BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843
www.boardofwatersupply.com

January 31, 2022

Dr. Elizabeth A. Char, MD
Director of Health
State of Hawaii
Department of Health
1250 Punchbowl Street
Honolulu, Hawaii 96813

Dear Dr. Char:

Subject: Honolulu Board of Water Supply (BWS) Request the Hawaii Department of Health (DOH) Revisit its Environmental Action Levels (EALs) for Total Petroleum Hydrocarbon Middle Distillate Fraction (TPH-d)

The BWS requests the DOH lower its current 400 µg/L EAL for TPH-d to its previous level that we believe are more protective of human health, the environment, and our critical drinking water resources.

In November 2017, the DOH increased its TPH-d drinking water health-based EAL from 160 micrograms per liter (µg/L) to 400 µg/L and increased its TPH-d taste and odor EAL from 100 µg/L to 500 µg/L (DOH 2016, 2017). At that time, DOH determined that TPH-d in tap water will change into a form that will stay in water and not be released into the air or absorbed through the skin, and therefore the EAL could be increased and not pose a significant threat to human health and the environment. The BWS disagrees and has consistently raised concerns about the DOH's rationale for the change (Lau et al. 2018a,b; 2019). Since TPH-d does not have an applicable drinking water standard, the BWS considers these EALs an important tool to assist water purveyors in ensuring that the water provided to customers is safe and free of objectionable qualities. The ongoing fuel releases from the Red Hill Bulk Fuel Storage Facility (Red Hill) and the contamination of the U.S. Navy's water distribution system, heighten our concerns and underscore the need to revise these EALs to their prior levels.

We were surprised both by the DOH's decision to raise its TPH-d EALs as well as its proffered rationale for doing so. The DOH (2017) justified its decision to increase the drinking water health-based EAL based in part on the following finding:

> [P]etroleum-related compounds reported in this range will be dominated by non-volatile, degradation compounds or "metabolites" of biogenic

> origin. The resulting action level is therefore based on ingestion only and does not incorporate an inhalation pathway.

In other words, the DOH effectively assumed that exposures to TPH-d do not occur via inhalation or skin absorption while showering, bathing, or washing dishes. As we have made clear in the past, this justification for the current drinking water toxicity EAL for TPH-d is incorrect (Lau 2018 a,b).

The studies relied upon by the DOH to raise its EALs are not sufficiently protective because they assess historical TPH release sites on the mainland (Lau 2018a). TPH-d in local groundwater may travel faster from a release site to drinking water wells through Hawaii's more hydraulically conductive volcanic soils and rock. Moreover, the Red Hill fuel facility equipment and operations can more directly contaminate drinking water wells, as demonstrated by releases in 2021 affecting the aquifer and the Joint Base Pearl Harbor Hickam (JBPHH) water system. Consequently, there may be less time for TPH-d to degrade to forms that remain in water, particularly for sites with recent or ongoing fuel releases like Red Hill. The DOH's assumption that TPH-d will degrade such that it does not result in inhalation or absorption exposures does not apply here as sampling results from the Navy's Red Hill Shaft clearly show that undegraded fuel product can travel and has travelled through the subsurface into the Navy's Red Hill Shaft drinking water source.

State Toxicologist Dr. Diana Felton recently testified that people can be exposed in the following ways: by ingestion, dermal exposure (absorption), and inhalation. Exposures to a petroleum-based product via the inhalation and skin absorption pathways are consistent with the recent reports from users of the U.S. Navy water distribution system of strong fuel odors from their tap water as well as documented symptoms, including skin irritation and rash, from individuals using the water. It is clear from the experiences of the service members and their families actually affected by exposure to petroleum constituents in their water that both the inhalation and skin absorption pathways should be considered when establishing DOH's health-based TPH-d EAL.

The DOH's explanation that its increased taste and odor EAL of 500 µg/L for TPH-d is based on more contemporary studies and is on the low side of published thresholds is equally unavailing. There is considerable uncertainty inherent in the studies referenced by the DOH in support of its decision to raise the TPH-d EAL (DOH, 2017; Lau 2018b, 2019). More importantly, this new EAL has not been verified to apply to a situation in which an actively used source of drinking water has been impacted by fuel releases and its validity has been directly refuted by recent experience. The Navy has reported taking hundreds of samples from its water distribution system and has generally maintained that none have indicted the presence of petroleum-related constituents at or above the DOH's current EALs. Despite these reported results, the water contamination crisis was discovered when Navy servicemembers and their families reported strong

fuel odors emanating from the water served from their taps. Given these reports, the DOH's current taste and odor EAL of 500 µg/L is simply too high.

The BWS understands that the DOH may now be using a more conservative EAL of 200 µg/L to assess the sufficiency of the Navy's efforts to flush the petroleum contamination from its water distribution system. While we support the application of a more protective standard to such efforts, we believe that a prompt revision of the TPH-d EALs is necessary to safeguard the public and our critical drinking water resources. The DOH indicated in February 2020 (Anderson, 2020) that Dr. Roger Brewer had initiated a laboratory study to investigate the chemistry and toxicity of dissolved TPH in groundwater from different types of fuel, and that the DOH intended to incorporate the results of this research to develop EALs for TPH in groundwater from a fresh petroleum release. The BWS continues to have great interest in the progress of such work and would appreciate an update on this laboratory study as well as the status of the DOH's further revision of the TPH EALs.

In the meantime, it is clear that use of DOH's current TPH-d EALs as a screening tool is not sufficiently protective of human health, the environment, or drinking water. EALs should err on the side of being conservative. Recent experience shows that the existing EALs are not. Accordingly, the BWS urges the DOH to act now to lower the TPH-d EALs at least back to previous levels that were more protective.

If you have any questions, please contact Mr. Erwin Kawata, Program Administrator of the Water Quality Division at (808) 748-5080.

Very truly yours,

ERNEST Y.W. LAU, P.E.
Manager and Chief Engineer

cc: Ms. Gabriela Carvalho, EPA Region 9
Dr. Diana Felton, DOH

References

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BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
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August 20, 2018

Dr. Bruce S. Anderson
Director
State of Hawaii
Department of Health
1250 Punchbowl Street
Honolulu, Hawaii 96813

Dear Dr. Anderson:

Subject: Honolulu Board of Water Supply (BWS) Request to Hawaii Department of Health (DOH) for an Explanation of the Basis for the Increase in the Environmental Action Levels (EALs) for Total Petroleum Hydrocarbon Middle Distillate Fraction (TPH-d)

In November 2017, the DOH raised its groundwater EALs for TPH-d. The TPH-d EAL based on health protection was increased from 160 micrograms per liter (µg/L) to 400 µg/L and the EAL based on odor or taste was increased from 100 µg/L to 500 µg/L (DOH 2016, 2017).

These EALs are amounts of TPH-d in water that DOH considers to be "safe" for drinking water and household use of tap water. An increase in TPH-d EALs means that DOH is now allowing more TPH-d in tapwater at what it regards as a safe level.

The BWS considers these EALs for certain constituents that do not have drinking water standards to help ensure that the water we provide our customers is safe and free of objectionable qualities. Consequently, the BWS respectfully requests a detailed explanation of the scientific basis of these changes in TPH-d EALs. This will greatly assist us in responding to public comments and concerns regarding the safety and quality of our water.

The DOH (2017) report (Volume 2, Appendix 1, Section 6.6, p. 6-12, pdf page 66) states that the reason for the EAL increase is because:

> *…petroleum-related compounds reported in this range will be dominated by non-volatile, degradation compounds or "metabolites" of biogenic origin (Zemo*

et al. 2013, 2016). The resulting action level is therefore based on ingestion only and does not incorporate an inhalation pathway.

In other words, DOH is assuming that TPH-d in tapwater will be almost entirely changed into a form that will stay in the water such that it will not be released into the air nor will it be absorbed through the skin. DOH thus appears to assume TPH-d will not get into the human body by breathing it or by taking it up through the skin while showering, bathing, or washing dishes. By assuming less exposure from these sources, DOH is effectively allowing more TPH-d in drinking water at the higher EAL concentration. However, the studies used to support this assumption (Zemo et al. 2013, 2016) are studies of historical TPH release sites on the mainland.

The BWS has concerns about using TPH-d analyses from the mainland in the establishment of a TPH-d EAL for use in Hawaii. TPH-d in local groundwater may travel faster from a release to drinking water wells because of Hawaii's more hydraulically conductive volcanic soils and rock. As a result, there may also be less time for TPH-d to degrade into forms that stay in the water, particularly for sites with recent or ongoing releases.

The BWS would like to know whether the DOH considered in its evaluation the unique subsurface conditions in Hawaii that differ from those at petroleum release sites on the mainland. Please provide your data and analyses from sites in Hawaii, including those with recent or ongoing releases, that support DOH's key assumption of near 100% change of TPH-d into a form that results in less exposure.

Thank you for your assistance with this request. If you have any questions, please contact Mr. Erwin Kawata, Program Administrator of the Water Quality Division at (808) 748-5080.

Very truly yours,

ERNEST Y. W. LAU, P.E.
Manager and Chief Engineer

cc: Mr. Steve Linder, United States Environmental Protection Agency, Region IX
Mr. Mark Manfredi, NAVFAC Hawaii

References

Hawaii Department of Health (DOH). 2016. Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater. Summer.

2017. Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater. Fall.

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BOARD OF WATER SUPPLY

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December 28, 2018

Dr. Bruce S. Anderson
Director
State of Hawaii, Department of Health
1250 Punchbowl Street
Honolulu, Hawaii 96813

Dear Dr. Anderson:

Subject: Response to Hawaii Department of Health (DOH) Reply to Honolulu Board of Water Supply (BWS) Request for an Explanation of the Basis for the Increase in the Environmental Action Levels (EALs) for Total Petroleum Hydrocarbon Middle Distillate Fraction (TPH-d)

Thank you for your letter (dated September 14, 2018) (Anderson, 2018a) in response to the BWS request (dated July 19, 2018) (Lau, 2018a) for detailed information regarding the scientific basis of the increase in the EALs for TPH-d. Our request noted that both the TPH-d EAL based on odor and taste and the EAL based on health protection for drinking water use were increased from 100 micrograms per liter (µg/L) to 500 µg/L and from 160 ug/L to 400 µg/L, respectively, in Fall 2017 (DOH, 2016; DOH, 2017).

Thank you also for your follow up letter (dated October 22, 2018) (Anderson, 2018b) in response to the BWS request (dated August 20, 2018) (Lau, 2018b) for additional clarification of the DOH's explanation for increasing the health-based EAL for TPH-d in Fall 2017 (DOH, 2016; DOH, 2017). Our letter also inquired as to whether the decision for raising the health-based EAL for TPH-d considered the unique subsurface conditions in Hawaii that differ from those in the mainland studies (Zemo et al. 2013, 2016) apparently used to support the key assumption that resulted in the increase in the EAL (Lau, 2018b).

In response to your September 14, 2018 letter, we request additional clarification from DOH as noted in our comments below and offer our rationale in support of a 160 µg/L health-based EAL, a 100 µg/L EAL for odor and taste, and our perspective on the purpose of groundwater screening levels.

Health-Based EAL

As noted by the BWS (Lau, 2018b), the DOH (2017) report (Volume 2, Appendix 1, Section 6.6, p. 6-12, pdf page 66) states that the reason for the EAL increase is because:

> *...petroleum-related compounds reported in this range will be dominated by non-volatile, degradation compounds or "metabolites" of biogenic origin (Zemo et al. 2013, 2016). The resulting action level is therefore based on ingestion only and does not incorporate an inhalation pathway.*

In other words, DOH is assuming that TPH-d in tap water will be entirely changed into a form that will stay in the water such that it will not be released into the air nor will it be absorbed through the skin. DOH thus assumes that exposures to TPH-d do not involve inhalation or absorption through the skin while showering, bathing, or washing dishes. By assuming less exposure from these sources, DOH is effectively allowing more TPH-d in drinking water at the higher EAL concentration. However, the studies used to support this assumption (Zemo et al. 2013, 2016) are studies of historical TPH release sites on the mainland.

According to the recent DOH response (Anderson 2018b), the TPH-d EAL was revised because DOH expects that 1) the hydrocarbon compounds measured in groundwater by the test method (Method 8015-DRO) will not be "significantly" volatile nor will they be absorbed through the skin, and 2) the biological degradation products are also not "significantly" volatile. Nevertheless, other information indicates that these assumptions are not necessarily correct, particularly for Hawaii.

Point 1: TPH-d Hydrocarbons Measured in Water will not be "Significantly" Volatile

This rationale was not previously provided by DOH (2017) in justifying the increase in the EAL. Although the laboratory method for quantifying the middle distillate fraction comprising TPH-d may include classes of compounds that are not significantly volatile (e.g., longer chain aliphatic hydrocarbons), not all of the various compounds quantified by this method will be soluble in water and therefore present in a groundwater sample.

The California State Water Resources Control Board, San Francisco Bay Region (Regional Water Board [RWB]) recognizes that only the fraction of TPH-d that is soluble in water will be quantified and reported in groundwater samples (RWB, 2016). RWB also notes that this soluble fraction of TPH-d, aromatic compounds with 9 to 16 carbon molecules, is also volatile (resulting in breathing vapors from water use) and passes through the skin (RWB, 2016). U.S. Environmental Protection Agency risk assessment calculations (U.S. EPA 2009, 2018) used by RWB (2016) indicate that exposure to TPH-d aromatic compounds via skin absorption is nearly equal exposure to that from the oral ingestion route of exposure. The inhalation route of exposure contributes nearly three times more exposure than the oral or dermal route of exposure. Thus, inhalation and dermal absorption are potentially very important routes for exposure to TPH-d in groundwater. RWB (2016) has accordingly derived a TPH-d screening level of

150 µg/L based on the soluble aromatic compounds in this hydrocarbon fraction, including oral, dermal, and inhalation exposure.

The DOH response notes that gasoline range volatile hydrocarbon compounds (less than 10-12 carbon molecules) are collectively tested for at sites along with TPH-d, and that this testing would pick up any volatile compounds that might pose vapor concerns. However, testing for TPH-g does not measure all of the middle distillate aromatic compounds (up to 16 carbon molecules) that are soluble and volatile. Thus, measurement of low TPH-g concentrations does not mean that elevated TPH-d concentrations in groundwater samples are not volatile.

Point 2: The Biological Degradation Products are not Significantly Volatile

The BWS is concerned about DOH's use of TPH-d data from the mainland to justify the TPH-d EAL in Hawaii (DOH 2017; Lau, 2018). DOH's response postulates that degradation may proceed faster in Hawaii because of higher year-round temperatures but does not address the likelihood that TPH-d in groundwater may travel faster from a release to drinking water wells in Hawaii because of its volcanic soils and rock. As a result, even with higher temperatures, there will be less time for TPH-d to degrade into forms that stay in the water and are not released to air or penetrate the skin. Sites with recent or ongoing releases will also have had less time for TPH-d to completely change.

The DOH response cites data collected from the Red Hill Tank Farm complex, noting that samples tested with and without silica gel cleanup (to remove biological degradation products) "consistently indicate that the majority of TPH-related compounds present are heavily degraded (NAVFAC 2016, 2017, 2018)". Nevertheless, the limited analysis with silica gel cleanup do not allow full characterization of the extent of degradation in these samples. Samples with and without silica gel cleanup for 2016, 2017 and 2018 for monitoring wells RHMW-01, RHMW-02, and RHMW-03 indicate between 14% to 100% of the TPH-d fraction is made up of hydrocarbons and not polar organic compounds as assumed by the DOH revised EAL (Table 1). For RHMW-02, concentrations of hydrocarbons after silica gel cleanup ranged from 230 to 640 µg/L (Table 1). All of these data except for three samples from 510 µg/L to 640 µg/L concentration would be screened out as not a health concern using the revised DOH health-based limit of 400 µg/L which assumes 100% non-volatile polar organic compounds. However, all of these concentrations would exceed health-based limits based on the soluble hydrocarbon fraction of TPH-d which is also volatile (e.g., 150 µg/L based on RWB 2016). They would also exceed the previous DOH health-based EAL of 160 µg/L. Thus, the revised EAL of 400 µg/L is not scientifically appropriate for evaluating whether the TPH-d results after silica gel cleanup pose health concerns. The revised EAL is also not appropriate for screening TPH-d results without silica gel cleanup given that site data in Hawaii indicate that samples are not 100% polar organics as assumed by DOH in the derivation of the revised EAL.

Table 1: Comparison of TPH-d concentrations, with and without Silica Gel Cleanup (SGC)*

Well ID	Sample Date	TPH (middle distillates), silica gel cleanup	TPH (middle distillates)
		concentration (ug/L)	
RHMW-01	10/17/2016	<25	120
	5/1/2017	<51	110
	6/5/2017	36	98
	7/5/2017	<25	110
	10/25/2017	<25	86
	3/12/2018	<25	150
	4/25/2018	-	<25
RHMW-02	10/19/2016	300	1300
	5/1/2017	<480	1000
	6/5/2017	570	1000
	7/6/2017	250	1000
	10/23/2017	230	1600
	3/13/2018	640	1900
	4/24/2018	510	2800
RHMW-03	10/19/2016	<25	65
	5/1/2017	<25	50
	6/6/2017	50	46
	7/6/2017	<25	49
	10/23/2017	<25	210
	3/12/2018	<25	190
	4/25/2018	<25	160

*Data from "Final Second Quarter 2018 – Quarterly Groundwater Monitoring Report" (NAVFAC, 2018; Table 4-1; page 39)

The DOH response also acknowledges the possibility of a sudden release of petroleum product but states that measurement of TPH-g along with TPH-d will be able to quantify the presence of volatiles after such a release. However, jet fuel has a limited amount of constituents in the carbon range measured by TPH-g (only those in the 9-12 carbon range). Larger aromatic compounds (up to 16 carbons) that are soluble and volatile will be measured as TPH-d and will not be detected by TPH-g analysis. The revised EAL for TPH-d thus will not be sufficiently protective in such a situation because it does not include exposure from airborne emissions or skin penetration by these soluble and volatile aromatic compounds.

EAL Based on Odor and Taste

Regarding the EAL for TPH-d based on odor and taste, thank you for pointing out the basis of this increase (DOH 2017 Volume 2, Appendix 1, Section 6.6). We note, however, the considerable uncertainty in studies used by DOH (2017) to increase this level from 100 to 500 µg/L. Therefore, DOH (2017) (Volume 2, Appendix 1, Section 6.6, p. 6-12, end of the third paragraph) notes:

> *The adequacy of this threshold* [500 µg/L] *should be verified if impacts to actively used sources of drinking water are identified.*

Please confirm that this new TPH-d odor and taste EAL of 500 µg/L cannot be used without verification in a situation in which an actively used source of drinking water has been impacted by a release. In addition, please provide details on who would be responsible for verifying the adequacy of this threshold in this situation.

Comment on the Purpose of Generic Groundwater Screening Levels

Screening levels are intended to be health protective of all possible conditions, such that if they are not exceeded, one is confident that no further action needs to be taken. Exceedance of screening levels triggers further investigation which then might determine whether chemical levels actually pose a concern for a specific situation. In this case, however, the revised EALs for TPH-d appear to be intended to be protective of expected or typical conditions (e.g., complete degradation whether that is actually the case or not, based on data from mainland sites), but not all possible conditions that might be occurring in Hawaii.

From our review of the available data and studies, we believe there is sufficient basis to warrant revision of the EALs for TPH-d that DOH set in 2017 to its former levels.

Thank you for the opportunity to comment and discuss this matter. If you have any questions, please contact Mr. Erwin Kawata, Program Administrator of the Water Quality Division at (808) 748-5080.

Very truly yours,

ERNEST Y.W. LAU, P.E.
Manager and Chief Engineer

cc: Mr. Steve Linder
United States Environmental Protection Agency
Region IX
75 Hawthorne Street
San Francisco, California 94105

Mr. Mark Manfredi
Red Hill Regional Program Director/Project Coordinator
NAVFAC Hawaii
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References

Anderson, B. 2018a. BWS Letter dated July 19, 2018. September 14.

_____. 2018b. Honolulu Board of Water Supply (BWS) Request to Hawaii Department of Health (DOH) for an Explanation of the Basis for the Increase in the Environmental Action Levels (EALs) for Total Petroleum Hydrocarbon Middle Distillate Fraction (TPH-d). October 22.

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Zemo, D.A., O'Reilly, K.T., Mohler, R.M., Magaw, R.I., Espino Devine, C., Ahn, S. and A.K. Tiwary. 2016. Life Cycle of Petroleum Biodegradation Metabolite Plumes, and Implications for Risk Management at Fuel Release Sites. Integrated Environmental Assessment and Management. DOI: 10.1002/ieam.1848.

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CITY AND COUNTY OF HONOLULU
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October 7, 2019

Bruce S. Anderson, Ph.D.
Director of Health
State of Hawaii, Department of Health
1250 Punchbowl Street
Honolulu, Hawaii 96813

Dear Dr. Anderson:

Subject: Response to Hawaii Department of Health (DOH) Reply to Honolulu Board of Water Supply (BWS) Request for an Explanation of the Basis for the Increase in the Environmental Action Levels (EALs) for Total Petroleum Hydrocarbon Middle Distillate Fraction (TPH-d)

Thank you for your August 26, 2019 letter (Anderson, 2019) in response to our request (Lau, 2018) for more clarification of the DOH's scientific basis for increasing the EALs for TPH-d. We also asked if DOH would consider an approach that we feel would be more applicable to Hawaii.

We appreciate DOH's willingness to consider updating the health-based EAL for TPH-d and to discuss the technical issues with the BWS. We would like to learn more about the approach you suggest and recommend we set up a conference call to discuss further and to establish a schedule for meeting in-person.

Regarding the EAL for TPH-d based on odor and taste, we wish to clarify that our letter (Lau, 2018) did not note that the 500 µg/L is predicted to be adequate under most circumstances. Instead, our letter noted considerable uncertainty in the studies used by DOH to increase the odor and taste EAL from 100 to 500 µg/L (DOH, 2017), and we requested confirmation that the new EAL of 500 µg/L cannot be used without verification in a situation in which an actively used source of drinking water has been impacted by a release. In addition, we asked for information on who would be responsible for verifying the adequacy of this threshold in such a situation.

Thank you for your response that the 500 µg/L EAL should be confirmed on a case-specific basis as adequate by entities using the groundwater as a source of drinking water. However, we request that DOH consider an approach in which the party that is threatening an actively used source of drinking water has the burden of demonstrating the adequacy of the 500 µg/L value before relying upon it. Otherwise, the drinking

water source could be contaminated to a TPH-d concentration (i.e., 500 µg/L) that may later be determined to be objectionable for drinking water users. Such an approach would be more protective of Hawaii's irreplaceable drinking water supply.

Thank you for the opportunity to comment and discuss this matter. If you have any questions, please contact Mr. Erwin Kawata, Program Administrator of the Water Quality Division at (808) 748-5080.

Very truly yours,

ERNEST Y.W. LAU, P.E.
Manager and Chief Engineer

cc: Mr. Steve Linder
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References

Anderson, B. 2019. Response to BWS letter dated December 28, 2018. State of Hawaii, Department of Health. August 26.

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BRUCE S. ANDERSON, Ph.D.
DIRECTOR OF HEALTH

STATE OF HAWAII
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In reply, please refer to:
File: **2020-10 RB**

February 13, 2020

Mr. Ernest Y.W. Lau, P.E.
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843

RE: Request for Additional Consideration of Toxicity-Based and Taste and Odor Threshold Action Levels for Total Petroleum Hydrocarbons (TPH) in Drinking Water.

Dear Mr. Lau:

Thank you for following up on DOH's 2017 updates to health-based and taste and odor-based environmental action levels (EALs) for Total Petroleum Hydrocarbons (TPH) in drinking water (Board of Water Supply (BWS) letter dated October 27, 2019). We appreciate your continuing technical engagement on Hazard Evaluation and Emergency Response (HEER) Office plans to further review TPH-d action levels for drinking water in 2020. As discussed, we recognize that additional guidance on the case-specific assessment of petroleum impacts to drinking water resources in high-risk areas is needed.

The following is noted in response to your letter:

- The TPH taste-and-odor threshold of 100 µg/L referenced in earlier EAL guidance was based on a mistranslation (Polish to English) of a 1940s era study that served as the sole reference in the 1982 USEPA document and was never valid;
- The updated DOH taste-and-odor action level for TPH of 500 µg/L is based on more recent studies and on the low side of published thresholds for fuel, which can be up to an order of magnitude higher;
- The BWS makes a reasonable point regarding the need for a drinking water, taste-and-odor threshold specific to the type of fuel stored at Red Hill, primarily JP-5;

- Specific protocols for the development of taste and odor will be compiled and referred to for a potential study of JP-5 in early 2020.

As a followup to our BWS letter dated August 26, 2019, Dr. Roger Brewer with our office has initiated a laboratory study to better define the chemistry and toxicity of dissolved TPH in groundwater underlying different types of fuel. Fuels being used in the study include gasoline, diesel, JP-5 and JP-8. The results of the study will be used to develop toxicity-based action levels for TPH in drinking water impacted by fresh releases of petroleum. These action levels are anticipated to be more stringent than current, default TPH action levels that assume degree of petroleum degradation before potential impacts to wells. The action levels can be used on a case-by-case basis to assess impacts in high-risk areas of the state, where the volume of fuel released and proximity to actively used water supply wells might preclude significant degradation before reaching a well.

The tests are anticipated to be completed within the next two months. Dr. Brewer will coordinate with local experts, including BWS staff, to review the results of the study and develop additional action levels. Downward adjustment of the default, TPH taste and odor threshold for assessment of groundwater in high-risk areas might also be appropriate and will be discussed.

The Board of Water Supply's input during the review and update of the HDOH action levels for TPH is again welcome. Please provide contact Dr. Roger Brewer (roger.brewer@doh.hawaii.gov) of my staff at your earliest convenience so that an introductory meeting of technical staff can be scheduled as soon as the new research data are available and to discuss possible interim measures for high-risk areas of vulnerable groundwater resources.

Thank you for your interest and I look forward to our cooperative input on this matter.

Sincerely,

BRUCE S. ANDERSON, Ph.D.
Director of Health

c: Joanna Seto, Safe Drinking Water Branch (SDWB)
Lene Ichinotsubo, Solid and Hazardous Waste Branch (SHWB)

BOARD OF WATER SUPPLY

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October 7, 2019

Bruce S. Anderson, Ph.D.
Director of Health
State of Hawaii, Department of Health
1250 Punchbowl Street
Honolulu, Hawaii 96813

Dear Dr. Anderson:

Subject: Response to Hawaii Department of Health (DOH) Reply to Honolulu Board of Water Supply (BWS) Request for an Explanation of the Basis for the Increase in the Environmental Action Levels (EALs) for Total Petroleum Hydrocarbon Middle Distillate Fraction (TPH-d)

Thank you for your August 26, 2019 letter (Anderson, 2019) in response to our request (Lau, 2018) for more clarification of the DOH's scientific basis for increasing the EALs for TPH-d. We also asked if DOH would consider an approach that we feel would be more applicable to Hawaii.

