcinogenic effects		8.7E+02	4.3E+03	NA
DICHLOROPHENOXYACETIC ACID (2,4-D)	3.5E+03	noncarcinogenic effects		3.5E+03	1.8E+04	NA
DICHLOROPROPANE, 1,2-	2.0E+01	noncarcinogenic effects	2.4E+01	2.0E+01	1.0E+02	1.4E+03
DICHLOROPROPENE, 1,3-	4.7E+01	carcinogenic effects	4.7E+01	9.5E+01	4.7E+02	1.6E+03
DIELDRIN	3.6E+01	noncarcinogenic effects	9.0E+01	3.6E+01	7.2E+01	NA
DIETHYLPHTHALATE	2.3E+05	noncarcinogenic effects		2.3E+05	1.2E+06	NA
DIMETHYLPHENOL, 2,4-	5.7E+03	noncarcinogenic effects		5.7E+03	2.9E+04	NA
DIMETHYLPHTHALATE	1.0E+06	maximum		2.9E+06	1.4E+07	NA
DINITROBENZENE, 1,3-	2.9E+01	noncarcinogenic effects		2.9E+01	1.4E+02	NA
DINITROPHENOL, 2,4-	5.8E+02	noncarcinogenic effects		5.8E+02	2.9E+03	NA
DINITROTOLUENE, 2,4- (2,4-DNT)	4.6E+02	carcinogenic effects	4.6E+02	5.8E+02	2.9E+03	NA
DINITROTOLUENE, 2,6- (2,6-DNT)	2.9E+02	noncarcinogenic effects		2.9E+02	1.4E+03	NA
DIOXANE, 1,4-	1.4E+03	carcinogenic effects	1.4E+03	8.7E+03	4.3E+04	NA
DIOXINS (TEQ)	1.5E-03	HDOH 2010a				
DIURON	5.8E+02	noncarcinogenic effects		5.8E+02	2.9E+03	NA
ENDOSULFAN	1.7E+03	noncarcinogenic effects		1.7E+03	8.7E+03	NA
ENDRIN	8.7E+01	noncarcinogenic effects		8.7E+01	4.3E+02	NA
ETHANOL	1.5E-03	commercial/industrial exposure				
ETHYLBENZENE	1.5E+02	carcinogenic effects	1.5E+02	6.8E+03	3.4E+04	4.8E+02
FLUORANTHENE	1.0E+04	noncarcinogenic effects		1.0E+04	5.2E+04	NA
FLUORENE	8.8E+03	noncarcinogenic effects		8.8E+03	4.4E+04	NA
GLYPHOSATE	2.9E+04	noncarcinogenic effects		2.9E+04	1.4E+05	NA
HEPTACHLOR	3.2E+01	carcinogenic effects	3.2E+01	1.4E+02	7.2E+02	NA
HEPTACHLOR EPOXIDE	3.8E+00	noncarcinogenic effects	1.6E+01	3.8E+00	1.9E+01	NA
HEXACHLOROBENZENE	9.0E+01	carcinogenic effects	9.0E+01	2.3E+02	1.2E+03	NA
HEXACHLOROBUTADIENE	2.9E+02	noncarcinogenic effects	1.8E+03	2.9E+02	1.4E+03	NA
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	1.1E+02	noncarcinogenic effects	1.6E+02	1.1E+02	5.5E+02	NA
HEXACHLOROETHANE	2.9E+02	noncarcinogenic effects	1.0E+04	2.9E+02	1.4E+03	NA
HEXAZINONE	9.6E+03	noncarcinogenic effects		9.6E+03	4.8E+04	NA
INDENO(1,2,3-cd)PYRENE	1.8E+02	carcinogenic effects	1.8E+02			NA
ISOPHORONE	5.8E+04	noncarcinogenic effects	1.5E+05	5.8E+04	2.9E+05	NA

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

CHEMICAL	Final Action Level (mg/kg)	Basis	[1]Carcinogens (Risk = 10^{-5}) (mg/kg)	[2]Noncarcinogens (HQ = 0.2) (mg/kg)	[2]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
LEAD	8.0E+02	commercial/industrial exposure				
MERCURY	8.9E+01	noncarcinogenic effects		8.9E+01	4.5E+02	NA
METHOXYCHLOR	1.4E+03	noncarcinogenic effects		1.4E+03	7.2E+03	NA
METHYL ETHYL KETONE	2.8E+04	saturation limit		6.5E+04	3.3E+05	2.8E+04
METHYL ISOBUTYL KETONE	3.4E+03	saturation limit		2.0E+04	9.9E+04	3.4E+03
METHYL MERCURY	4.4E+01	noncarcinogenic effects		4.4E+01	2.2E+02	NA
METHYL TERT BUTYL ETHER	1.2E+03	carcinogenic effects	1.2E+03	2.1E+04	1.0E+05	8.9E+03
METHYLENE CHLORIDE	3.0E+02	carcinogenic effects	3.0E+02	3.0E+03	1.5E+04	3.3E+03
METHYLNAPHTHALENE, 1-	2.9E+02	carcinogenic effects	2.9E+02	1.2E+04	5.9E+04	NA
METHYLNAPHTHALENE, 2-	7.0E+02	noncarcinogenic effects		7.0E+02	3.5E+03	NA
MOLYBDENUM	2.2E+03	noncarcinogenic effects		2.2E+03	1.1E+04	NA
NAPHTHALENE	9.6E+01	carcinogenic effects	9.6E+01	1.9E+02	9.4E+02	NA
NICKEL	8.7E+02	noncarcinogenic effects		8.7E+02	4.3E+03	NA
NITROBENZENE	1.3E+02	carcinogenic effects	1.3E+02	1.8E+02	8.9E+02	3.0E+03
NITROGLYCERIN	2.9E+01	noncarcinogenic effects	8.5E+03	2.9E+01	1.4E+02	NA
NITROTOLUENE, 2-	6.0E+01	carcinogenic effects	6.0E+01	2.4E+02	1.2E+03	NA
NITROTOLUENE, 3-	4.3E+03	noncarcinogenic effects		4.3E+03	2.2E+04	NA
NITROTOLUENE, 4-	1.1E+03	noncarcinogenic effects	9.0E+03	1.1E+03	5.7E+03	NA
PENTACHLOROPHENOL	2.4E+02	carcinogenic effects	2.4E+02	9.5E+02	4.8E+03	NA
PENTAERYTHRITOLTETRANITRATE (PETN)	5.8E+02	noncarcinogenic effects	3.6E+04	5.8E+02	2.9E+03	NA
PERCHLORATE	3.1E+02	noncarcinogenic effects		3.1E+02	1.5E+03	NA
PHENANTHRENE	9.3E+03	noncarcinogenic effects		9.3E+03	4.7E+04	NA
PHENOL	8.3E+04	noncarcinogenic effects		8.3E+04	4.1E+05	NA
POLYCHLORINATED BIPHENYLS (PCBs)	2.5E+01	noncarcinogenic effects	6.3E+01	2.5E+01	2.5E+01	NA
PROPICONAZOLE	3.8E+03	noncarcinogenic effects		3.8E+03	1.9E+04	NA
PYRENE	7.6E+03	noncarcinogenic effects		7.6E+03	3.8E+04	NA
SELENIUM	2.2E+03	noncarcinogenic effects		2.2E+03	1.1E+04	NA
SILVER	2.2E+03	noncarcinogenic effects		2.2E+03	1.1E+04	NA
SIMAZINE	1.2E+03	carcinogenic effects	1.2E+03	1.4E+03	7.2E+03	NA
STYRENE	8.7E+02	saturation limit		1.2E+04	5.8E+04	8.7E+02
TERBACIL	3.8E+03	noncarcinogenic effects		3.8E+03	1.9E+04	NA
tert-BUTYL ALCOHOL	2.4E+03	carcinogenic effects	2.4E+03			3.2E+05
TETRACHLOROETHANE, 1,1,1,2-	5.2E+01	carcinogenic effects	5.2E+01	8.0E+02	4.0E+03	6.8E+02
TETRACHLOROETHANE, 1,1,2,2-	1.6E+01	carcinogenic effects	1.6E+01	8.8E+03	4.4E+04	1.9E+03
TETRACHLOROETHYLENE	1.7E+01	carcinogenic effects	1.7E+01	7.5E+02	3.7E+03	1.7E+02
TETRACHLOROPHENOL, 2,3,4,6-	8.7E+03	noncarcinogenic effects		8.7E+03	4.3E+04	NA
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	2.1E+04	noncarcinogenic effects		2.1E+04	1.1E+05	NA
THALLIUM	2.2E+01	noncarcinogenic effects		2.2E+01	2.2E+01	NA
TOLUENE	8.2E+02	saturation limit		1.6E+04	8.2E+04	8.2E+02
TOXAPHENE	1.3E+02	carcinogenic effects	1.3E+02			NA
TPH (gasolines)	1.7E+03	noncarcinogenic effects		1.7E+03	1.7E+03	5.4E+03
TPH (middle distillates)	5.0E+02	saturation limit		1.5E+03	1.5E+03	5.0E+02
TPH (residual fuels)	2.5E+05	noncarcinogenic effects		2.5E+05	2.5E+05	NA
TRICHLOROBENZENE, 1,2,4-	8.2E+01	noncarcinogenic effects	1.9E+02	8.2E+01	4.1E+02	NA
TRICHLOROETHANE, 1,1,1-	6.4E+02	saturation limit		1.1E+04	5.7E+04	6.4E+02
TRICHLOROETHANE, 1,1,2-	2.0E+00	noncarcinogenic effects	2.9E+01	2.0E+00	1.0E+01	5.2E+02

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

CHEMICAL	Final Action Level (mg/kg)	Basis	[1]Carcinogens (Risk = 10^{-5}) (mg/kg)	[2]Noncarcinogens (HQ = 0.2) (mg/kg)	[2]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
TRICHLOROETHYLENE	2.7E+01	noncarcinogenic effects	7.6E+01	2.7E+01	1.4E+02	6.9E+02
TRICHLOROPHENOL, 2,4,5-	2.9E+04	noncarcinogenic effects		2.9E+04	1.4E+05	NA
TRICHLOROPHENOL, 2,4,6-	2.9E+02	noncarcinogenic effects	1.3E+04	2.9E+02	1.4E+03	NA
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	2.9E+03	noncarcinogenic effects		2.9E+03	1.4E+04	NA
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	2.3E+03	noncarcinogenic effects		2.3E+03	1.2E+04	NA
TRICHLOROPROPANE, 1,2,3-	1.0E-01	carcinogenic effects	1.0E-01	6.1E+00	3.1E+01	1.2E+03
TRICHLOROPROPENE, 1,2,3-	7.5E-01	noncarcinogenic effects		7.5E-01	3.7E+00	2.7E+03
TRIFLURALIN	2.2E+03	noncarcinogenic effects	1.9E+04	2.2E+03	1.1E+04	NA
TRINITROBENZENE, 1,3,5-	1.2E+04	noncarcinogenic effects		1.2E+04	6.0E+04	NA
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	1.2E+03	noncarcinogenic effects		1.2E+03	5.8E+03	NA
TRINITROTOLUENE, 2,4,6- (TNT)	1.9E+02	noncarcinogenic effects	6.3E+03	1.9E+02	9.5E+02	NA
VANADIUM	2.2E+03	noncarcinogenic effects		2.2E+03	1.1E+04	NA
VINYL CHLORIDE	1.0E+01	carcinogenic effects	1.0E+01	1.2E+02	6.1E+02	3.9E+03
XYLENES	3.9E+02	saturation limit		7.8E+02	3.9E+03	3.9E+02
ZINC	1.3E+05	noncarcinogenic effects		1.3E+05	6.6E+05	NA

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

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

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

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

Notes:

See text for equations and assumptions used in models.

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

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

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

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

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

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

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

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

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

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

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

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

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

TABLE J. TARGET ORGANS AND CHRONIC HEALTH EFFECTS
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CHEMICAL PARAMETER	Target Organs And Health Effects														
	[a]Carcinogen	[b]Mutagen	[c]Alimentary Tract	Cardiovascular	Developmental	Endocrine	Eye	Hematologic	Immune	Kidney	Nervous	Reproductive	Respiratory	[d]Skin	Other
VANADIUM	D		3							3			2,3		
VINYL CHLORIDE	A	M	1,2,3,5		1,3			2,3	3		3	1,3		2	No chronic toxicity factors.
XYLENES	D										1,2,3,4,5		1		
ZINC	D			1		3		1,3,4,5					1		

Notes:

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

Carcinogen Classification

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

References:

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6. ORNL, 2007, Risk Assessment Information System (RAIS), Toxicity Profiles: Oak Ridge National Laboratory/U.S. Department of Energy (accessed December 2007), RAGs A Format, especially Critical Effect used for derivation of RfDs, http://risk.lsd.ornl.gov/tox/rap_toxp.shtml
7. USEPA National Primary Drinking Water Standards (March 2001): U.S. Environmental Protection Agency, Office of Water, EPA 816-F-01-007, http://www.epa.gov/safewater/consumer/pdf/mcl.pdf (selectively used)
8. TPH whole product toxicity based review of TPH Working Group petroleum carbon fraction guidance (TPHWG 1998, Volume 4) and Massachusetts DEP VPH/EPH guidance (MADEP 2002a).
For additional online references, see also: Hazardous Substances (On-line) Database: U.S. National Library of Medicine, Toxicology Data Network, http://toxnet.nlm.nih.go\

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

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

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

CHEMICAL PARAMETER	Range (mg/kg)	[2]Upper Bound (mg/kg)	[3]Background Threshold Value (mg/kg)	[4]Selected Action Level (mg/kg)
CYANIDE (Free)				
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)				
DALAPON				
DIBENZO(a,h)ANTHTRACENE				
DIBROMO,1,2- CHLOROPROPANE,3-				
DIBROMOCHLOROMETHANE				
DIBROMOETHANE, 1,2-				
DICHLOROBENZENE, 1,2-				
DICHLOROBENZENE, 1,3-				
DICHLOROBENZENE, 1,4-				
DICHLOROBENZIDINE, 3,3-				
DICHLORODIPHENYLDICHLOROETHANE (DDD)				
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)				
DICHLORODIPHENYLTRICHLOROETHANE (DDT)				
DICHLOROETHANE, 1,1-				
DICHLOROETHANE, 1,2-				
DICHLOROETHYLENE, 1,1-				
DICHLOROETHYLENE, Cis 1,2-				
DICHLOROETHYLENE, Trans 1,2-				
DICHLOROPHENOL, 2,4-				
DICHLOROPHENOXYACETIC ACID (2,4-D)				
DICHLOROPROPANE, 1,2-				
DICHLOROPROPENE, 1,3-				
DIELDRIN				
DIETHYLPHTHALATE				
DIMETHYLPHENOL, 2,4-				
DIMETHYLPHTHALATE				
DINITROBENZENE, 1,3-				
DINITROPHENOL, 2,4-				
DINITROTOLUENE, 2,4- (2,4-DNT)				
DINITROTOLUENE, 2,6- (2,6-DNT)				
DIOXANE, 1,4-				
DIOXINS (TEQ)				2.0E-05
DIURON				
ENDOSULFAN				
ENDRIN				
ETHANOL				
ETHYLBENZENE				
FLUORANTHENE				
FLUORENE				
GLYPHOSATE				
HEPTACHLOR				
HEPTACHLOR EPOXIDE				
HEXACHLOROBENZENE				

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

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

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

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

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

Notes:

1. Excludes samples with known or suspected anthropogenic contamination (see primary reference).
2. Upper Bound concentration selected based on evaluation of univariate sample data plots.
3. Background Threshold Value set to maximum-reported concentration, excluding samples with suspected anthropogenic contamination.
4. Selected action level based on Upper Bound concentration unless otherwise noted.
5. BTV for arsenic based on profession judgment (widespread use as herbicide; clear break from anticipated, natural background not apparent on univariate graphs).
6. BTV for lead set equal to selected, Upper Bound concentration (common contamination of soil with leaded paint or auto exhaust from leaded gasoline; clear break from anticipated, natural background not apparent on univariate graphs).

TABLE L. SOIL ECOTOXICITY ACTION LEVELS

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

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

TABLE L. SOIL ECOTOXICITY ACTION LEVELS

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

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

TABLE L. SOIL ECOTOXICITY ACTION LEVELS

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

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

TABLE L. SOIL ECOTOXICITY ACTION LEVELS

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

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

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

Appendix D
Contractor Guidelines

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Appendix D
Contractor Guidelines

GENERAL GUIDELINES

The HART contractor guideline sheets are for distribution to contractors performing intrusive subsurface work for the Honolulu Rail Transit Project. These sheets are typically not required for contractors performing non-intrusive activities, such as traffic control setup/takedown and land surveying unless they may come into contact with contaminated media. If you are not sure whether these guidelines apply, contact HART for clarification. The responsibilities of the contractors are as follows:

1. Select and review the sheet(s) that will apply to the project.
2. Print, review, fill out, and sign the sheet(s).
3. Maintain a copy of the sheet(s) on site to refer to in the field.

The guideline sheets summarize the requirements for identifying and managing contaminated soil, water, free phase petroleum products, vapor, debris, and unanticipated or unknown materials. Signing these sheets demonstrates the contractors understanding of the process. The details of these requirements are identified in the Environmental Hazard Management Plan (EHMP) approved by the State of Hawaii Department of Health (HDOH). Any deviations from this plan and the attached management sheets must be approved by HART and HDOH.

REFERENCE SHEET INDEX

REFERENCE SHEET NUMBER	TITLE	EHMP TEXT REFERENCE
D-1	Employee Sign-off Form	5.1
D-2	Pre-Construction Environmental Screening Form	5.2
D-3	Inactive Pipeline and Underground Storage Tank Removal Management Plan	5.3
D-4	Soil Management Plan	5.4
D-5	Groundwater, Storm Water and Decontamination Water Management Plan	5.5, 5.6, 5.7
D-6	Free Product Management Plan	5.8
D-7	Vapor Management Plan	5.9
D-8	Debris Management Plan	5.10
D-9	Unanticipated or Unknown Materials Management Plan	5.11
D-10	Post-Construction Environmental Reporting Form	5.12, 6.1
D-11	Release Response Plan	6.1
D-12	Release Report Form	6.2, 6.3, 6.4
D-13	Deviation Form	1.6, 5.1, 5.14

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Appendix D-1

Employee Sign-off Form

INSTRUCTIONS

The Contractor and Subcontractor staff listed herein have been provided with a copy of the Programmatic EHE-EHMP, have read and understood it, and agree to abide by its provisions.

SIGNATURES

Project Name:		**Project Number**	
EMPLOYEE NAME (Please print)	**EMPLOYEE SIGNATURE**	**COMPANY**	**DATE**

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Appendix D-2

Pre-Construction Environmental Screening Form

Purpose of this Form: This form is to be completed by the Contractor and HART to communicate and document any potential environmental hazards expected in a given Work Area. If the Contractor anticipates changes to protocols specified in the EHMP, HART will be notified immediately and the Contractor will fill out and submit Appendix D-13, Deviation Form, in accordance with Section 5.14.1.

PROJECT INFORMATION

To be completed by the Contractor

Contractor: _____

Contractor Point of Contact (POC): _____

Contractor POC Phone Number(s): _____

HART POC Consulted about the Project:: _____

HART POC Phone Number(s): _____

Date Project Reviewed: _____

NOTE: Any work on this project that does not fall directly under the above description of work MUST be reviewed separately by HART.

Project Schedule: _____ To _____

Name and affiliation of person completing form: _____

Types of work scheduled during this time period (please check all that apply):

- ☐ AIS trenching
- ☐ Geotechnical borings
- ☐ Clearing/grubbing
- ☐ Grading
- ☐ Tree relocation
- ☐ Other: _____
- ☐ Utility relocation
- ☐ Sewer jacketing
- ☐ Potholing
- ☐ Column shafts
- ☐ Station touchdowns
- ☐ Test or Method shaft
- ☐ Production shaft
- ☐ Building demolition
- ☐ Footings
- ☐ Rail at grade

☐ Attach Figure(s) of Work Areas

Will excess soil and/or water be generated? ☐ Yes* ☐ No

*If yes, identify reuse/disposal plan, use additional pages if necessary:

WORK AREA AND ACTIVITY	SOIL Reuse Area/Disposal	GROUNDWATER Reinfiltration/Reinjection?

TURN THE PAGE FOR ADDITIONAL INFORMATION ON CONTAMINATED SITES (COMPLETED BY HART)

SCREENING RESULTS

			Contaminants of Potential Concern / Analytical Method													Required Management Plan						
Location ID	*To be completed by HART* *Environmental Sites within 150 meter buffer*	*EHMP/LUCs within 150 meters*	VOCs by SW8260	PAH by SW8270	TPH-GRO by SW8015	TPH-DRO by SW8015	TPH-RRO by SW8015	Cadmium by SW6010/ SW6020	Chromium by SW6010/ SW6020	Lead by SW6010/ SW6020	PCBs by SW8082	Pesticides by SW8081	Herbicides by SW8151	Dioxins/Furans by SW8280 /SW8290	Additional Analyses (see below)	D-3 Inactive Pipeline or UST	D-4 Soil	D-5 Water	D-6 Free Product	D-7 Vapor	D-8 Debris	D-8 Unknown/Unanticipated

Additional Analysis: _____

Appendix D-3

Inactive Pipeline and Underground Storage Tank Removal Management Plan

Notice: Any deviation from the work described herein requires consultation and approval from HART. ***This plan is valid only for the project listed below.***

Purpose of This Sheet: This reference sheet provides inactive pipeline and underground storage tank (UST) management instructions for contractors working on the HRTP. Additional details are provided in Section 5.3 of the Programmatic EHE-EHMP. If the Contractor anticipates changes to protocols specified in the EHMP, HART will be notified immediately and the Contractor will fill out and submit Appendix D-13, Deviation Form, in accordance with Section 5.14.1.

PROJECT INFORMATION

Contractor:
Phase:
Work Area(s):
Work Activities Covered by this Reference Sheet:
Contractor Point of Contact (POC) or Person Consulted about Project:
HART POC or Person Consulted about the Project:
HART POC Phone Number(s):
Date Project Reviewed:

PLANNING

Has **Appendix D-2, Pre-Construction Environmental Screening Form** been received and reviewed by the Contractor?

☐ Yes ☐ No*

***If no, do not proceed with work until the Appendix D-2, Pre-Construction Environmental Screening Form** been received and reviewed.

Was inactive pipeline or UST expected?

☐ Yes ☐ No*

***If no, do not proceed with work until HART has been notified and the Appendix D-11, Release Response Plan and Appendix D-12, Release Response Report have been Completed.**

If a UST removal is planned, has the Contractor coordinated with the HDOH SHW Branch, UST Section and/or the HDOH HEER Branch?

☐ Yes ☐ No*

*If no, do not proceed with work until HDOH coordination is completed. If you have any questions, call their office at (808) 586-4226 (UST) or (808) 586-4249.

If unknown or unexpected inactive pipeline or UST is encountered, stop work immediately and notify the HART POC for further consultation on removal, containment, and disposition. An unknown or unexpected inactive pipeline or UST will be reported as a release to HDOH.

GENERAL GUIDELINES

Before performing any intrusive subsurface work, review historical documents and plans for information on inactive pipelines and UST. In some instances, previously unknown inactive pipelines and USTs may be discovered for the first time during subsurface activities. Coordinate with property owners when working in segments where there is a high probability of encountering inactive pipelines and USTs. If any unexpected inactive pipelines or USTs are encountered, HART and HDOH notification and follow-up reporting are required in accordance with **Appendix D-11, Release Response Plan**.

To the extent possible, leave inactive pipelines and USTs in the ground. Handle excavated soil and water in accordance with the applicable management plans. If pipelines or USTs are damaged during construction activities they may need to be sealed or removed. Attempt to identify the nature of the pipeline or UST and confirm that it is not active.

All UST removals shall be coordinated with the HDOH Solid and Hazardous Waste Branch, UST Section and the Honolulu Fire Department. Notice of intent to close a UST must be provided to the HODH at least **30 days** prior to the actual date of closure. In limited circumstances, USTs that are inadvertently discovered during construction may be removed sooner than 30 days with prior coordination with and approval from HDOH. UST removal should be conducted in general accordance with the HDOH Technical Guidance Manual (TGM) for UST and Release Response (HDOH, March 2000) and/or the TGM for the Implementation of the Hawaii State Contingency Plan (HDOH, November 2009).

HDOH UST regulations require owners and operators to undertake specific actions and make reports to the HDOH SHWB, UST section when they close regulated USTs. These requirements are detailed in the *Technical Guidance Manual for UST Closure and Release Response* (HDOH, 2000). Certain types of USTs, for example, heating-fuel USTs, are specifically exempt from UST regulations (Hawaii Revised Statutes 342L-1 and Hawaii Administrative Rules, Title 11, Chapter 281-03). Potential releases from non-regulated USTs, including heating-fuel USTs, are governed under Hawaii Revised Statutes, Chapter 128D, Hawaii Environmental Response Law; and Hawaii Administrative Rules, Title 11, Chapter 451, State Contingency Plan. The HDOH-HEER Office provides regulatory oversight for release response actions taken under the State Contingency Plan. In most cases where unknown or unregistered USTs are encountered in excavations and there is no other information available related to the prior use of the UST, it will most likely be managed as an unregulated UST.

If any unknown or unexpected pipeline or UST is encountered, stop work immediately and notify the HART POC for further consultation on removal, containment, and disposition.

FIELD SCREENING AND EXPOSURE MONITORING

The exposure limits are based on OSHA-permissible exposure limits or other more stringent published government agency exposure limits adopted by the Contractor. Follow the exposure monitoring plan included in construction contractor Health and Safety Plans.

Field screening for visual and olfactory evidence of contamination consists of:

- Looking for free product, soil staining, or debris (asphalt, piping/conduit not associated with utilities, construction debris, or evidence of dumping).
- Looking for separate phase petroleum product (for example oil), sheens, or discoloration of the water.
- Being aware of and investigating any unusual odors.
- You may need to use field screening equipment (for example, a photoionization detector), test kits, or consult with HART if you are unfamiliar with testing requirements.

PROCEDURES

To the extent possible, leave inactive pipelines and USTs in the ground. In the event that they need to be removed, the following guidelines apply:

Pipeline and UST Tapping, Draining, and Removal

Do not attempt to remove without first evaluating the contents, evacuating the contents, or determining that it is empty. To the extent practicable,

- Remove any fluids before cutting the pipeline or UST.
- Sample or test petroleum fluids to determine how they can be reused, recycled, or disposed.
- Use a non-sparking tool to tap the pipeline or UST and evaluate contents. Remove residual fluids as necessary. If the pipelines are asbestos covered, appropriate personal protective equipment (PPE) (including breathing apparatus) may be required.
- For pipelines, cover area below and adjacent to the cutting location with absorbent material. In addition, place a catch basin directly beneath the tap or cutting location. Pipelines may be under pressure; therefore, a vacuum truck should be onsite during cutting to recover any released fluids. Pipeline fluids collected in the catch basin should be removed and properly disposed of.
- Remove pipeline segments as necessary by cutting. If there is a potential explosion hazard, use a wet saw or other non-sparking tool. If the pipelines are asbestos covered, wear appropriate PPE (including breathing apparatus).
- Seal or close-off cut ends of remaining pipeline segments to prevent potential leakage. Suitable seals include cement plugs, blind flanges, or other methods not involving hot welding. Welding is not appropriate because of the potentially explosive nature of fuel and its associated vapors.

Removed Pipe and UST Handling

In many cases, sections of removed pipeline contain heavy viscous petroleum products that appear to be immobile. However, once the pipes and product heat up, the product can liquefy and cause a release. If sections of waste pipe are stored onsite before disposal, do the following:

- Line the area with plastic and berm to contain any fuel that may mobilize because of atmospheric heating.

Any debris excavated should be reused or sent for recycling after decontamination. Examples of debris that can be recycled include asphalt (e.g., crushed and reused as road base), concrete (e.g., reused to construct a

berm), or clearing and grubbing and untreated wood debris (e.g., ground up and reused as mulch or compost at landscaped sites along the HRTP corridor).

NOTE: Debris recycling IS NOT the same as disposal. If debris is simply disposed of, a waste manifest is required.

ENGINEERING AND ADMINISTRATIVE CONTROLS

Dust and vapor control methods may be necessary during construction-related work in which inactive pipelines are encountered and investigated. Other controls may also include the use of plastic sheeting for stockpiling and covering, rolloff boxes, or other storage containers to segregate or store soil (Section 5.4), groundwater (Section 5.5), free product (Section 5.8), or other materials (such as asphalt, concrete, pipeline segments) removed during the course of construction.

INSPECTIONS

A key component of the plan is routine inspections. All locations, particularly those locations where a greater possibility exists to encounter inactive pipelines, will require Contractor to:

- Survey for utilities including inactive pipelines, and other anomalies prior to any intrusive activities
- Continuously inspect disturbed ground during intrusive activities.

RECORDKEEPING AND REPORTING

Notify the HART POC if an unknown or unexpected inactive pipeline or UST is encountered or observed. Unknown or unexpected inactive pipeline or UST will be reported as a release to accordance with Appendix D-11 and D-12. If changes in the UST or pipeline removal procedures are needed, report to supervisors, and adjust as needed. Changes will be reported in writing to HART using Appendix D-13. Upon receipt, HART will notify HDOH within 24 hours.

Submit Appendix D-10, Post-Construction Environmental Reporting Form to HART within 30 days of completing Task within the Work Area. Each Post-Construction Environmental Reporting Form (see Appendix D-10) shall include:

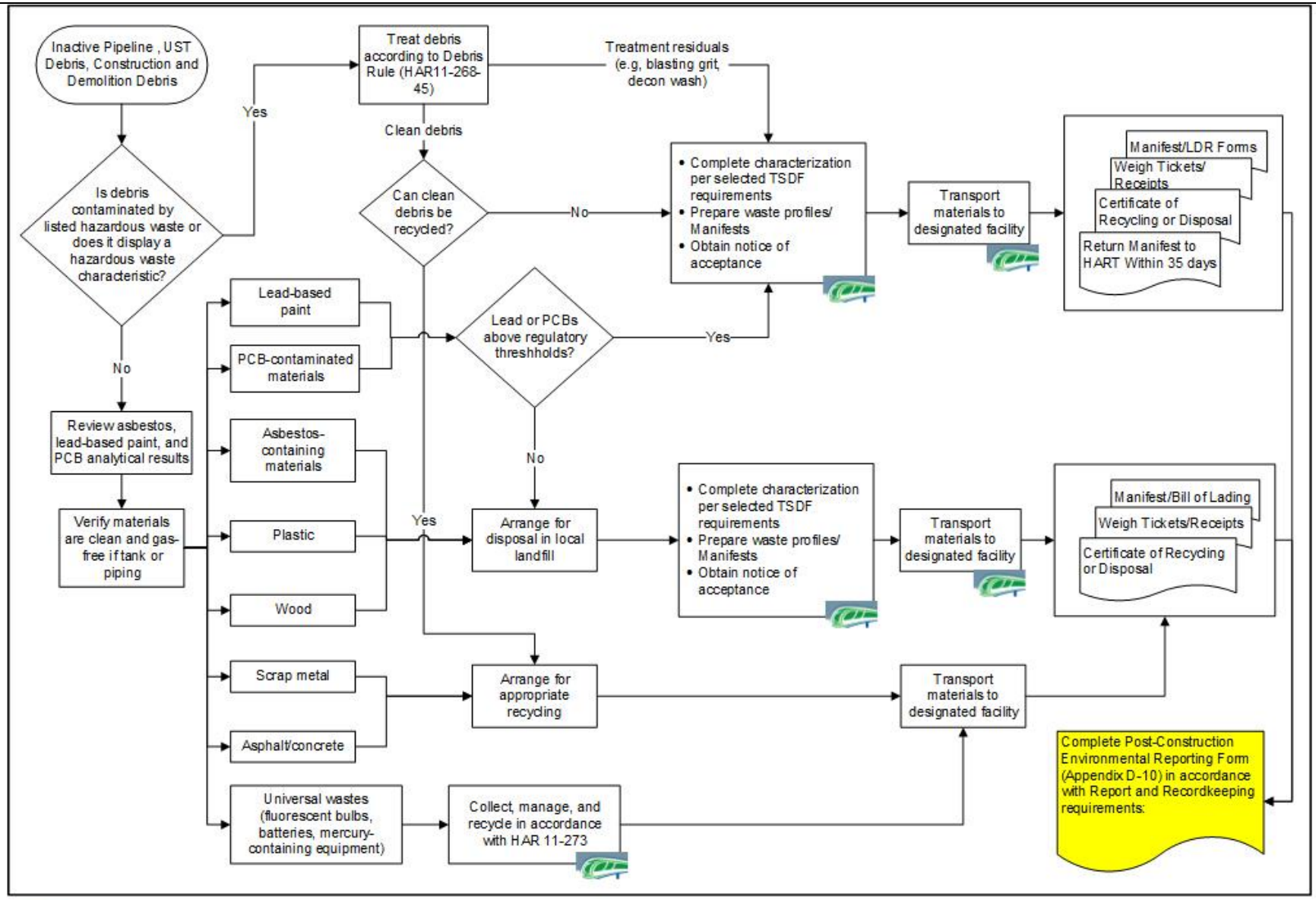
- General Information: Contractor, location and activity where pipeline or UST was encountered.
- Supplemental information/reference to other site media generated, e.g., water from dewatering, decontamination, etc. (multiple media shall be reported in a single form).
- Detailed records of field observations should include the location of the pipeline or UST relative to fixed landmarks (including Global Position System [GPS] coordinates) and the depth, diameter, pipeline or UST type, and any other distinguishing features, type of fuel, beginning and ending fluid levels, volumes of each type of fluid removed (for example, water and fuel), flow rates, direction of flow, any other information pertinent to the pipeline contents, and detailed photographs.
- Field screening/sampling results for contaminant identification and exposure monitoring.