We appreciate DOH's willingness to consider updating the health-based EAL for TPH-d and to discuss the technical issues with the BWS. We would like to learn more about the approach you suggest and recommend we set up a conference call to discuss further and to establish a schedule for meeting in-person.

Regarding the EAL for TPH-d based on odor and taste, we wish to clarify that our letter (Lau, 2018) did not note that the 500 µg/L is predicted to be adequate under most circumstances. Instead, our letter noted considerable uncertainty in the studies used by DOH to increase the odor and taste EAL from 100 to 500 µg/L (DOH, 2017), and we requested confirmation that the new EAL of 500 µg/L cannot be used without verification in a situation in which an actively used source of drinking water has been impacted by a release. In addition, we asked for information on who would be responsible for verifying the adequacy of this threshold in such a situation.

Thank you for your response that the 500 µg/L EAL should be confirmed on a case-specific basis as adequate by entities using the groundwater as a source of drinking water. However, we request that DOH consider an approach in which the party that is threatening an actively used source of drinking water has the burden of demonstrating the adequacy of the 500 µg/L value before relying upon it. Otherwise, the drinking

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water source could be contaminated to a TPH-d concentration (i.e., 500 µg/L) that may later be determined to be objectionable for drinking water users. Such an approach would be more protective of Hawaii's irreplaceable drinking water supply.

Thank you for the opportunity to comment and discuss this matter. If you have any questions, please contact Mr. Erwin Kawata, Program Administrator of the Water Quality Division at (808) 748-5080.

Very truly yours,

ERNEST Y.W. LAU, P.E.
Manager and Chief Engineer

cc: Mr. Steve Linder
United States Environmental Protection Agency
Region IX
75 Hawthorne Street
San Francisco, California 94105

References

Anderson, B. 2019. Response to BWS letter dated December 28, 2018. State of Hawaii, Department of Health. August 26.

Hawaii Department of Health (DOH). 2017. Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater. Volume 2, Background Documentation for the Development of Tier 1 Environmental Action Levels. Appendix 1 Detailed Lookup Tables, Section 6.6. Hawaii Edition.

Lau, E.Y.W. 2018. Honolulu Board of Water Supply (BWS) Request to Hawaii Department of Health (DOH) for an Explanation of the Basis for the Increase in the Environmental Action Levels (EALs) for Total Petroleum Hydrocarbon Middle Distillate Fraction (TPH-d). December 28.

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Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater

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

Appendix 1: Detailed Lookup Tables

Hawai‘i Edition

Prepared by:

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Summer 2016 (updated December 2016)
(refer to Updates worksheet in EAL Surfer for summary of most recent updates)

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DISCLAIMER

This document, *Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater* (Summer 2016), is a technical report prepared by staff of the Hawai'i Department of Health (HDOH), Environmental Management Division. The document updates and replaces the document *Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater* (Interim Final, Fall 2011 and interim updates).

The document provides guidance for identification and evaluation of environmental hazards associated with contaminated soil and groundwater. The Environmental Action Levels (EALs) presented in this document and the accompanying text are specifically *not* intended to serve as: 1) a stand-alone decision making tool, 2) guidance for the preparation of baseline environmental risk assessments, 3) a rule to determine if a waste is hazardous under the state or federal regulations, or 4) a rule to determine when the release of hazardous substances must be reported to the HDOH.

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

This document will be periodically updated. Please send comments, edits, etc. in writing to the above contact. This document is not copyrighted. Copies may be freely made and distributed. It is cautioned, however, that reference to the action levels presented in this document without adequate review of the accompanying narrative could result in misinterpretation and misuse of the information.

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

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8 SUPPLEMENTAL HDOH TECHNICAL GUIDANCE DOCUMENTS

9 UPDATES TO 2011 EHE GUIDANCE DOCUMENT

GLOSSARY OF TERMS

AWQC: Aquatic Water Quality Criteria
CCC: Criterion for Continuous Concentration
CCM: Criterion for Maximum Concentration
EPA: Environmental Protection Agency
ESL: Environmental Screening Level
FVC: Final Chronic Value
HIDOH: Hawai'i Department of Health
HH: Human Health-consumption of aquatic organisms
LOEL: Lowest-Observed-Effects Level
MADEP: Massachusetts Department of Environmental Protection
MCL: Maximum Concentration Level
MOEE: Ontario Ministry of Environment and Energy
MTBE: Methyl tert-Butyl Ethylene
PCE: Tetrachloroethylene
PRG: Preliminary Remediation Goals
RBSL: Risk-Based Screening Level
RSL: Regional Screening Level
RWQCB: Regional Water Quality Control Board
TPH: Total Petroleum Hydrocarbons
USEPA: U.S. Environmental Protection Agency
USDOE: U.S. Department of Energy

APPENDIX 1

DEVELOPMENT OF TIER 1 LOOKUP TABLES

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

APPENDIX 1
DEVELOPMENT OF TIER 1 LOOKUP TABLES

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1 Development of Tier 1 Lookup Tables

1.1 Introduction

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

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

Indoor Air and Soil vapor:

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

Soil:

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

Groundwater:

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

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

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

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

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

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

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

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

As discussed in Volume 1, analysis and evaluation of TPH in conjunction with targeted, individual petroleum compounds such as benzene is required at petroleum-release sites. Contrary to past beliefs, the combined TPH compounds will drive risk posed by petroleum

contamination at many sites, rather than individual chemicals like benzene or naphthalene. Risk is based on a combination of toxicity and mass. While the latter may be more toxic on a relative scale, the overwhelming mass of otherwise less toxic, non-specific, aliphatic and aromatic compounds can ultimately pose a greater risk to human health and the environment.

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

1.2 Example Selection of Tier 1 EALs for Tetrachloroethylene

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

The Tier 1 EAL for PCE in shallow soil is selected as the lowest of the individual action levels for Direct Exposure (0.64 mg/kg), Vapor Intrusion (1.8 mg/kg), Gross Contamination (170 mg/kg) and Groundwater Protection (leaching concerns, (0.64 mg/kg). The final soil EAL for PCE is the lowest of the individual action levels, or 0. 64 mg/kg, based on potential vapor intrusion concerns for buildings overlying contaminated soil (see also Table A-1 in this appendix and Table A in Volume 1).

The process for selection of a Tier 1 PCE EAL in groundwater is similar (refer to Figure 2). Individual action levels for Drinking Water (5.0 ug/L), Vapor Intrusion (3,500 µg/L), Discharge to Surface Water (53 µg/L) and Gross Contamination (170 µg/L) concerns are compared and the lowest of these is selected for inclusion in the Volume 1 summary, Tier 1 lookup tables. In this example, the groundwater action level for drinking water concerns drives potential risks and is selected as the Tier 1 EAL (5.0 µg/L).

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

The process described above was carried out for each of the 100+ chemicals included in the Tier 1 lookup tables under each combination of groundwater beneficial use, soil depth and land use. The results are summarized in Tables A and B (soil) and Table D (groundwater) of this appendix. As can be seen from a review of these tables, the selection of final, Tier 1 EALs for highly mobile or highly toxic chemicals is typically driven by groundwater protection or vapor intrusion concerns (e.g., see selection process for benzene or vinyl chloride EALs in Table A-1). Final EALs for chemicals that are relatively immobile in soils but highly toxic are typically driven by direct-exposure concerns (e.g., see selection process for polychlorinated biphenyls (PCBs) in Table A-1). In contrast, selection of EALs for heavy metals that are relatively non-toxic to humans is typically driven by ecological concerns or ceiling levels for general resource degradation (e.g., see selection process for copper EAL in Table A-1). For chemicals that have particularly strong odors, selection of EALs may be driven in part by gross contamination concerns ("ceiling levels", e.g., see TPH EALs in Table B-2). The consideration of gross contamination becomes especially important in the selection of alternative action levels for relatively immobile chemicals in isolated, deep soils (e.g., refer to Tables F-3).

1.3 Toxicity Factors and Physiochemical Constants

Toxicity factors and physiochemical constants used in the soil, tapwater and vapor intrusion models for risk to human health are taken directly from the May 2016 USEPA Regional Screening Levels (RSLs) guidance except as noted in footnotes to Table H (USEPA 2016). The USEPA Region IX Preliminary Remediation Goals (PRGs) used route-to-route extrapolation to develop interim inhalation toxicity factors for chemical where studies specific to this pathway were not available or inadequate to develop toxicity factors (USEPA 2004a; see also USEPA 1993, 2011a). This approach is excluded in the 2011 USEPA RSLs. The guidance instead calls for a case-by-case review of this issue by local toxicologists. It is the opinion of the HEER office toxicologists of Hawai‘i Department of Health (HDOH) that use of route-to-route extrapolation to estimate interim toxicity factors for chemicals where published factors are lacking is appropriate, especially for volatile chemicals. Chemicals where this approach was used are noted in the footnotes of Table H.

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

Chemicals are subdivided in terms of volatility into the following categories for use in this guidance (see Table H):

- Volatile: Henry's Constant >0.00001 (atm-m^3/mole]) OR VP >1 mm Hg AND molecular weight <200;
- Semivolatile: Henry's Constant >0.00001 (atm-m^3/mole) OR VP >1 mm Hg and molecular weight ≥200;
- Nonvolatile: Henry's Constant ≤0.00001 (atm-m^3/mole) AND VP ≤1 mm Hg.

Soil and groundwater screening levels for vapor intrusion are only developed for "volatile" chemicals as defined above (Tables E-1a and E-1b), although indoor air and subslab soil vapor screening levels are also included for semi-volatile chemicals (Tables E-2 and E-3). Tapwater and soil direct exposure screening levels are calculated using the "volatile" chemical model incorporated into the USEPA RSLs for both "volatile" and "semi-volatile" chemicals (Tables F-3b and K-1 through K-3). Soil and water screening levels for nonvolatile chemicals are generated using alternative models, as discussed below.

1.4 Cumulative Risk

Additive risk due to the potential presence of multiple chemicals with similar target health effects is addressed under Tier 1 through use of conservative target health risks and exposure assumptions (exposure frequency and duration, ingestion and inhalation rates, etc.) and target risk levels. This allows the action levels to be used without the need to evaluate cumulative risk in cases where up to three carcinogens and five noncarcinogens with similar systemic health effects are present.

Exposure assumptions used to develop direct-exposure and indoor-air action levels primarily reflect parameter values presented in USEPA risk assessment guidance for Superfund sites (refer to USEPA 2016). Alternative, and in some cases less conservative, exposure assumptions are presented in the USEPA technical document *Exposure Factors Handbook* (USEPA 2011c), among other examples. For example, recommended inhalation rates for residents are 11.3 m^3/day for women and 15.2 m^3/day for men, in comparison to the value of 20 m^3/day used to develop the direct-exposure action levels presented in this appendix (Section 4). The average time (50th percentile) spent at one residence is also stated to be 9 years, in contrast to the more conservative exposure duration used of 30 years (revised to 26 years in the 2015 USEPA RSL guidance; USEPA 2016a). The average occupational tenure is similarly stated to be 6.6 years, in contrast to the occupational exposure duration used of 25 years. While the more conservative exposure assumptions are still generally recommended for use in site-specific risk assessments, the variance in the assumptions helps to demonstrate the overall conservative nature of the models referenced in this document.

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

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

A cumulative, target Hazard Index of 1.0 is typically used in human health risk assessments for evaluation of noncarcinogenic risks. The USEPA RSLs for soil were developed based on a chemical-specific, target Hazard Quotient of 1.0 (USEPA 2016). To account for potential cumulative effects, the USEPA RSLs for soil are adjusted to a target Hazard Quotient of 0.2 for use in the EAL lookup tables, unless otherwise noted in Section 4 (see also Table I series). This adjustment reflects an assumption that up to five chemicals with the same chronic health effects may be present at a given site. A similar target Hazard Quotient was used by the Massachusetts Department of Environmental Protection (MADEP) (MADEP 1994) and Ontario Ministry of Environment and Energy (MOEE) (MOEE 1996) to develop action levels for direct-exposure concerns. Additional evaluation may be required for sites where more than five chemicals with similar noncarcinogenic health effects are present. For reference, a compilation of chronic health effects for the chemicals listed in the EALs is provided in Table J of this appendix. Risk-based action levels for drinking water (tapwater) are based on a target Hazard Quotient of 1.0 and do not take into account potential cumulative health risks (refer to Section 4.2).

A Hazard Quotient of 1.0 was used for calculation of risk-based action levels for Total Petroleum Hydrocarbons (TPH, see Section 6 and Appendix 6). The TPH parameter considers all compounds within specified carbon ranges. In effect, this partially addresses potential cumulative risk concerns and a less stringent target Hazard Quotient is considered justified. The need to calculate cumulative risks in more detail should be evaluated on a site-by-site basis.

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

2 Background and Use of Vapor Intrusion Models

2.1 Background

This section describes the general approach used to develop vapor intrusion action levels for indoor air, subslab soil vapor, soil and groundwater, presented in Sections 3, 4 and 5 of this document. Indoor air action levels are based on a model used by USEPA to generate Regional Screening Levels (RSLs) for ambient air (USEPA 2016). Subslab soil vapor action levels were developed based on estimations of indoor air exchange rates (IAERs) and building slab vapor entry rates for tropical settings published by Brewer et al. (2014). A copy of the paper is included in Appendix 3. Corresponding vapor intrusion action levels for soil and groundwater were generated using a computer spreadsheet model published by the U.S Environmental Protection Agency (USEPA 2004b and updates).

The USEPA vapor intrusion model incorporates a model presented in the document *Heuristic Model for Predicting the Intrusion Rate of Contaminant Vapors into Buildings* (Johnson and Ettinger, 1991). These models were developed to study radon intrusion into homes but were subsequently modified for use with any volatile chemical. Development of the models included calibration with field data. They are thus based on empirical data and not purely theoretical. Excerpts of key text from the USEPA guidance document is provided in Appendix 3, as is a sensitivity evaluation of the Johnson and Ettinger model.

Refer to Section 4.5 in Volume 1 of this guidance for a basic overview of vapor intrusion. The model considers both diffusive and convective flow of subsurface vapors into buildings. Diffusive flow occurs as soil vapor migrates from areas of higher concentration to areas of lower concentration. Wind effects and indoor heating can cause a decrease in air pressure inside a building and lead to upward, advective flow of subslab vapors through cracks and gaps in the floor. Potential adverse impacts to indoor air are driven by the concentration of volatile organic chemicals (VOCs) in the intruding vapors, the vapor entry rate into the structure and the exchange rate of the building with fresh, outdoor air.

2.2 Vapor Intrusion Model Parameters

Example printouts of the model as used to calculate action levels for this document are included in Appendix 4. Input parameter values used in the models are noted in the

examples (front pages). Default parameters values presented in the spreadsheet technical document were generally selected for use.

2.2.1 Target Risks

Human exposure assumptions were set equal to assumptions used in the USEPA RSLs. Unless otherwise noted in Table E-3. Action levels were calculated using a target risk of 10^{-6} for chemicals with carcinogenic health effects and a target Hazard Quotient of 0.2 for chemicals with noncarcinogenic health effects (1.0 for TPH, see Section 6). For consistency purposes, default physio-chemical constants included in the original, USEPA vapor intrusion models were replaced with constants used in the USEPA RSL models if different (refer to Table H and Appendix 4).

2.2.2 Assumed Building Parameters

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

Default indoor-air exchange rates of one-time per hour for residences and two-times per hour for commercial/industrial buildings were used (see Brewer et al. 2014; directly input into the model). Based on the input building design and volume, this generates an indoor air exchange rate of 225 m^3/hour or 3,750 L/min for a residential home model and 7,500 L/min for a commercial building of the same size (see Appendix 4). The IAERs are assumed to be conservative for the tropical climate of Hawai‘i, where buildings are not heated and windows at homes are often left open year round. Air exchange rates could be lower for homes and buildings that rely on heating, air conditioning and ventilation (HVAC) systems for ventilation. This would result in lower vapor entry rates, however, especially in cases where air conditioning is being used due to over pressurization of lower floors (see Brewer et al. 2014). Assumptions regarding persistent vapor entry due to wind effects and open windows are therefore considered to be conservative.

2.2.3 Assumed Vapor Entry Rate

An annual average, subslab vapor entry rate (Qsoil) of 2 L/min (per 100 m^2 floor area) was incorporated into the vapor intrusion models, based on estimations tropical climates

presented in Brewer et al. (2014). This was generated in the models by inputting "Sand" as the soil type for Layer A soil type and a default value of 20 g/cm-s^2 for the "Soil-Building Pressure Differential" parameter (see Appendix 4). The latter reflects the assumed, annual-average difference between indoor and outdoor air pressures and an under pressurization of the structure. This generates a default vapor flux rate through the building slab of approximately 38 cm^3/second or two liters per minute. **A vapor entry rate of 2 L/min per 100m^2 floor space should be maintained for site-specific models where a larger building size is used unless otherwise approved by HDOH.**

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

The default, annual average vapor entry rates incorporated into the models are intended to reflect an overall lower vapor intrusion risk for buildings in tropical climates in comparison to colder climates, where buildings are heated for much of the year and thus more susceptible to vapor intrusion (see Brewer et al. 2014). Higher, assumed indoor-outdoor pressure differentials and correspondingly higher average vapor entry rates are typically recommended for buildings in colder climates (Brewer et al. 2014; see also USEPA 2004b, 2015a). This would be reflected by a corresponding reduction in soil vapor, soil and groundwater action levels for vapor intrusion. Example modification of HDOH action levels for use in other climate zone is included in Section 13 of the HEER office *Technical Guidance Manual* (HDOH 2016 and updates).

2.2.4 Assumed Indoor Air:Sublsab Soil Vapor Attenuation Factors

A key part of the action levels is the assumed attenuation of subsurface vapors as they intrude a building and mix with indoor air. Shallow soil vapor action levels for vapor intrusion are calculated by dividing the indoor air goal by an Indoor Air:Subslab Soil vapor attenuation factor that reflects dilution of subsurface vapors upon mixing with indoor air:

$$Soil\ Vapor\ Action\ Level = \frac{Indoor\ Air\ Action\ Level}{Subslab\ Attenuation\ Factor}$$

The subslab soil attenuation factor (SSAF) reflects the ratio of the estimated, mean annual vapor entry rate and the mean annual IAER for tropical climates (see Brewer et al. 2014).

$$SSAF = \frac{Vapor\ Entry\ Rate\ (L/min)}{Indoor\ Air\ Exchange\ Rate\ (L/min)}$$

This generates a default, SSAF of approximately 0.0005 (1/2,000) for residential homes and 0.00025 (1/4,000) for commercial and industrial buildings. These attenuation factors are used in Section 3 to calculate subslab vapor intrusion action levels for subslab soil vapor. The default building pressure differential and IAERs are incorporated into the soil and groundwater vapor intrusion models to generate correlative action levels for those media.

Note that the vapor intrusion models used to develop soil and groundwater action levels are not sensitive to the "Soil-Building Pressure Differential" parameter. A reduction or increase in the input pressure differential and the calculated SSAF will not result in a significant change in the action levels. This is because the mass of a VOC entering an overlying structure during a given time period is governed by rate of upward diffusion from the source into the advective zone under the slab, not by the vapor entry rate, and remains unchanged. The mass of VOCs that diffuses into the advective zone and is ultimately drawn into the overlying building over a given time period is unaffected by the vapor entry rate. Reducing the flow rate of vapors under the slab and into the structure by half, for example from 4 L/min to 2 L/min, will result in a doubling of VOC concentrations in vapors under the slab. The volume of vapors entering the building is concurrently reduced by half during the same time period, however, effectively cancelling out the doubling of VOC concentrations in the vapor. This can be observed in the vapor intrusion models by reducing the "Soil-Building Pressure Differential" parameter from 40 to 20 g/cm-s^2. This results in a reduction of the calculated vapor entry rate from approximately 4 L/min to 2 L/min without causing a noticeable change in calculated screening level for a given VOC.

3 Indoor Air and Soil Vapor Action levels

3.1 Introduction

This section describes the development of risk-based action levels for indoor air and subslab soil vapors. Indoor air action levels were developed based on models and exposure assumptions incorporated into the USEPA Regional Screening Levels (RSLs) for ambient air (USEPA 2016). Corresponding action levels for VOCs in subslab soil vapors were estimated based on attenuation factors published by Brewer et al. (2014). These action levels are intended to correlate with and be used in conjunction with vapor intrusion action levels for subsurface soil and groundwater presented in Chapters 4 and 5 respectively.

3.2 Indoor Air Action levels

Indoor air action levels were calculated using the following equation incorporated in the model (see USEPA RSL equations in Appendix 2):

Carcinogens:

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

Noncarcinogens:

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

where:

Cia = Target indoor air concentration;

TR = Target risk (carcinogens);

THQ = Target hazard quotient (noncarcinogens);

ATc = Averaging time for carcinogens;

ATnc = Averaging time for noncarcinogens;

URF = Unit risk factor for carcinogens (carcinogens);

RfC = Reference concentration (noncarcinogens);

EF = Exposure frequency;

ED = Exposure duration;

ET = Exposure time.

Exposure time is expressed in terms of a 24 hour day. An ET of 24hr/24hrs is assumed for residents. An ET of 8hrs/24hrs is assumed for commercial/industrial workers (see Appendix 2). A summary of the indoor-air goals calculated is provided in Table C-3. A target excess cancer risk was of 10^{-6} was used for carcinogenic VOCs. A noncancer, target Hazard Quotient of 0.2 was used for all chemicals except TPH, where a Hazard Quotient of 1.0 was used (refer also to Section 6). Inhalation toxicity factors for volatile chemicals are summarized in Table H.

3.3 Soil Vapor Action levels

Section 2.2.4 describes the development of default, subslab attenuation factors (SSAFs) for subsurface vapors that intrude homes and impact indoor air. A default SSAF of 0.0005 was estimated for residential homes. A default SSAF of 0.00025 was estimated for commercial/industrial structures. The latter assumes better and more consistent ventilation of businesses during normal operating hours.

Soil vapor action levels (C_{sv}) were subsequently calculated as:

$$Csv = \frac{Indoor\ Air\ Action\ Level\ (\mu g/m^3)}{SSAF}$$

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

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

This issue should be evaluated on a site-by-site basis as needed. As a conservative measure, and for the purpose of this screening levels document, it is recommended that indoor-air goals be used as "not-to-exceed" criteria and adjustment of models and soil

vapor to address potential mass-balance not be carried out in the absence of strong site data. This issue is currently under reviewed. Additional information will be incorporated into the EAL document as available.

4 Soil Action levels

4.1 Introduction – Selection of Tier 1 Soil EALs

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

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

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

4.2 Soil Action levels for Direct-Exposure Concerns

4.2.1 Direct Exposure Models and Assumptions

Direct exposure soil action levels for unrestricted land use (referred to in previous editions as "residential"), commercial/industrial-only land use and construction/trench worker exposure are presented in Tables I-1 through I-3, respectively. A summary of the models

and assumptions used to develop the direct-exposure action levels for soil is provided in Appendix 2. Action levels for the Unrestricted Land Use category are based on a standard, residential exposure scenario (refer to Appendix 2). The action levels are considered to be adequate for residential housing, schools, day care and medical facilities, parks and similar sites with sensitive land use. The action levels are intended to be protective of residents and workers who may be exposed to chemicals in exposed soils on regular basis via incidental ingestion, dermal absorption, and inhalation of vapors and particulate matter.

The direct-exposure action levels closely follow the approach used to develop the USEPA RSLs, with the exceptions noted below (RSLs; USEPA 2016). Direct-exposure soil action levels generated for the Unrestricted Land Use category are consistently more stringent (lower) than action levels developed for the commercial/industrial and construction/trench worker exposure scenarios. This is due to the longer, assumed exposure duration (years) and frequency (days per year) as well as the presence of young children in comparison to the latter two scenarios (see Appendix 2). Action levels for construction and trench workers take precedence over action levels based on residential and/or commercial/industrial exposure scenarios if lower. This is indeed the case for several chemicals that in pose an increased risk via inhalation of dust particles, including a number of trace metals as well as some volatile compounds (see Table I-2).

Preliminary Remediation Goals (PRGs) previously published USEPA Region IX included a hybrid, direct-exposure action level for total chromium in soil based on an assumed 1:6 ratio of Cr VI (highly toxic) to Cr III (minimally toxic) (USEPA 2004a). This is not included in more recently published, USEPA RSLs (USEPA 2016) and likewise omitted from the HDOH EALs. The soil action level for total chromium is instead based on an assumed natural background concentration of 500 mg/kg, based primarily based on data for soils developed over basaltic bedrock (refer to Table K). If the reported concentration of total chromium in soil exceeds 500 mg/kg then an additional evaluation of background concentrations in the area should be carried out and/or chromium in the soil should be speciated into Cr III and Cr VI and data compared to action levels for these compounds. Note that background concentrations of total chromium in soils developed over caprock can be lower than 100 mg/kg. If a release of Cr VI is suspected at a site then chromium should be speciated and evaluated, even if total chromium concentrations do not exceed the default action level of 500 mg/kg.

4.2.2 Target Risks

Direct-exposure soil action levels for contaminants that pose carcinogenic health concerns are based on an excess cancer risk of 10^{-6} (one-in-a-million), except as noted below. This follows the approach used in the USEPA RSLs. Action levels for contaminants that pose noncarcinogenic health concerns are based on a target Hazard Quotient of 0.2 unless otherwise noted. The USEPA RSLs for noncancer concerns are in contrast based on a

target Hazard Quotient of 1.0, with a stipulation that cumulative health risks should be estimated at sites where multiple contaminants with similar, chronic health effects are present. In reality this is almost never done. A target Hazard Quotient of 0.2 is used in this guidance to take into account upfront the potential presence of up to five contaminants with the same chronic target health effects at a given site. The incorporation of conservative, target health risks for both cancer and noncancer concerns for development of the direct-exposure action levels negates the need to calculate cumulative health risks at the majority of sites where contaminated soil is identified.

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

Other exceptions to the default target risk of 10^{-6} include direct-exposure action levels for polynuclear aromatic hydrocarbons (PAHs) and PCBs. Low levels of **PAHs** in soil are ubiquitous in urban environments due to auto exhaust and the use of asphalt. Anthropogenic, background concentrations of PAHs in urban area soils due to auto exhaust and other sources can easily exceed risk-based screening levels based on a conservative, excess cancer risk of 10^{-6}. Massachusetts, for example, using a background soil screening level of 2.0 mg/kg for benzo(a)pyrene (MADEP 2002a). A target excess cancer risk of 10^{-4} was therefore used to help screen out low-risk sites and identify sites with potentially significant levels of PAHs above typical urban background. This generates, for example, a residential soil action level of 1.6 mg/kg for benzo(a)pyrene, just below the default screening level used by Massachusetts (refer to Table I-1). A target risk of 10^{-5} was retained, however, for commercial/industrial and construction worker exposure scenarios, since the resulting screening levels are above anticipated background (refer to Tables I-2 and I-3).

Note that concentrations of PAHs in coal tar and older formulations of asphalt and can be orders of magnitude higher that direct-exposure action levels set at a target risk of 10^{-4} Since asphalt is likewise ubiquitous in urban environments, cleanup of soil contaminated with small particles of asphalt that was used in its intended manner is generally not warranted. This exception would not apply to sites where asphalt, coal tar or similar materials was manufactured and disposed of as waste associated with these operations.

A similar approach was taken for **PCBs**. Use of PCBs in transformers, capacitors and other electrical equipment was widespread in the 1960s and 1970s. Although less widespread than PAHs, ambient levels in soil often fall within a target risk range of 10^{-5} and 10^{-6}. In

order to again help focus attention on sites where significant releases of PCBs occurred, a target excess cancer risk of 10^{-5} was used to develop direct-exposure action levels for soil. A target Hazard Quotient of 0.2 for noncarcinogenic effects was retained. Note that noncarcinogenic effects drives human health concerns for PCBs in soils under a residential exposure scenario (refer to Table I-1).

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

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

A target excess cancer risk of 10^{-4} was used for **aldrin** and **dieldrin** was used to reflect low confidence in cancer slope factors and the potency of these chemicals (see update notes in Appendix 9). Updated cancer- and noncancer-based toxicity published by Hooker et al. (2013) were used to develop screening levels. A target noncancer Hazard Quotient of 0.5 was used to reflect the common co-occurrence of these two chemicals in the absence of other contaminants (aldrin used as a termiticide around and beneath older buildings, with dieldrin as a breakdown product).

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

Separate guidance has been prepared for **arsenic** (HDOH 2011b) and **dioxins** (HDOH 2010) in soil. Soil action levels presented in the respective technical memorandums are incorporated into the I-series tables of Appendix 1. Bioaccessibility tests are recommended for site-specific evaluation of arsenic-contaminated soil when the upper background concentration in soil is exceeded (e.g., 24 mg/kg). The World Health Organization Reference Dose used to develop the dioxin action levels incorporates an assumed bioavailability of 50%.

A target noncancer Hazard Quotient of 1.0 was used to generate soil action levels for **thallium** due to the potential for natural, background levels of thallium to exceed the unadjusted, direct-exposure action level (Tier 1 action level 0.78 mg/kg). Naturally occurring thallium in iron-rich, volcanic soils is expected to be tightly bound to the soil and not significantly bioavailable. This is not considered in the direct-exposure models. The potential for a release of highly bioavailable, thallium salts at a site should be evaluated in cases where the Tier 1 action level is exceeded. Based on limited data, natural background levels of thallium in soil could approach 15 mg/kg (HDOH 2011a).

The direct exposure soil action level of 200 mg/kg for **lead** in residential (unrestricted) soil is based on consideration of both health risk and anthropogenic background in urban areas. The current, USEPA residential RSL of 400 mg/kg is intended to reflect a target blood-lead level in children of 10 µg/dl (USEPA 2016). The HDOH action level in part reflects recommendations to reduce the target blood level to 5 µg/dl (USEPA 2011b; USCDC 2012a,b). The model used to calculate soil screening levels for lead is not linear, however (USEPA 2007). Any future, revised USEPA RSL based on the lower blood level is likely to be somewhat lower than the HDOH action level.

A reduction in the soil action level for lead below 200 mg/kg is not practical for heavily developed, urban areas, however. Background, anthropogenic levels of lead in urban soils from past auto exhaust and other sources is estimated to average 75-200 mg/kg and in places far exceed these values (USEPA 1994, 1998). In HDOH's experience, the use of an action level below 200 mg/kg can complicate the identification and characterization of localized contamination that could conceivable be remediated. The HEER office does, however, recommend the inclusion of soil that exceeds the natural background action level for lead of 73 mg/kg (HDOH 2011) in remediation plans when practicable and when the contamination can be attributed to a specific release. In contrast, if sample data indicate a concentration of lead above 200 mg/kg but below the USEPA RSL of 400 mg/kg a specific source cannot be identified then no further action is generally warranted. Capping or other efforts to minimization of exposure of young children should be considered where area-wide impacts above 400 mg/kg lead are identified, regardless of the suspected source.

4.2.3 Exposed or Potentially Exposed Soils

Direct-exposure soil action levels for unrestricted ("residential") land use (Table I-1) and commercial/industrial land use (Table I-2) are based on an assumption that the soil is, or at some time in the future could be, exposed at the ground surface where regular exposure of residents or workers could occur (refer to Section 2.4 in Volume 1). Equations and exposure assumptions used in each scenario are summarized in Appendix 2. For residential properties, it is assumed that soil within 3 meters (approximately 10 feet) of the ground surface could be exposed at the ground surface at some time in the future. For commercial/industrial properties, it is assumed that soil within one meter of the ground

surface could be exposed. This should be reviewed on a site-by-site basis and provisions for long-term management of deeper or otherwise isolated soil made as necessary. As discussed in the next section, risk-based soil action levels for construction/trench workers take precedence over action levels for unrestricted or commercial/industrial land use if lower (refer to next section).

4.2.4 Isolated Soils

By default, soils are assumed to be "isolated" if they are greater than three meters below ground surface in a residential setting and one meter in a commercial/industrial setting (refer to previous section and Section 2.4 of Volume 1). Direct-exposure action levels for deep or otherwise isolated soils are based on the potential exposure of construction and utility workers to contaminants in soil (Table I-3). A summary of exposure assumptions used to generate the action levels is provided in Appendix 2. The exposure assumptions are based on guidance presented in the USEPA Exposure Factor Handbook (USEPA 2011c), trench-worker risk assessment guidance developed by the Massachusetts Department of Environmental Protection (MADEP 1994), general direct-exposure assumptions included in the USEPA RSL document, and professional judgment (see Appendix 2, Table 1). As discussed above, action levels were calculated using a target risk of $1x10^{-5}$ for chemicals with carcinogenic health effects and a target Hazard Quotient of 0.2 for chemicals with noncarcinogenic health effects (0.5 for TPH). A more detailed summary of exposure assumptions and selected parameter values is included in Appendix 2.

As can been seen in Table I-2, soil action levels for construction/trench workers are lower than action levels generated for commercial/industrial exposure for Cr VI and cobalt under the construction/ trench worker scenario. Action levels for these chemicals are more stringent under the construction/trench worker exposure scenario than under the commercial/industrial exposure scenario (see Table I-2). This is due to the combined high oral and/or inhalation toxicity of these chemicals and the assumed higher soil ingestion rate and higher level of air-born dust under the construction/trench worker exposure scenario. As noted in Table I-2, commercial/industrial land use direct-exposure action levels for these chemicals are replaced with construction/trench worker action levels for use in the lookup tables if less stringent.

4.2.5 Soil Saturation Levels

For chemicals that are liquids under ambient conditions, upper limits for soil direct-exposure action levels are set at the chemicals theoretical soil saturation limit or "Csat" (refer to Appendix 2, 2011). As discussed below, soil action levels for volatile chemicals are only valid if they are below the chemicals Csat concentration. Csat concentrations represent an upper limit to the applicability of the soil screening level Volatilization Factor

(VF) model because a basic principle of the model (Henry's Law) does not apply when contaminants are present in free phase (USEPA 1996a, 2002, 2004a, 2011). VF-based inhalation soil screening levels are reliable only if they are at or below Csat. This is discussed in more detail below.

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

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

When Csat is exceeded, the assumed presence of free product violates the use of only the Henry's Law constant used to estimate the concentration of the chemical in soil vapor and subsequently the vapor emission rate at the ground surface. As noted in USEPA risk assessment guidance, the direct-exposure model is no longer valid above this concentration (USEPA 1996a, 2002, 2004b, 2011). Csat is used to set maximum direct-exposure action levels for volatile contaminants in the USEPA RSLs (USEPA 2016) and in past publications of the USEPA Region IX Preliminary Remediation Goals (USEPA 2004a).

Soil vapor data can be used to estimate vapor emission from soil where Csat concentrations of a volatile chemical are exceeded, although direct-exposure models that allow input of soil vapor data have not been published (in preparation by HEER office). Vapor flux at the surface in the presence of free product can also be modeled mathematically. A model to do this is presented in Appendix A of the USEPA vapor intrusion guidance (USEPA 2004b, see Appendix 4). This is incorporated into the USEPA vapor intrusion model but has yet to be included in USEPA direct exposure models for soil (e.g., USEPA 2016; see below). As discussed above for direct-exposure models, the USEPA vapor intrusion model incorporates a chemicals Henry's Law constant to estimate the concentration of the

chemical in soil vapor up to Csat. When a residual phase is present, the vapor concentration is independent of the soil concentration but proportional to the mole fraction of the individual component of the residual phase mixture. At this point, the vapor intrusion model numerically estimates the equilibrium vapor concentration of the chemical in soil vapor for a series of time-steps. For each time-step, the mass of each constituent that is volatilized is calculated using Raoult's Law and the appropriate mole fraction. At the end of each time-step, the total mass lost is subtracted from the initial mass and the mole fractions are recomputed for the next time-step to take into account mass balanced over time. Refer to the USEPA vapor intrusion guidance for additional information.

The 1996 and 2002 editions of USEPA's *Soil Screening Levels* guidance make an apparent error in the conclusion that the emission flux from soil to air for a chemical reaches a plateau when a chemicals Csat concentration in soil has been reached (USEPA 1996a, 2002, "Soil Saturation Limit"). This error is repeated in the recently published USEPA RSLs guidance (USEPA 2016). Each document mistakenly states that Csat represents the concentration *at which soil pore air is saturated with the target contaminant*. This is not the case. As noted above, Csat represents the concentration of the chemical in soil in which the *sorbed- and dissolved-phases* are saturated. Saturation of these phases in the soil does *not* necessarily indicate that the vapor phase of the chemical has reached its maximum, nor that the vapor flux rate at the surface has reached a maximum. The concentration of a chemical in soil vapor at a soil concentration of Csat merely reflects equilibrium conditions with the chemical in soil moisture at the chemicals solubility limit. Saturation of the vapor phase will only occur in the presence of free product in the soil, when the gas phase reaches equilibrium with the *Nonaqueous Phase Liquid* or "NAPL." The concentration of the chemical in the vapor phase at this point is likely to be significantly higher than at the point that the soil moisture has reached the solubility limit of the chemical. This is why the Henry's Law Constant-dependent, vapor flux model incorporated into most soil action level models (including the one used in this guidance) is only valid in the absence of free product in the soil (i.e., concentration of chemical in soil <Csat). This is also the case frequently observed in soil vapor studies, where the concentration of a volatile chemical in soil vapor increases significantly in the presence of free product.

4.3 Soil Action levels for Potential Vapor Intrusion Concerns

Soil action levels for the evaluation of potential vapor intrusion concerns are presented in Table C-1b. As discussed in Chapter 4, the use of soil vapor data and action levels to evaluate this concern is preferred (refer also to Section 7 of the HEER *Technical Guidance Manual*). Vapor intrusion action levels were calculated for both unrestricted ("residential") and commercial/industrial land-use exposure scenarios. Only the action levels for unrestricted land use were carried forward for consideration in compilation of final, Tier 1 EALs (refer to Table A and B series).

A spreadsheet included with guidance published by the U.S. Environmental Protection Agency (USEPA 2004) was used to generate soil action levels for potential vapor intrusion concerns. A summary of these action levels is provided in Table C-1b. Correlative soil vapor action levels are provided in Table C-2. Target indoor air goals are provided in Table C-3. Target groundwater action levels for vapor intrusion hazards are presented in Table C-1a.

As discussed in Section 2, the spreadsheet is based on a model presented in the paper *Heuristic Model for Predicting the Intrusion Rate of Contaminant Vapors into Buildings* (Johnson and Ettinger 1991). The model considers both diffusive and convective flow of subsurface vapors into buildings. Summary text from the guidance document accompanying the spreadsheet is provided in Appendix 3, as is a sensitivity evaluation of the Johnson and Ettinger model. Example printouts of the model as used to calculate action levels for this document are included in Appendix 4. A more detailed discussion of models is provided in Section 5.4 for correlative groundwater action levels.

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

A default Soil-Building Pressure Differential of 20g/cm-s^2 was used. This generates a target vapor entry rate through the building slab of approximately 38 cm^3/second or two liters per minute (refer to Section 2.2.3).

For nonchlorinated VOCs, field experience suggests that the vapor intrusion model typically overestimates in vapor-phase concentrations of these chemicals by an order of magnitude or more, due in part to high rates of natural biodegradation. Evaluation of this issue is ongoing. To address this in the lookup tables, soil action levels generated with the model were adjusted upwards by a factor of 10 (see Table C-1b). Collection of soil vapor data and concurrent use of soil vapor action levels for vapor intrusion concerns is strongly recommended for sites where this pathway may be of significant concern.

The spreadsheet calculates the theoretical emission rate of a chemical into an overlying building based on the properties of the chemical and the soil type. For highly volatile

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

The same action levels developed for shallow soils should be applied to deep soils for initial, screening surfaces. While conservative, the parameter for depth to impacted soil does not significantly control calculated action levels for soils within 5 to 10 meters of the ground surface. As discussed in Volume 1, the collection of soil vapor data is preferred over the use of models for more detailed evaluations of vapor intrusion hazards.

4.4 Soil Action levels for Leaching Hazards

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

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

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

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

where: DAF = SESOIL-based dilution/attenuation factor;
H = Henry's Law Constant (atm-m^3/mol);
Koc = Organic carbon partition coefficient (cm^3/g);
C_{soil} = Leaching based soil concentration (mg/kg);
C_{gw} = Target groundwater action level (µg/L).

The term DAF is defined for the purposes of the model as the concentration of the contaminant in soil (in mg/kg) divided by the concentration of the contaminant in

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

SESOIL models the generation and downward migration of leachate in the vadose zone. The AT123D application models the mixing of leachate with groundwater immediately below the impacted area. A more detailed discussion of the derivation and application of the SESOIL/AT123D algorithm as modified by the Massachusetts DEP and adopted for use by the Ontario MOEE is provided in Appendix 5. The algorithm is based on a three-meter thick vadose zone characterized by one meter of impacted soil sandwiched between two one-meter thick layers of clean soil. The lower layer immediately overlies groundwater. All vadose-zone soil is conservatively assumed to be very permeable sand that freely allows the migration of leachate to groundwater. The organic carbon content of the soil is assumed to be 0.1%. (Note that this is more conservative than the 0.6% organic carbon content assumed in the direct-exposure models.) Mixing with groundwater is modeled over a 10-meter by 10-meter area. Use of a thicker assumed sequence of impacted soil would not significantly alter the results of the model given the assumed one-meter depth to groundwater.

The model assumes an annual rainfall of 1,100 mm (approximately 43 inches). A total of 720 mm (28 inches) of the total rainfall is assumed to infiltrate the ground surface and reach groundwater (assumed to be conservative for the majority of developed areas in Hawai‘i). This is assumed to also be adequate for higher rainfall areas, although a site-specific evaluation may be required for large (e.g., > one-half acre) areas of contaminated soil with persistent and highly mobile chemicals. Biodegradation during migration of leachate to groundwater is not considered. This could cause the model to be especially over conservative for non-chlorinated, petroleum compounds. The model does, however, allow for resorption and volatilization of chemicals from the leachate during migration based on the physio-chemical properties of the chemical and the assumed soil properties. Groundwater is assumed to flow at a moderate rate of approximately 73m (240 feet) per year. The concentration of a chemical in leachate is assumed to be further reduced upon mixing of the leachate with groundwater (dilution factor approximately 3).

For moderately volatile and sorptive chemicals (e.g., benzene), action levels developed using the SESOIL-derived algorithm are similar to action levels generated using the full SESOIL application under a scenario where impacted soil is within a few meters of groundwater (e.g., HDOH 1995, carried out by the principal editor of this document). Comparison to action levels developed by full but still conservative use of SESOIL

suggests, however, that the simplified algorithm may be excessively conservative in the following cases:

- Leaching of highly volatile chemicals (e.g., vinyl chloride);
- Leaching of highly sorptive chemicals (e.g., PAHs);
- Leaching of highly biodegradable chemicals (e.g., common petroleum compounds);
- Sites where the depth to groundwater is greater than 10 meters below the base of the impacted soil.

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

SESOIL modeling carried out by the Hawai'i Department of Health (HIDOH 1995) and site-specific, SPLP soil batch test carried out by consultants and HDOH between 2005 and 2011 (see Fall 2011 update memo in Appendix 9) suggested that chemicals with sorption coefficients greater than 30,000 cm^3/g will be essentially immobile in the surface under normal soil conditions and not likely to impact groundwater. The SESOIL models were run conservatively assuming an annual rainfall of 400 cm/year (158 inches/year), an infiltration rate of 144 cm/year (57 inches/year) and very permeable soil overlying fractured bedrock.

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

The majority of PCBs releases are related to 1242 to 1260 range Arochlors or similar mixtures. The default koc of 33,000 cm^3/g presented in Table H was considered to be adequately conservative for this range and used in the leaching model. For less chlorinated

PCB mixtures, a site-specific evaluation of potential leaching concerns and even possible vapor emission concerns is required.

Leaching based action levels were generated only for chemicals considered to be significantly soluble and mobile in groundwater under normal, ambient conditions (e.g., pH 5.0 to 9.0 and normal redox conditions). Leaching-based soil action levels were not developed for metals. Leaching of metals from soil is highly dependent on the species of the metal present and the geochemical nature of the soil. At sites where physio-chemical conditions may promote enhanced leaching of metals and other chemicals from soils or waste piles (e.g., mining related wastes), the use of laboratory-based leaching tests is recommended (refer to Section 4.2.3 in Volume 1).

Leaching based soil action levels were developed for perchlorate (ClO4). Perchlorate, a salt, is not significantly sorptive, volatile or biodegradable under normal conditions. Use of the SESOIL/AT123D algorithm was therefore not considered appropriate. As an alternative, a simple, chemical partitioning model presented in the USEPA *Soil Screening Level Guidance* document was referred to (USEPA 2002):

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

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

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

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

The default water-filled porosity in the models is 0.15 and the default soil bulk density is 1.5. Based on groundwater action levels for perchlorate of 3.6 µg/L for drinking water resources and 600 µg/L for non-drinking water resources (refer to Tables D-1a and D-1b), leaching based soil action levels of 0.00036 mg/kg and 0.06 mg/kg are generated, respectively. A dilution/attenuation factor of 20 was incorporated to account for mixing of leachate with groundwater (USEPA 2002). This yielded final soil action levels for leaching concerns for perchlorate of 0.007 mg/kg and 1.2 mg/kg (refer to Table E). Laboratory-based tests are recommended for more site-specific analysis of potential leaching of perchlorate from soil (refer to Chapter 4 in Volume 1).

4.5 Soil Ceiling Levels for Gross Contamination Concerns

Ceiling levels for gross contamination concerns are presented in each of the EAL summary tables for soil. These action levels are intended to be protective against odor and other nuisance and aesthetic concerns, as well as restrict the presence of potentially mobile, free product and limit the overall degradation of soil quality (i.e., "gross contamination"). The selection of soil ceiling levels was based on methods originally published by the Massachusetts DEP (MADEP 1994) and also used by the Ontario MOEE (MOEE 1996), as described in the Table F series of this appendix. Only the gross contamination action levels for shallow, exposed soils are carried forward for consideration in the Tier 1 EALs (refer to Table A and B series). Alternative action levels for isolated or deeper soils are provided for reference in site-specific Environmental Hazard Evaluations as needed.

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

4.6 Soil Action levels for Terrestrial Ecotoxicity

Soil action levels for the protection of terrestrial flora and fauna were included in 2009 and earlier edition of the HEER office EALs. The action levels were taken directly from guidance developed by the Ontario MOEE (MOEE 1996). Action levels were available for heavy metals and a small number of high-molecular-weight organic compounds and

pesticides. Action levels for both unrestricted ("residential") and commercial/industrial land use scenarios were presented, although only the unrestricted land use action levels are considered in the Tier 1 EALs. Alternative action levels for commercial/industrial land use were provided for reference in site-specific Environmental Hazard Evaluations as needed.

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

5 Groundwater and Surface Water Action Levels

5.1 Introduction

Action levels for groundwater are summarized in the "D" series of tables at the end of this appendix. A discuss of individual concerns considered in the action levels is provided in this Chapter and summarized below. For the purpose of developing Tier 1 action levels, it is assumed that all groundwater could at some point in time potentially discharge to a body of surface water. Discharge could occur through natural processes (e.g., natural discharge of groundwater to a stream, river, lake, wetland, bay, etc. via springs) or through human activities (e.g., pumping and discharge of groundwater at remediation or construction dewatering projects).

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

As discussed below, groundwater action levels for potential discharges to aquatic habitats consider chronic surface water quality goals for sites within 150m of a surface water body and acute goals for sites >150m from a surface water body. Although not used for groundwater action levels, HDOH standards for the potential bioaccumulation of contaminants in aquatic organisms and subsequent consumption of the organisms by humans must be used to evaluate actual impacts to a body of surface water. A summary of these standards is provided in Table D-3f for reference.

Groundwater action levels should be compared to dissolved-phase chemical concentrations unless instructed by the overseeing regulatory agency. This may require filtering of turbid samples (refer to Section 6 of the HEER Office *Technical Guidance Manual*). Filtering should not be carried out on samples to be tested for volatile chemicals.

5.2 Action levels for Drinking Water (Toxicity)

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

- HDOH Maximum Contaminant Level;
- USPEPA Primary Maximum Contaminant Level;
- Risk-based goal based on USEPA Region IX Tapwater model.

HDOH and/or USEPA Primary Maximum Contaminant Level (MCLs) are available for approximately half of the chemicals listed in the lookup tables (HDOH 2002; USEPA 2006). Although numerous factors are taken into account in development of primary MCLs (toxicity, detection limits, attainability, etc.), these standards are primarily intended to address toxicity to humans in drinking water supplies and are used for this purpose in this document.

For chemicals where Primary MCLs have not been promulgated, a tapwater model presented in the USEPA RSLs (RSL) document (USEPA 2016) was used to calculate alternative drinking water goals (Table D-4). Toxicity factors and physiochemical constants published in the 2011 USEPA RSLs were used to develop the action levels with the exceptions noted in Table H (refer to Section 1.3). The action levels are based on a target excess cancer risk of 10^{-6} and a target Hazard Quotient for noncancer concerns of 1.0. Note that the noncancer action levels in particular may not be adequate to address potential cumulative risks concerns. The need to evaluate cumulative risks should be determined on a site-by-site basis (refer to Chapter 4 of Volume 1).

For volatile chemicals, the tapwater goals take into account uptake via inhalation of vapors during showering and other activities in addition to toxicity via normal ingestion of drinking water. Goals for nonvolatile chemicals are based on ingestion only. Equations for the USEPA RSLs for tapwater are included in Appendix 2. Risk-based goals for noncarcinogenic effects take precedence over goals for carcinogenic effects if lower. Note that the more recent RSL tapwater model includes an additional and complicated component for dermal absorption of VOCs during water use. Risk posed by exposure to VOCs in drinking water is largely driven by ingestion, however, and to a lesser extent inhalation. The inclusion of a dermal absorption pathway in the model does not significantly alter the resulting screening level and was not incorporated into the ESL model.

Drinking water goals intended to address taste and odor concerns (e.g., Secondary MCLs) take precedence if lower than toxicity-based goals. For example, the USEPA Primary MCL for xylenes is 10,000 µg/L. The USEPA Secondary MCL for xylenes is only 20 µg/L, however. The latter value should be (and is) used as the groundwater action level for drinking water concerns. This is discussed under ceiling levels for groundwater (see Section 5.5).

5.3 Action levels for Aquatic Habitat Protection

5.3.1 Basis of Action Levels

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

5.3.2 Surface Water Aquatic Habitat Goals

A summary of aquatic habitat goals considered for use in this document is provided in Tables D-3a and D-3b. Separate goals were compiled for freshwater and saltwater habitats.

The goals reflect a compilation of standards formally promulgated in state law by HDOH and goals published by USEPA and other sources. Formal standards have not been promulgated for the majority of chemicals listed. Final goals were selected based on the following order of preference and availability, unless otherwise noted in Table D-4f:

- HDOH Surface Water Standard (HDOH 2012b);
- USEPA Region 4 (USEPA 2015c);
- USEPA Office of Pesticides (USEPA 2016b);
- USGS National Water Quality Program (USGS 2012);
- U.S. Department of Energy (USDOE 1996);
- Ontario MOEE (MOEE 1996);
- USEPA AQUIRE database (USEPA 2008b);
- Toxicity-based drinking water goal.

An exception to this approach is the use of a general, acute aquatic toxicity action level of 300 µg/L published by the Canadian Council of Ministers of the Environment (CCME) for semivolatile PAHs, excluding naphthalenes (CCME 2002; refer to Table D-4e). Goals provided in each reference are generally based on dissolved-phase concentrations of the chemicals in water. Goals for arsenic, chromium III, chromium VI, lead, mercury, nickel, selenium, silver and zinc are, however, based on total concentrations (see USEPA 2015c).

The USEPA AQUIRE ECOTOX database of ecotoxicity studies was referred to for chemicals with no published aquatic habitat goals, primarily a small number of pesticides (USEPA 2008b). Emphasis was placed 96 hour-duration aquatic animal studies (48 hours for daphnia studies). Modification factors in general followed recommendations and methods provided in the USEPA Great Lakes water quality initiative guidance (USEPA 1995). Goals provided in each reference are generally based on dissolved-phase concentrations of the chemicals in water.

Note that many if not most of the referenced aquatic ecotoxicity action levels focus on toxicity to fish and benthic organisms. Action levels based on toxicity to aquatic plants could be lower. A more site-specific evaluation of this issue should be considered where discharges of impacted groundwater might adversely affect aquatic plants.

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

Chronic and acute surface water standards specific to Hawaii are presented in the Hawaii Administrative Rules, Title 11, Chapter 54, Section 11-54-04: Basic Water Quality Criteria (HDOH 2012b). Surface water standards for potential bioaccumulation of chemicals in aquatic organisms and subsequent human consumption of these organisms are presented in Table D-4f. Both Hawaii and Federal standards are given. Aquatic toxicity action levels presented in Table D-4e that include a component of bioaccumulation and potential impacts to predators are noted in red (see USEPA 2015c).