- Summary of management activities (e.g., stockpiling, drums, super sacks, other) and location of management area including temporary management within work area and/or at alternate on site location within the rail corridor.
- Methods used to conduct waste characterization including hazardous waste determination.
- Waste tracking log to identify the disposition of all soil removed from the site.

Notes:

SIGNATURE

Contractor Name and Title | Signature | Date



Coordinate with HART

LDR = Land Disposal Restriction
PCB = Polychlorinated biphenyls
TSDF = Treatment Storage and Disposal Facility
HAR = Hawaii Administrative Rules

Inactive Pipeline, UST Debris, Construction and Demolition Debris Waste Management

Appendix D-4
Soil Management Plan

Notice: Any deviation from the work described below requires consultation with HART. ***This plan is valid only for the project listed below.***

Purpose of This Sheet: This reference sheet provides soil management instructions for contractors who are working on the HRTP. The contractor is responsible for following these requirements while working at the project site. Additional details are provided in Section 5.4 of the Programmatic EHE-EHMP. If the Contractor anticipates changes to protocols specified in the EHMP, HART will be notified immediately and the Contractor will fill out and submit Appendix D-13, Deviation Form, in accordance with Section 5.14.1.

PROJECT INFORMATION

Contractor:
Phase:
Work Area(s):
Work Activities Covered by this Reference Sheet:
Contractor Point of Contact (POC):
Contractor POC Phone Number(s):
HART POC Consulted about the Project::
HART POC Phone Number(s):
Date Project Reviewed:

PLANNING

Has **Appendix D-2, Pre-Construction Environmental Screening Form** been received and reviewed by the contractor?

☐ Yes ☐ No*

***If no, do not proceed with work until Appendix D-2, Pre-Construction Environmental Screening Form is complete.**

GENERAL GUIDELINES

This soil management plan provides requirements for excavating, stockpiling, re-using and disposing of petroleum-impacted soils. Whenever possible, *minimize the soil moved/disturbed and* immediately reuse excavated soil within the Work Area where it was generated. The alternatives for management of

excess soil generated in order of preference include: reuse within the Work Area, reuse within the Rail Corridor, reuse Off Site, and disposal.

FIELD SCREENING AND EXPOSURE MONITORING

Field screening and exposure monitoring should be performed for two primary reasons:

1) To identify potentially contaminated soil and
2) To monitor for worker exposure during construction activities

Field screening for visual and olfactory evidence of contamination consists of:

- Looking for free product, staining, or debris (asphalt, lumber, piping/conduit not associated with utilities, construction debris, or evidence of dumping).
- Being aware of and investigating any unusual odors.
- You may need to use field screening equipment (for example, a photoionization detector [PID]), test kits, or consult with HART if you are unfamiliar with testing requirements.

Other qualitative tests for determining the presence of free product and/or grossly contaminated soil (TPH > 5,000 mg/kg) include water, glove, and paper towel field screening techniques.

- Water testing for gross contamination consists of placing a handful of soil into a small container with enough water to break apart and saturate the soil particles and observing for the presence of a sheen or separate phase product on the surface of the water, or on the edges or bottom of the container
- Glove testing for gross contamination of TPH consists of squeezing a handful of soil in a gloved hand. If oil droplets remain on the glove after releasing the soil, assume that TPH > 5,000 mg/kg
- Paper towel testing for gross contamination of TPH consists of squeezing a handful of soil in a paper towel. If oil droplets appear on the paper towel, assume that TPH > 5,000 mg/kg

Exposure Monitoring: Worker exposure limits during construction are based on OSHA-permissible exposure limits or other more stringent published government agency exposure limits adopted by the contractor. Follow the exposure monitoring plan that is included in contractor Health and Safety Plans.

Note: Some contaminants are not easy to identify in the field, (for example, metals, pesticides, or dioxins may be present in soil with no staining, odor, or elevated PID measurements). Refer to Appendix D-2 Pre-Construction Environmental Screening Form for contaminant types and determine whether field screening technique is available.

EXCAVATION AND STOCKPILING

If the Contractor determines the soil is potentially contaminated based on field screening or exposure monitoring results, notify the HART POC.

Segregate potentially contaminated soil from clean soil generated during excavation. Stockpile potentially contaminated soil on a liner (for example, plastic sheeting) near the excavation. If excavated soil cannot be stockpiled near the excavation within the Work Area due to space or time restrictions, transport the soil to an alternate location within the Rail Corridor after discussion with and approval

from HART. Additional permits may be necessary. Stockpiles must be covered at the end of each work day, and during periods of heavy rain. Saturated soils must also have a perimeter berm (for example, hay bales or sand bags placed beneath the liner) to allow for collection of any free liquids draining from the stockpile. Pump (or otherwise remove) accumulated free liquids to a covered/sealable container. Covers and berms must be secured in place when not in use or actively managed. Inspect covers daily (or as frequently as necessary) and repair/replace immediately to ensure that they remain intact.

If excavated soil is saturated with something other than water (for example, with oil or fuel), it must be placed in a container (for example, drums, lined leak-proof roll-off boxes or containers) and covered.

Digging: ***The top-most soil layers shall be kept in a separate pile from deeper soil underneath. This top-most soil layer shall be placed on the surface when the soil is put back in the excavation if possible.***

TEMPORARY STORAGE

Soil may be temporarily stored within the Work Area or within the Rail Corridor.

- Load soil that cannot be reused into containers (for example, a roll-off box or end-dump truck). Drain any liquids associated with the soil before stockpiling. Dispose of liquids properly. If free product is observed in the excavation, remove and properly dispose of free product.
- Decontaminate vehicles transporting contaminated or potentially contaminated stockpiled soil (roll-off boxes and end-dump trucks) following each vehicle's final load at the end of each workday. The Transporter will complete decontamination procedures at the point of disposal or return the roll-off to the site for decontamination.
- If the excess soil is determined to be hazardous waste by pre-characterization or field screening results, the contractor must manage the soil as hazardous waste in accordance with the appropriate Hawaii Administrative Rules and the contractor's waste management plan. **Note:** Movement of soil within the rail corridor (considered onsite) does not trigger hazardous waste manifest requirements. Hazardous waste manifests are required when moving hazardous waste off-site for disposal (outside the rail corridor).
- If excess soil needs to be containerized, it must be labeled. In general, an "On-Hold Pending Analysis" label or "Nonhazardous Waste" label (assuming the soil is nonhazardous) with the following information should be attached to the container:
  - ❑ Date soil placed in container.
  - ❑ Name of specific project site where soil was generated.
  - ❑ Construction project contact and phone number.
  - ❑ Name and phone number.
  - ❑ Site name and ID.

Waste-specific information (for example, soil from 6 inches to 6 feet below grade at boring number 11).

MANAGING EXCESS SOIL

Soil may have limited reuse options under the following restricting conditions (check the box for soil conditions encountered during this task):

- ☐ The soil does not meet the applicable geotechnical standards (for example, compaction), physical standards (for example, saturated soils), or other contract or work plan requirements for backfill defined by construction documents.
- ☐ The soil is displaced (for example, excess soil from placing a pipeline in a trench or a concrete foundation in an excavation or a column in a borehole).

All excess soil must be managed in accordance with applicable regulations. Consult with HART's POC. See attached flow chart.

If there is excess soil remaining after the excavation has been filled that is suitable for reuse, use the following checklist and decision matrix to determine which steps to follow.

Historical Evidence of Contamination[1]?	Field Evidence of Contamination[2]? No	Field Evidence of Contamination[2]? Yes
No	Scenario 1	Scenario 2
Yes	Scenario 3	Scenario 4

[1] Historical evidence of contamination is defined as having concentrations of contaminants >HDOH Tier 1 EALs for unrestricted use, over drinking water, <150 m to surface water. Sites with no known contamination based on due diligence reports and/or sites that have been investigated and shown to have concentrations of contaminants <HDOH Tier 1 EALs for unrestricted use, over drinking water, <150 m to surface water are considered to have no known historical evidence of contamination.

[2] Field evidence of contamination is defined as having visual, olfactory, or field instrument measurement of contamination

- ☐ **Scenario 1. There is no historical or field evidence of contamination.**

  No sampling required if reused within Work Area, Rail Corridor, or Off Site.

  Sampling may be required for disposal if required by disposal/receiving facility.

- ☐ **Scenario 2. There is no historical evidence of contamination, but there is field evidence of contamination.**

  No sampling required if reused within Work Area as long as does not contain free product, is not grossly contaminated, and is not characterized as hazardous waste.

  Sampling required if reused within Rail Corridor or Off Site. Collect one sample per 500 cy; reuse only if < HDOH Tier 1 EAL for unrestricted use, over drinking water, <150m to surface water.

Sampling may be required for disposal and should be performed in accordance with disposal facility requirements.

- ☐ **Scenario 3. There is historical evidence of contamination, but there is no field evidence of contamination.**

  No sampling required if reused within Work Area as long as does not contain free product, is not grossly contaminated, and is not characterized as hazardous waste.

  Sampling required if reused within Rail Corridor or Off Site. Collect one sample per 500 cy; reuse only if < HDOH Tier 1 EAL for unrestricted use, over drinking water, <150m to surface water.

  Sampling may be required for disposal and should be performed in accordance with disposal facility requirements.

- ☐ **Scenario 4. There is historical evidence of contamination and field evidence of contamination.**

  No sampling required if reused within Work Area as long as does not contain free product, is not grossly contaminated, and is not characterized as hazardous waste.

  Sampling required if reused within Rail Corridor or Off Site. Collect one sample per 500 cy; reuse only if < HDOH Tier 1 EAL for unrestricted use, over drinking water, <150m to surface water.

  Sampling may be required for disposal and should be performed in accordance with disposal facility requirements.

Treatment of Contaminate Soil: Under limited circumstances, treatment within the Work Area or within the Rail Corridor may be considered to reduce contaminant concentrations to increase the reuse and/or disposal options.

SOIL SAMPLE COLLECTION

In some cases, soil sampling and analysis may be needed to determine whether soils can be reused or disposed. If necessary, the following number of samples should be collected as a default:

- Collect one multi-increment sample for every 500 cubic yards (CY) of affected soil (staged in stockpiles of 100 CY or less). The collection of samples from larger volumes of soil should be discussed with the HEER office on a case-by-case basis.
- Each multi-increment sample should consist of 30-100 soil increments collected in a random, stratified manner from the entire volume of soil (500 CY) for which the sample will represent.

For further description of soil stockpile characterization, review the HDOH HEER's October 2011 "Guidance for the Evaluation of Imported and Exported Fill Material, Including Contaminant Characterization of Stockpiles" (HDOH HEER, 2011).

BACKFILLING THE EXCAVATION

Whenever possible, the contractor shall place the soil back into the excavation where it was generated and at the approximate depth from which it was removed. Place contaminated soil above the tidally-influenced high water table to prevent leaching and cap with a minimum of 1 foot of clean soil. Soil containing concentrations of total petroleum hydrocarbons >5,000 mg/kg should not be reused.

An additional impermeable cap may be required if contamination poses a significant threat to drinking water or surface water. In cases where soil cannot be reused in the Work Area, sample and analyze soil to evaluate reuse potential within the Rail Corridor or offsite (outside the Rail Corridor).

Consult with HART POC prior to placing petroleum contaminated soil shallower than 3 feet below ground surface. In some cases where landscaping, utilities, or buildings or occupied spaces are planned, placing soil at depths shallower than 3 feet may not be acceptable.

RECORDKEEPING AND REPORTING

Notify the HART POC if an unknown or unexpected soil contamination is encountered or observed. Unknown or unexpected contamination will be reported as a release to accordance with Appendix D-11 and D-12. If changes in the soil handling procedures are needed, report to supervisors, and adjust as needed. Changes will be reported in writing to HART using Appendix D-13. Upon receipt, HART will notify HDOH within 24 hours.

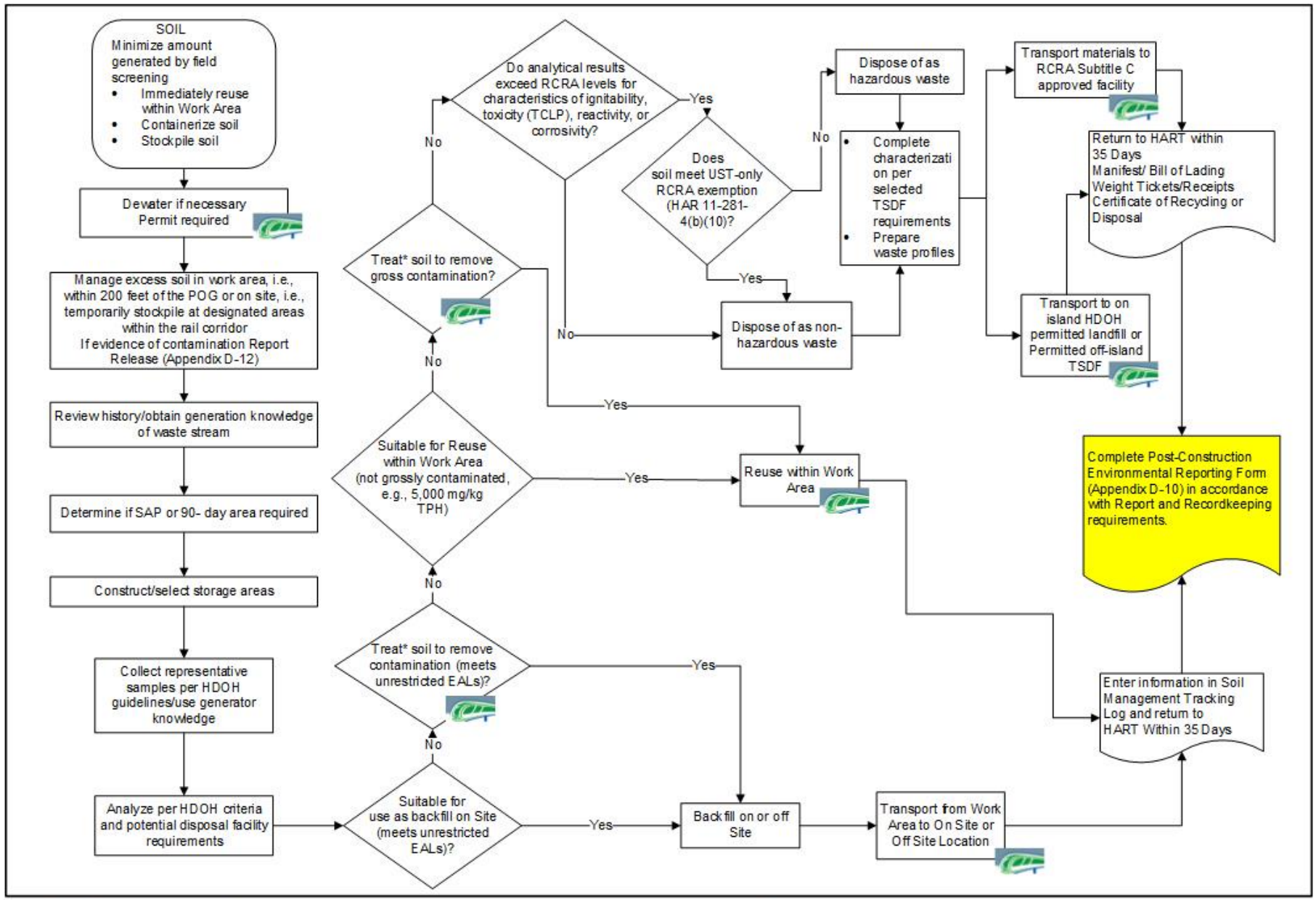
Submit Appendix D-10, Post-Construction Environmental Reporting Form to HART within 30 days of completing Task within the Work Area. Each Post-Construction Environmental Reporting Form (see Appendix D-10) shall include:

- General Information: Contractor, location and activity which generated soil.
- Supplemental information/reference to other site media generated, e.g., water from dewatering, decontamination, etc.
- Field screening/sampling results for contaminant identification and exposure monitoring, including equipment calibration records.
- Approximate volumes of soil generated from site activities, placed back in the excavation it came from within the work area including descriptions of specific areas and depths to which soil was placed, clean cap material placed over contaminated soil, and excess soil that could not be returned to the work area.
- A summary of soil management activities (e.g., stockpiling, drums, super sacks, other) and location of management area including temporary management within work area and/or at alternate on site location within the rail corridor.
- A figure indicating location(s) of soil management area(s), areas where soil was reused on site, and areas capped with clean soil.
- Data used to determine if soil is suitable for reuse or must be removed for disposal.
- Methods used to conduct waste characterization including hazardous waste determination.
- A soil management and waste tracking log to identify the disposition of all soil removed from the site.

Notes:

SIGNATURE

Contractor Name and Title or Signature Date



Coordinate with HART

POG = Point of generation (must dispose of hazardous waste within 90 days)
PCS = Petroleum Contaminated Soil
SAP = Satellite Accumulation Point
TSDF = Treatment Storage and Disposal Facility
UST = Underground Storage Tank
HAR = Hawaii Administrative Rules
* Treatment options shall be considered on a site-by-site basis and must be coordinated through HART

Soil Management

Appendix D-5

Groundwater, Storm Water and Decontamination Water Management Plan

Notice: Any deviation from the work described below requires consultation with HART. ***This plan is valid only for the project listed below.***

Purpose of This Sheet: This reference sheet provides water management instructions for contractors who are working on the HRTP. The Contractor is responsible for following these requirements while working at the project site. Additional details are provided in Section 5.5 of the Programmatic EHE-EHMP. If the Contractor anticipates changes to protocols specified in the EHMP, HART will be notified immediately and the Contractor will fill out and submit Appendix D-13, Deviation Form, in accordance with Section 5.14.1.

PROJECT INFORMATION

Contractor:
Phase:
Work Area(s):
Work Activities Covered by this Reference Sheet:
Contractor Point of Contact (POC) or Person Consulted about Project:
HART (POC) or Person Consulted about the Project:
HART POC Phone Number(s):
Date Project Reviewed:

NOTE: Any work on this project that does not fall directly under the above description of work MUST be reviewed separately by HART.

PLANNING

Has the **Appendix D-2, Pre-Construction Environmental Screening Form** been received and reviewed by the construction contractor?

☐ Yes ☐ No*

GENERAL GUIDELINES

***If no, do not proceed with work until the Pre-Construction environmental screening is complete.**

The Contractor is responsible for planning for and obtaining permits associated with handling, storage, and disposal of all water generated or impacted by the contractor's actions.

Water will be managed as required by the HDOH's National Pollutant Discharge Elimination System (NPDES) General Permit; this permit has specific requirements for various waters, such as:

- Construction dewatering effluent
- Storm water associated with construction activities

If discharge to storm drains or surface water is proposed, additional coordination with HDOH Clean Water Branch, and a NPDES General Permit will be required. NPDES General Permit requirements are not covered in this plan and must be coordinated separately through the Clean Water Branch. If discharge water was generated within regulated contaminated areas, additional coordination with HDOH HEER is required and Aquatic Habitat Goals (Chronic Toxicity) will apply to discharge within these areas, in addition to any criteria applicable to the NPDES General Permit.

If separate phase petroleum product (such as oil) is encountered when dewatering or removing groundwater, contact the HART POC immediately. Signs of free product in water include an oily sheen, a petroleum or chemical odor, and/or discoloration. All water with product MUST be put in containers and managed in accordance with the EHMP. See also Appendix D-6, Free Product Management Plan.

***NPDES General Permit requirements are not covered in this plan and must be coordinated separately through the Clean Water Branch.**

FIELD SCREENING AND EXPOSURE MONITORING

The exposure limits are based on OSHA-permissible exposure limits or other more stringent published government agency exposure limits adopted by the Contractor. Follow the exposure monitoring plan that is included in the Contractor Health and Safety Plans.

Field screening for visual and olfactory evidence of contamination includes the following:

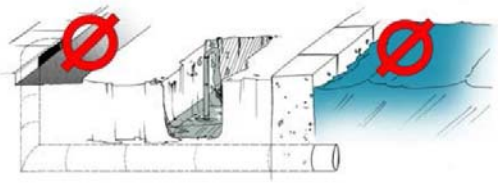
- Looking for separate phase petroleum product (for example oil), sheens, or discoloration of the water.
- Being aware of and investigating any unusual odors.
- You may need to use field screening equipment (for example, a photoionization detector) or test kits or consult with the HART POC if you are unfamiliar with testing requirements.

WATER HANDLING

All water without separate phase petroleum product, sheens, or known dissolved contaminants must be managed in accordance with applicable regulations. Consult with the HART POC; sampling may be required to determine how to manage the water. Typically, water may be managed as follows:

- Let groundwater infiltrate into the ground near the location where it was extracted (typically within 100-200 feet). Example: Put the water back into the excavation or into an infiltration gallery (excavation must be as wide as or wider than it is deep) at the site. Sampling may be needed to allow the water to go back into the excavation or infiltration gallery. Oily water CANNOT be put directly onto the ground surface, storm drains, or sanitary sewer.
- Contaminated groundwater CANNOT be allowed to contaminate clean soil, groundwater, or surface water.

- Discharge the water to the sanitary sewer. This must be coordinated through the HART POC and the City and County. Sampling will likely be required before discharge.
- Perform on-site treatment of the water. This must be coordinated through the HART POC. Sampling may be required.
- Perform off-site treatment or recycling. This must be coordinated through the HART POC. Sampling may be required by the facility receiving the water.



WATER GENERATED FROM DEWATERING MAY NOT BE PUMPED DIRECTLY TO THE GROUND SURFACE OR SANITARY SEWER WITHOUT PRIOR PERMITS AND APPROVALS.

WATER GENERATED FROM DEWATERING MAY BE REINFILTRATED INTO A SEPARATE NEARBY PIT OR GALLERY. OILY WATER MUST BE TREATED TO REMOVE FREE PRODUCT PRIOR TO REINFILTRATION. REINFILTRATION PITS OR GALLERIES DEEPER THAN 10 FEET WILL REQUIRE PRIOR APPROVAL FROM HDOH SAFE DRINKING WATER BRANCH.

CONTAMINATED WATER MANAGEMENT

When water is encountered, use the following checklist and decision matrix to determine which steps to follow.

Is soil contaminated above risk-based levels based on Appendix D-2, Pre-Construction Environmental Screening Form?

☐ Yes ☐ No

Soil Contaminated? \ Groundwater Contaminated?	No	Yes
No	Scenario 1	Scenario 2
Yes	Scenario 3	Scenario 4

The Contractor in coordination with the HART POC should check and sign one of the four boxes below. Signing the box will indicate which groundwater and soil contamination scenario applies to the work area.

❑ **Scenario 1. Neither the soil nor the groundwater is contaminated.**

Construction storm water and dewatering water can be managed as required by the General Permit only. No other requirements apply. Consult with HART POC.

❑ **Scenario 2. The groundwater is contaminated, but the soil is not.**

The groundwater cannot be allowed to drain back into the soil but may be reinfiltrated Within the Work Area (100-200 feet), as long as free product is removed and can be done at a rate that does not spread contamination. If reinfiltration is not possible, conduct proper management and disposal. Consult with HART POC.

❑ **Scenario 3. The soil is contaminated, but the groundwater is not.**

In general, most water must be managed as required by the General Permit. Groundwater may be allowed to drain onto an area of the site where the soil is not contaminated (the area must be approved by the HART POC).

❑ **Scenario 4. Both soil and groundwater are contaminated.**

Water must be managed as required by the General Permit. The groundwater may be drained back into the ground at the HRTP site, but cannot be allowed to run off site. Water should be returned to the same work area from which it was generated. Any water that cannot be put back into the ground will have to be treated or transported for disposal. Consult with HART POC.

OTHER PLANS

The HDOH NPDES General Permit requires certain plans, depending on the type of work. These plans include:

- Construction Plans. Construction will require a Construction Best Management Practices (BMPs) Plan and Post-Construction Pollution Control Measures and may require a Storm Water Pollution Prevention Plan (SWPPP) and post-construction pollution control measures. Check HDOH's Clean Water Branch website at http://health.hawaii.gov/cwb/ for additional requirements.
- Dewatering Plans. Dewatering will require a Dewatering Plan, a Dewatering System Maintenance Plan, a Construction Pollution Prevention Plan, and an Erosion Control Plan.

STORAGE

Removed water that cannot go back into the ground or directly into the sewer must be stored on the construction site, near the excavation or elsewhere within the rail corridor (for example, at a temporary staging area) as directed by the HART POC. The water must be stored in containers (e.g., drums, tanks) and labeled. The HART POC will advise on the specific type of label to be attached to the container (e.g., Nonhazardous Waste), which will, at a minimum, contain the following information:

- Date water placed in container.
- Name of the specific project site where water was generated.
- Construction project contact and phone number.

- HART name and phone number.
- Site name and ID.
- Waste-specific information (for example, water from 6 feet below ground surface at Middle Street Station).

RECORDKEEPING AND REPORTING

Notify the HART POC if an unknown or unexpected water contamination is encountered or observed. Unknown or unexpected contamination will be reported as a release to accordance with Appendix D-11 and D-12. If changes in the water handling procedures are needed, report to supervisors, and adjust as needed. Changes will be reported in writing to HART using Appendix D-13. Upon receipt, HART will notify HDOH within 24 hours.

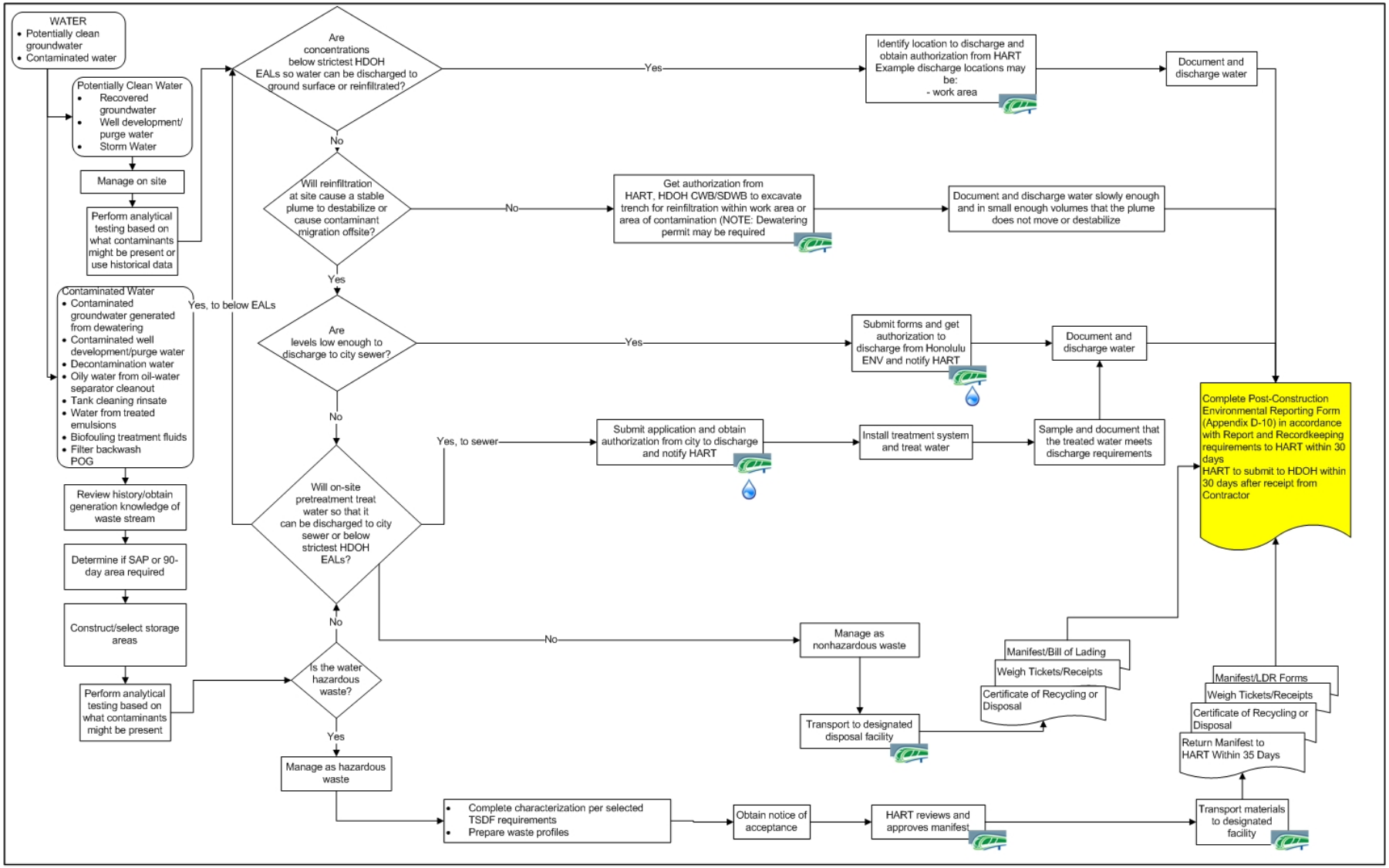
Submit Appendix D-10, Post-Construction Environmental Reporting Form to HART within 30 days of completing Task within the Work Area. Each Post-Construction Environmental Reporting Form shall include:

- General Information: Contractor, location and activity which generated soil.
- Supplemental information/reference to other site media generated, e.g., soil (multiple media shall be reported in a single form).
- Field screening/sampling results for contaminant identification and exposure monitoring, including equipment calibration records.
- Approximate volumes of water generated from site activities, reinfiltrated within the work area including descriptions of specific areas and depths placed, and excess water that could not be returned to the work area.
- A summary of water management activities (e.g., reinfiltration, treatment/disposal) and location of management area including temporary management within work area and/or at alternate on site location within the rail corridor.
- A figure indicating location(s) of soil management area(s), areas where soil was reused on site, and areas capped with clean soil. Data used to determine if water is suitable for reuse or must be removed for disposal.
- Methods used to conduct waste characterization including hazardous waste determination.
- A water management and waste tracking log to identify the disposition of all water removed from the site.