5.3.3 Groundwater Action levels for Aquatic Habitat Impacts

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

Dilution of groundwater upon discharge to surface water was not considered in the selection of groundwater action levels for aquatic habitat protection. Benthic organisms were assumed to be exposed to the full concentration of chemicals in impacted groundwater prior to mixing of the groundwater with surface water. Potential dilution of groundwater upon discharge to surface water or in groundwater "mixing zones" adjacent to shorelines areas was therefore not appropriate for development of conservative action levels. Adjustment of the final groundwater action levels with respect to potential dilution may, however, be appropriate on a site-specific basis (e.g., no significant benthic habitat present, see Volume 1, Section 4.3).

Note that natural background concentrations of boron, copper, lead, mercury, selenium, thallium and zinc among other metals could exceed groundwater action levels presented in the lookup tables. This issue should be evaluated on a site-by-site basis and discussed with HDOH where necessary. This potential issue has been noted for shallow groundwater in caprock sediments around the islands, although data are too sparse to prepare a strong summary.

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

5.4 Groundwater Action levels for Potential Vapor Intrusion Concerns

5.4.1 Vapor Intrusion Model Parameters

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

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

Default building parameters including anticipated IAERs and vapor entry rates are discussed in Section 2. The same building characteristic assumptions are used to develop action levels for subslab soil vapor, soil and groundwater. In particular, a default Soil-Building Pressure Differential of 20g/cm-s^2 was incorporated into the model. This generates a targeted vapor entry rate through the building slab of approximately 38 cm^3/second or 2 L/min (refer to Section 2.2.3). This, combined with the default, input IAERs for residential versus commercial/industrial settings, is used to generate a targeted SSAF for the intrusion and mixing of vapors into the overlying building. The SSAF subsequently plays an important role in generation of corresponding vapor intrusion action levels for VOCs in underlying groundwater.

For the purposes of this document, the vadose-zone soil profile overlying groundwater is modeled as one meter of coarse-grained, dry, sandy soil (S) overlying two meters of somewhat more moist clayey loam (CL, 1/3 sand, 1/3 silt, 1/3 clay). This is considered to be representative of fill material commonly placed beneath the slabs of new buildings. "Sand" is defined as material that is equal to or greater than 0.075 mm in diameter (i.e., will not pass through a U.S. Standard 200 mesh sieve). Silt and clay are defined as material that is less than 0.075 mm in diameter (i.e., will pass through a U.S. Standard 200 mesh sieve). These definitions are consistent with default parameter values for soil types presented in the USEPA model (USEPA 2004). The depth from the ground surface to the top of impacted groundwater in both sets of models was assumed to be 3.0m. This is just above the minimum thickness allowed for modeling of vapor transport through a low to moderate permeability vadose-zone soil profile, due to capillary fringe height constraints.

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

Input soil parameter values for total porosity, water-filled porosity and fraction organic carbon for the upper portion of the soil profiles were set equal to values used by USEPA in development of the RSLs (USEPA 2016). Soil moisture was assumed to be somewhat higher for the lower soil units than the upper units, at 0.30 (vs 0.15), consistent with the default recommended in the USEPA vapor intrusion guidance document. Default values presented in the spreadsheet were used for remaining soil properties.

Default soil vapor permeability values for the selected soil types were used in the models. For site-specific estimation of this parameter, the use of rigorous, in-situ methods intended

for the design of soil vapor extraction systems is recommended. Secondary porosity and permeability in fine-grained soils can be significantly enhanced by plant roots, desiccation cracks, disturbance during redevelopment, faulting, etc. Reliance on a small number of borings or laboratory analysis could significantly underestimate the actual vapor permeability of the site and in turn underestimate the risk of potential impacts to indoor air.

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

5.4.2 Adjustment of Action levels

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

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

5.5 Water Ceiling Levels for Gross Contamination Concerns

Ceiling levels based on gross contamination concerns for surface water and groundwater are summarized in the Table G series. Ceiling levels for surface water and groundwater that is considered to be a current or potential source of drinking water are based on the lowest of the chemicals taste and odor threshold (e.g., Secondary MCLs), one-half the solubility and a maximum of 50000 µg/L for any chemical based on general resource degradation concerns (Tables G-1 and G-4, after MADEP 1994). Taste and odor thresholds for drinking water were selected in the following order of preference and availability:

- HDOH Secondary MCLs (HDOH 2002);
- USEPA Secondary MCLs;
- California Department of Health Services Taste and Odor Action Levels;
- Taste and odor levels developed by Amoore and Hautala (as presented in Central Valley Regional Water Quality Control [RWQCBCV] 2007);
- Odor thresholds presented in Massachusetts DEP (MADEP 1994) and Ontario MOEE (MOEE 1996) guidance documents and other published reports (e.g., Young et al 1996).

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

Ceiling levels for surface water and groundwater that is NOT considered to be a current or potential source of drinking water were selected in a similar manner with the exception that the drinking water taste and odor thresholds were replaced with general nuisance thresholds and gross contamination concerns (Tables G-2 and G-4). Nuisance thresholds are intended to reflect the concentration at which a chemical in water poses unacceptable odor problems or sheens.

Thresholds presented in the Massachusetts DEP and Ontario MOEE guidance documents were used as the primary sources of data. Taste and odor levels developed by Amoore and Hautala (in RWQCBCV 2007) were referred to for chemicals that lack odor thresholds in the Ontario guidance, although conservative considerations for drinking water concerns could cause these criteria to be overly stringent. It is apparent, however, that similar sources were used to develop both the Ontario MOEE and the Amoore and Hautala databases (compare Tables G-1 and G-2). In keeping with the Ontario and Massachusetts guidance documents, a ten-fold dilution/attenuation of chemical concentrations in groundwater upon discharge to surface water was assumed (non-drinking water resources, gross contamination action levels only). The potential for an adverse buildup of

contaminants in sediment over time through long-term discharges of contaminated groundwater should be evaluated on a case-by-case basis (e.g., sorption and buildup of dissolved-phase petroleum onto organic material in sediment over time).

The nuisance threshold for methyl tertiary butyl ether (MTBE) is based on average, upper range at which most subjects in a USEPA study could smell MTBE in water (180 µg/L), as summarized in the public health goals document for MTBE prepared by Cal EPA (CalEPA 1999a). This was selected as a nuisance action level for MTBE in surface water. Assuming a dilution factor of ten yields the odor threshold of 1,800 µg/L for groundwater.

5.6 Other Groundwater Action levels

Additional action levels for groundwater provided in the California EPA technical document *A Compilation of Water Quality Goals* include USEPA and National Academy of Sciences "Suggested No-Adverse-Response (SNARL)" goals for toxicity other than cancer risk and "Agricultural Water Quality" goals developed by the United Nations (RWQCBCV 2007). The SNARL goals largely duplicate risk-based action levels for drinking water presented in Table D-3. Agricultural Water Quality goals for 12 metals are provided in Table D-5. These goals were not considered in the final lookup tables but may need to be considered on a site-specific basis. The agricultural goals are higher than action levels for both drinking water and surface water protection for 7 of the 12 metals listed. Agricultural goals for copper, cobalt, selenium and zinc are higher than goals for aquatic habitat protection but are lower than goals for drinking water (i.e., drinking water goals may not be adequately protective for irrigation use). The agricultural goal for molybdenum is lower than both the drinking water goal and the surface water goal for this metal. The development of these goals was not reviewed for preparation of the EAL document.

Table 5-1. Environmental concerns considered in groundwater action levels.

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

6 Soil, Soil vapor and Groundwater Action Levels for TPH

6.1 Introduction

Petroleum is a complex mixture of hundreds of different compounds composed of hydrogen and carbon (i.e., "hydrocarbon" compounds). The carbon range makeup of common petroleum fuels is noted in Figure 3. Non-specific, aliphatic and aromatic compounds and related degradation compounds make up the overwhelming majority of the mass in fuels and in vapors emitted from fuels (see Appendix 6). These compound and related, degradation compounds are collectively measured and assessed at "Total Petroleum Hydrocarbons or "TPH" (refer to Volume 1, Section 2.6.1). Risk to human health and the environmental posed by petroleum releases is evaluated in terms of both TPH and individual, "indicator" compounds such as benzene, toluene, ethylbenzene and xylenes (BTEX) as well as naphthalene and other targeted polyaromatic hydrocarbons (PAHs). The latter only make up a small percentage of the total mass in fuels and in vapors but can pose a significant risk due to their higher toxicity.

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

The development of risk-based action levels for TPH in soil, soil vapor and groundwater is described below. For the purposes of this document, petroleum mixtures are subdivided into "gasolines", "middles distillates" and "residual fuels", following the methodology used by the American Petroleum Institute (API 1994). Middle distillates include common diesel fuel, kerosene and jet fuels such as JP-8. The action levels are based on the assumed carbon range makeup of fuel types and associated vapors in conjunction with carbon range-specific toxicity factors published by USEPA and Massachusetts, among other agencies.

Several published documents were available to select a default, carbon range makeup of different fuel types (e.g., TPHCWG 1998, MADEP 1997, 2003). Published data on the carbon range makeup and toxicity of vapors associated with petroleum fuels are limited.

In 2011, the HEER office carried out a soil vapor study of key, petroleum-contaminated sites in Hawai‘i to help fill this data gap and updated the environmental hazard evaluation (EHE) guidance and associated TPH EALs (HDOH 2012a). The results of that study are summarized below. A paper published on the study (Brewer et al. 2013) and an overview of common questions regarding TPH are included in Appendix 6.

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

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

As discussed in the Volume 1, the use of EALs as final "cleanup levels" for petroleum-related compounds that are known to be highly biodegradable may be unnecessarily conservative. This is especially true for TPH and petroleum-related compounds. Final cleanup levels should be evaluated on a site-specific basis and in conjunction with guidance from the overseeing regulatory agency (e.g., refer to HDOH 2007).

6.2 TPH Carbon Range Makeup of Fuels and Fuel Vapors

A summary of the selected, default carbon range TPH makeup of fuels and fuel vapors is provided in Table 6-2. This was used in combination with carbon range toxicity factors published by USEPA and other agencies to developed risk-based action levels for TPH in indoor air, soil vapor, soil and groundwater. A copy of the paper published on the 2011 HDOH soil vapor study is provided in Appendix 6 (Brewer et al. 1013).

A detailed review of the chemistry and carbon range makeup of different petroleum fuel types is presented in guidance published by the Total Petroleum Hydrocarbon Working

Group (TPHCWG 1998). Summaries have also been published by several states, including Massachusetts (MADEP 1997, 2003) and Indiana (IDEM 2010). A brief overview is provided below, with a focus on gasoline, #2 diesel fuel and residual fuels such as motor oil.

6.2.1 Gasolines

Gasolines are defined as petroleum mixtures characterized by a predominance of branched alkanes and aromatic hydrocarbons with carbon ranges of C6 to C12 and lesser amounts of straight-chain alkanes, alkenes and cycloalkanes of the same carbon range (TPHCWG 1998). Based on information published by the State of Indiana, a relative TPH carbon range makeup of gasoline fuels (not including BTEX, naphthalene and other individual, targeted compounds) of 45% C5-C8 aliphatics, 12% C9-C12 aliphatics and 43% C9-C12 aromatics was selected for development of TPHgasoline action levels for soil and groundwater (see Table 6-2a). Separately targeted, individual such as BTEX and naphthalene generally do not make up more than 5% of gasoline fuels in Hawai‘i. Other compounds such as MTBE are not added in significant quantities.

An assumed TPH carbon range makeup of vapors associated with gasolines of 77.3% C5-C8 aliphatics, 7.3% C9-C12 aliphatics and 15.4% C9-C10 aromatics was selected for development of TPHgasoline soil gas screening levels. This is based on the median carbon range composition of gasoline vapors published in the USEPA Petroleum Vapor Intrusion database (see Table 6-2b; Brewer et al. 2013; see also USEPA 2012). A much great dominance of gasoline vapors by C5-C8 aliphatics has been reported by other entities (e.g., BioVapor 2010). The higher, relative proportions of longer chain aliphatics and heavier aromatics in the USEPA database could be due to weathering, inadvertent inclusion of vapor data from middle distillate release sites and/or the incorporation of volatile metabolites in the data. The latter issue has not been studied in detail.

Vapors associated with fresh gasoline are dominated by C2-C4 aliphatics and C5-C8 aliphatics, with only a minor component (<5%) of BTEX and non-specific aromatic compounds (see Appendix 6). Vapors associated with weathered fuel, as is the case at most gasoline-release sites, are dominated by C5-C8 aliphatics with little to no C2-C4 aliphatics remaining and again a relatively minor component of BTEX and non-specific aromatic compounds (see Appendix 6; may differ on the mainland due to local gasoline formulations). The C2-C4 aliphatics primarily pose explosion hazards. Chronic toxicity factors have not been developed for these compounds.

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

preferential loss of benzene). The ratio of TPH to benzene can be much higher at releases of more recent (post 2005) release of low-benzene gasoline (see Brewer et al 2013).

6.2.2 Middle Distillates

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

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

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

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

subsequently under represent the potential vapor intrusion hazard posed by the contamination.

In order to address this potential concern HDOH collected TO-17 sorbent tube soil vapor samples at five key petroleum sites as part of its TPH vapor study (see HDOH 2012a). The TO-17 samples allowed full capture and extraction of the full range of petroleum compounds present in the soil vapor. The samples were collected by drawing a fixed volume of soil vapor (e.g., 50ml) through a narrow tube filed with a carbon-based sorbent material (see Appendix 6). Summa canister samples were also collected at the sites for comparison. The laboratory extracts and measures the mass of targeted VOCs captured by the sorbent material. Dividing this by the volume of soil vapor (or air) drawn through the tube yields the original concentration of the individual VOC in the soil vapor..

Soil vapor data collected by HDOH at several middle distillate release sites in Hawai‘i revealed wide variations in the ratio of C5-C8 and C9-C12+ aliphatic compounds between and even within sites (HDOH 2012a; Brewer et al. 2013; see Appendix 6). In some cases C9-C12+ aliphatics dominated, in agreement with published chromatograms for headspace samples over diesel fuel (e.g. Hayes 2007, NCFS 2011). In other cases C5-C8 aliphatics dominated. This may have been in part due to mixing of vapors with nearby gasoline releases and/or the breakdown of longer-chain aliphatics into shorter chain aliphatics at more weather sites. Vapor samples collected over fresh fuels were likewise mixed (see Appendix 6), although it is suspected that the fuel associated with the sample that reported a higher proportion of C5-C8 aliphatics may have been excessively warmed in the sun prior to collection of the vapor sample. The distinct presence of C9-C12+ aliphatics in the soil vapor samples, however, clearly distinguishes sites with middle distillate contamination from gasoline-release sites.

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

Small amounts of BTEX and naphthalene were reported in vapor samples collected over fresh fuel. Benzene, naphthalene and other aromatic compounds were present in only trace amounts in soil vapor samples collected at targeted middle distillate release sites, however (generally <0.1%). The ratio of TPH to benzene was typically greater than 1,000:1 and in some cases over 10,000:1. Non-specific aliphatics clearly drove vapor intrusion risks at these sites over individual compounds such as benzene and naphthalene. Testing for only the latter in the soil vapor samples would have significantly underestimated the vapor intrusion risk.

6.2.3 Residual Fuels Distillates

Residual fuels (e.g., Fuel Oil Nos. 4, 5, and 6, lubricating oils, "waste oils", "oil and grease," asphalts, etc.) are characterized complex, polar PAHs, naphthenoaromatics, asphaltenes and other high-molecular-weight, saturated hydrocarbon compounds with carbon ranges that in general fall between C24 and C40. Published data on the specific, aliphatic and aromatic makeup of the TPH fraction of residual fuels after subtracting individual, targeted PAH compounds was not identified for use in this guidance but is expected to vary widely between different products and wastes.

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

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

comparison to gasoline- and even diesel-contaminated sites (with the exception of MGP site). Methane buildup may also be a concern at heavy fuel release sites.

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

6.3 Carbon Range TPH Toxicity Factors and Physiochemical Constants

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

Weighted RfC ($\mu g/m^3$) =

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

Weighted RfD (mg/kg-day) =

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

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

Weighted, inhalation Reference Concentrations of 571 µg/m^3 and 126 µg/m^3 were calculated for TPHgasolines and TPHmiddle distillates, respectively.

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

6.4 TPH Action Levels for Indoor Air and Soil vapor

Preliminary, risk-based action levels for TPHgasolines and TPH middle distillates in indoor air and soil vapor as were calculated in the same manner as done for other volatile chemicals but with the use of a target, noncancer Hazard Quotient of 1.0 (see above and equations in Appendix 2). An indoor action level of 290 µg/m^3 was calculated for TPHgasolines. An indoor action level of 130 µg/m^3 was calculated for TPHmiddle distillates. Soil vapor action levels were calculated using the default, Indoor Air:Soil vapor attenuation factors discussed in Section 2 (Residential: 1/2,000, Commercial/Industrial: 1/4,000). This generates residential soil vapor action levels of 590,000 µg/m^3 for TPHgasolines and 260,000 µg/m^3 for TPHmiddle distillates (Table 6-5; soil vapor action levels for carbon ranges also provided). Commercial/Industrial action levels are much higher-4,900,000 µg/m^3 for TPHgasolines and 2,200,000 µg/m^3 for TPHmiddle distillates. This is due to both an adult-only exposure scenario and an average, daily exposure time of 8 hours instead of 24 hours (see Appendix 2).

Petroleum release sites often contain a mix of fuels. Vapors in soil vapor could likewise be a mix of several fuel types. Applying soil vapor (and indoor air) action levels for gasolines versus middle distillate fuels is therefore not straightforward. The default, carbon range makeup assumed in the action levels can be re-evaluated on a site-specific basis as needed. Note also that the TPH indoor air action levels could be below ambient background levels for indoor and outdoor air, due to the use of petroleum-based cleaners, auto exhaust, etc.

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

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

6.5 TPH Action Levels for Soil

6.5.1 TPH (gasolines, middle distillates)

Risk-based, direct-exposure action levels for TPHgasolines and TPHmiddle distillates in soil can be calculated in the same manner as done for individual chemicals, using the toxicity factors noted above and physiochemical constants noted in Table H (see Chapter 4). The model calculated residential direct-exposure soil action levels of 250 mg/kg and 260 mg/kg using this approach. These action levels are highly conservative, in that they do not address biodegradation of TPH in soil over time. This is especially true for especially soil exposed at the surface.

As discussed in Chapter 4, maximum, direct-exposure action levels for volatile liquids in soil are normally set equal to the contaminants theoretical soil saturation level or Csat. This represents the concentration above which the contaminant can no longer be sorbed to soil particles (e.g., organic carbon or clay) or dissolved into the soil moisture (e.g., solubility limits reached). Above this concentration, free product will be present in the soil. This is important because the validity of the USEPA model used to calculate action levels for direct-exposure hazards above the Csat concentration for volatile chemicals is questinable (refer to Section 4.2.5). Maximum, direct-exposure action levels for volatile liquids in soil are therefore in general set to the chemical Csat concentration (e.g., refer to xylene action levels in Table I series).

This approach was used to establish Csat and maximum direct-exposure action levels for TPHgasolines (5,400 mg/kg; e.g., refer to Table I series). For TPH as middle distillates (e.g., diesel) the theoretical Csat concentration is much lower – 150mg/kg. This is due to the assumed, lower solubility of diesel and related middle distillate fuels (5 mg/L vs 150 mg/L for TPHgasoline, refer to Table H). Confidence in the Csat value of 150 mg/kg is low, however, and this value is considered to be excessively conservative for use as a maximum, direct exposure action level. The use of alternative approaches to evaluate direct-exposure hazards posed by TPHmiddle distillates and other volatile contaminants in soil is currently being evaluated (e.g., using soil vapor rather than soil data). For the purposes of this document, it is assumed that the gross contamination action level for TPHmiddle distillates of 500 mg/kg is adequate for protection of direct-exposure hazards posed by TPHmd. This value was used as an alternative Csat action level for TPHmiddle

distillates in the Table I series. Residual fuels are not considered to pose significant vapor emission hazards other than the potential generation of methane and related explosion hazards (refer to Volume 1).

Massachusetts developed generic physio-chemical constants for the C11-C22 aromatics carbon range fraction based on a review of compounds included within this fraction (MADEP 2002b). These constants were adopted in this document to develop a soil leaching action level for TPH as gasolines and middle distillates (see Tables E and H). The soil action level calculated for leaching of TPH from soil and protection of groundwater that is a source of drinking water (rounded to 100 mg/kg) is coincidental with action levels presented in other technical documents prepared by local regulatory agencies in California (e.g., RWQCBSF 1990; RWQCBLA 1996). Similarly, the soil action level calculated for leaching of TPH from soil and protection of groundwater that could discharge into a body of surface water (rounded to 400 mg/kg [gasolines] and 500 mg/kg [middle distillates]) is coincidental with the action level developed for use in the CalEPA Board Order for the San Francisco Airport (RWQCB SF 1999a).

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

6.5.2 TPH (residual fuels)

Risk-based, direct-exposure action levels for TPH as residual fuels were calculated in the same manner as done for individual chemicals, using the toxicity factors and physiochemical constants noted earlier. The action levels developed incorporate the Particulate Emission Factor used by USEPA to calculate RSLs for nonvolatile contaminants (USEPA 2016, refer to Appendix 2). Risk-based action levels for TPHresidual fuels in drinking water and soil were then developed in the same manner as done for other chemicals (Table D-3 and Table I series, respectively). As discussed in Volume 1, testing for individual, target indicator compounds is also recommended for soil and groundwater contaminated by heavy fuels (e.g., PAHs, heavy metals, etc.).

Individual PAHs are likely to drive health risks posed by soils contaminated with residual fuels. The non-specific, TPH fraction of the petroleum may, however, pose gross contamination concerns even in the absence of significant PAHs. Following Massachusetts DEP guidance (MADEP 1997a,b), ceiling levels for gross contamination concerns of 500

mg/kg and 2,500 mg/kg were selected for exposed or potentially exposed soils in unrestricted ("residential") and commercial/industrial land use scenarios, respectively (see Table F series). The MADEP ceiling level of 5,000 mg/kg was selected for isolated or otherwise deep soils.

The Massachusetts DEP did not develop specific action levels for leaching of heavy hydrocarbons from soil (refer to C19-C36 carbon range summary in Appendix 6). Residual fuels are by definition characterized by a predominance hydrocarbon compounds with carbon ranges greater than C24. These compounds are considered to be substantially less mobile in the subsurface that hydrocarbon compounds that make up the lighter-weight petroleum mixtures. For TPH that is characterized by a predominance of C23-C32 carbon range compounds, the California EPA Los Angeles Regional Water Board proposes a action level of 1,000 mg/kg for protection of drinking water resources (RWQCBLA 1996). This action level was adopted for use in this document (refer to Table E). The target TPH action level for groundwater was not specifically stated but is presumably 100 µg/L or less.

The Los Angeles Regional Water Quality Control Board did not present a similar action level for potential leaching of TPH from soil and subsequent discharge of impacted groundwater to a body of surface water. Although conservative, the Los Angeles TPH soil leaching action level of 1,000 mg/kg was retained for this purpose (see Table E, refer also to Section 4.4).

The toxicity of mineral oils and vegetable oils is low. The oils are more viscous and less volatile than fuels. Significant vapor emissions from contaminated soil and groundwater are not anticipated, although methane buildup could be a concern for very large, subsurface releases. For the purpose of this guidance and in order to address potential gross contamination concerns, a TPH action level of 5,000 mg/kg is recommended for exposed soils or soils within three feet of the ground surface that has been contaminated with mineral or vegetable oil. For deeper soils an action level of 25,000 mg/kg is recommended. Refer also to the HEER Office 2007 guidance for the long-term management of petroleum-contaminated sites (HDOH 2007). These action levels are not specifically called out in the EAL lookup tables. Soil and other media contaminated by releases of oil from electrical equipment should also be tested for PCBs unless it can be demonstrated that PCB-based oils were never used in the equipment.

6.6 TPH Action levels For Groundwater

Regulatory drinking water standards for TPH and petroleum in general have not been developed. Toxicity-based drinking water goals of 300 µg/L for gasoline, 160 µg/L for diesel and 2,400 µg/L for residual fuels were developed using on the USEPA RSL Tapwater model and the above-noted toxicity factors (refer to Table F-3). A TPH-diesel

(middle distillate) taste and odor threshold of 100 µg/L referenced in the technical document *A Compilation of Water Quality Goals* (RWQCBCV 2007) was referred to as a substitute secondary action level for all categories of TPH (see Table G-1). This takes precedence over the toxicity-based action level for selection of a final drinking water action level (see Tables D-1a and D-1b).

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

The groundwater nuisance and odor concerns action level of 5,000 µg/L for TPH (all categories) noted in the Table G series for nondrinking water was taken directly from Massachusetts DEP risk assessment guidance (MADEP 1997a,b). MADEP lists a gross contamination, "Ceiling Value" of 50,000 µg /L for all aliphatic and aromatic carbon ranges. This includes an assumed a dilution factor of "10", however. The dilution factor was omitted for used in the action levels, since as a default groundwater should meet surface water action levels at the point of discharge, both for aquatic toxicity and potential nuisance concerns. This also corresponds with the approximate solubility of diesel fuel and light motor oil in fresh water (ATSDR 2001) and is intended to address potential nuisance issues (odors, etc.) if discharged to surface water. The TPH ceiling levels for gross contamination concerns are based on 1/2 the solubility of the respective TPH categories (refer to Table G series). The solubility of gasoline in freshwater is approximately 150,000 µg/L. The solubility of diesel range and heavier fuels is assumed to be approximately 5,000 µg/L. These action levels are intended to highlight the potential presence of free product on groundwater.

6.7 Additional Target Indicator Compounds

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

targeted PAHs). Indicator chemicals typically recommended for petroleum mixtures include (after CalEPA 1996):

Monocyclic Aromatic Compounds (primarily gasolines and middle distillates)

- benzene
- ethylbenzene
- toluene
- xylene

Fuel additives (primarily gasolines)

- MTBE
- other oxygenates as necessary

Polycyclic Aromatic Compounds (primarily middle distillates and residual fuels)

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

The TPH EALs should be used in conjunction with EALs for these chemicals. Note that volatile chemicals such as butylbenzene, isopropyl benzene, isopropyl toluene and trimethylbenzenes are often reported in analyses of gasoline and other light-end petroleum products. These chemicals are collectively addressed under action levels for "TPH" and generally do not need to be evaluated separately.