Notes:

SIGNATURE

Contractor Name and Title Signature Date



Coordinate with Honolulu ENV

Coordinate with HART

POG = Point of generation (must dispose of hazardous waste within 90 days)

SAP = Satellite Accumulation Point (less than 55 gallons at all times under the control of the person generating the waste)

TSDF = Treatment Storage and Disposal Facility

HDOH = Hawaii Department of Health

SDWB = Safe Drinking Water Branch

Notes:

(1) Also check the storm water permit for requirements

Water Management

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Notice: Any deviation from the work described below requires consultation with HART. ***This plan is valid only for the project listed below.***

Purpose of This Sheet: This reference sheet provides contaminated debris management instructions for contractors who are working on the HRTP. The Contractor is responsible for following these guidelines while working at the project site. Additional details are provided in Section 5.8 of the Programmatic EHE-EHMP. If the Contractor anticipates changes to protocols specified in the EHMP, HART will be notified immediately and the Contractor will fill out and submit Appendix D-13, Deviation Form, in accordance with Section 5.14.1.

PROJECT INFORMATION

Contractor:
Phase:
Work Area(s):
Work Activities Covered by this Reference Sheet:
Contractor Point of Contact (POC) or Person Consulted about Project:
HART POC or Person Consulted about the Project:
HART POC Phone Number(s):
Date Project Reviewed:

PLANNING

Has **Appendix D-2, Pre-Construction Environmental Screening Form** been received and reviewed by the Contractor?

☐ Yes ☐ No*

***If no, do not proceed with work until the Appendix D-2, Pre-Construction Environmental Screening Form is complete.**

GENERAL GUIDELINES

The presence of free product increases both the risk of exposure, and the risk of a possible fire or explosion particularly in confined spaces such as trenches or walled structures. If any free product is encountered, notify HART and HDOH in accordance with Appendix D-11 and D-12.

The basic procedures needed to handle contaminated soil and groundwater should guide the preparation of work areas for addressing free product. In addition to following safe work practices, the Work Area Contractors should:

- Monitor using an explosimeter and utilize intrinsically safe equipment where vapors may be present.
- Have a Class A-B-C fire extinguisher onsite at all times. The availability of additional fire suppression foam should be identified.

FIELD SCREENING AND EXPOSURE MONITORING

Notify HART when free product is anticipated or encountered in the field. Management Reference Sheet Instructions.

The exposure limits are based on OSHA-permissible exposure limits or other more stringent published government agency exposure limits adopted by the Contractor. Follow the exposure management plan included in the Contractor Health and Safety Plans (HSPs).

PROCEDURES

Field screening for olfactory evidence of contamination includes monitoring vapor concentrations using a photoionization detector or similar instrument, and responding to elevated concentrations based on the readings. The Contractor should also monitor for explosive vapors using a combustible gas indicator or similar instrument.

Free product will be removed to the extent practicable. If free product is found during construction, several additional procedures should be undertaken beyond those identified in the procedures for handling contaminated soil and groundwater. These include the following:

- Monitor the ambient air space within the work area for evidence of an explosive environment.
- Stop work and report the release in accordance with HAR 11-451. Return to work when advised by the State On-Scene Coordinator.
- Take precautions to prevent release or spread of petroleum hydrocarbon products.
- Use effective methods of free product removal which may include but are not limited to use of absorbents, skimming, water table depression, vapor extraction/groundwater extraction and dual-phase recovery.
- Dry and properly dispose of absorbent pads, socks or other materials used for product recovery.
- Sample and test petroleum fluids to determine how they can be recycled or disposed.
- Test and dispose of recovered fuel offsite at approved waste disposal or blending/reuse facilities in accordance with applicable regulations.

A detailed plan for free product removal may need to be developed by the contractor if free product is encountered during construction. Additional information about free product removal can be found in the 1996 EPA guidance document “How to Effectively Recover Free Product at Leaking Underground Storage Tank Sites: A Guide for State Regulators.

ENGINEERING AND ADMINISTRATIVE CONTROLS

Although free product might be encountered while installing column foundations and relocating utilities, with normal work progression, explosive vapors associated with free product are unlikely to accumulate in confined spaces. If they do accumulate, vapors increase the risk of fire and explosion. Accordingly, if free product is encountered, the workspace atmosphere must be monitored with an explosimeter to ensure that vapor concentrations do not exceed the Lower Explosive Limit (LEL).

In most areas, Level D personal protective equipment (PPE) will be appropriate for workers during construction and while loading, transporting, disposing, and managing soils. If chemicals exceed threshold concentrations, the PPE should be upgraded to Level C. The criteria for doing so are identified in the Contractor HSP. Respiratory protection and vapor monitoring are described in the **Appendix D-7, Vapor Management Plan**.

INSPECTIONS

Regular and routine inspections of the procedures used to capture, store, treat and dispose of water and soil should also be conducted to detect and address free product if it is found. When free product is identified, the environmental professional or industrial hygienist should complete an initial evaluation of the explosive concentrations within all work and confined spaces in the area, and they should regularly monitor the workspace atmosphere until the risk posed by the free product either passes or is mitigated.

STORAGE

If excess free product is generated coordinate with HART. Storage and transport of free product will require additional labels and placards. Further coordination with HART is required if free product is stored.

RECORD KEEPING AND REPORTING

Notify the HART POC if free product is encountered or observed. Free product will be reported as a release to accordance with Appendix D-11 and D-12. If changes in the free product handling procedures are needed, report to supervisors, and adjust as needed. Changes will be reported in writing to HART using Appendix D-13. Upon receipt, HART will notify HDOH within 24 hours.

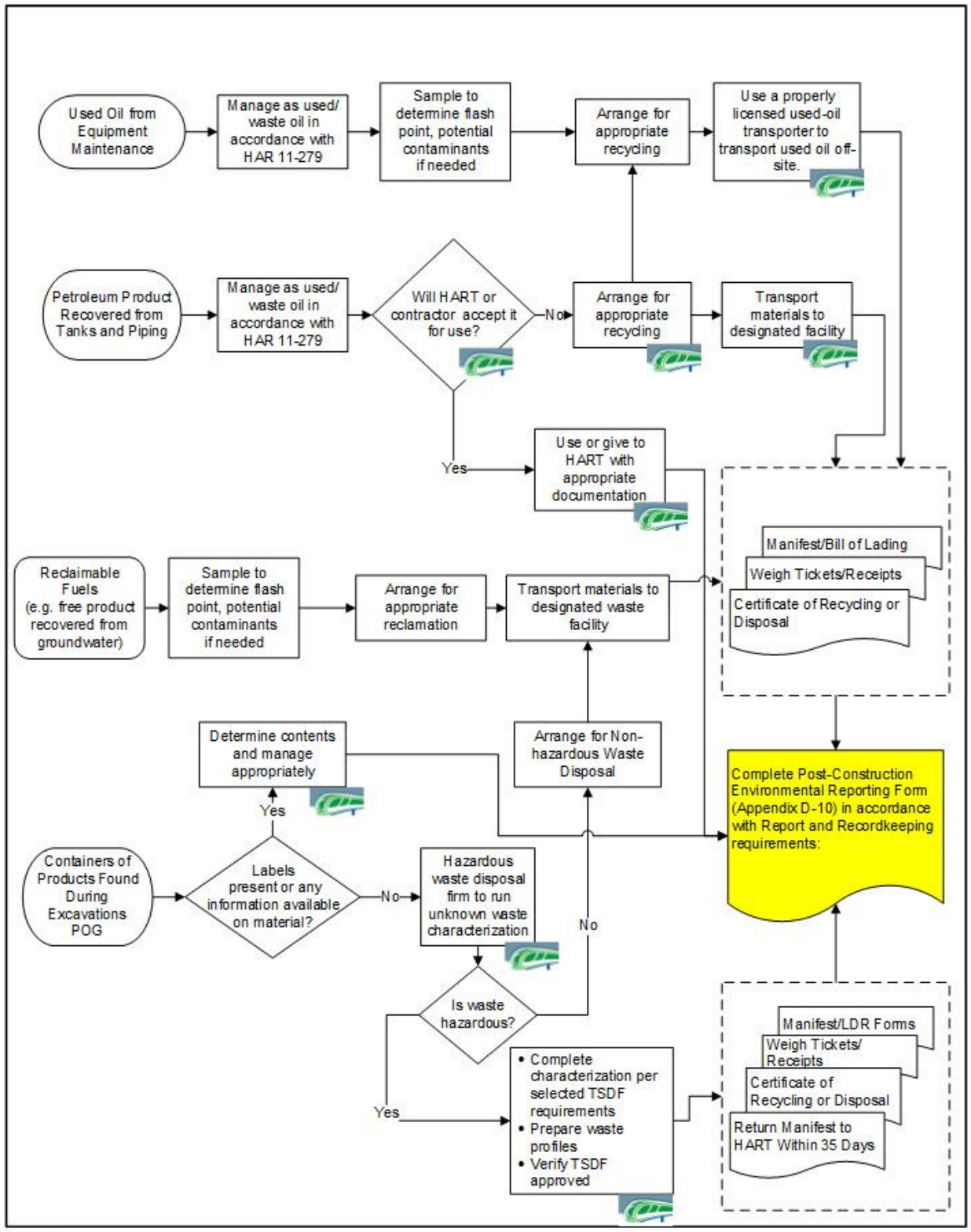
Submit Appendix D-10, Post-Construction Environmental Reporting Form to HART within 30 days of completing Task within the Work Area. Each Post-Construction Environmental Reporting Form (Appendix D-10) shall include:

- General Information: Contractor, location and activity where free product was encountered.

- Supplemental information/reference to other site media generated, e.g., water from dewatering, decontamination, etc.
- Detailed records of workspace monitoring (including LEL measurements), product recovery, and response activities must be maintained.
- Field screening/sampling results for contaminant identification and exposure monitoring, including equipment calibration records.
- Summarize management activities (e.g., beginning and ending fluid levels, volumes of each type of fluid removed (for example, water and fuel), flow rates, direction of flow, and any other information pertinent to the pipeline contents. Include a figure.
- Methods used to conduct waste characterization including hazardous waste determination.
- A waste tracking log.

Notes:

SIGNATURE



Coordinate with HART

POG = Point of generation (must dispose of hazardous waste within 90 days)
TSDF = Transportation and Disposal Facility
HART = Hawaii Administrative Rule

Spent/Recovered Petroleum Products Management

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Appendix D-7
Vapor Management Plan

Notice: Any deviation from the work described below requires consultation with HART. ***This plan is valid only for the project listed below.***

Purpose of This Sheet: This reference sheet provides vapor management instructions for Contractors who are working on the HRTP. The Contractor is responsible for following these requirements while working at the project site. Additional details are provided in Section 5.9 of the Programmatic EHE-EHMP. If the Contractor anticipates changes to protocols specified in the EHMP, HART will be notified immediately and the Contractor will fill out and submit Appendix D-13, Deviation Form, in accordance with Section 5.14.1.

PROJECT INFORMATION

Contractor:
Phase:
Work Area(s):
Work Activities Covered by this Reference Sheet:
Contractor Point of Contact (POC):
Contractor POC Phone Number(s):
HART POC Consulted about the Project::
HART POC Phone Number(s):
Date Project Reviewed:

PLANNING

Has the **Appendix D-2, Pre-Construction Environmental Screening Form** been received and reviewed by the construction contractor?

☐ Yes ☐ No*

***If no, do not proceed with work until the Appendix D-2, Pre-Construction Environmental Screening Form is complete.**

GENERAL GUIDELINES

The potential hazards posed by vapors are direct exposure through inhalation, flammability and explosivity. Some sections of the HRTP route are in areas where contaminated soil, contaminated groundwater, and free product are encountered. Work in these areas have a higher chance of encountering hazardous vapors.

If volatile chemicals are identified during HRTP activities, the concentrations of these vapors must be controlled pursuant to HDOH and Environmental Protection Agency (EPA) regulations and guidelines.

The goal of response actions is to ensure workers are not exposed to hazardous volatized chemical vapor concentrations, and that the public is not adversely affected. The tasks needed to manage vapor exposure are summarized below.

This plan describes the necessary controls to minimize the exposure of workers to hazardous chemical vapors, and reduce the risk of explosions and fires created by these chemicals. Included are procedures to detect and mitigate potential fire and explosion hazards posed by explosive vapors.

FIELD SCREENING AND EXPOSURE MONITORING

The exposure limits are based on OSHA-permissible exposure limits or other more stringent published government agency exposure limits adopted by the Contractor. Follow the exposure monitoring plan included in the Contractor Health and Safety Plan (HSPs).

Field screening for visual and olfactory evidence of contamination includes:

- Looking for free product, staining, or debris (asphalt, lumber, piping/conduit not associated with utilities, construction debris, or evidence of dumping).
- Being aware of and investigating any unusual odors.
- In areas of suspected contamination, use field screening equipment (for example, a photoionization detector [PID]) or test kits or consult with HART if you are unfamiliar with testing requirements.
- Monitoring within the workspace and at the perimeter of the work area. Note: Confined space entry and excavation entry may require additional requirements in accordance with Contractor's respiratory protection program and HSP.
- Monitoring before workers enter the work area when there is the potential for workers to be exposed to hazardous vapors, in accordance with Contractor's HSP.
- Calibrating conventional and contaminant-specific PID instruments as required using appropriate calibration procedures. A conventional PID should be calibrated using a 100-ppm isobutylene standard. A benzene-specific PID should be calibrated using a 5-ppm benzene standard. Measurements of the standard calibration gas must be periodically made to confirm that the PID remains accurate. Maintain calibration records. Repair or replace test equipment found to be defective or damaged.

RELEASE RESPONSE

Have hazardous vapor concentrations been detected above worker protection action levels as defined in the health and safety plan?

☐ Yes* ☐ No

***If yes, STOP WORK and implement Appendix D-11, Release Response Plan. Return to work after consulting with your health and safety manager and HART POC.**

ENGINEERING AND ADMINISTRATIVE CONTROLS

Vapors in construction areas often will be diluted by prevailing ambient air and trade winds. Vapor control methods, however, may be needed when contaminated soil, groundwater, free product, or hazardous vapor concentrations are detected. In addition to respiratory protection, the emission and migration of volatile chemicals should be minimized with engineering controls and safe work practices. Possible vapor emission controls to consider include:

- Installing barriers that prevent individuals from unnecessarily entering work zones.
- Using recirculated air conditioning in automobile and equipment cabs in or near work zones.
- Monitoring wind direction and standing upwind of volatile organic compound vapor sources whenever possible, or instituting a modified work schedule.
- Minimizing the size of excavations, backfilling excavations in a timely manner, covering soil stockpiles with plastic sheeting, and dust suppression using applied water.
- Upgrading personal protective equipment (PPE) to Level C.
- Leaving work areas and venting the area if air monitoring indicates that vapor concentrations exceed safe threshold levels.
- Shutting down work and reassessing the hazards when engineering, administrative, and PPE controls do not adequately mitigate exposure.

RECORDKEEPING AND REPORTING

If changes in the vapor management procedures are needed, report to supervisors, and adjust as needed. Changes will be reported in writing to HART using Appendix D-13. Upon receipt, HART will notify HDOH within 24 hours. **Submit Appendix D-10, Post-Construction Environmental Reporting Form to HART within 30 days of completing Task within the Work Area.** Each Post-Construction Environmental Reporting Form (see Appendix D-10) shall include:

- General Information: Contractor, location and activity where contaminated vapors were encountered.
- Supplemental information/reference to other site media generated, e.g., free product/water from dewatering, soil from excavation, etc.
- Field screening/sampling results for contaminant identification and exposure monitoring, including equipment calibration records.

Notes:

SIGNATURE

Contractor Name and Title	Signature	Date

Appendix D-8

Debris Management Plan

Notice: Any deviation from the work described below requires consultation with HART. ***This plan is valid only for the project listed below.***

Purpose of This Sheet: This reference sheet provides contaminated debris management instructions for contractors who are working on the HRTP. The Contractor is responsible for following these guidelines while working at the project site. Additional details are provided in Section 5.9 of the Programmatic EHE-EHMP. If the Contractor anticipates changes to protocols specified in the EHMP, HART will be notified immediately and the Contractor will fill out and submit Appendix D-13, Deviation Form, in accordance with Section 5.14.1.

PROJECT INFORMATION

Contractor:
Phase:
Work Area(s):
Work Activities Covered by this Reference Sheet:
Contractor Point of Contact (POC) or Person Consulted about Project:
HART POC or Person Consulted about the Project:
HART POC Phone Number(s):
Date Project Reviewed:

PLANNING

Has the **Appendix D-2, Pre-Construction Environmental Screening Form** been received and reviewed by the construction contractor?

☐ Yes ☐ No*

***If no, do not proceed with work until the Appendix D-2, Pre-Construction Environmental Screening Form is complete.**

GENERAL GUIDELINES

Minimize the material moved/disturbed at the site. The Contractor is responsible for planning for and incurring all costs associated with handling, storage, and disposal of debris generated by the Contractor's actions.

If any unknown or unexpected drum, bottle, or other container is encountered, stop work immediately and notify the HART POC for further consultation on release reporting, removal, containment, and disposition.

Removed debris should be recycled whenever possible. General guidelines for debris are as follows:

- Segregate types of debris for storage and disposal (e.g., segregate clearing and grubbing debris from excavated debris, segregate types of excavated debris [metal from concrete, for example]).
- Remove excess soil from debris. Manage excess soil in accordance with **Appendix D-4, Soil Management Plan**. **Note:** Debris-contaminated soil may fail the toxicity characteristic leaching procedure analysis and be considered a hazardous waste.
- If the Contractor determines that the debris is hazardous (in consultation with the HART POC), the Contractor will inform the HART POC where they plan to set up hazardous waste Satellite Accumulation Points (SAPs) and additional coordination with the HDOH Solid and Hazardous Waste Branch will be required.

FIELD SCREENING AND EXPOSURE MONITORING

The exposure limits are based on OSHA-permissible exposure limits or other more stringent published government agency exposure limits adopted by the Contractor. Follow the exposure monitoring plan included in the Contractor Health and Safety Plans.

Field screening will include monitoring vapor concentrations using a PID or similar instrument, and responding to elevated concentrations based on the readings. The Contractor should also monitor for explosive vapors using a combustible gas indicator or similar instrument.

BACKFILLING

The top 6 inches of soil must be used to backfill the uppermost 6 inches of the excavation when the materials are replaced. Ideally, any debris present in the top 6 inches of the excavation would not be returned to the excavation as backfill.

If debris is not reused or sent for recycling, then the debris must be managed as excess and disposed.

STORAGE

Removed debris must be stored on the construction site near the cleared area or excavation. Debris must be stored in stockpiles, or in containers (e.g., drums or roll-off boxes) that are provided with covers. Stockpiles must have a liner to prevent a release or infiltration of liquids and/or stormwater, and, if directed by the HART POC, stockpiles must have a cover and perimeter berm. Covers will be secured in-place when the stockpile or container is not in use and at the end of each workday, or as necessary to prevent wind dispersion or runoff from major precipitation events. Covers will be inspected daily (or as frequently as necessary) and repaired/replaced immediately to ensure that they remain intact.

DEBRIS RECYCLING

Any excavated debris should be reused or sent for recycling or disposal to a HDOH permitted solid waste management facility after decontamination. Examples of debris that can be recycled include asphalt (e.g., crushed and reused as road base), concrete that meets the inert fill definition in Hawaii Revised Statues (HRS) 342H-1 (e.g., reused to construct a berm or fill), or clearing and grubbing and untreated wood debris (e.g., ground up and reused as mulch or compost at landscaped sites along the HRTP corridor). **NOTE:** Debris recycling IS NOT the same as disposal. If debris is simply disposed of, a waste manifest is required. If debris cannot be sent for recycling, it must be managed as excess debris (see attached flowchart).

If debris is sent offsite, it must first be decontaminated. For example:

- Soil on metals must be cleaned off (e.g., soil brushed off or washed off).
- Soil on concrete must be cleaned off (e.g., soil brushed off, washed off, or grit blasted). Concrete will also need to be chemically tested to see whether it meets recycling or disposal standards before it can be sent off-site for recycling or disposal. Concrete may be recycled if it is clean (unpainted, or analytical results to show that it is not painted with lead-based paint and does not contain other contaminants such as asbestos). Concrete used as fill onsite shall meet HRS 342H-1's definition of inert fill (e.g, does not have exposed rebar and is less than 8 inches in diameter).
- Soil should be removed to the extent possible from clearing and grubbing debris.

Sampling of the soil or clean debris may be required. Any soil or water generated by decontamination must be managed in accordance with the **Appendix D-4, Soil Management Plan** or **Appendix D-5, Water Management Plan**. Other materials generated during cleaning (e.g., grit blasting) must be stored in containers and will be managed as excess material (see below).

LABELING CONTAINERS

All excess debris must be managed in accordance with applicable regulations. Consult with the HART POC. If there is excess debris remaining after the excavation has been filled, it may be managed in the following ways:

- **Contact the HART POC as soon as possible once you know you will be generating excess debris.** If the excess debris is determined to be hazardous waste, the contractor must manage the debris as hazardous waste, in accordance with the appropriate Hawaii Administrative Rules.
- Containers of excess debris must be labeled. In general (assuming the debris is nonhazardous), a Nonhazardous Waste label with the following information should be attached to the container:
  - ❑ Date water placed in container.
  - ❑ Name of project generating debris.
  - ❑ Construction project contact and phone number.
  - ❑ HART name and phone number.
  - ❑ Site name and ID.

- ❑ Waste-specific information (e.g., debris from 6 inches to 6 feet below grade at boring 111).
- Stockpiles of excess debris should have the above information readily available (e.g., in the construction trailer or posted at the stockpile).

RECORDKEEPING AND REPORTING

If changes in the management procedures are needed, report to supervisors, and adjust as needed. Changes will be reported in writing to HART using Appendix D-13. Upon receipt, HART will notify HDOH within 24 hours.

Submit Appendix D-10, Post-Construction Environmental Reporting Form to HART within 30 days of completing Task within the Work Area. Each Post-Construction Environmental Reporting Form (Appendix D-10) shall include:

- General Information: Contractor, location and activity where debris was encountered.
- Supplemental information/reference to other site media generated, e.g., water from dewatering, decontamination, etc.
- Field screening/sampling results for contaminant identification and exposure monitoring, including equipment calibration records.
- Approximate volume of debris generated from site activities.
- A summary of materials management activities (e.g., stockpiling, drums, super sacks, other).
- A figure indicating location(s) location of management area including temporary management within work area and/or at alternate on site location within the rail corridor.
- Data used for waste characterization including hazardous waste determination.
- A management and tracking log to identify the disposition of all materials removed from the site.

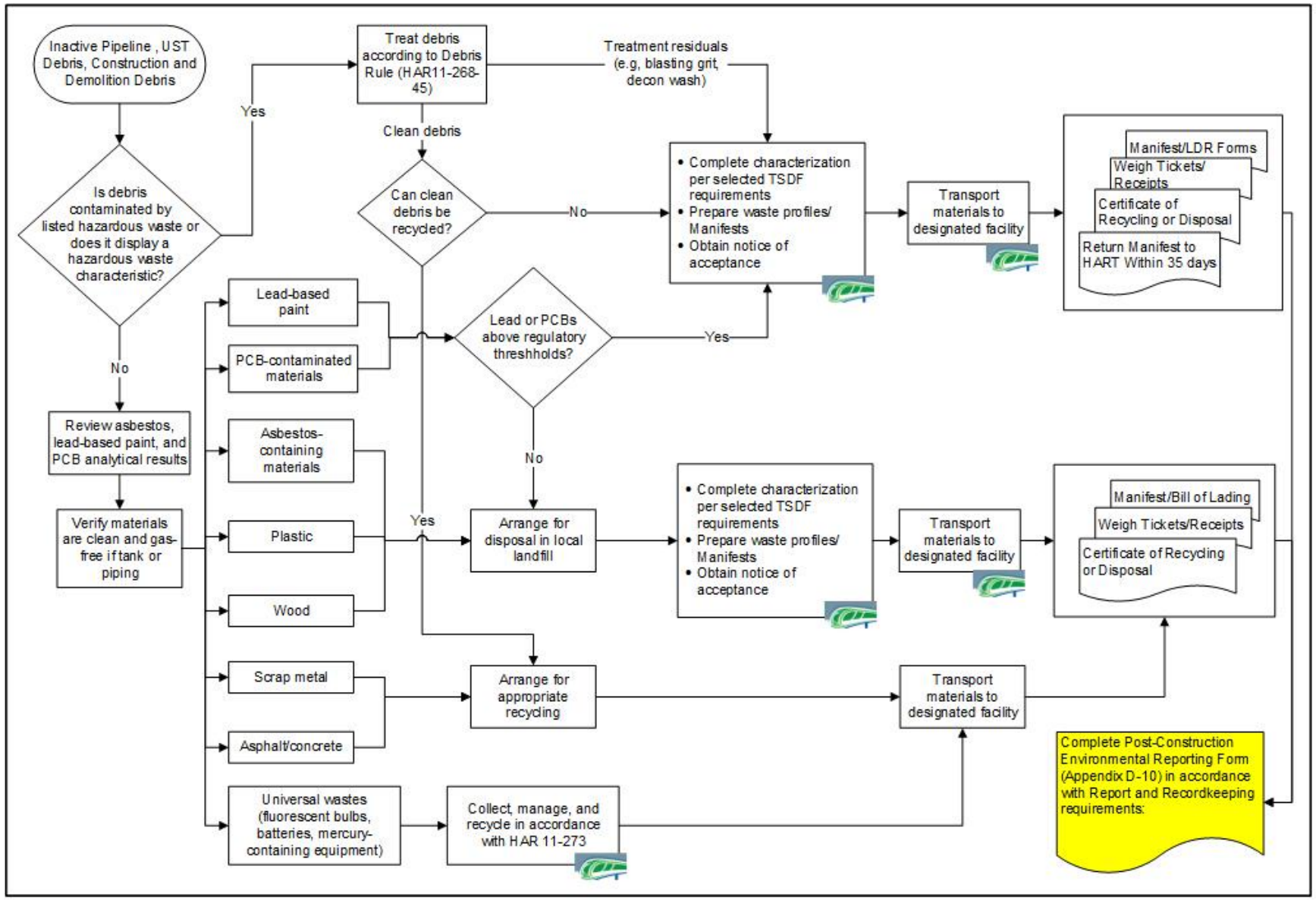
The top 6 inches of soil must be used to backfill the uppermost 6 inches of the excavation when the materials are replaced. Ideally, any debris present in the top 6 inches of the excavation would not be returned to the excavation as backfill.

If debris is not reused or sent for recycling, then the debris must be managed as excess and disposed.

Notes:

SIGNATURE

Contractor Name and Title	Signature	Date



Coordinate with HART

LDR = Land Disposal Restriction
PCB = Polychlorinated biphenyls
TSDF = Treatment Storage and Disposal Facility

Inactive Pipeline, UST Debris, Construction and Demolition Debris Waste Management

Appendix D-9

Unanticipated or Unknown Materials Management Plan

Notice: Any deviation from the work described below requires consultation with HART. ***This plan is valid only for the project listed below.***

Purpose of This Sheet: This reference sheet provides instructions for managing unanticipated or unknown materials. The Contractor working on the HRTP is responsible for following these guidelines while working at the project site. Additional details are provided in Section 5.11 of the Programmatic EHE-EHMP. If the Contractor anticipates changes to protocols specified in the EHMP, HART will be notified immediately and the Contractor will fill out and submit Appendix D-13, Deviation Form, in accordance with Section 5.14.1.

PROJECT INFORMATION

Contractor:
Phase:
Work Area(s):
Work Activities Covered by this Reference Sheet:
Contractor Point of Contact (POC) or Person Consulted about Project:
HART POC or Person Consulted about the Project:
HART POC Phone Number(s):
Date Project Reviewed:

PLANNING

Has the **Appendix D-2, Pre-Construction Environmental Screening Form** been received and reviewed by the Contractor?

☐ Yes ☐ No*

GENERAL GUIDELINES

***If no, do not proceed with work until Appendix D-2, Pre-Construction Environmental Screening Form is complete.**

Previously unknown materials may be encountered during the course of construction at the project site and may be hazardous or not hazardous, but still regulated. These unknown materials may also require management and/or offsite reuse, recycling, or disposal.

The Contractor shall manage all unanticipated or unknown materials in a manner that will prevent exposure to project personnel and the public, and cross contamination. Unknown materials may include anything, such as drums, debris, sludges, soils that appear to contain asbestos.

In all cases where unanticipated or unknown materials are encountered:

- Notify HDOH-HEER office and property owners immediately.
- Proceed with work in areas of unanticipated contamination after reporting to HDOH and approval to proceed and only if covered by one of the other existing contractor guidelines. If contaminants or media are not covered under existing guidelines, separate plans and guidelines must be developed.
- Do not attempt to remove unknown materials. Only a subcontractor experienced in handling unknowns shall handle unknown materials. The unknown materials will be representatively sampled and tested to determine how they can be recycled or disposed of in full accordance with Title 11, 58.1 and Chapters 260-279 of the Hawaii Administrative Rules and any other state and federal regulation governing this activity.

Refer to other reference sheets for Inactive Pipelines or Underground Storage Tanks (D-3), soil (D-4, water (D-5), free product (D-6), vapor (D-7), debris (D-8).

FIELD SCREENING AND EXPOSURE MONITORING

The exposure limits are based on OSHA-permissible exposure limits or other more stringent published government agency exposure limits adopted by the Contractor. Follow the exposure monitoring plan included in the Contractor Health and Safety Plans (HSPs).

Field screening will include monitoring for vapor concentrations using a photoionization detector or similar instrument, and respond to elevated concentrations based on the readings. The Contractor should also monitor for explosive vapors using a combustible gas indicator or similar instrument.

PROCEDURES

Notify HDOH-HEER office and property owners immediately if any unanticipated or unknown materials or contamination are encountered.

Do not attempt to remove unknown materials. Only a subcontractor experienced in handling unknowns shall handle unknown materials. The unknown materials will be representatively sampled and tested to determine how they can be recycled or disposed of in full accordance with Hawaii Revised Statues Title 11, 58.1 and Chapters 260-279 and any other state and federal regulation governing this activity.

Any pipelines, soil, water, free product, vapor, or debris associated with the unknown materials will be handled as discussed in reference sheets for Inactive Pipelines or Underground Storage Tanks (D-3), soil (D-4, water (D-5), free product (D-6), vapor (D-7), debris (D-8).

ENGINEERING AND ADMINISTRATIVE CONTROLS

Dust and vapor control methods may be needed during movement or handling of unknown materials. These controls include minimizing the size of excavations, covering stockpiled materials with plastic sheeting, controlling vapor emissions with ventilation, and spraying water to suppress dust.

In most areas, Level D personal protective equipment (PPE) will be appropriate for workers during construction and while loading, transporting, disposing, and managing unknown materials. If chemicals exceed threshold concentrations, the PPE will be upgraded to Level C. The criteria for doing so are identified in the project HSP, and in **Appendix D-7, Vapor Management Plan** (Section 5.9).

INSPECTIONS

Regular and routine inspections of management practices are needed to ensure compliance and to make adjustments in work procedures. Where workers could be exposed to contaminants associated with unknown materials:

- Inspect materials, stockpiles daily.
- Repair damage or defects to any component of the engineering or administrative controls immediately.
- Inspect and replace PPE as needed.

RECORDKEEPING AND REPORTING

Notify the HART POC if an unanticipated and unknown materials are encountered or observed. Unanticipated and unknown materials will be reported as a release to accordance with Appendix D-11 and D-12. If changes in the management procedures are needed, report to supervisors, and adjust as needed. Changes will be reported in writing to HART using Appendix D-13. Upon receipt, HART will notify HDOH within 24 hours.

Submit Appendix D-10, Post-Construction Environmental Reporting Form to HART within 30 days of completing Task within the Work Area. Each Post-Construction Environmental Reporting Form (Appendix D-10) shall include:

- General Information: Contractor, location and activity where unanticipated or unknown materials were encountered.
- Supplemental information/reference to other site media generated, e.g., water from dewatering, decontamination, etc.
- Field screening/sampling results for contaminant identification and exposure monitoring, including equipment calibration records.