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

6.8 Ethanol

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

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

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

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

*VOCs include BTEX and chlorinated solvent compounds

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

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

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

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

Carbon Range	[1]$TPH_{gasoline}$	[1]TPH_{diesel}
C5-C8 aliphatics	77.3%	25%
C9-C18 aliphatics	7.3%	75%
C9-C16 aromatics	15.4%	0%

1. Median carbon range makeup of gasoline vapors in USEPA 2013 Petroleum Vapor Intrusion database (see Brewer et al. 2013; Appendix 6).
2. HDOH soil vapors study and published information (see Brewer et al. 2013; Appendix 6).

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

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

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

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

Carbon Range	RfD_{0ral} (mg/kg-day)	RfC ($\mu g/m^3$)
$TPH_{gasolines}$	0.03	281
$TPH_{middle\ distillates}$	0.02	126
$TPH_{residual\ fuels}$	0.12	-

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

	[1]Indoor Air		[1]Subslab Soil vapor	
Carbon Range	**Residential (µg/m³)**	**Commercial/ Industrial (µg/m³)**	**Residential (µg/m³)**	**Commercial/ Industrial (µg/m³)**
C5-C8 aliphatics	630	2,600	1,300,000	11,700,000
C9-C18 aliphatics	100	440	210,000	1,800,000
C19+ aliphatics	-	-	-	-
C9+ aromatics	100	440	210,000	1,800,000

1. Assumed indoor air:subslab vapor attenuation factor: Residential = 0.0005; C/I = 0.00025 (see Section 3.3). Noncancer Hazard Quotient = 1.0. Calculate cumulative risk if used to evaluate site-specific carbon range data for soil vapor.

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

	Indoor Air		Subslab Soil vapor	
Carbon Range	**Residential (µg/m³)**	**Commercial/ Industrial (µg/m³)**	**Residential (µg/m³)**	**Commercial/ Industrial (µg/m³)**
$TPH_{gasolines}$	290	1,200	590,000	4,900,000
$TPH_{middle\ distillates}$	130	330	260,000	2,200,000
[1]$TPH_{residual\ fuels}$	-	-	-	-

1. Use TPHmiddle distillate indoor air and soil vapor action levels at sites contaminated with residual fuels if vapors present.

7 Other Issues

7.1 Background Concentrations

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

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

Background concentrations of total chromium in soil developed over basaltic bedrock can exceed several hundred ppm and in some areas up to several thousand ppm (HDOH 2011a). An upperbound, total chromium concentration of 1,100 mg/kg was selected to help to screen out sites where releases of chromium used as a screening can be assumed (see Table K; applies to volcanic soils). Note that background concentrations of total chromium in soils developed over caprock can be lower than 100 mg/kg. If a release of chromium VI

is suspected then chromium should be speciated and evaluated even if total chromium concentrations do not exceed this action level.

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

7.2 Laboratory Reporting Levels

Laboratory method reporting limits and background concentrations of chemicals were not directly considered in development of the lookup tables. As discussed in Volume 1 of this document, however, reporting limits approved by the overseeing regulatory agency should be used in place of the EALs presented in this document when higher.

7.3 Reporting of Soil Data

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

From a site-investigation and risk assessment-standpoint, a difference in the reported concentration of a chemical of 10-20% is not necessarily significant. **For consistency and for comparison to soil EALs presented in this document, however, soil data should be reported on dry-weight basis.** This is in part because soil ingestion rates assumed in direct-exposure models (see Appendices 1 and 2) are based on dry-weight studies (USEPA 2011c). Comparison of wet-weight data to direct-exposure action level would technically require adjustment of the direct-exposure action levels to reflect wet weight-based soil ingestion rates. A site-specific consideration of wet-weight soil data will be dependent on assumptions in the model(s) being used to evaluate risk or generate environmental action

levels. Existing wet-weight soil data may not necessarily need to be adjusted prior to comparison to the EALs unless the introduced bias is considered to be a potentially significant factor at the site. (Note that sediment data should also be reported on a dry-weight basis.)

7.4 Additional Soil Parameters

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

7.5 Degradation to Daughter Products

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

Tier 1 lookup tables generated by the Massachusetts Department of Environmental Protection (MADEP) and other regulatory agencies incorporate a very conservative assumption that the entire mass of a parent chemical will be eventually be transformed to the daughter product at the same initial concentration (e.g., MADEP 1994, MOEE 1996). MADEP reduces the initially derived action levels for parent compounds to reflect the action levels for the more toxic daughter product, without taking into account issues such as the lower molecular weights (and lower ultimate masses) of the daughter products.

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

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FIGURES

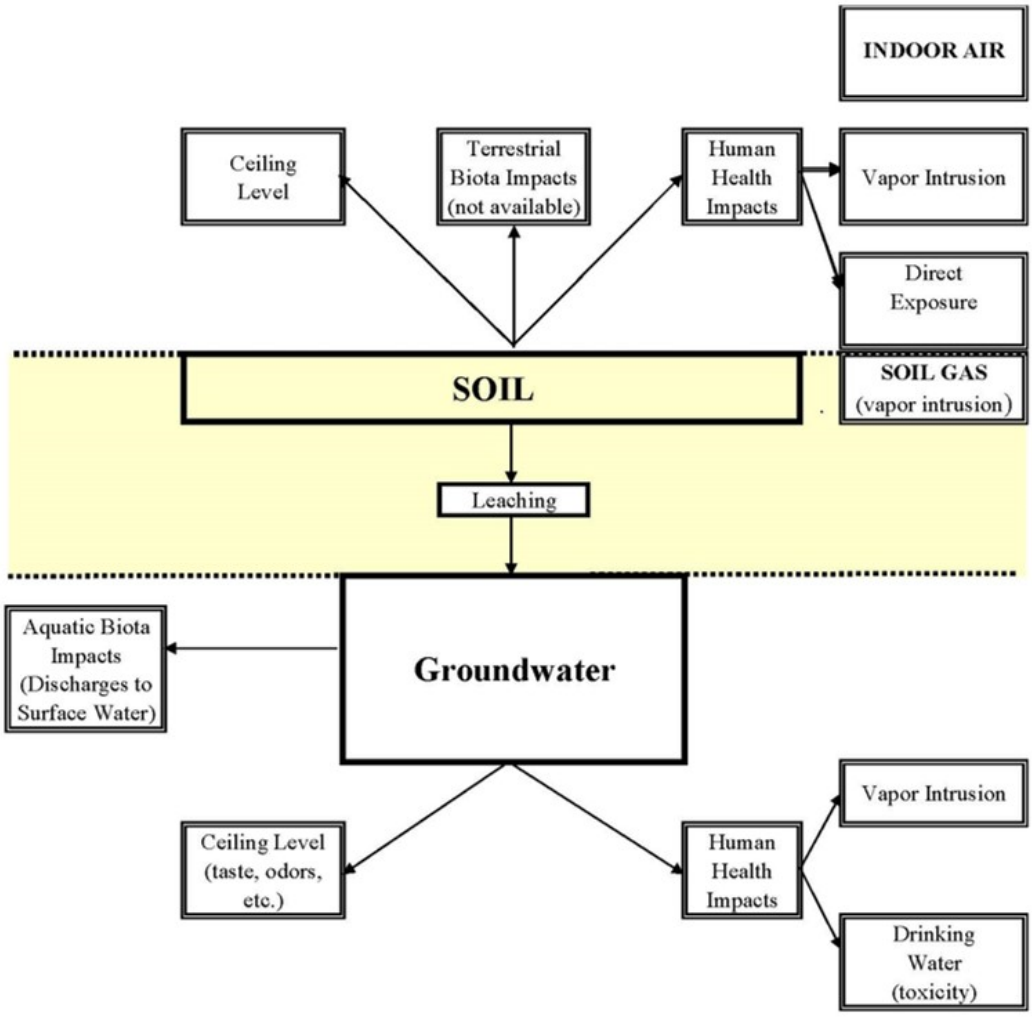

Figure 1. Summary of environmental hazards considered in action levels. Additional site-specific considerations include groundwater beneficial use, depth to impacted soil, soil type and land use. Evaluation of environmental hazards in additional to those shown should be carried out in a site-specific EHE.

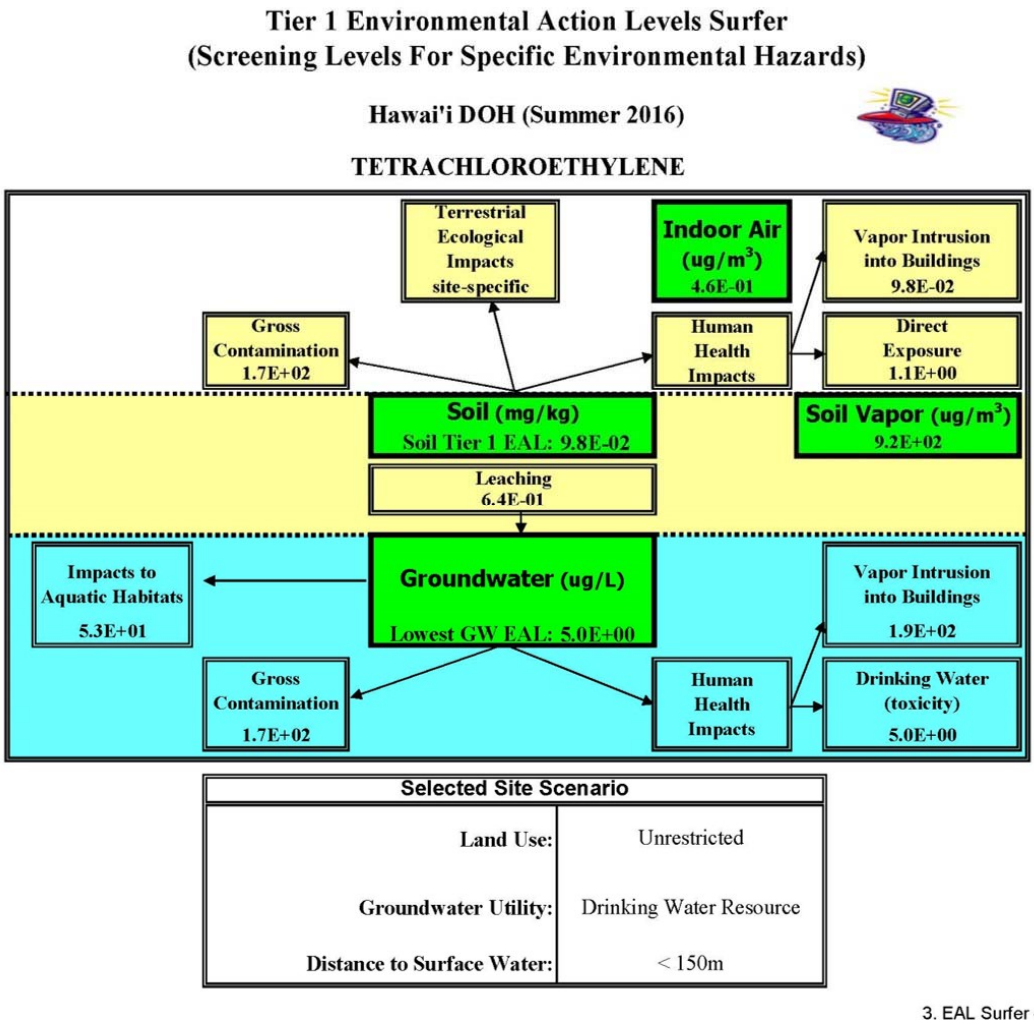

Figure 2. Summary of individual action levels used to select final, Tier 1 EALs for tetrachloroethylene (PCE) in soils situated within 10 feet of the ground surface and in groundwater that is a current or potential source of drinking water; based on a residential land-use scenario. Final EALs presented in Volume 1 summary tables are the lowest of the individual action levels. Vapor intrusion concerns drive selection of the final soil Tier 1 EAL (0.098 mg/kg). For groundwater, drinking water toxicity concerns drive selection of final Tier 1 EAL (5.0 ug/L).

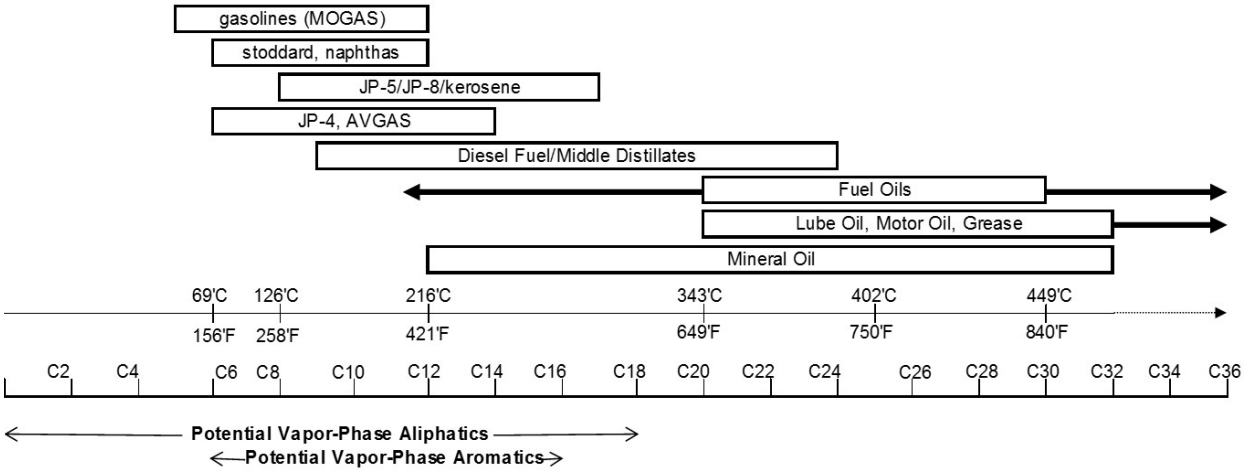

Figure 3. Fuel types versus carbon range composition.

DETAILED ACTION LEVEL TABLES

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

	(mg/kg)							
						[1]Human Health		Leaching & Groundwater Protection
CHEMICAL PARAMETER	Final EAL	Basis	[1]Gross Contamination (Odors, etc.) Table F-2	Terrestrial Ecotoxicity Table L	Background Table K	Direct Exposure Table I-1	Vapor Intrusion Into Buildings Table C-1b	Drinking Water Resource Table E
ACENAPHTHENE	1.2E+02	Vapor Intrusion	1.0E+03	site-specific		6.6E+02	1.2E+02	1.2E+02
ACENAPHTHYLENE	1.0E+02	Groundwater Protection	5.0E+02	site-specific		3.4E+02	(Use soil gas)	1.0E+02
ACETONE	8.7E+00	Groundwater Protection	5.0E+02	site-specific		1.2E+04	1.4E+04	8.7E+00
ALDRIN	3.9E+00	Direct Exposure	1.0E+03	site-specific		3.9E+00		8.4E+00
AMETRYN	1.3E+01	Groundwater Protection	5.0E+02	site-specific		1.1E+02		1.3E+01
AMINO,2- DINITROTOLUENE,4,6-	1.9E+00	Groundwater Protection	5.0E+02	site-specific		3.1E+01		1.9E+00
AMINO,4- DINITROTOLUENE,2,6-	1.9E+00	Groundwater Protection	5.0E+02	site-specific		3.1E+01		1.9E+00
ANTHRACENE	4.2E+00	Vapor Intrusion	5.0E+02	site-specific		3.5E+03	4.2E+00	4.2E+00
ANTIMONY	6.3E+00	Direct Exposure	1.0E+03	site-specific	2.4E+00	6.3E+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		2.4E+00		1.1E-01
BARIUM	1.0E+03	Ceiling Value	1.0E+03	site-specific	6.9E+02	3.1E+03		(Use batch test)
BENOMYL	1.6E-01	Groundwater Protection	1.0E+03	site-specific		6.3E+02		1.6E-01
BENZENE	3.0E-01	Groundwater Protection	5.0E+02	site-specific		1.2E+00	7.7E-01	3.0E-01
BENZO(a)ANTHRACENE	1.0E+01	Groundwater Protection	5.0E+02	site-specific		1.6E+01		1.0E+01
BENZO(a)PYRENE	1.6E+00	Direct Exposure	5.0E+02	site-specific		1.6E+00		2.0E+01
BENZO(b)FLUORANTHENE	5.4E+00	Groundwater Protection	5.0E+02	site-specific		1.6E+01		5.4E+00
BENZO(g,h,i)PERYLENE	3.5E+01	Groundwater Protection	5.0E+02	site-specific		4.8E+02		3.5E+01
BENZO(k)FLUORANTHENE	2.9E+01	Groundwater Protection	5.0E+02	site-specific		1.6E+02		2.9E+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)	2.3E+02
BIS(2-CHLOROETHYL)ETHER	7.5E-05	Groundwater Protection	5.0E+02	site-specific		2.4E-01	7.9E-03	7.5E-05
BIS(2-CHLORO-1-METHYLETHYL)ETHER	4.0E-03	Groundwater Protection	5.0E+02	site-specific		3.8E+00	(Use soil gas)	4.0E-03
BIS(2-ETHYLHEXYL)PHTHALATE	3.9E+01	Direct Exposure	5.0E+02	site-specific		3.9E+01		1.9E+02
BORON	1.0E+03	Ceiling Value	1.0E+03	site-specific		3.1E+03		(Use batch test)
BROMODICHLOROMETHANE	2.5E-03	Groundwater Protection	9.3E+02	site-specific		3.2E-01	1.6E-02	2.5E-03
BROMOFORM	6.9E-01	Groundwater Protection	5.0E+02	site-specific		2.0E+01		6.9E-01
BROMOMETHANE	2.2E-01	Vapor Intrusion	5.0E+02	site-specific		1.5E+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	1.0E-01	Vapor Intrusion	4.5E+02	site-specific		7.1E-01	1.0E-01	9.1E-01
CHLORDANE (TECHNICAL)	1.7E+01	Direct Exposure	1.0E+03	site-specific		1.7E+01		2.3E+01
CHLOROANILINE, p-	7.3E-03	Groundwater Protection	1.0E+03	site-specific		2.7E+00		7.3E-03
CHLOROBENZENE	2.2E+00	Vapor Intrusion	5.0E+02	site-specific		5.9E+01	2.2E+00	2.9E+00
CHLOROETHANE	1.2E+00	Groundwater Protection	5.0E+02	site-specific		2.1E+03	4.5E+02	1.2E+00
CHLOROFORM	2.6E-02	Vapor Intrusion	5.0E+02	site-specific		3.4E-01	2.6E-02	2.0E+00
CHLOROMETHANE	4.0E+00	Vapor Intrusion	1.0E+02	site-specific		2.4E+01	4.0E+00	1.1E+01
CHLOROPHENOL, 2-	1.2E-02	Groundwater Protection	1.0E+02	site-specific		7.0E+01	4.2E+01	1.2E-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	3.0E+01	Direct Exposure	1.0E+03	site-specific		3.0E+01		(Use batch test)
CHRYSENE	3.0E+01	Groundwater Protection	1.0E+03	site-specific		1.6E+03		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)	4.8E+00	Direct Exposure	1.0E+02	site-specific		4.8E+00	(Use soil gas)	(Use batch test)
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	1.0E-02	Groundwater Protection	5.0E+02	site-specific		6.1E+00		1.0E-02

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

	(mg/kg)							
						[1]Human Health		Leaching & Groundwater Protection
CHEMICAL PARAMETER	Final EAL	Basis	[1]Gross Contamination (Odors, etc.) Table F-2	Terrestrial Ecotoxicity Table L	Background Table K	Direct Exposure Table I-1	Vapor Intrusion Into Buildings Table C-1b	Drinking Water Resource Table E
DALAPON	1.1E-01	Groundwater Protection	5.0E+02	site-specific		3.8E+02		1.1E-01
DIBENZO(a,h)ANTHTRACENE	1.6E+00	Direct Exposure	5.0E+02	site-specific		1.6E+00		2.9E+01
DIBROMO,1,2- CHLOROPROPANE,3-	8.1E-04	Groundwater Protection	5.0E+02	site-specific		5.7E-03	(Use soil gas)	8.1E-04
DIBROMOCHLOROMETHANE	2.1E-03	Groundwater Protection	1.0E+02	site-specific		1.0E+00	2.9E-02	2.1E-03
DIBROMOETHANE, 1,2-	4.2E-04	Groundwater Protection	5.0E+02	site-specific		3.9E-02	1.0E-03	4.2E-04
DICHLOROBENZENE, 1,2-	7.5E-01	Groundwater Protection	3.8E+02	site-specific		3.8E+02	8.9E+00	7.5E-01
DICHLOROBENZENE, 1,3-	5.7E-01	Groundwater Protection	1.0E+02	site-specific		2.0E+02	(Use soil gas)	5.7E-01
DICHLOROBENZENE, 1,4-	5.5E-02	Vapor Intrusion	5.0E+02	site-specific		2.8E+00	5.5E-02	3.9E-01
DICHLOROBENZIDINE, 3,3-	9.2E-02	Groundwater Protection	5.0E+02	site-specific		1.2E+00		9.2E-02
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.3E+00	Direct Exposure	5.0E+02	site-specific		2.3E+00		6.3E+01
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.0E+00	Direct Exposure	5.0E+02	site-specific		2.0E+00		2.8E+01
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.9E+00	Direct Exposure	1.0E+03	site-specific		1.9E+00		5.6E+00
DICHLOROETHANE, 1,1-	1.1E-01	Groundwater Protection	5.0E+02	site-specific		3.8E+00	3.8E-01	1.1E-01
DICHLOROETHANE, 1,2-	2.3E-02	Vapor Intrusion	5.0E+02	site-specific		5.0E-01	2.3E-02	7.0E-02
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-	3.6E-01	Vapor Intrusion	1.0E+02	site-specific		3.9E+00	3.6E-01	2.2E+00
DICHLOROETHYLENE, Trans 1,2-	3.6E+00	Vapor Intrusion	5.0E+02	site-specific		2.9E+01	3.6E+00	6.5E+00
DICHLOROPHENOL, 2,4-	7.3E-03	Groundwater Protection	5.0E+02	site-specific		3.8E+01		7.3E-03
DICHLOROPHENOXYACETIC ACID (2,4-D)	3.4E-01	Groundwater Protection	5.0E+02	site-specific		1.4E+02		3.4E-01
DICHLOROPROPANE, 1,2-	6.0E-02	Vapor Intrusion	1.0E+02	site-specific		1.1E+00	6.0E-02	1.4E-01
DICHLOROPROPENE, 1,3-	1.7E-02	Groundwater Protection	5.0E+02	site-specific		1.9E+00	1.5E-01	1.7E-02
DIELDRIN	2.5E+00	Direct Exposure	1.0E+03	site-specific		2.5E+00		2.4E+01
DIETHYLPHTHALATE	1.7E+01	Groundwater Protection	5.0E+02	site-specific		1.0E+04		1.7E+01
DIMETHYLPHENOL, 2,4-	3.3E+01	Groundwater Protection	1.0E+02	site-specific		2.5E+02		3.3E+01
DIMETHYLPHTHALATE	7.4E+01	Groundwater Protection	5.0E+02	site-specific		1.3E+05		7.4E+01
DINITROBENZENE, 1,3-	1.2E-01	Groundwater Protection	5.0E+02	site-specific		1.3E+00		1.2E-01
DINITROPHENOL, 2,4-	3.1E+00	Groundwater Protection	5.0E+02	site-specific		2.5E+01		3.1E+00
DINITROTOLUENE, 2,4- (2,4-DNT)	2.4E-02	Groundwater Protection	5.0E+02	site-specific		1.7E+00		2.4E-02
DINITROTOLUENE, 2,6- (2,6-DNT)	5.1E-03	Groundwater Protection	5.0E+02	site-specific		3.6E-01		5.1E-03
DIOXANE, 1,4-	2.1E-04	Groundwater Protection	5.0E+02	site-specific		5.4E+00	(Use soil gas)	2.1E-04
DIOXINS (TEQ)	2.4E-04	Direct Exposure	1.0E+03	site-specific	2.0E-05	2.4E-04		3.0E-01
DIURON	7.3E-01	Groundwater Protection	5.0E+02	site-specific		2.5E+01		7.3E-01
ENDOSULFAN	1.3E+01	Groundwater Protection	5.0E+02	site-specific		9.4E+01		1.3E+01
ENDRIN	3.8E+00	Direct Exposure	5.0E+02	site-specific		3.8E+00		3.0E+01
ETHANOL	4.5E+00	Groundwater Protection	5.0E+02	site-specific			(Use soil gas)	4.5E+00
ETHYLBENZENE	3.7E+00	Groundwater Protection	4.8E+02	site-specific		6.3E+01	2.4E+01	3.7E+00
FLUORANTHENE	1.2E+02	Groundwater Protection	5.0E+02	site-specific		4.8E+02		1.2E+02
FLUORENE	9.3E+01	Vapor Intrusion	5.0E+02	site-specific		4.6E+02	9.3E+01	3.6E+02
GLYPHOSATE	2.4E+02	Groundwater Protection	5.0E+02	site-specific		1.3E+03		2.4E+02
HEPTACHLOR	1.4E-01	Direct Exposure	1.0E+03	site-specific		1.4E-01		4.5E+01
HEPTACHLOR EPOXIDE	7.1E-02	Direct Exposure	1.0E+03	site-specific		7.1E-02		1.2E+01
HEXACHLOROBENZENE	2.2E-01	Direct Exposure	5.0E+02	site-specific		2.2E-01		2.3E-01
HEXACHLOROBUTADIENE	4.1E-02	Groundwater Protection	5.0E+02	site-specific		1.3E+00		4.1E-02
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	7.5E-02	Groundwater Protection	5.0E+02	site-specific		5.7E-01		7.5E-02
HEXACHLOROETHANE	2.3E-02	Groundwater Protection	5.0E+02	site-specific		2.0E+00		2.3E-02

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

	(mg/kg)							
						[1]Human Health		Leaching & Groundwater Protection
CHEMICAL PARAMETER	Final EAL	Basis	[1]Gross Contamination (Odors, etc.) Table F-2	Terrestrial Ecotoxicity Table L	Background Table K	Direct Exposure Table I-1	Vapor Intrusion Into Buildings Table C-1b	Drinking Water Resource Table E
HEXAZINONE	1.4E+01	Groundwater Protection	5.0E+02	site-specific		4.2E+02		1.4E+01
INDENO(1,2,3-cd)PYRENE	9.6E+00	Groundwater Protection	5.0E+02	site-specific		1.6E+01		9.6E+00
ISOPHORONE	8.9E-01	Groundwater Protection	5.0E+02	site-specific		5.7E+02		8.9E-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 batch test)
METHOXYCHLOR	1.6E+01	Groundwater Protection	5.0E+02	site-specific		6.3E+01		1.6E+01
METHYL ETHYL KETONE	6.2E+00	Groundwater Protection	5.0E+02	site-specific		5.6E+03	2.2E+03	6.2E+00
METHYL ISOBUTYL KETONE	3.8E+00	Groundwater Protection	1.0E+02	site-specific		3.4E+03	1.3E+03	3.8E+00
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		5.0E+01	2.3E+00	2.8E-02
METHYLENE CHLORIDE	1.2E-01	Groundwater Protection	5.0E+02	site-specific		5.8E+01	2.2E+01	1.2E-01
METHYLNAPHTHALENE, 1-	2.5E+00	Groundwater Protection	5.0E+02	site-specific		1.0E+02	5.9E+01	2.5E+00
METHYLNAPHTHALENE, 2-	4.1E+00	Groundwater Protection	5.0E+02	site-specific		3.9E+01	5.0E+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	7.0E+00	4.4E+00
NICKEL	4.1E+02	Background	1.0E+03	site-specific	4.1E+02	3.1E+02		(Use batch test)
NITROBENZENE	5.3E-03	Groundwater Protection	5.0E+02	site-specific		5.6E+00	(Use soil gas)	5.3E-03
NITROGLYCERIN	3.9E-02	Groundwater Protection	5.0E+02	site-specific		1.3E+00		3.9E-02
NITROTOLUENE, 2-	4.9E-03	Groundwater Protection	5.0E+02	site-specific		2.2E+00	(Use soil gas)	4.9E-03
NITROTOLUENE, 3-	1.2E-01	Groundwater Protection	5.0E+02	site-specific		1.3E+00		1.2E-01
NITROTOLUENE, 4-	2.9E-01	Groundwater Protection	5.0E+02	site-specific		3.4E+01		2.9E-01
PENTACHLOROPHENOL	9.8E-02	Groundwater Protection	5.0E+02	site-specific		1.0E+00		9.8E-02
PENTAERYTHRITOLTETRANITRATE (PETN)	2.1E+00	Groundwater Protection	5.0E+02	site-specific		2.5E+01		2.1E+00
PERCHLORATE	7.0E-03	Groundwater Protection	1.0E+03	site-specific		1.1E+01		7.0E-03
PHENANTHRENE	4.6E+02	Direct Exposure	5.0E+02	site-specific		4.6E+02	(Use soil gas)	5.5E+02
PHENOL	9.3E+00	Groundwater Protection	5.0E+02	site-specific		3.8E+03		9.3E+00
POLYCHLORINATED BIPHENYLS (PCBs)	1.2E+00	Direct Exposure	5.0E+02	site-specific		1.2E+00		3.4E+01
PROPICONAZOLE	6.7E+01	Groundwater Protection	5.0E+02	site-specific		1.6E+02		6.7E+01
PYRENE	4.4E+01	Vapor Intrusion	5.0E+02	site-specific		3.6E+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	9.7E-02	Groundwater Protection	5.0E+02	site-specific		4.5E+00		9.7E-02
STYRENE	9.1E-01	Groundwater Protection	5.0E+02	site-specific		8.7E+02	4.5E+02	9.1E-01
TERBACIL	2.2E+00	Groundwater Protection	5.0E+02	site-specific		1.6E+02		2.2E+00
tert-BUTYL ALCOHOL	3.6E-02	Groundwater Protection	1.0E+02	site-specific		9.9E+01	(Use soil gas)	3.6E-02
TETRACHLOROETHANE, 1,1,1,2-	1.8E-02	Groundwater Protection	1.0E+02	site-specific		2.2E+00	(Use soil gas)	1.8E-02
TETRACHLOROETHANE, 1,1,2,2-	1.4E-03	Groundwater Protection	5.0E+02	site-specific		6.5E-01	1.0E-02	1.4E-03
TETRACHLOROETHYLENE	9.8E-02	Vapor Intrusion	1.7E+02	site-specific		1.1E+00	9.8E-02	6.4E-01
TETRACHLOROPHENOL, 2,3,4,6-	5.1E-01	Groundwater Protection	5.0E+02	site-specific		3.8E+02		5.1E-01
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	8.8E+01	Groundwater Protection	5.0E+02	site-specific		7.7E+02		8.8E+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	4.9E-01	Direct Exposure	5.0E+02	site-specific		4.9E-01		2.5E+02
TPH (gasolines)	1.0E+02	Ceiling Value	1.0E+02	site-specific		4.8E+02	(Use soil gas)	1.0E+02
TPH (middle distillates)	1.0E+02	Groundwater Protection	5.0E+02	site-specific		2.6E+02	(Use soil gas)	1.0E+02

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

	(mg/kg)							
						[1]Human Health		Leaching & Groundwater Protection
CHEMICAL PARAMETER	Final EAL	Basis	[1]Gross Contamination (Odors, etc.) Table F-2	Terrestrial Ecotoxicity Table L	Background Table K	Direct Exposure Table I-1	Vapor Intrusion Into Buildings Table C-1b	Drinking Water Resource Table E
TPH (residual fuels)	5.0E+02	Ceiling Value	5.0E+02	site-specific		9.4E+03		1.0E+03
TRICHLOROBENZENE, 1,2,4-	1.6E-01	Vapor Intrusion	5.0E+02	site-specific		8.2E+00	1.6E-01	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	8.9E-02	Vapor Intrusion	5.0E+02	site-specific		8.9E-01	8.9E-02	3.6E-01
TRICHLOROPHENOL, 2,4,5-	4.5E+00	Groundwater Protection	1.0E+02	site-specific		1.3E+03		4.5E+00
TRICHLOROPHENOL, 2,4,6-	4.5E-01	Groundwater Protection	5.0E+02	site-specific		1.3E+01		4.5E-01
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	3.6E+00	Groundwater Protection	1.0E+03	site-specific		1.3E+02		3.6E+00
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	1.5E+00	Groundwater Protection	5.0E+02	site-specific		1.0E+02		1.5E+00
TRICHLOROPROPANE, 1,2,3-	1.6E-03	Direct Exposure	1.0E+02	site-specific		1.6E-03	(Use soil gas)	1.3E-02
TRICHLOROPROPENE, 1,2,3-	8.1E-02	Groundwater Protection	1.0E+02	site-specific		1.6E-01	(Use soil gas)	8.1E-02
TRIFLURALIN	2.8E+01	Groundwater Protection	1.0E+02	site-specific		9.0E+01		2.8E+01
TRINITROBENZENE, 1,3,5-	7.5E+00	Groundwater Protection	5.0E+02	site-specific		4.5E+02		7.5E+00
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	3.1E+01	Groundwater Protection	5.0E+02	site-specific		3.1E+01		3.1E+01
TRINITROTOLUENE, 2,4,6- (TNT)	1.2E+00	Groundwater Protection	5.0E+02	site-specific		7.3E+00		1.2E+00
VANADIUM	7.7E+02	Background	1.0E+03	site-specific	7.7E+02	7.8E+01		(Use batch test)
VINYL CHLORIDE	3.6E-02	Vapor Intrusion	5.0E+02	site-specific		5.9E-02	3.6E-02	3.5E-01
XYLENES	2.1E+00	Groundwater Protection	2.6E+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		6.6E+02	1.2E+02	1.2E+02
ACENAPHTHYLENE	5.5E+00	Groundwater Protection	5.0E+02	site-specific		3.4E+02	(Use soil gas)	5.5E+00
ACETONE	9.2E-01	Groundwater Protection	5.0E+02	site-specific		1.2E+04	1.4E+04	9.2E-01
ALDRIN	3.9E+00	Direct Exposure	1.0E+03	site-specific		3.9E+00		8.4E+00
AMETRYN	1.3E+01	Groundwater Protection	5.0E+02	site-specific		1.1E+02		1.3E+01
AMINO,2- DINITROTOLUENE,4,6-	8.5E-01	Groundwater Protection	5.0E+02	site-specific		3.1E+01		8.5E-01
AMINO,4- DINITROTOLUENE,2,6-	5.2E-01	Groundwater Protection	5.0E+02	site-specific		3.1E+01		5.2E-01
ANTHRACENE	4.2E+00	Vapor Intrusion	5.0E+02	site-specific		3.5E+03	4.2E+00	4.2E+00
ANTIMONY	6.3E+00	Direct Exposure	1.0E+03	site-specific	2.4E+00	6.3E+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		2.4E+00		1.1E-01
BARIUM	1.0E+03	Ceiling Value	1.0E+03	site-specific	6.9E+02	3.1E+03		(Use batch test)
BENOMYL	7.8E-03	Groundwater Protection	1.0E+03	site-specific		6.3E+02		7.8E-03
BENZENE	3.0E-01	Groundwater Protection	5.0E+02	site-specific		1.2E+00	7.7E-01	3.0E-01
BENZO(a)ANTHRACENE	1.0E+01	Groundwater Protection	5.0E+02	site-specific		1.6E+01		1.0E+01
BENZO(a)PYRENE	1.6E+00	Direct Exposure	5.0E+02	site-specific		1.6E+00		5.9E+00
BENZO(b)FLUORANTHENE	5.4E+00	Groundwater Protection	5.0E+02	site-specific		1.6E+01		5.4E+00
BENZO(g,h,i)PERYLENE	3.5E+01	Groundwater Protection	5.0E+02	site-specific		4.8E+02		3.5E+01
BENZO(k)FLUORANTHENE	2.9E+01	Groundwater Protection	5.0E+02	site-specific		1.6E+02		2.9E+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)	2.3E+02
BIS(2-CHLOROETHYL)ETHER	7.5E-05	Groundwater Protection	5.0E+02	site-specific		2.4E-01	7.9E-03	7.5E-05
BIS(2-CHLORO-1-METHYLETHYL)ETHER	4.0E-03	Groundwater Protection	5.0E+02	site-specific		3.8E+00	(Use soil gas)	4.0E-03
BIS(2-ETHYLHEXYL)PHTHALATE	3.9E+01	Direct Exposure	5.0E+02	site-specific		3.9E+01		1.9E+02
BORON	1.0E+03	Ceiling Value	1.0E+03	site-specific		3.1E+03		(Use batch test)
BROMODICHLOROMETHANE	2.5E-03	Groundwater Protection	9.3E+02	site-specific		3.2E-01	1.6E-02	2.5E-03
BROMOFORM	6.9E-01	Groundwater Protection	5.0E+02	site-specific		2.0E+01		6.9E-01
BROMOMETHANE	2.2E-01	Vapor Intrusion	5.0E+02	site-specific		1.5E+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	1.0E-01	Vapor Intrusion	4.5E+02	site-specific		7.1E-01	1.0E-01	9.1E-01
CHLORDANE (TECHNICAL)	1.7E+01	Direct Exposure	1.0E+03	site-specific		1.7E+01		2.3E+01
CHLOROANILINE, p-	7.3E-03	Groundwater Protection	1.0E+03	site-specific		2.7E+00		7.3E-03
CHLOROBENZENE	1.5E+00	Groundwater Protection	5.0E+02	site-specific		5.9E+01	2.2E+00	1.5E+00
CHLOROETHANE	1.2E+00	Groundwater Protection	5.0E+02	site-specific		2.1E+03	4.5E+02	1.2E+00
CHLOROFORM	2.6E-02	Vapor Intrusion	5.0E+02	site-specific		3.4E-01	2.6E-02	7.9E-01
CHLOROMETHANE	4.0E+00	Vapor Intrusion	1.0E+02	site-specific		2.4E+01	4.0E+00	1.1E+01
CHLOROPHENOL, 2-	1.2E-02	Groundwater Protection	1.0E+02	site-specific		7.0E+01	4.2E+01	1.2E-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	3.0E+01	Direct Exposure	1.0E+03	site-specific		3.0E+01		(Use batch test)
CHRYSENE	3.0E+01	Groundwater Protection	1.0E+03	site-specific		1.6E+03		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)	4.8E+00	Direct Exposure	1.0E+02	site-specific		4.8E+00	(Use soil gas)	(Use batch test)
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	1.0E-02	Groundwater Protection	5.0E+02	site-specific		6.1E+00		1.0E-02
DALAPON	1.1E-01	Groundwater Protection	5.0E+02	site-specific		3.8E+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	1.6E+00	Direct Exposure	5.0E+02	site-specific		1.6E+00		2.9E+01
DIBROMO,1,2- CHLOROPROPANE,3-	8.1E-04	Groundwater Protection	5.0E+02	site-specific		5.7E-03	(Use soil gas)	8.1E-04
DIBROMOCHLOROMETHANE	2.1E-03	Groundwater Protection	1.0E+02	site-specific		1.0E+00	2.9E-02	2.1E-03
DIBROMOETHANE, 1,2-	4.2E-04	Groundwater Protection	5.0E+02	site-specific		3.9E-02	1.0E-03	4.2E-04
DICHLOROBENZENE, 1,2-	7.5E-01	Groundwater Protection	3.8E+02	site-specific		3.8E+02	8.9E+00	7.5E-01
DICHLOROBENZENE, 1,3-	5.7E-01	Groundwater Protection	1.0E+02	site-specific		2.0E+02	(Use soil gas)	5.7E-01
DICHLOROBENZENE, 1,4-	5.5E-02	Vapor Intrusion	5.0E+02	site-specific		2.8E+00	5.5E-02	3.9E-01
DICHLOROBENZIDINE, 3,3-	9.2E-02	Groundwater Protection	5.0E+02	site-specific		1.2E+00		9.2E-02
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.3E+00	Direct Exposure	5.0E+02	site-specific		2.3E+00		6.3E+01
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.0E+00	Direct Exposure	5.0E+02	site-specific		2.0E+00		2.8E+01
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.9E+00	Direct Exposure	1.0E+03	site-specific		1.9E+00		5.6E+00
DICHLOROETHANE, 1,1-	1.1E-01	Groundwater Protection	5.0E+02	site-specific		3.8E+00	3.8E-01	1.1E-01
DICHLOROETHANE, 1,2-	2.3E-02	Vapor Intrusion	5.0E+02	site-specific		5.0E-01	2.3E-02	7.0E-02
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-	3.6E-01	Vapor Intrusion	1.0E+02	site-specific		3.9E+00	3.6E-01	2.2E+00
DICHLOROETHYLENE, Trans 1,2-	3.6E+00	Vapor Intrusion	5.0E+02	site-specific		2.9E+01	3.6E+00	6.5E+00
DICHLOROPHENOL, 2,4-	7.3E-03	Groundwater Protection	5.0E+02	site-specific		3.8E+01		7.3E-03
DICHLOROPHENOXYACETIC ACID (2,4-D)	3.4E-01	Groundwater Protection	5.0E+02	site-specific		1.4E+02		3.4E-01
DICHLOROPROPANE, 1,2-	6.0E-02	Vapor Intrusion	1.0E+02	site-specific		1.1E+00	6.0E-02	1.4E-01
DICHLOROPROPENE, 1,3-	2.1E-03	Groundwater Protection	5.0E+02	site-specific		1.9E+00	1.5E-01	2.1E-03
DIELDRIN	2.5E+00	Direct Exposure	1.0E+03	site-specific		2.5E+00		2.4E+01
DIETHYLPHTHALATE	3.7E+00	Groundwater Protection	5.0E+02	site-specific		1.0E+04		3.7E+00
DIMETHYLPHENOL, 2,4-	9.8E+00	Groundwater Protection	1.0E+02	site-specific		2.5E+02		9.8E+00
DIMETHYLPHTHALATE	2.6E+01	Groundwater Protection	5.0E+02	site-specific		1.3E+05		2.6E+01
DINITROBENZENE, 1,3-	1.2E-01	Groundwater Protection	5.0E+02	site-specific		1.3E+00		1.2E-01
DINITROPHENOL, 2,4-	1.1E+00	Groundwater Protection	5.0E+02	site-specific		2.5E+01		1.1E+00
DINITROTOLUENE, 2,4- (2,4-DNT)	2.4E-02	Groundwater Protection	5.0E+02	site-specific		1.7E+00		2.4E-02
DINITROTOLUENE, 2,6- (2,6-DNT)	5.1E-03	Groundwater Protection	5.0E+02	site-specific		3.6E-01		5.1E-03
DIOXANE, 1,4-	2.1E-04	Groundwater Protection	5.0E+02	site-specific		5.4E+00	(Use soil gas)	2.1E-04
DIOXINS (TEQ)	2.4E-04	Direct Exposure	1.0E+03	site-specific	2.0E-05	2.4E-04		3.0E-01
DIURON	7.3E-01	Groundwater Protection	5.0E+02	site-specific		2.5E+01		7.3E-01
ENDOSULFAN	1.3E+01	Groundwater Protection	5.0E+02	site-specific		9.4E+01		1.3E+01
ENDRIN	3.8E+00	Direct Exposure	5.0E+02	site-specific		3.8E+00		3.0E+01
ETHANOL	4.5E+00	Groundwater Protection	5.0E+02	site-specific			(Use soil gas)	4.5E+00
ETHYLBENZENE	9.0E-01	Groundwater Protection	4.8E+02	site-specific		6.3E+01	2.4E+01	9.0E-01
FLUORANTHENE	8.7E+01	Groundwater Protection	5.0E+02	site-specific		4.8E+02		8.7E+01
FLUORENE	9.3E+01	Vapor Intrusion	5.0E+02	site-specific		4.6E+02	9.3E+01	9.3E+01
GLYPHOSATE	2.4E+02	Groundwater Protection	5.0E+02	site-specific		1.3E+03		2.4E+02
HEPTACHLOR	1.4E-01	Direct Exposure	1.0E+03	site-specific		1.4E-01		4.5E+01
HEPTACHLOR EPOXIDE	7.1E-02	Direct Exposure	1.0E+03	site-specific		7.1E-02		1.2E+01
HEXACHLOROBENZENE	2.2E-01	Direct Exposure	5.0E+02	site-specific		2.2E-01		2.3E-01
HEXACHLOROBUTADIENE	4.1E-02	Groundwater Protection	5.0E+02	site-specific		1.3E+00		4.1E-02
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	2.9E-02	Groundwater Protection	5.0E+02	site-specific		5.7E-01		2.9E-02
HEXACHLOROETHANE	2.3E-02	Groundwater Protection	5.0E+02	site-specific		2.0E+00		2.3E-02
HEXAZINONE	1.4E+01	Groundwater Protection	5.0E+02	site-specific		4.2E+02		1.4E+01
INDENO(1,2,3-cd)PYRENE	9.6E+00	Groundwater Protection	5.0E+02	site-specific		1.6E+01		9.6E+00

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

	(mg/kg)							
						[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
ISOPHORONE	8.9E-01	Groundwater Protection	5.0E+02	site-specific		5.7E+02		8.9E-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 batch test)
METHOXYCHLOR	1.6E+01	Groundwater Protection	5.0E+02	site-specific		6.3E+01		1.6E+01
METHYL ETHYL KETONE	6.2E+00	Groundwater Protection	5.0E+02	site-specific		5.6E+03	2.2E+03	6.2E+00
METHYL ISOBUTYL KETONE	5.0E-01	Groundwater Protection	1.0E+02	site-specific		3.4E+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		5.0E+01	2.3E+00	2.8E-02
METHYLENE CHLORIDE	1.2E-01	Groundwater Protection	5.0E+02	site-specific		5.8E+01	2.2E+01	1.2E-01
METHYLNAPHTHALENE, 1-	8.9E-01	Groundwater Protection	5.0E+02	site-specific		1.0E+02	5.9E+01	8.9E-01
METHYLNAPHTHALENE, 2-	1.9E+00	Groundwater Protection	5.0E+02	site-specific		3.9E+01	5.0E+01	1.9E+00
MOLYBDENUM	7.8E+01	Direct Exposure	1.0E+03	site-specific	4.0E+00	7.8E+01		(Use batch test)
NAPHTHALENE	3.1E+00	Groundwater Protection	5.0E+02	site-specific		2.8E+01	7.0E+00	3.1E+00
NICKEL	4.1E+02	Background	1.0E+03	site-specific	4.1E+02	3.1E+02		(Use batch test)
NITROBENZENE	5.3E-03	Groundwater Protection	5.0E+02	site-specific		5.6E+00	(Use soil gas)	5.3E-03
NITROGLYCERIN	3.9E-02	Groundwater Protection	5.0E+02	site-specific		1.3E+00		3.9E-02
NITROTOLUENE, 2-	4.9E-03	Groundwater Protection	5.0E+02	site-specific		2.2E+00	(Use soil gas)	4.9E-03
NITROTOLUENE, 3-	1.2E-01	Groundwater Protection	5.0E+02	site-specific		1.3E+00		1.2E-01
NITROTOLUENE, 4-	2.9E-01	Groundwater Protection	5.0E+02	site-specific		3.4E+01		2.9E-01
PENTACHLOROPHENOL	9.8E-02	Groundwater Protection	5.0E+02	site-specific		1.0E+00		9.8E-02
PENTAERYTHRITOLTETRANITRATE (PETN)	2.1E+00	Groundwater Protection	5.0E+02	site-specific		2.5E+01		2.1E+00
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		4.6E+02	(Use soil gas)	6.9E+01
PHENOL	1.8E+00	Groundwater Protection	5.0E+02	site-specific		3.8E+03		1.8E+00
POLYCHLORINATED BIPHENYLS (PCBs)	1.2E+00	Direct Exposure	5.0E+02	site-specific		1.2E+00		3.4E+01
PROPICONAZOLE	2.5E+01	Groundwater Protection	5.0E+02	site-specific		1.6E+02		2.5E+01
PYRENE	4.4E+01	Vapor Intrusion	5.0E+02	site-specific		3.6E+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	9.7E-02	Groundwater Protection	5.0E+02	site-specific		4.5E+00		9.7E-02
STYRENE	9.1E-01	Groundwater Protection	5.0E+02	site-specific		8.7E+02	4.5E+02	9.1E-01
TERBACIL	2.2E+00	Groundwater Protection	5.0E+02	site-specific		1.6E+02		2.2E+00
tert-BUTYL ALCOHOL	3.6E-02	Groundwater Protection	1.0E+02	site-specific		9.9E+01	(Use soil gas)	3.6E-02
TETRACHLOROETHANE, 1,1,1,2-	1.8E-02	Groundwater Protection	1.0E+02	site-specific		2.2E+00	(Use soil gas)	1.8E-02
TETRACHLOROETHANE, 1,1,2,2-	1.4E-03	Groundwater Protection	5.0E+02	site-specific		6.5E-01	1.0E-02	1.4E-03
TETRACHLOROETHYLENE	9.8E-02	Vapor Intrusion	1.7E+02	site-specific		1.1E+00	9.8E-02	6.4E-01
TETRACHLOROPHENOL, 2,3,4,6-	5.6E-02	Groundwater Protection	5.0E+02	site-specific		3.8E+02		5.6E-02
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	1.9E+01	Groundwater Protection	5.0E+02	site-specific		7.7E+02		1.9E+01
THALLIUM	7.8E-01	Direct Exposure	1.0E+03	site-specific	2.5E-01	7.8E-01		(Use batch test)
TOLUENE	7.8E-01	Groundwater Protection	5.0E+02	site-specific		8.2E+02	8.2E+02	7.8E-01
TOXAPHENE	4.9E-01	Direct Exposure	5.0E+02	site-specific		4.9E-01		2.5E+02
TPH (gasolines)	1.0E+02	Ceiling Value	1.0E+02	site-specific		4.8E+02	(Use soil gas)	1.0E+02
TPH (middle distillates)	1.0E+02	Groundwater Protection	5.0E+02	site-specific		2.6E+02	(Use soil gas)	1.0E+02
TPH (residual fuels)	5.0E+02	Ceiling Value	5.0E+02	site-specific		9.4E+03		1.0E+03
TRICHLOROBENZENE, 1,2,4-	1.6E-01	Vapor Intrusion	5.0E+02	site-specific		8.2E+00	1.6E-01	1.6E+01
TRICHLOROETHANE, 1,1,1-	1.2E+00	Groundwater Protection	5.0E+02	site-specific		6.4E+02	2.2E+02	1.2E+00

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

(mg/kg)

CHEMICAL PARAMETER	Final EAL	Basis	[1]Gross Contamination (Odors, etc.) Table F-2	Terrestrial Ecotoxicity Table L	Background Table K	[1]Human Health: Direct Exposure Table I-1	[1]Human Health: Vapor Intrusion Into Buildings Table C-1b	Leaching & Groundwater Protection: Drinking Water Resource Table E
TRICHLOROETHANE, 1,1,2-	8.9E-03	Vapor Intrusion	1.0E+02	site-specific		3.2E-01	8.9E-03	7.6E-02
TRICHLOROETHYLENE	8.9E-02	Vapor Intrusion	5.0E+02	site-specific		8.9E-01	8.9E-02	3.6E-01
TRICHLOROPHENOL, 2,4,5-	5.0E-01	Groundwater Protection	1.0E+02	site-specific		1.3E+03		5.0E-01
TRICHLOROPHENOL, 2,4,6-	3.1E-01	Groundwater Protection	5.0E+02	site-specific		1.3E+01		3.1E-01
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	3.6E+00	Groundwater Protection	1.0E+03	site-specific		1.3E+02		3.6E+00
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	8.7E-01	Groundwater Protection	5.0E+02	site-specific		1.0E+02		8.7E-01
TRICHLOROPROPANE, 1,2,3-	1.6E-03	Direct Exposure	1.0E+02	site-specific		1.6E-03	(Use soil gas)	1.3E-02
TRICHLOROPROPENE, 1,2,3-	8.1E-02	Groundwater Protection	1.0E+02	site-specific		1.6E-01	(Use soil gas)	8.1E-02
TRIFLURALIN	1.8E+01	Groundwater Protection	1.0E+02	site-specific		9.0E+01		1.8E+01
TRINITROBENZENE, 1,3,5-	2.8E+00	Groundwater Protection	5.0E+02	site-specific		4.5E+02		2.8E+00
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	3.1E+01	Groundwater Protection	5.0E+02	site-specific		3.1E+01		3.1E+01
TRINITROTOLUENE, 2,4,6- (TNT)	1.2E+00	Groundwater Protection	5.0E+02	site-specific		7.3E+00		1.2E+00
VANADIUM	7.7E+02	Background	1.0E+03	site-specific	7.7E+02	7.8E+01		(Use batch test)
VINYL CHLORIDE	3.6E-02	Vapor Intrusion	5.0E+02	site-specific		5.9E-02	3.6E-02	3.5E-01
XYLENES	1.4E+00	Groundwater Protection	2.6E+02	site-specific		1.2E+02	4.5E+01	1.4E+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 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)