- Approximate volume of unanticipated/unknown materials generated from site activities, including specific areas and depths encountered, and any clean caps placed over top of contaminated media
- A summary of materials management activities (e.g., stockpiling, drums, super sacks, other).
- A figure indicating location(s) location of management area including temporary management within work area and/or at alternate on site location within the rail corridor.
- Data used for waste characterization including hazardous waste determination.
- A management and tracking log to identify the disposition of all materials removed from the site.

Notes:

SIGNATURE

Contractor Name and Title	Signature	Date

Appendix D-10

Post-Construction Environmental Reporting Form

Purpose of this Form: This form identifies reporting requirements of the EHMP. This form shall be completed by the Contractor and submitted to HART within 30 days of completing the Task within the Work Area. If the Contractor anticipates changes to protocols specified in the EHMP, HART will be notified immediately and the Contractor will fill out and submit Appendix D-13, Deviation Form, in accordance with Section 5.14.1.

PROJECT INFORMATION

Contractor:
Phase:
Work Area(s):
Work Activities Covered by this Reference Sheet:
Contractor Point of Contact (POC) or Person Consulted about Project:
HART POC or Person Consulted about the Project:
HART POC Phone Number(s):

WORK ACTIVITIES

Types of work completed during this time period (please check all that apply):

- ☐ AIS trenching
- ☐ Geotechnical borings
- ☐ Grading
- ☐ Clearing/grubbing
- ☐ Tree relocation
- ☐ Other: _____
- ☐ Utility relocation
- ☐ Sewer jacketing
- ☐ Potholing
- ☐ Column shafts
- ☐ Station touchdowns
- ☐ Method shaft
- ☐ Test shaft
- ☐ Building demolition
- ☐ Footings
- ☐ Rail at grade

WORK AREA INFORMATION

Location:	TMK:
Address:	Stationing/Reference Point:
Surrounding Land Use: (check all that apply) ☐ Agriculture ☐ Commercial/Industrial ☐ Residential ☐ Recreational ☐ Mixed Use Describe: _____	
Ecological Pathways/Receptors: (check all that apply) ☐ Terrestrial ☐ Aquatic Describe: _____	

PRE-CONSTRUCTION SCREENING RESULTS

Contaminated Sites Identified within 150 meters of Work Area? ☐ Yes* ☐ No

*If yes, list contaminated sites below or Attached a completed copy of **Appendix D-2, Pre-Construction Environmental Screening Form** and attach to this form.

Site Name:	**COPCs:**
1) _____	☐ GRO ☐ DRO ☐ RRO ☐ VOC ☐ PAH ☐ Metals ☐ Other
2) _____	☐ GRO ☐ DRO ☐ RRO ☐ VOC ☐ PAH ☐ Metals ☐ Other
3) _____	☐ GRO ☐ DRO ☐ RRO ☐ VOC ☐ PAH ☐ Metals ☐ Other
4) _____	☐ GRO ☐ DRO ☐ RRO ☐ VOC ☐ PAH ☐ Metals ☐ Other
5) _____	☐ GRO ☐ DRO ☐ RRO ☐ VOC ☐ PAH ☐ Metals ☐ Other

INACTIVE PIPELINE OR UST MANAGEMENT SUMMARY ☐ Not Applicable

Type: ☐ Pipeline* ☐ UST* ☐ Other ☐ None (If none, move to **Soil Management Summary**)

*** If the inactive pipeline or UST was encountered unexpectedly, report to HART and complete Appendix D-12, Release Report Form** and attach to this form.

Dimensions: Piping: _____ Linear Feet

UST dimensions and capacity: _____ X _____ (_____ gallons)

INACTIVE PIPELINE OR UST MANAGEMENT SUMMARY, continued

Materials of Construction: ☐ Steel ☐ FRP ☐ ACM ☐ PVC ☐ Other: _____

Trending in Excavation (attach sketch, figures, and/or photos):

☐ All ☐ North ☐ South ☐ East ☐ West ☐ Mauka ☐ Makai

Contents: ☐ Gasoline ☐ Diesel ☐ Used Oil ☐ Waste Oil ☐ Solvents ☐ Unknown

☐ Other (describe): _____

Describe Field Screening Results:

Visual: _____

Olfactory: _____

PID Measurements: min: _____ / max: _____

Field Instrument/Test Kit Results: _____

Describe Material Stockpiled or Contained on Onsite: (attach pages for multiple stockpiles/containers)

Volume of material stockpiled or contained: _____ cubic yards

Dimensions of stockpiles or containers: _____

Storage Details: (see **Appendix D-3, Inactive Pipeline and UST Management Plan**)

Location of stored stockpiles/containers: _____

☐ Contaminated stockpiles segregated and labeled Describe methods used for labeling, e.g., adhesive labels, paint, signage, etc.

_____

☐ Stockpiles/containers stored Describe methods used for stockpiling/BMPs, e.g., lined/covered stockpiles, BMPs, etc.

_____

Contaminated Media Present? e.g., soil, water, free product ☐ Yes* ☐ No

* If yes, complete appropriate media management section on this form.

Disposition: ☐ Left in-place within Work Area ☐ Moved to laydown yard ☐ Recycled or Disposed

Location:_____

☐ Attach recycling receipt, weight tickets, disposal manifest

Were any deviations from the EHMP implemented? ☐ Yes* ☐ No

* If yes complete **Appendix D-13, Deviation Form** and attach to this form.

SOIL MANAGEMENT SUMMARY

☐ Not Applicable

Describe Field Screening Results:

☐ Attach additional log sheet for multiple measurements

Visual: _____

Olfactory: _____

PID Measurements: Headspace min: _____ / max:_____ Ambient min: _____ / max:_____

Gross Contamination Screening Results

Water Test: ☐ Sheen ☐ Oil droplets ☐ Separate phase sinking fluid ☐ None ☐ Not applicable ☐ Other _____

Glove Test: ☐ Oil droplets ☐ None ☐ Not applicable

Paper Towel Test: ☐ Oil droplets ☐ None ☐ Not applicable

Field instrument/Test Kit Results: _____

Contaminated Soil Present? ☐ Yes* ☐ No

*If yes, report to HART and Complete **Appendix D-12, Release Report Form** and attach to this form.

Contaminated Soil limited to Work Area ☐ Yes ☐ No*

*If no, does contamination extend beyond limits of excavation and if so, in which direction?

☐ All ☐ North ☐ South ☐ East ☐ West ☐ Mauka ☐ Makai

Water Encountered? ☐ Yes* ☐ No

*If yes, report to HART and Complete **Water Management Summary**

Free Product Encountered? ☐ Yes* ☐ No

*If yes, report to HART and Complete **Free Product Management Summary**

Soil Stockpiled or Contained?

☐ Within Work Area ☐ Onsite within Rail Corridor

Location(s): _____

Stockpiles : Dimension/Volume of clean stockpiles _____ / _____ cubic yards

Dimension/Volume of contaminated stockpiles _____ / _____ cubic yards

Containers type and number: ☐ Rolloff _____ ☐ Super Sack _____ ☐ Drum _____ ☐ Other:_____

Storage Details: (see **Appendix D-4, Soil Management Plan**)

Location of stored stockpiles/containers: _____

☐ Containers/stockpiles labeled. Describe methods used for labeling, e.g., adhesive labels, paint, signage, etc.

_____

SOIL MANAGEMENT SUMMARY, continued

☐ Containers/stockpiles stored Describe methods used for stockpiling/BMPs, e.g., lined/covered stockpiles, BMPs, etc.

_____

☐ Nonconformance with EHMP ☐ Yes* ☐ No

*If yes, fill in table below and attach additional pages, if necessary

Deficiencies with containers/drums/stockpiles:	How Resolved:	Date Corrected:
_____	_____	_____
_____	_____	_____

Samples Collected ☐ Yes* ☐ No

* If yes, provide sample details

Sample ID: _____

Sampling Method:

☐ Multi-Increment Sample (MIS) _____ # of increments/sample _____

☐ Composite _____ # of composite samples/sample _____

Laboratory Analyses: ☐ GRO ☐ DRO ☐ RRO ☐ VOC ☐ PAH ☐ Metals

☐ Other:_____

Sample Analytical Results Summary:

☐ <HDOH Tier 1 EALs for unrestricted use for sites where groundwater is a current or potential source of drinking water, <150 meters to nearest surface water

☐ >HDOH Tier 1 EALs for unrestricted use for sites where groundwater is a current or potential source of drinking water, <150 meters to nearest surface water

Limited Reuse/Waste Characterization:

☐ <HDOH Tier 1 EALs for commercial/industrial use for sites where groundwater is NOT a current or potential source of drinking water, >150 meters to nearest surface water

☐ >HDOH Tier 1 EALs for commercial/industrial use for sites where groundwater is NOT a current or potential source of drinking water, >150 meters to nearest surface water

☐ <RCRA Characteristic Criteria: ☐ Ignitability ☐ Corrosivity ☐ Reactivity ☐ RCRA 8 TCLP metals

☐ >RCRA Characteristic Criteria: ☐ Ignitability ☐ Corrosivity ☐ Reactivity ☐ RCRA 8 TCLP metals

☐ Other COC Landfill Restrictions: ☐ PCBs<1ppm ☐ Paint Filter

☐ Other: _____

☐ Sample analytical results attached

Describe Clean and Contaminated Soil Disposition and Volume (provide map for all locations)

Clean Soil (<Tier 1 EAL)

☐ Reused within Work Area _____ cubic yards

☐ Reused within Rail Corridor _____cubic yards

Location: _____

TMK: _____

SOIL MANAGEMENT SUMMARY, continued

Address: _____

☐ Figure attached

☐ Reused Offsite _____ cubic yards

Location: _____

TMK: _____

Address: _____

☐ Figure attached

☐ Disposed Offsite _____ cubic yards

Landfill:_____

Contaminated Soil: ☐ Gross Contamination ☐ > Residential Tier 1 EAL ☐ > Industrial Tier 1 EAL

☐ Reused within Work Area _____ cubic yards

☐ Reused within Rail Corridor _____cubic yards (*to be considered on a site-by-site basis*)

Location: _____

TMK: _____

Address: _____

☐ Figure attached

☐ Disposed Offsite _____ cubic yards

Landfill:_____

☐ Attach recycling receipt, weight tickets, disposal manifest, and Soil Tracking Log

Were any deviations from the EHMP implemented? ☐ Yes* ☐ No

* If yes complete **Appendix D-13, Deviation Form** and attach to this form.

WATER MANAGEMENT SUMMARY

☐ Not Applicable

Water Encountered? ☐ Yes ☐ No If no move to **Free Product Management Summary**

Groundwater or Surface Water Contaminated? ☐ Groundwater ☐ Surface ☐ Water ☐ None

If yes, complete **Appendix D-12, Release Report Form** and attach to this form.

Name of nearest Surface Water Body: _____

Distance to nearest Surface Water Body: _____ meters

Describe Field Screening Results:

Visual: _____

Olfactory: _____

Field Instrument/Test Kit Results: _____

WATER MANAGEMENT SUMMARY, continued

Describe Water Contamination (sheen, floating oil, etc.)

*If free product encountered, complete **Free Product Management Summary***

Estimated Extent of Contaminated Water

Water Limited to Work Area ❑ Yes ❑ No*

*If no, does contamination extend beyond limits of excavation and if so, in which direction?

❑All ❑ North ❑ South ❑ East ❑ West ❑ Mauka ❑ Makai

Water Reinfiltratied or Reinjected to Ground? ❑ Yes ❑ No

❑ REQUIRED – Coordination with HART POC and HDOH SDWB

❑ REQUIRED – Water must be treated to remove free product prior to reinfiltration

Method:

❑ Return to excavation

❑ Reinjection well and UIC Permit Obtained and UIC Permit Number: _____

❑ Rinfiltration trench/pit/hole: Volume/Dimensions: _____ /_____ Distance from excavation ___ ft.

❑ Discharge to sanitary sewer

Water Contained and Stored onsite? ❑ Yes* ❑ No *If yes, provide

Volume/Dimensions: _____ / _____ and Number of containers/tanks:_____

Storage Details: (see **Appendix D-5, Water Management Plan**)

Location of stored containers/tanks: _____

❑ Containers/tanks labeled Describe methods used for labeling, e.g., adhesive labels, paint, signage, etc.

_____

❑ Containers/tanks stored Describe methods used for stockpiling/BMPs, e.g., lined/covered stockpiles, BMPs, etc.

_____

❑ Nonconformance with EHMP ❑ Yes* ❑ No

*If yes, fill in table below and attach additional pages, if necessary

Deficiencies with containers/tanks:	How Resolved:	Date Corrected:

WATER MANAGEMENT SUMMARY, continued

Samples Collected ☐ Yes* ☐ No * If yes, provide sample details
Sample ID: _____
Sampling Method: ☐ Composite _____ # of composite samples/sample _____
☐ Discrete Sample _____ # of discrete samples _____
Laboratory Analyses: ☐ GRO ☐ DRO ☐ RRO ☐ VOC ☐ PAH ☐ Metals
☐ Other:_____

Sample Analytical Results Summary:
☐ <HDOH Tier 1 EALs for unrestricted use for sites where groundwater is a current or potential source of drinking water, <150 meters to nearest surface water
☐ >HDOH Tier 1 EALs for unrestricted use for sites where groundwater is a current or potential source of drinking water, <150 meters to nearest surface water
Waste Characterization:
☐ <HDOH Tier 1 EALs for commercial/industrial use for sites where drinking water is NOT a current or potential source of drinking water, >150 meters to nearest surface water
☐ >HDOH Tier 1 EALs for commercial/industrial use for sites where drinking water is NOT a current or potential source of drinking water, >150 meters to nearest surface water
☐ <RCRA Characteristic Criteria: ☐ Ignitability ☐ Corrosivity ☐ Reactivity ☐ RCRA 8 TCLP metals
☐ >RCRA Characteristic Criteria: ☐ Ignitability ☐ Corrosivity ☐ Reactivity ☐ RCRA 8 TCLP metals
☐ Other Landfill Restrictions:
☐ Other: _____
☐ Sample analytical results attached
☐ Attach recycling receipt, weight tickets, disposal manifest, and Water Tracking Log

Were any deviations from the EHMP implemented? ☐ Yes* ☐ No
* If yes complete **Appendix D-13, Deviation Form** and attach to this form.

FREE PRODUCT MANAGEMENT SUMMARY ☐ Not Applicable

Free Product Encountered? ☐ Yes* ☐ No
*If yes, complete **Appendix D-12, Release Report Form** and attach to this form.

FREE PRODUCT MANAGEMENT SUMMARY, continued

Describe Field Screening Results:

Visual: _____

Olfactory: _____

PID Measurements: min: _____ / max: _____

Field Instrument/Test Kit Results: _____

Free Product Contained onsite? ☐ Yes ☐ No

Provide volume/dimensions of containers/tanks:_____

Describe Free Product Impacts (saturated soil, sheen, floating oil, etc)

Estimated Extent of Free Product:

Free Product Limited to Work Area ☐ Yes ☐ No*

If no, does contamination extend beyond limits of excavation and if so, in which direction?

☐ All ☐ North ☐ South ☐ East ☐ West ☐ Mauka ☐ Makai

Free Product Impacts to Surface Water? (sheen, floating oil, etc) ☐ Yes ☐ No

Name of nearest Surface Water Body: _____

Distance to nearest Surface Water Body: _____ meters

Free Product Recovery :

☐ Absorbent Booms/Pillows/Sheets (estimated gallons) ☐ Drums

☐ Pump/Vacuum Truck Recovery (estimated gallons) ☐ Other:_____

Storage Details: (see **Appendix D-6, Free Product Management Plan**)

Location of stored containers: _____

☐ Containers/tanks labeled Describe methods used for labeling, e.g., adhesive labels, paint, signage, etc. _____

☐ Containers/tanks stored Describe methods used for stockpiling/BMPs, e.g., lined/covered stockpiles, BMPs, etc.