CHEMICAL PARAMETER	Final EAL	Basis	[1]Gross Contamination (Odors, etc.) Table F-2	Terrestrial Ecotoxicity Table L	Background Table K	[1]Human Health: Direct Exposure Table I-1	[1]Human Health: Vapor Intrusion Into Buildings Table C-1b	Leaching & Groundwater Protection: NON-Drinking Water Resource Table E
ACENAPHTHENE	1.2E+02	Vapor Intrusion	1.0E+03	site-specific		6.6E+02	1.2E+02	1.7E+02
ACENAPHTHYLENE	1.3E+02	Groundwater Protection	5.0E+02	site-specific		3.4E+02	(Use soil gas)	1.3E+02
ACETONE	9.2E+00	Groundwater Protection	5.0E+02	site-specific		1.2E+04	1.4E+04	9.2E+00
ALDRIN	3.9E+00	Direct Exposure	1.0E+03	site-specific		3.9E+00		1.8E+01
AMETRYN	1.1E+02	Direct Exposure	5.0E+02	site-specific		1.1E+02		1.3E+02
AMINO,2- DINITROTOLUENE,4,6-	7.5E+00	Groundwater Protection	5.0E+02	site-specific		3.1E+01		7.5E+00
AMINO,4- DINITROTOLUENE,2,6-	4.6E+00	Groundwater Protection	5.0E+02	site-specific		3.1E+01		4.6E+00
ANTHRACENE	4.2E+00	Vapor Intrusion	5.0E+02	site-specific		3.5E+03	4.2E+00	4.2E+00
ANTIMONY	6.3E+00	Direct Exposure	1.0E+03	site-specific	2.4E+00	6.3E+00		(Use batch test)
ARSENIC	2.4E+01	Background	1.0E+03	site-specific	2.4E+01	2.3E+01		(Use batch test)
ATRAZINE	2.4E+00	Direct Exposure	5.0E+02	site-specific		2.4E+00		1.2E+01
BARIUM	1.0E+03	Ceiling Value	1.0E+03	site-specific	6.9E+02	3.1E+03		(Use batch test)
BENOMYL	1.6E-01	Groundwater Protection	1.0E+03	site-specific		6.3E+02		1.6E-01
BENZENE	7.7E-01	Vapor Intrusion	5.0E+02	site-specific		1.2E+00	7.7E-01	1.0E+02
BENZO(a)ANTHRACENE	1.6E+01	Direct Exposure	5.0E+02	site-specific		1.6E+01		1.4E+02
BENZO(a)PYRENE	1.6E+00	Direct Exposure	5.0E+02	site-specific		1.6E+00		7.8E+01
BENZO(b)FLUORANTHENE	1.6E+01	Direct Exposure	5.0E+02	site-specific		1.6E+01		7.5E+01
BENZO(g,h,i)PERYLENE	3.5E+01	Groundwater Protection	5.0E+02	site-specific		4.8E+02		3.5E+01
BENZO(k)FLUORANTHENE	3.9E+01	Groundwater Protection	5.0E+02	site-specific		1.6E+02		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)	2.3E+02
BIS(2-CHLOROETHYL)ETHER	7.9E-03	Vapor Intrusion	5.0E+02	site-specific		2.4E-01	7.9E-03	9.6E-01
BIS(2-CHLORO-1-METHYLETHYL)ETHER	4.0E-03	Groundwater Protection	5.0E+02	site-specific		3.8E+00	(Use soil gas)	4.0E-03
BIS(2-ETHYLHEXYL)PHTHALATE	3.9E+01	Direct Exposure	5.0E+02	site-specific		3.9E+01		5.4E+02
BORON	1.0E+03	Ceiling Value	1.0E+03	site-specific		3.1E+03		(Use batch test)
BROMODICHLOROMETHANE	1.6E-02	Vapor Intrusion	9.3E+02	site-specific		3.2E-01	1.6E-02	2.1E+00
BROMOFORM	9.5E+00	Groundwater Protection	5.0E+02	site-specific		2.0E+01		9.5E+00
BROMOMETHANE	2.2E-01	Vapor Intrusion	5.0E+02	site-specific		1.5E+00	2.2E-01	1.8E+00
CADMIUM	1.4E+01	Direct Exposure	1.0E+03	site-specific	2.3E+00	1.4E+01		(Use batch test)
CARBON TETRACHLORIDE	1.0E-01	Vapor Intrusion	4.5E+02	site-specific		7.1E-01	1.0E-01	2.0E+01
CHLORDANE (TECHNICAL)	1.7E+01	Direct Exposure	1.0E+03	site-specific		1.7E+01		2.3E+01
CHLOROANILINE, p-	2.7E+00	Direct Exposure	1.0E+03	site-specific		2.7E+00		8.6E+00
CHLOROBENZENE	2.2E+00	Vapor Intrusion	5.0E+02	site-specific		5.9E+01	2.2E+00	1.3E+01
CHLOROETHANE	1.2E+01	Groundwater Protection	5.0E+02	site-specific		2.1E+03	4.5E+02	1.2E+01
CHLOROFORM	2.6E-02	Vapor Intrusion	5.0E+02	site-specific		3.4E-01	2.6E-02	3.1E+00
CHLOROMETHANE	4.0E+00	Vapor Intrusion	1.0E+02	site-specific		2.4E+01	4.0E+00	1.1E+01
CHLOROPHENOL, 2-	1.2E-01	Groundwater Protection	1.0E+02	site-specific		7.0E+01	4.2E+01	1.2E-01
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	3.0E+01	Direct Exposure	1.0E+03	site-specific		3.0E+01		(Use batch test)
CHRYSENE	3.0E+01	Groundwater Protection	1.0E+03	site-specific		1.6E+03		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)	4.8E+00	Direct Exposure	1.0E+02	site-specific		4.8E+00	(Use soil gas)	(Use batch test)
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	6.1E+00	Direct Exposure	5.0E+02	site-specific		6.1E+00		7.7E+00
DALAPON	1.6E+00	Groundwater Protection	5.0E+02	site-specific		3.8E+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)

CHEMICAL PARAMETER	Final EAL	Basis	[1]Gross Contamination (Odors, etc.) Table F-2	Terrestrial Ecotoxicity Table L	Background Table K	[1]Human Health: Direct Exposure Table I-1	[1]Human Health: Vapor Intrusion Into Buildings Table C-1b	Leaching & Groundwater Protection: NON-Drinking Water Resource Table E
DIBENZO(a,h)ANTHTRACENE	1.6E+00	Direct Exposure	5.0E+02	site-specific		1.6E+00		4.0E+02
DIBROMO,1,2- CHLOROPROPANE,3-	8.1E-04	Groundwater Protection	5.0E+02	site-specific		5.7E-03	(Use soil gas)	8.1E-04
DIBROMOCHLOROMETHANE	2.9E-02	Vapor Intrusion	1.0E+02	site-specific		1.0E+00	2.9E-02	4.6E+00
DIBROMOETHANE, 1,2-	1.0E-03	Vapor Intrusion	5.0E+02	site-specific		3.9E-02	1.0E-03	2.0E-01
DICHLOROBENZENE, 1,2-	7.5E+00	Groundwater Protection	3.8E+02	site-specific		3.8E+02	8.9E+00	7.5E+00
DICHLOROBENZENE, 1,3-	4.2E+01	Groundwater Protection	1.0E+02	site-specific		2.0E+02	(Use soil gas)	4.2E+01
DICHLOROBENZENE, 1,4-	5.5E-02	Vapor Intrusion	5.0E+02	site-specific		2.8E+00	5.5E-02	8.5E+00
DICHLOROBENZIDINE, 3,3-	1.2E+00	Direct Exposure	5.0E+02	site-specific		1.2E+00		2.2E+01
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.3E+00	Direct Exposure	5.0E+02	site-specific		2.3E+00		6.3E+01
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.0E+00	Direct Exposure	5.0E+02	site-specific		2.0E+00		1.4E+02
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.9E+00	Direct Exposure	1.0E+03	site-specific		1.9E+00		5.6E+00
DICHLOROETHANE, 1,1-	3.8E-01	Vapor Intrusion	5.0E+02	site-specific		3.8E+00	3.8E-01	3.3E+01
DICHLOROETHANE, 1,2-	2.3E-02	Vapor Intrusion	5.0E+02	site-specific		5.0E-01	2.3E-02	2.6E+00
DICHLOROETHYLENE, 1,1-	8.9E+00	Vapor Intrusion	5.0E+02	site-specific		4.9E+01	8.9E+00	6.5E+02
DICHLOROETHYLENE, Cis 1,2-	3.6E-01	Vapor Intrusion	1.0E+02	site-specific		3.9E+00	3.6E-01	4.1E+01
DICHLOROETHYLENE, Trans 1,2-	3.6E+00	Vapor Intrusion	5.0E+02	site-specific		2.9E+01	3.6E+00	1.7E+02
DICHLOROPHENOL, 2,4-	7.3E-02	Groundwater Protection	5.0E+02	site-specific		3.8E+01		7.3E-02
DICHLOROPHENOXYACETIC ACID (2,4-D)	6.4E-01	Groundwater Protection	5.0E+02	site-specific		1.4E+02		6.4E-01
DICHLOROPROPANE, 1,2-	6.0E-02	Vapor Intrusion	1.0E+02	site-specific		1.1E+00	6.0E-02	2.7E+00
DICHLOROPROPENE, 1,3-	1.5E-01	Vapor Intrusion	5.0E+02	site-specific		1.9E+00	1.5E-01	8.9E+00
DIELDRIN	2.5E+00	Direct Exposure	1.0E+03	site-specific		2.5E+00		2.4E+01
DIETHYLPHTHALATE	1.7E+01	Groundwater Protection	5.0E+02	site-specific		1.0E+04		1.7E+01
DIMETHYLPHENOL, 2,4-	5.7E+01	Groundwater Protection	1.0E+02	site-specific		2.5E+02		5.7E+01
DIMETHYLPHTHALATE	7.4E+01	Groundwater Protection	5.0E+02	site-specific		1.3E+05		7.4E+01
DINITROBENZENE, 1,3-	1.3E+00	Direct Exposure	5.0E+02	site-specific		1.3E+00		5.8E+00
DINITROPHENOL, 2,4-	2.5E+01	Direct Exposure	5.0E+02	site-specific		2.5E+01		2.9E+01
DINITROTOLUENE, 2,4- (2,4-DNT)	1.7E+00	Direct Exposure	5.0E+02	site-specific		1.7E+00		1.1E+01
DINITROTOLUENE, 2,6- (2,6-DNT)	3.6E-01	Direct Exposure	5.0E+02	site-specific		3.6E-01		1.1E+01
DIOXANE, 1,4-	5.4E+00	Direct Exposure	5.0E+02	site-specific		5.4E+00	(Use soil gas)	2.3E+01
DIOXINS (TEQ)	2.4E-04	Direct Exposure	1.0E+03	site-specific	2.0E-05	2.4E-04		3.0E-01
DIURON	3.6E+00	Groundwater Protection	5.0E+02	site-specific		2.5E+01		3.6E+00
ENDOSULFAN	1.3E+01	Groundwater Protection	5.0E+02	site-specific		9.4E+01		1.3E+01
ENDRIN	3.8E+00	Direct Exposure	5.0E+02	site-specific		3.8E+00		3.0E+01
ETHANOL	4.5E+00	Groundwater Protection	5.0E+02	site-specific			(Use soil gas)	4.5E+00
ETHYLBENZENE	1.7E+01	Groundwater Protection	4.8E+02	site-specific		6.3E+01	2.4E+01	1.7E+01
FLUORANTHENE	1.2E+02	Groundwater Protection	5.0E+02	site-specific		4.8E+02		1.2E+02
FLUORENE	9.3E+01	Vapor Intrusion	5.0E+02	site-specific		4.6E+02	9.3E+01	4.6E+02
GLYPHOSATE	5.0E+02	Ceiling Value	5.0E+02	site-specific		1.3E+03		7.5E+03
HEPTACHLOR	1.4E-01	Direct Exposure	1.0E+03	site-specific		1.4E-01		4.5E+01
HEPTACHLOR EPOXIDE	7.1E-02	Direct Exposure	1.0E+03	site-specific		7.1E-02		1.2E+01
HEXACHLOROBENZENE	2.2E-01	Direct Exposure	5.0E+02	site-specific		2.2E-01		2.3E-01
HEXACHLOROBUTADIENE	1.3E+00	Direct Exposure	5.0E+02	site-specific		1.3E+00		2.2E+00
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	7.5E-02	Groundwater Protection	5.0E+02	site-specific		5.7E-01		7.5E-02
HEXACHLOROETHANE	2.0E+00	Direct Exposure	5.0E+02	site-specific		2.0E+00		5.7E+00
HEXAZINONE	4.2E+02	Direct Exposure	5.0E+02	site-specific		4.2E+02		1.1E+03

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

	(mg/kg)							
						[1]Human Health		Leaching & Groundwater Protection
CHEMICAL PARAMETER	Final EAL	Basis	[1]Gross Contamination (Odors, etc.) Table F-2	Terrestrial Ecotoxicity Table L	Background Table K	Direct Exposure Table I-1	Vapor Intrusion Into Buildings Table C-1b	NON-Drinking Water Resource Table E
INDENO(1,2,3-cd)PYRENE	1.6E+01	Direct Exposure	5.0E+02	site-specific		1.6E+01		3.1E+01
ISOPHORONE	4.7E+01	Groundwater Protection	5.0E+02	site-specific		5.7E+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 batch test)
METHOXYCHLOR	1.6E+01	Groundwater Protection	5.0E+02	site-specific		6.3E+01		1.6E+01
METHYL ETHYL KETONE	5.5E+01	Groundwater Protection	5.0E+02	site-specific		5.6E+03	2.2E+03	5.5E+01
METHYL ISOBUTYL KETONE	6.5E+00	Groundwater Protection	1.0E+02	site-specific		3.4E+03	1.3E+03	6.5E+00
METHYL MERCURY	1.6E+00	Direct Exposure	1.0E+02	site-specific		1.6E+00		(Use batch test)
METHYL TERT BUTYL ETHER	2.3E+00	Vapor Intrusion	1.0E+02	site-specific		5.0E+01	2.3E+00	1.0E+01
METHYLENE CHLORIDE	2.2E+01	Vapor Intrusion	5.0E+02	site-specific		5.8E+01	2.2E+01	2.0E+02
METHYLNAPHTHALENE, 1-	1.6E+01	Groundwater Protection	5.0E+02	site-specific		1.0E+02	5.9E+01	1.6E+01
METHYLNAPHTHALENE, 2-	1.7E+01	Groundwater Protection	5.0E+02	site-specific		3.9E+01	5.0E+01	1.7E+01
MOLYBDENUM	7.8E+01	Direct Exposure	1.0E+03	site-specific	4.0E+00	7.8E+01		(Use batch test)
NAPHTHALENE	7.0E+00	Vapor Intrusion	5.0E+02	site-specific		2.8E+01	7.0E+00	5.4E+01
NICKEL	4.1E+02	Background	1.0E+03	site-specific	4.1E+02	3.1E+02		(Use batch test)
NITROBENZENE	5.6E+00	Direct Exposure	5.0E+02	site-specific		5.6E+00	(Use soil gas)	7.5E+01
NITROGLYCERIN	1.3E+00	Direct Exposure	5.0E+02	site-specific		1.3E+00		3.1E+00
NITROTOLUENE, 2-	2.2E+00	Direct Exposure	5.0E+02	site-specific		2.2E+00	(Use soil gas)	3.9E+01
NITROTOLUENE, 3-	1.3E+00	Direct Exposure	5.0E+02	site-specific		1.3E+00		2.3E+01
NITROTOLUENE, 4-	2.5E+01	Groundwater Protection	5.0E+02	site-specific		3.4E+01		2.5E+01
PENTACHLOROPHENOL	1.0E+00	Direct Exposure	5.0E+02	site-specific		1.0E+00		1.3E+00
PENTAERYTHRITOLTETRANITRATE (PETN)	2.5E+01	Direct Exposure	5.0E+02	site-specific		2.5E+01		2.3E+03
PERCHLORATE	1.2E+00	Groundwater Protection	1.0E+03	site-specific		1.1E+01		1.2E+00
PHENANTHRENE	4.6E+02	Direct Exposure	5.0E+02	site-specific		4.6E+02	(Use soil gas)	7.0E+02
PHENOL	9.3E+00	Groundwater Protection	5.0E+02	site-specific		3.8E+03		9.3E+00
POLYCHLORINATED BIPHENYLS (PCBs)	1.2E+00	Direct Exposure	5.0E+02	site-specific		1.2E+00		4.3E+01
PROPICONAZOLE	1.1E+02	Groundwater Protection	5.0E+02	site-specific		1.6E+02		1.1E+02
PYRENE	4.4E+01	Vapor Intrusion	5.0E+02	site-specific		3.6E+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	1.9E+00	Groundwater Protection	5.0E+02	site-specific		4.5E+00		1.9E+00
STYRENE	1.0E+01	Groundwater Protection	5.0E+02	site-specific		8.7E+02	4.5E+02	1.0E+01
TERBACIL	2.2E+00	Groundwater Protection	5.0E+02	site-specific		1.6E+02		2.2E+00
tert-BUTYL ALCOHOL	9.9E+01	Direct Exposure	1.0E+02	site-specific		9.9E+01	(Use soil gas)	3.1E+02
TETRACHLOROETHANE, 1,1,1,2-	2.2E+00	Direct Exposure	1.0E+02	site-specific		2.2E+00	(Use soil gas)	2.3E+01
TETRACHLOROETHANE, 1,1,2,2-	1.0E-02	Vapor Intrusion	5.0E+02	site-specific		6.5E-01	1.0E-02	4.3E+00
TETRACHLOROETHYLENE	9.8E-02	Vapor Intrusion	1.7E+02	site-specific		1.1E+00	9.8E-02	2.5E+01
TETRACHLOROPHENOL, 2,3,4,6-	5.1E-01	Groundwater Protection	5.0E+02	site-specific		3.8E+02		5.1E-01
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	1.1E+02	Groundwater Protection	5.0E+02	site-specific		7.7E+02		1.1E+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	4.9E-01	Direct Exposure	5.0E+02	site-specific		4.9E-01		2.5E+02
TPH (gasolines)	1.0E+02	Ceiling Value	1.0E+02	site-specific		4.8E+02	(Use soil gas)	2.0E+03
TPH (middle distillates)	2.6E+02	Direct Exposure	5.0E+02	site-specific		2.6E+02	(Use soil gas)	5.0E+03
TPH (residual fuels)	5.0E+02	Ceiling Value	5.0E+02	site-specific		9.4E+03		5.0E+03

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

(mg/kg)

CHEMICAL PARAMETER	Final EAL	Basis	[1]Gross Contamination (Odors, etc.) Table F-2	Terrestrial Ecotoxicity Table L	Background Table K	[1]Human Health: Direct Exposure Table I-1	[1]Human Health: Vapor Intrusion Into Buildings Table C-1b	Leaching & Groundwater Protection: NON-Drinking Water Resource Table E
TRICHLOROBENZENE, 1,2,4-	1.6E-01	Vapor Intrusion	5.0E+02	site-specific		8.2E+00	1.6E-01	9.8E+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	8.9E-02	Vapor Intrusion	5.0E+02	site-specific		8.9E-01	8.9E-02	1.5E+01
TRICHLOROPHENOL, 2,4,5-	4.5E+00	Groundwater Protection	1.0E+02	site-specific		1.3E+03		4.5E+00
TRICHLOROPHENOL, 2,4,6-	2.5E+00	Groundwater Protection	5.0E+02	site-specific		1.3E+01		2.5E+00
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	1.2E+01	Groundwater Protection	1.0E+03	site-specific		1.3E+02		1.2E+01
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	7.9E+00	Groundwater Protection	5.0E+02	site-specific		1.0E+02		7.9E+00
TRICHLOROPROPANE, 1,2,3-	1.6E-03	Direct Exposure	1.0E+02	site-specific		1.6E-03	(Use soil gas)	3.0E+00
TRICHLOROPROPENE, 1,2,3-	8.1E-02	Groundwater Protection	1.0E+02	site-specific		1.6E-01	(Use soil gas)	8.1E-02
TRIFLURALIN	5.6E+01	Groundwater Protection	1.0E+02	site-specific		9.0E+01		5.6E+01
TRINITROBENZENE, 1,3,5-	7.5E+00	Groundwater Protection	5.0E+02	site-specific		4.5E+02		7.5E+00
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	3.1E+01	Groundwater Protection	5.0E+02	site-specific		3.1E+01		3.1E+01
TRINITROTOLUENE, 2,4,6- (TNT)	7.3E+00	Direct Exposure	5.0E+02	site-specific		7.3E+00		9.8E+01
VANADIUM	7.7E+02	Background	1.0E+03	site-specific	7.7E+02	7.8E+01		(Use batch test)
VINYL CHLORIDE	3.6E-02	Vapor Intrusion	5.0E+02	site-specific		5.9E-02	3.6E-02	3.3E+00
XYLENES	2.4E+01	Groundwater Protection	2.6E+02	site-specific		1.2E+02	4.5E+01	2.4E+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)	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		6.6E+02	1.2E+02	1.2E+02
ACENAPHTHYLENE	5.5E+00	Groundwater Protection	5.0E+02	site-specific		3.4E+02	(Use soil gas)	5.5E+00
ACETONE	9.2E-01	Groundwater Protection	5.0E+02	site-specific		1.2E+04	1.4E+04	9.2E-01
ALDRIN	3.9E+00	Direct Exposure	1.0E+03	site-specific		3.9E+00		8.4E+00
AMETRYN	5.0E+01	Groundwater Protection	5.0E+02	site-specific		1.1E+02		5.0E+01
AMINO,2- DINITROTOLUENE,4,6-	8.5E-01	Groundwater Protection	5.0E+02	site-specific		3.1E+01		8.5E-01
AMINO,4- DINITROTOLUENE,2,6-	5.2E-01	Groundwater Protection	5.0E+02	site-specific		3.1E+01		5.2E-01
ANTHRACENE	4.2E+00	Vapor Intrusion	5.0E+02	site-specific		3.5E+03	4.2E+00	4.2E+00
ANTIMONY	6.3E+00	Direct Exposure	1.0E+03	site-specific	2.4E+00	6.3E+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		2.4E+00		4.5E-01
BARIUM	1.0E+03	Ceiling Value	1.0E+03	site-specific	6.9E+02	3.1E+03		(Use batch test)
BENOMYL	7.8E-03	Groundwater Protection	1.0E+03	site-specific		6.3E+02		7.8E-03
BENZENE	7.7E-01	Vapor Intrusion	5.0E+02	site-specific		1.2E+00	7.7E-01	4.3E+00
BENZO(a)ANTHRACENE	1.0E+01	Groundwater Protection	5.0E+02	site-specific		1.6E+01		1.0E+01
BENZO(a)PYRENE	1.6E+00	Direct Exposure	5.0E+02	site-specific		1.6E+00		5.9E+00
BENZO(b)FLUORANTHENE	1.6E+01	Direct Exposure	5.0E+02	site-specific		1.6E+01		6.8E+01
BENZO(g,h,i)PERYLENE	3.5E+01	Groundwater Protection	5.0E+02	site-specific		4.8E+02		3.5E+01
BENZO(k)FLUORANTHENE	3.9E+01	Groundwater Protection	5.0E+02	site-specific		1.6E+02		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)	2.3E+02
BIS(2-CHLOROETHYL)ETHER	7.9E-03	Vapor Intrusion	5.0E+02	site-specific		2.4E-01	7.9E-03	9.6E-01
BIS(2-CHLORO-1-METHYLETHYL)ETHER	4.0E-03	Groundwater Protection	5.0E+02	site-specific		3.8E+00	(Use soil gas)	4.0E-03
BIS(2-ETHYLHEXYL)PHTHALATE	3.9E+01	Direct Exposure	5.0E+02	site-specific		3.9E+01		1.9E+02
BORON	1.0E+03	Ceiling Value	1.0E+03	site-specific		3.1E+03		(Use batch test)
BROMODICHLOROMETHANE	1.6E-02	Vapor Intrusion	9.3E+02	site-specific		3.2E-01	1.6E-02	2.1E+00
BROMOFORM	2.0E+00	Groundwater Protection	5.0E+02	site-specific		2.0E+01		2.0E+00
BROMOMETHANE	2.2E-01	Vapor Intrusion	5.0E+02	site-specific		1.5E+00	2.2E-01	7.6E-01
CADMIUM	1.4E+01	Direct Exposure	1.0E+03	site-specific	2.3E+00	1.4E+01		(Use batch test)
CARBON TETRACHLORIDE	1.0E-01	Vapor Intrusion	4.5E+02	site-specific		7.1E-01	1.0E-01	1.8E+00
CHLORDANE (TECHNICAL)	1.7E+01	Direct Exposure	1.0E+03	site-specific		1.7E+01		2.3E+01
CHLOROANILINE, p-	3.6E-01	Groundwater Protection	1.0E+03	site-specific		2.7E+00		3.6E-01
CHLOROBENZENE	1.5E+00	Groundwater Protection	5.0E+02	site-specific		5.9E+01	2.2E+00	1.5E+00
CHLOROETHANE	1.2E+01	Groundwater Protection	5.0E+02	site-specific		2.1E+03	4.5E+02	1.2E+01
CHLOROFORM	2.6E-02	Vapor Intrusion	5.0E+02	site-specific		3.4E-01	2.6E-02	7.9E-01
CHLOROMETHANE	4.0E+00	Vapor Intrusion	1.0E+02	site-specific		2.4E+01	4.0E+00	1.1E+01
CHLOROPHENOL, 2-	1.2E-01	Groundwater Protection	1.0E+02	site-specific		7.0E+01	4.2E+01	1.2E-01
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	3.0E+01	Direct Exposure	1.0E+03	site-specific		3.0E+01		(Use batch test)
CHRYSENE	3.0E+01	Groundwater Protection	1.0E+03	site-specific		1.6E+03		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)	4.8E+00	Direct Exposure	1.0E+02	site-specific		4.8E+00	(Use soil gas)	(Use batch test)
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	1.2E+00	Groundwater Protection	5.0E+02	site-specific		6.1E+00		1.2E+00