_____

☐ Nonconformance with EHMP ☐ Yes* ☐ No

*If yes, fill in table below and attach additional pages, if necessary

Deficiencies with containers/tanks:	How Resolved:	Date Corrected:
_____	_____	_____
_____	_____	_____

FREE PRODUCT MANAGEMENT SUMMARY, continued

Free Product Sampling: ❑ Halogen Field Test Kit Result _____ppm ❑ Analytical results attached

Free Product Disposition: # of Gallons Reused/Recycled Offsite _____ gallons
# of Gallons Disposed Offsite as Hazardous Waste _____ gallons

❑ Attach recycling receipt, disposal manifest, and Free Product Tracking Log

Were any deviations from the EHMP implemented? ❑ Yes* ❑ No
* If yes complete **Appendix D-13, Deviation Form** and attach to this form.

VAPOR MANAGEMENT SUMMARY

❑ Not Applicable

Elevated Vapors Encountered in the Subsurface? ❑ Yes* ❑ No
*If yes, complete **Appendix D-12, Release Report Form** and check the box(s) for appropriate media:
❑ Inactive Pipelines/UST ❑ Soil ❑ Water ❑ Free Product

Describe Field Screening Results
Visual: _____
Olfactory: _____
PID Measurements: Ambient min: _____ / max:_____

Were any deviations from the EHMP implemented? □ Yes* □ No
* If yes complete **Appendix D-13, Deviation Form** and attach to this form.

DEBRIS MANAGEMENT SUMMARY

❑ Not Applicable

Debris Encountered? ❑ Yes* ❑ No
*If yes, complete **Appendix D-12, Release Report Form**

DEBRIS MANAGEMENT SUMMARY, continued

Describe Field Screening Results:

Visual: _____

Olfactory: _____

PID Measurements: min: _____ / max: _____

Field Instrument/Test Kit Results: _____

Describe Debris Impacts:

Debris Limited to Work Area? ☐ Yes ☐ No*

*If no, does contamination extend beyond limits of excavation and if so, in which direction?

☐ All ☐ North ☐ South ☐ East ☐ West ☐ Mauka ☐ Makai

Debris Contained onsite?

Volume of material stockpile or contained: _____ cubic yards

Dimensions of stockpiles or containers: _____

Storage Details: (see **Appendix D-8, Debris Management Plan**)

Location of stored stockpiles/containers: _____

☐ Contaminated stockpiles segregated and labeled Describe methods used for labeling, e.g., adhesive labels, paint, signage, etc.

_____

☐ Stockpiles/containers stored Describe methods used for stockpiling/BMPs, e.g., lined/covered stockpiles, BMPs, etc.

_____

☐ Nonconformance with EHMP ☐ Yes* ☐ No

*If yes, fill in table below and attach additional pages, if necessary

Deficiencies with containers/tanks:	How Resolved:	Date Corrected:
_____	_____	_____

Debris Disposition:

☐ Recycled Offsite _____ tons

☐ Disposed Offsite _____tons

☐ Attach recycling receipt, weight tickets, disposal manifest, and Debris Tracking Log attached

Were any deviations from the EHMP implemented? ☐ Yes* ☐ No

* If yes complete **Appendix D-13, Deviation Form** and attach to this form.

UNANTICIPATED MATERIALS MANAGEMENT SUMMARY

☐ Not Applicable

Unanticipated Materials Encountered? ☐ Yes* ☐ No

*If yes, complete **Appendix D-12, Release Report Form**

Describe Field Screening Results:

Visual: _____

Olfactory: _____

PID Measurements: min: _____ / max: _____

Field Instrument/Test Kit Results: _____

Describe Unanticipated Materials Impacts:

Unanticipated Material Limited to Work Area? ☐ Yes ☐ No

If no, does contamination extend beyond limits of excavation and if so, in which direction?

☐ All ☐ North ☐ South ☐ East ☐ West ☐ Mauka ☐ Makai

Unanticipated Materials Contained onsite?

Volume of materials stockpile or contained: _____ cubic yards

Dimensions of stockpiles or containers: _____

Storage Details: (see **Appendix D-9, Unanticipated Materials Management Plan**)

☐ Contaminated stockpiles segregated and labeled Describe methods used for labeling, e.g., adhesive labels, paint, signage, etc.

_____

☐ Stockpiles/containers stored Describe methods used for stockpiling/BMPs, e.g., lined/covered stockpiles, BMPs, etc.

_____

☐ Nonconformance with EHMP ☐ Yes* ☐ No

*If yes, fill in table below and attach additional pages, if necessary

Deficiencies with containers/tanks:	How Resolved:	Date Corrected:
_____	_____	_____
_____	_____	_____

Unanticipated Materials Disposition:

☐ Recycled Offsite _____ tons

☐ Disposed Offsite _____tons

☐ Attach recycling receipt, weight tickets, disposal manifest, and Debris Tracking Log attached

Were any deviations from the EHMP implemented? ☐ Yes* ☐ No

* If yes complete **Appendix D-13, Deviation Form** and attach to this form.

SIGNATURE

Contractor Name and Title Signature Date

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Appendix D-11
Release Response Plan

Notice: Any deviation from the work described below requires consultation with HART.

Purpose of This Sheet: This reference sheet provides release response instructions for Contractors who are working on the HRTP. The Contractor is responsible for following these requirements while working at the project site. If the Contractor anticipates changes to protocols specified in the EHMP, HART will be notified immediately and the Contractor will fill out and submit Appendix D-13, Deviation Form, in accordance with Section 5.14.1.

PROJECT INFORMATION

Contractor:
Phase:
Work Area(s):
Work Activities Covered by this Reference Sheet:
Contractor Point of Contact (POC):
Contractor POC Phone Number(s):
HART POC or Person Consulted about the Project::
HART POC Phone Number(s):
Date Project Reviewed:

GENERAL GUIDELINES

This sheet describes what to do in the event of an unplanned or accidental release of a hazardous substance. Contractors need to minimize the possibility of spills or a release during excavation by:

- Familiarizing themselves with the site conditions.
- Following appropriate plans, including health and safety, soil and groundwater management plans, and Spill Prevention, Control, and Countermeasures Plan.
- At all times, being prepared to encounter and manage a potential spill.

If an apparent imminent danger is observed, call 9-1-1. Immediately identify the source, quantity and severity of the release. The source of the release should be eliminated to the extent practicable, without endangering workers.

During construction, a release could occur if a hazardous substances accidently leaks from heavy equipment, vehicles, or damaged storage containers. A release could also occur if the Contractor encounters a hazardous substance or a potentially hazardous substance in the air, water or soil. Per agreement with HDOH, the following observations constitute a release:

- A hydrocarbon sheen on surface or groundwater.
- Any amount of free product observed.

- Any visual evidence of contamination (for example, buried ash, buried asphalt, or construction debris).
- Any evidence of unusual odors or a headspace PID reading greater than 10 ppm.

PROCEDURES

Stop work if one or more of the following conditions are encountered:

- If an explosion threat exists and notify the Honolulu Fire Department by calling 911.
- If an imminent threat to human health or the environment exists, or if human or environmental receptors are impacted (for example, exposed people falling ill or suffering sudden illness), notify the Honolulu Fire Department by calling 911.
- If there is a release of a chemical or hazard not covered by the EHMP, notify HART.
- If a larger than anticipated release is encountered, notify HART.
- If there is a release encountered in a location where contamination was not expected, notify HART.

If one or more of these conditions occurs the following actions should be taken:

- Identify, source, quantity, and severity of the spill.
- If a fire or explosion threat exists, notify the Honolulu Fire Department.
- If the spill is of a volatile, flammable, or combustible liquid (for example, gasoline, diesel fuel), eliminate possible ignition sources and direct workers to remain upwind. In addition, a combustible gas meter or similar instrument should be used to monitor for explosive vapors.
- Immediate emergency response actions should be taken if a worker or member of the public is injured.
- Eliminate the source of the spill to the extent practicable, without endangering workers (for example, shutting off a valve, turning off an engine, righting an overturned container).
- Protect sensitive ecological receptors threatened by the spill.
- Only trained onsite personnel should perform initial response activities wearing appropriate personal protective equipment. To the extent possible and practicable, the spill should be contained to a small area, prevented from migrating, and cleaned up with absorbent materials. Follow-up response actions (for example, assessment, final cleanup, reporting), should be done by qualified individuals.
- If contaminated media is removed as part of the response activities, the material should be characterized and disposed in accordance with state and federal regulations.
- Report the release to the HART.

RELEASE RESPONSE TEAM

In the event of a release, the following team will determine the necessary response, make proper notifications and perform the response. Fill in the contact information for this project.

Name	Phone
HART POC Name:	
HART Health and Safety Manager Name:	
On-Site Construction POC Name:	
HARTs Public Affairs Contact (to contact landowners) Name:	

NOTIFICATION

Immediate verbal notification is required.

Has the Contractor called the HART POC immediately to report the release?

☐ Yes ☐ No*

*If no, contact the HART POC immediately.

Same day follow-up written notification is required.

Has **Appendix D-12, Environmental Release Reporting Form** been completed and submitted to the environmental contractor within 24 hours of the release?

☐ Yes ☐ No*

*If no, complete **Appendix D-12, Environmental Release Reporting Form** immediately.

OTHER POTENTIAL CONTACTS

Other potential contacts may be notified by the Contractor

Organization	When to call	Phone
HDOH HEER Office	Any significant release not identified during the Pre-Construction Environmental Screening Form	(808) 586-4249 (808) 247-2191 (after hours)
Fire, Ambulance, or Police	In the event of fire danger or injury	911

Organization	When to call	Phone
National Response Center (NRC) Name:	In the event of a spill of a reportable quantity; Any petroleum or chemical release to surface water	800-424-8802
United States Coast Guard Name:	In the event of any sheens on harbor waters	(808) 842- 2600 For oil spills, also call NRC
Gas Utility Name:	In the event of damage or break	(808) 526- 0066
Electric Utility Name:	In the event of damage or break	(808) 548 - 7961
Water Utility Name:	In the event of damage or break	(808) 748 - 5000
Local Emergency Planning Committee (LEPC) Name:	Any significant release	For immediate threat/harm to public or environment 911; For non-emergency, call 723-8960 to report
Landowner Name:	Any significant release	(___) ___ - ____

Notes:

SIGNATURE

Contractor Name and Title Signature Date

Appendix D-12

Release Report Form

Purpose of this form: This form is to be completed by HART's Contractor that encountered/observed the release during construction. If an environmental release occurs notification is required. See Section 6.0 of the EHMP for more information.

RELEASE INFORMATION

HDOH Release Identification #: _____

Name and Affiliation of Person Completing Form: _____

Date and time: _____

INCIDENT INFORMATION

Date and time of the incident: _____

Weather at time of incident:

Temperature:_____ ☐Sunny ☐Partly Cloudy ☐Rainy ☐Wind (Direction/Speed): _____

Damage to Structures: Yes/No Catastrophic Release (e.g., fire, explosion): Yes/No Other: _____

Types of environmental release (please check all that applies):

- ☐ Hydrocarbon sheen on surface water or groundwater
- ☐ Any amount of free product observed
- ☐ Discovery of a potentially hazardous material, including contaminated soil and or groundwater
- ☐ Any visual evidence of contamination (e.g., staining, ash, asphalt, construction debris, illegal dumping)
- ☐ Any olfactory evidence of contamination or a PID reading >10 ppm
- ☐ Any amount of oil >25 gallons released to the environment or <25 gallons and not contained or remediated within 72 hours
- ☐ Other: _____

Media into which the release occurred or is likely to occur (Indicate all those that apply):

☐Air ☐Soil ☐Groundwater ☐Stream ☐Ocean ☐Other:_____

Does this incident require intiation of Stop Work procedures? Yes/No

Name (trade and chemical) of the hazardous substance released: _____

Approximate quantity of the hazardous substance released:_____

Location of release:

GPS Coordinates: _____
TMK Number: _____
Address: _____

Decribe how the incident occurred including the potential source:

Field Measurements:

☐Ambient PID reading (ppm): _____

☐Headspace PID reading (ppm) and depth interval: _____

☐Other: _____

Duration of the release: _____

RESPONSE INFORMATION

Describe corrective actions taken to eliminate the source of the release:

Reuse in Work Area:

- Groundwater reinjected/reinfiltrated within work area where generated? Yes/No
- Soil returned to excavation? Yes/No

Temporary Storage Details:

- Volume of soil stored: _____ cubic yards
- Volume of water stored: _____ cubic yards
- Location of stored stockpiles/containers/tanks: _____
- Contaminated stockpiles segregated and labeled in accordance with EHMP? Yes/No
- Stockpiles/containers stored in accordance with EHMP? Yes/No

NOTIFICATION INFORMATION

Name	Phone
HART POC (Caller) Name: _____	
HART POC Name: _____	
HART Health and Safety Manager Name: _____	
HDOH On-Scene Coordinator Name: _____	
On-Site Construction POC Name: _____	
Property Owner Name: _____	

List the names of other federal, state, or local government agencies that have been notified of the release:

HEALTH INFORMATION

Was there any immediate danger to life and/or health posed by the release? Yes/No

Known or anticipated acute health risks:

- Was PPE used properly? Yes/No
- Was the workspace atmosphere monitored for dust and vapors? Yes/No
- Was HART's H&S Contractor consulted? Yes/No

Known or anticipated chronic health risks:

- Was PPE used properly? Yes/No
- Was the workspace atmosphere monitored for dust and vapors? Yes/No
- Was HART's H&S Contractor consulted? Yes/No

Was advice regarding medical attention necessary for exposed individuals? Yes/No

Potential impacts to public health or welfare:

- Is the release in a residential area? Yes/No
- Is the release in a commercial area? Yes/No
- Is the release below the surface? Yes/No
- Is the release covered with asphalt, cement, or vegetation? Yes/No

Potential impacts to the environment:

- Is the release less than 150 meters from surface water? Yes/No
- Is the release below the surface? Yes/No
- Is the release within groundwater? Yes/No
- Is the release covered with asphalt, cement, or vegetation? Yes/No

FOLLOW-UP INFORMATION REQUIRED:

Information to be submitted to HDOH:

☐ Limited reuse/waste characterization sample analytical results

☐ Soil disposition information including volume of soil reused, location of reused soil, volume of soil disposed of at a permitted off-site facility, and location of the permitted off-site facility

☐ Groundwater disposition information including volume of water disposed of at a permitted off-site facility and location of the permitted off-site facility

Check the box for information attached to this form:
☐ Photographs
☐ Maps
☐ Laboratory data
☐ Other:_____

SIGNATURE

"I certify under penalty of law that I have personally examined and am familiar with the information submitted and believe the submitted info is true, accurate, and complete."

Signature: _____ Date: _____
Printed Name: Daniel A. Grabauskas
Title: Executive Director and CEO
Company: HART

Appendix D-13
Deviation Form

Purpose of this Form: This form is to be completed by the Contractor and HART to communicate and document any deviations from the work described in the EHE-EHMP.

PROJECT INFORMATION

Contractor:
Phase:
Work Area(s):
Work Activities Covered by this Reference Sheet:
Contractor Point of Contact (POC):
Contractor POC Phone Number(s):
HART POC Consulted about the Project::
HART POC Phone Number(s):
Date Project Reviewed:

DESCRIPTION OF DEVIATION

Date of Work to be Done	Date of Notification of Deviation to HART
Date of Notification to HDOH	Reason for Deviation

Planned deviation: ☐ Yes ☐ No

If yes, is this a request for approval? ☐ Yes ☐ No

If no, was Deviation Approved in advance? ☐ Yes ☐ No

For deviations not planned 30 days in advance, please specify reason advance notice was not given:

DESCRIPTION OF DEVIATION, continued

Deviation relates to:

☐ Inactive Pipeline and UST Management Plan

☐ Soil Management Plan

☐ Water Management Plan

☐ Free Product Management Plan

☐ Debris Management Plan

☐ Release Reporting

☐ Plans Not Listed

☐ Other: _____

Describe the deviation below:

_____

_____

_____

_____

_____

_____

Is this a recurring issue? ☐ Yes ☐ No

If yes, do you have suggestions for improvements to HART's EHMP? ☐ Yes ☐ No

Describe suggestions below:

_____

_____

_____

_____

_____

_____

☐ Attachments (Any specs, plans, etc. documenting the deviation)

ACKNOWLEDGEMENT

CONTRACTOR:
NAME & SIGNATURE DATE:

HART:
NAME & SIGNATURE DATE:

HDOH:
NAME & SIGNATURE DATE:

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