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
DALAPON	1.6E-01	Groundwater Protection	5.0E+02	site-specific		3.8E+02		1.6E-01
DIBENZO(a,h)ANTHTRACENE	1.6E+00	Direct Exposure	5.0E+02	site-specific		1.6E+00		2.5E+02
DIBROMO,1,2- CHLOROPROPANE,3-	8.1E-04	Groundwater Protection	5.0E+02	site-specific		5.7E-03	(Use soil gas)	8.1E-04
DIBROMOCHLOROMETHANE	2.9E-02	Vapor Intrusion	1.0E+02	site-specific		1.0E+00	2.9E-02	3.4E-01
DIBROMOETHANE, 1,2-	1.0E-03	Vapor Intrusion	5.0E+02	site-specific		3.9E-02	1.0E-03	2.0E-01
DICHLOROBENZENE, 1,2-	1.1E+00	Groundwater Protection	3.8E+02	site-specific		3.8E+02	8.9E+00	1.1E+00
DICHLOROBENZENE, 1,3-	2.5E+00	Groundwater Protection	1.0E+02	site-specific		2.0E+02	(Use soil gas)	2.5E+00
DICHLOROBENZENE, 1,4-	5.5E-02	Vapor Intrusion	5.0E+02	site-specific		2.8E+00	5.5E-02	7.3E-01
DICHLOROBENZIDINE, 3,3-	1.2E+00	Direct Exposure	5.0E+02	site-specific		1.2E+00		2.4E+00
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.3E+00	Direct Exposure	5.0E+02	site-specific		2.3E+00		6.3E+01
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.0E+00	Direct Exposure	5.0E+02	site-specific		2.0E+00		2.8E+01
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.9E+00	Direct Exposure	1.0E+03	site-specific		1.9E+00		5.6E+00
DICHLOROETHANE, 1,1-	3.8E-01	Vapor Intrusion	5.0E+02	site-specific		3.8E+00	3.8E-01	1.9E+00
DICHLOROETHANE, 1,2-	2.3E-02	Vapor Intrusion	5.0E+02	site-specific		5.0E-01	2.3E-02	2.6E+00
DICHLOROETHYLENE, 1,1-	4.2E+00	Groundwater Protection	5.0E+02	site-specific		4.9E+01	8.9E+00	4.2E+00
DICHLOROETHYLENE, Cis 1,2-	3.6E-01	Vapor Intrusion	1.0E+02	site-specific		3.9E+00	3.6E-01	2.0E+01
DICHLOROETHYLENE, Trans 1,2-	3.6E+00	Vapor Intrusion	5.0E+02	site-specific		2.9E+01	3.6E+00	3.6E+01
DICHLOROPHENOL, 2,4-	7.3E-02	Groundwater Protection	5.0E+02	site-specific		3.8E+01		7.3E-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-	6.0E-02	Vapor Intrusion	1.0E+02	site-specific		1.1E+00	6.0E-02	2.7E+00
DICHLOROPROPENE, 1,3-	2.1E-03	Groundwater Protection	5.0E+02	site-specific		1.9E+00	1.5E-01	2.1E-03
DIELDRIN	2.5E+00	Direct Exposure	1.0E+03	site-specific		2.5E+00		2.4E+01
DIETHYLPHTHALATE	3.7E+00	Groundwater Protection	5.0E+02	site-specific		1.0E+04		3.7E+00
DIMETHYLPHENOL, 2,4-	9.8E+00	Groundwater Protection	1.0E+02	site-specific		2.5E+02		9.8E+00
DIMETHYLPHTHALATE	2.6E+01	Groundwater Protection	5.0E+02	site-specific		1.3E+05		2.6E+01
DINITROBENZENE, 1,3-	5.8E-01	Groundwater Protection	5.0E+02	site-specific		1.3E+00		5.8E-01
DINITROPHENOL, 2,4-	1.1E+00	Groundwater Protection	5.0E+02	site-specific		2.5E+01		1.1E+00
DINITROTOLUENE, 2,4- (2,4-DNT)	8.7E-01	Groundwater Protection	5.0E+02	site-specific		1.7E+00		8.7E-01
DINITROTOLUENE, 2,6- (2,6-DNT)	3.6E-01	Direct Exposure	5.0E+02	site-specific		3.6E-01		7.9E+00
DIOXANE, 1,4-	5.4E+00	Direct Exposure	5.0E+02	site-specific		5.4E+00	(Use soil gas)	2.3E+01
DIOXINS (TEQ)	2.4E-04	Direct Exposure	1.0E+03	site-specific	2.0E-05	2.4E-04		3.0E-01
DIURON	1.1E+00	Groundwater Protection	5.0E+02	site-specific		2.5E+01		1.1E+00
ENDOSULFAN	1.3E+01	Groundwater Protection	5.0E+02	site-specific		9.4E+01		1.3E+01
ENDRIN	3.8E+00	Direct Exposure	5.0E+02	site-specific		3.8E+00		3.0E+01
ETHANOL	4.5E+00	Groundwater Protection	5.0E+02	site-specific			(Use soil gas)	4.5E+00
ETHYLBENZENE	9.0E-01	Groundwater Protection	4.8E+02	site-specific		6.3E+01	2.4E+01	9.0E-01
FLUORANTHENE	8.7E+01	Groundwater Protection	5.0E+02	site-specific		4.8E+02		8.7E+01
FLUORENE	9.3E+01	Vapor Intrusion	5.0E+02	site-specific		4.6E+02	9.3E+01	9.3E+01
GLYPHOSATE	5.0E+02	Ceiling Value	5.0E+02	site-specific		1.3E+03		6.3E+02
HEPTACHLOR	1.4E-01	Direct Exposure	1.0E+03	site-specific		1.4E-01		4.5E+01
HEPTACHLOR EPOXIDE	7.1E-02	Direct Exposure	1.0E+03	site-specific		7.1E-02		1.2E+01
HEXACHLOROBENZENE	2.2E-01	Direct Exposure	5.0E+02	site-specific		2.2E-01		2.3E-01
HEXACHLOROBUTADIENE	6.1E-02	Groundwater Protection	5.0E+02	site-specific		1.3E+00		6.1E-02
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	2.9E-02	Groundwater Protection	5.0E+02	site-specific		5.7E-01		2.9E-02
HEXACHLOROETHANE	6.8E-01	Groundwater Protection	5.0E+02	site-specific		2.0E+00		6.8E-01

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

	(mg/kg)							
						[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	3.7E+02	Groundwater Protection	5.0E+02	site-specific		4.2E+02		3.7E+02
INDENO(1,2,3-cd)PYRENE	1.6E+01	Direct Exposure	5.0E+02	site-specific		1.6E+01		3.1E+01
ISOPHORONE	1.0E+01	Groundwater Protection	5.0E+02	site-specific		5.7E+02		1.0E+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 batch test)
METHOXYCHLOR	1.6E+01	Groundwater Protection	5.0E+02	site-specific		6.3E+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		3.4E+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	2.3E+00	Vapor Intrusion	1.0E+02	site-specific		5.0E+01	2.3E+00	4.1E+00
METHYLENE CHLORIDE	2.2E+01	Vapor Intrusion	5.0E+02	site-specific		5.8E+01	2.2E+01	3.6E+01
METHYLNAPHTHALENE, 1-	8.9E-01	Groundwater Protection	5.0E+02	site-specific		1.0E+02	5.9E+01	8.9E-01
METHYLNAPHTHALENE, 2-	1.9E+00	Groundwater Protection	5.0E+02	site-specific		3.9E+01	5.0E+01	1.9E+00
MOLYBDENUM	7.8E+01	Direct Exposure	1.0E+03	site-specific	4.0E+00	7.8E+01		(Use batch test)
NAPHTHALENE	3.1E+00	Groundwater Protection	5.0E+02	site-specific		2.8E+01	7.0E+00	3.1E+00
NICKEL	4.1E+02	Background	1.0E+03	site-specific	4.1E+02	3.1E+02		(Use batch test)
NITROBENZENE	5.6E+00	Direct Exposure	5.0E+02	site-specific		5.6E+00	(Use soil gas)	1.4E+01
NITROGLYCERIN	3.5E-01	Groundwater Protection	5.0E+02	site-specific		1.3E+00		3.5E-01
NITROTOLUENE, 2-	2.2E+00	Direct Exposure	5.0E+02	site-specific		2.2E+00	(Use soil gas)	4.4E+00
NITROTOLUENE, 3-	1.3E+00	Direct Exposure	5.0E+02	site-specific		1.3E+00		2.5E+00
NITROTOLUENE, 4-	2.8E+00	Groundwater Protection	5.0E+02	site-specific		3.4E+01		2.8E+00
PENTACHLOROPHENOL	7.8E-01	Groundwater Protection	5.0E+02	site-specific		1.0E+00		7.8E-01
PENTAERYTHRITOLTETRANITRATE (PETN)	2.5E+01	Direct Exposure	5.0E+02	site-specific		2.5E+01		2.3E+03
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		4.6E+02	(Use soil gas)	6.9E+01
PHENOL	1.8E+00	Groundwater Protection	5.0E+02	site-specific		3.8E+03		1.8E+00
POLYCHLORINATED BIPHENYLS (PCBs)	1.2E+00	Direct Exposure	5.0E+02	site-specific		1.2E+00		3.4E+01
PROPICONAZOLE	2.5E+01	Groundwater Protection	5.0E+02	site-specific		1.6E+02		2.5E+01
PYRENE	4.4E+01	Vapor Intrusion	5.0E+02	site-specific		3.6E+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	2.2E-01	Groundwater Protection	5.0E+02	site-specific		4.5E+00		2.2E-01
STYRENE	2.9E+00	Groundwater Protection	5.0E+02	site-specific		8.7E+02	4.5E+02	2.9E+00
TERBACIL	2.2E+00	Groundwater Protection	5.0E+02	site-specific		1.6E+02		2.2E+00
tert-BUTYL ALCOHOL	9.9E+01	Direct Exposure	1.0E+02	site-specific		9.9E+01	(Use soil gas)	1.1E+02
TETRACHLOROETHANE, 1,1,1,2-	3.2E-01	Groundwater Protection	1.0E+02	site-specific		2.2E+00	(Use soil gas)	3.2E-01
TETRACHLOROETHANE, 1,1,2,2-	1.0E-02	Vapor Intrusion	5.0E+02	site-specific		6.5E-01	1.0E-02	3.6E+00
TETRACHLOROETHYLENE	9.8E-02	Vapor Intrusion	1.7E+02	site-specific		1.1E+00	9.8E-02	6.8E+00
TETRACHLOROPHENOL, 2,3,4,6-	5.6E-02	Groundwater Protection	5.0E+02	site-specific		3.8E+02		5.6E-02
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	1.9E+01	Groundwater Protection	5.0E+02	site-specific		7.7E+02		1.9E+01
THALLIUM	7.8E-01	Direct Exposure	1.0E+03	site-specific	2.5E-01	7.8E-01		(Use batch test)
TOLUENE	7.8E-01	Groundwater Protection	5.0E+02	site-specific		8.2E+02	8.2E+02	7.8E-01
TOXAPHENE	4.9E-01	Direct Exposure	5.0E+02	site-specific		4.9E-01		2.5E+02
TPH (gasolines)	1.0E+02	Ceiling Value	1.0E+02	site-specific		4.8E+02	(Use soil gas)	4.0E+02
TPH (middle distillates)	2.6E+02	Direct Exposure	5.0E+02	site-specific		2.6E+02	(Use soil gas)	5.0E+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
TPH (residual fuels)	5.0E+02	Ceiling Value	5.0E+02	site-specific		9.4E+03		1.0E+03
TRICHLOROBENZENE, 1,2,4-	1.6E-01	Vapor Intrusion	5.0E+02	site-specific		8.2E+00	1.6E-01	2.6E+01
TRICHLOROETHANE, 1,1,1-	1.2E+00	Groundwater Protection	5.0E+02	site-specific		6.4E+02	2.2E+02	1.2E+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	8.9E-02	Vapor Intrusion	5.0E+02	site-specific		8.9E-01	8.9E-02	3.4E+00
TRICHLOROPHENOL, 2,4,5-	5.0E-01	Groundwater Protection	1.0E+02	site-specific		1.3E+03		5.0E-01
TRICHLOROPHENOL, 2,4,6-	3.1E-01	Groundwater Protection	5.0E+02	site-specific		1.3E+01		3.1E-01
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	1.2E+01	Groundwater Protection	1.0E+03	site-specific		1.3E+02		1.2E+01
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	8.7E-01	Groundwater Protection	5.0E+02	site-specific		1.0E+02		8.7E-01
TRICHLOROPROPANE, 1,2,3-	1.6E-03	Direct Exposure	1.0E+02	site-specific		1.6E-03	(Use soil gas)	3.0E-01
TRICHLOROPROPENE, 1,2,3-	8.1E-02	Groundwater Protection	1.0E+02	site-specific		1.6E-01	(Use soil gas)	8.1E-02
TRIFLURALIN	1.8E+01	Groundwater Protection	1.0E+02	site-specific		9.0E+01		1.8E+01
TRINITROBENZENE, 1,3,5-	2.8E+00	Groundwater Protection	5.0E+02	site-specific		4.5E+02		2.8E+00
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	3.1E+01	Groundwater Protection	5.0E+02	site-specific		3.1E+01		3.1E+01
TRINITROTOLUENE, 2,4,6- (TNT)	6.1E+00	Groundwater Protection	5.0E+02	site-specific		7.3E+00		6.1E+00
VANADIUM	7.7E+02	Background	1.0E+03	site-specific	7.7E+02	7.8E+01		(Use batch test)
VINYL CHLORIDE	3.6E-02	Vapor Intrusion	5.0E+02	site-specific		5.9E-02	3.6E-02	3.3E+00
XYLENES	1.4E+00	Groundwater Protection	2.6E+02	site-specific		1.2E+02	4.5E+01	1.4E+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 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	6.2E+08	1.0E+09
ALDRIN	SV	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		
BENOMYL	NV	S		
#BENZENE	V	L	2.3E+03	2.0E+04
BENZO(a)ANTHRACENE	SV	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	1.8E+02	1.5E+03
BIS(2-CHLORO-1-METHYLETHYL)ETHER	V	L	(Use soil gas)	(Use soil gas)
BIS(2-ETHYLHEXYL)PHTHALATE	NV	S		
BORON	NV	S		
BROMODICHLOROMETHANE	V	L	1.1E+02	1.0E+03
BROMOFORM	SV	S		
BROMOMETHANE	V	G	4.1E+02	3.4E+03
CADMIUM	NV	S		
CARBON TETRACHLORIDE	V	L	1.1E+02	9.6E+02
CHLORDANE (TECHNICAL)	SV	S		
CHLOROANILINE, p-	NV	S		
CHLOROBENZENE	V	L	1.2E+04	1.0E+05
CHLOROETHANE	V	G	6.0E+05	5.1E+06
CHLOROFORM	V	L	1.1E+02	9.5E+02
CHLOROMETHANE	V	G	5.2E+03	4.4E+04
CHLOROPHENOL, 2-	V	L	1.0E+05	8.4E+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	4.5E+02	3.9E+03
DIBROMOETHANE, 1,2-	V	S	1.9E+01	1.6E+02
DICHLOROBENZENE, 1,2-	V	L	8.3E+04	1.6E+05
DICHLOROBENZENE, 1,3-	V	L	(Use soil gas)	(Use soil gas)
DICHLOROBENZENE, 1,4-	V	S	4.5E+02	3.9E+03
DICHLOROBENZIDINE, 3,3-	NV	S		
DICHLORODIPHENYLDICHLOROETHANE (DDD)	NV	S		
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	SV	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)
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	NV	S		
DICHLOROETHANE, 1,1-	V	L	1.1E+03	9.6E+03
DICHLOROETHANE, 1,2-	V	L	1.8E+02	1.6E+03
DICHLOROETHYLENE, 1,1-	V	L	6.6E+03	5.6E+04
DICHLOROETHYLENE, Cis 1,2-	V	L	1.3E+03	1.1E+04
DICHLOROETHYLENE, Trans 1,2-	V	L	6.6E+03	5.5E+04
DICHLOROPHENOL, 2,4-	NV	S		
DICHLOROPHENOXYACETIC ACID (2,4-D)	NV	S		
DICHLOROPROPANE, 1,2-	V	L	3.4E+02	2.9E+03
DICHLOROPROPENE, 1,3-	V	L	6.7E+02	5.9E+03
DIELDRIN	NV	S		
DIETHYLPHTHALATE	NV	S		
#DIMETHYLPHENOL, 2,4-	NV	S		
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-	V	L	(Use soil gas)	(Use soil gas)
DIOXINS (TEQ)	SV	S		
DIURON	NV	S		
ENDOSULFAN	SV	S		
ENDRIN	NV	S		
ETHANOL	V	L	(Use soil gas)	(Use soil gas)
#ETHYLBENZENE	V	L	7.6E+04	1.7E+05
FLUORANTHENE	NV	S		
#FLUORENE	V	S	1.7E+03	1.7E+03
GLYPHOSATE	NV	S		
HEPTACHLOR	SV	S		
HEPTACHLOR EPOXIDE	SV	S		
HEXACHLOROBENZENE	SV	S		
HEXACHLOROBUTADIENE	SV	S		
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	NV	S		
HEXACHLOROETHANE	SV	S		
HEXAZINONE	NV	S		
INDENO(1,2,3-cd)PYRENE	NV	S		
ISOPHORONE	NV	L		
LEAD	NV	S		
MERCURY	NV	S		
METHOXYCHLOR	NV	S		
#METHYL ETHYL KETONE	V	L	2.2E+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	3.1E+04	2.7E+05
METHYLENE CHLORIDE	V	L	7.6E+04	7.9E+05
#METHYLNAPHTHALENE, 1-	V	S	2.6E+04	2.6E+04
#METHYLNAPHTHALENE, 2-	V	S	2.5E+04	2.5E+04
MOLYBDENUM	NV	S		
#NAPHTHALENE	V	S	2.9E+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-	NV	S		
NITROTOLUENE, 4-	NV	S		
PENTACHLOROPHENOL	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)
PENTAERYTHRITOLTETRANITRATE (PETN)	NV	S		
PERCHLORATE	NV	S		
PHENANTHRENE	V	S	(Use soil gas)	(Use soil gas)
PHENOL	NV	S		
POLYCHLORINATED BIPHENYLS (PCBs)	SV	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	2.4E+02	2.1E+03
TETRACHLOROETHYLENE	V	L	1.9E+02	1.7E+03
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	1.2E+03	1.0E+04
TRICHLOROETHANE, 1,1,1-	V	L	3.4E+05	1.3E+06
TRICHLOROETHANE, 1,1,2-	V	L	1.1E+02	9.0E+02
TRICHLOROETHYLENE	V	L	2.1E+02	1.8E+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	(Use soil gas)	(Use soil gas)
TRICHLOROPROPENE, 1,2,3-	V	L	(Use soil gas)	(Use soil gas)
TRIFLURALIN	SV	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	1.8E+01	6.1E+02
#XYLENES	V	L	1.1E+05	1.1E+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)

For VLOOKUP	CHEMICAL PARAMETER	Physical State		[1]Unrestricted Land Use (mg/kg)	Commercial/ Industrial Land Use Only (mg/kg)
ACENAPHTH	#ACENAPHTHENE	V	S	1.2E+02	1.2E+02
ACENAPHTH	ACENAPHTHYLENE	V	S	(Use soil gas)	(Use soil gas)
ACETONE	#ACETONE	V	L	1.4E+04	1.1E+05
ALDRIN	ALDRIN	SV	S		
AMETRYN	AMETRYN	NV	S		
AMINO,2- DI	AMINO,2- DINITROTOLUENE,4,6-	NV	S		
AMINO,4- DI	AMINO,4- DINITROTOLUENE,2,6-	NV	S		
ANTHRACEN	#ANTHRACENE	V	S	4.2E+00	4.2E+00
ANTIMONY	ANTIMONY	NV	S		
ARSENIC	ARSENIC	NV	S		
ATRAZINE	ATRAZINE	NV	S		
BARIUM	BARIUM	NV	S		
BENOMYL	BENOMYL	NV	S		
BENZENE	#BENZENE	V	L	7.7E-01	5.6E+00
BENZO(a)AN	BENZO(a)ANTHRACENE	SV	S		
BENZO(a)PY	BENZO(a)PYRENE	NV	S		
BENZO(b)FL	BENZO(b)FLUORANTHENE	NV	S		
BENZO(g,h,i)	BENZO(g,h,i)PERYLENE	NV	S		
BENZO(k)FL	BENZO(k)FLUORANTHENE	NV	S		
BERYLLIUM	BERYLLIUM	NV	S		
BIPHENYL, 1	BIPHENYL, 1,1-	V	S	(Use soil gas)	(Use soil gas)
BIS(2-CHLOI	BIS(2-CHLOROETHYL)ETHER	V	L	7.9E-03	6.7E-02
BIS(2-CHLOI	BIS(2-CHLORO-1-METHYLETHYL)ETHER	V	L	(Use soil gas)	(Use soil gas)
BIS(2-ETHYL	BIS(2-ETHYLHEXYL)PHTHALATE	NV	S		
BORON	BORON	NV	S		
BROMODICH	BROMODICHLOROMETHANE	V	L	1.6E-02	1.2E-01
BROMOFOR	BROMOFORM	SV	S		
BROMOMET	BROMOMETHANE	V	G	2.2E-01	1.6E+00
CADMIUM	CADMIUM	NV	S		
CARBON TE	CARBON TETRACHLORIDE	V	L	1.0E-01	7.3E-01
CHLORDANE	CHLORDANE (TECHNICAL)	SV	S		
CHLOROANI	CHLOROANILINE, p-	NV	S		
CHLOROBEN	CHLOROBENZENE	V	L	2.2E+00	1.6E+01
CHLOROETH	CHLOROETHANE	V	G	4.5E+02	2.1E+03
CHLOROFOI	CHLOROFORM	V	L	2.6E-02	1.9E-01
CHLOROME	CHLOROMETHANE	V	G	4.0E+00	2.8E+01
CHLOROPHI	CHLOROPHENOL, 2-	V	L	4.2E+01	3.5E+02
CHROMIUM	CHROMIUM (Total)	NV	S		
CHROMIUM	CHROMIUM III	NV	S		
CHROMIUM	CHROMIUM VI	NV	S		
CHRYSENE	CHRYSENE	NV	S		
COBALT	COBALT	NV	S		
COPPER	COPPER	NV	S		
CYANIDE (FI	CYANIDE (Free)	V	S	(Use soil gas)	(Use soil gas)
CYCLO-1,3,5	CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	NV	S		
DALAPON	DALAPON	NV	L		
DIBENZO(a,h	DIBENZO(a,h)ANTHTRACENE	NV	S		
DIBROMO,1,	DIBROMO,1,2- CHLOROPROPANE,3-	V	L	(Use soil gas)	(Use soil gas)
DIBROMOCH	DIBROMOCHLOROMETHANE	V	S	2.9E-02	2.1E-01
DIBROMOET	DIBROMOETHANE, 1,2-	V	S	1.0E-03	7.3E-03
DICHLOROB	DICHLOROBENZENE, 1,2-	V	L	8.9E+00	6.2E+01
DICHLOROB	DICHLOROBENZENE, 1,3-	V	L	(Use soil gas)	(Use soil gas)
DICHLOROB	DICHLOROBENZENE, 1,4-	V	S	5.5E-02	4.0E-01
DICHLOROB	DICHLOROBENZIDINE, 3,3-	NV	S		
DICHLOROD	DICHLORODIPHENYLDICHLOROETHANE (DDD)	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)

For VLOOKUP	CHEMICAL PARAMETER	Physical State		[1]Unrestricted Land Use (mg/kg)	Commercial/ Industrial Land Use Only (mg/kg)
DICHLOROD	DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	SV	S		
DICHLOROD	DICHLORODIPHENYLTRICHLOROETHANE (DDT)	NV	S		
DICHLOROE	DICHLOROETHANE, 1,1-	V	L	3.8E-01	2.7E+00
DICHLOROE	DICHLOROETHANE, 1,2-	V	L	2.3E-02	1.7E-01
DICHLOROE	DICHLOROETHYLENE, 1,1-	V	L	8.9E+00	6.2E+01
DICHLOROE	DICHLOROETHYLENE, Cis 1,2-	V	L	3.6E-01	2.5E+00
DICHLOROE	DICHLOROETHYLENE, Trans 1,2-	V	L	3.6E+00	2.5E+01
DICHLOROP	DICHLOROPHENOL, 2,4-	NV	S		
DICHLOROP	DICHLOROPHENOXYACETIC ACID (2,4-D)	NV	S		
DICHLOROP	DICHLOROPROPANE, 1,2-	V	L	6.0E-02	4.4E-01
DICHLOROP	DICHLOROPROPENE, 1,3-	V	L	1.5E-01	1.1E+00
DIELDRIN	DIELDRIN	NV	S		
DIETHYLPH	DIETHYLPHTHALATE	NV	S		
DIMETHYLPI	#DIMETHYLPHENOL, 2,4-	NV	S		
DIMETHYLPI	DIMETHYLPHTHALATE	NV	S		
DINITROBEN	DINITROBENZENE, 1,3-	NV	S		
DINITROPHE	DINITROPHENOL, 2,4-	NV	S		
DINITROTOL	DINITROTOLUENE, 2,4- (2,4-DNT)	NV	S		
DINITROTOL	DINITROTOLUENE, 2,6- (2,6-DNT)	NV	S		
DIOXANE, 1,	DIOXANE, 1,4-	V	L	(Use soil gas)	(Use soil gas)
DIOXINS (TE	DIOXINS (TEQ)	SV	S		
DIURON	DIURON	NV	S		
ENDOSULFA	ENDOSULFAN	SV	S		
ENDRIN	ENDRIN	NV	S		
ETHANOL	ETHANOL	V	L	(Use soil gas)	(Use soil gas)
ETHYLBENZ	#ETHYLBENZENE	V	L	2.4E+01	1.7E+02
FLUORANTH	FLUORANTHENE	NV	S		
FLUORENE	#FLUORENE	V	S	9.3E+01	9.3E+01
GLYPHOSAT	GLYPHOSATE	NV	S		
HEPTACHLO	HEPTACHLOR	SV	S		
HEPTACHLO	HEPTACHLOR EPOXIDE	SV	S		
HEXACHLOR	HEXACHLOROBENZENE	SV	S		
HEXACHLOR	HEXACHLOROBUTADIENE	SV	S		
HEXACHLOR	HEXACHLOROCYCLOHEXANE (gamma) LINDANE	NV	S		
HEXACHLOR	HEXACHLOROETHANE	SV	S		
HEXAZINON	HEXAZINONE	NV	S		
INDENO(1,2,	INDENO(1,2,3-cd)PYRENE	NV	S		
ISOPHORON	ISOPHORONE	NV	L		
LEAD	LEAD	NV	S		
MERCURY	MERCURY	NV	S		
METHOXYCI	METHOXYCHLOR	NV	S		
METHYL ETI	#METHYL ETHYL KETONE	V	L	2.2E+03	1.6E+04
METHYL ISO	#METHYL ISOBUTYL KETONE	V	L	1.3E+03	3.4E+03
METHYL ME	METHYL MERCURY	NV	S		
METHYL TEI	METHYL TERT BUTYL ETHER	V	L	2.3E+00	1.7E+01
METHYLENE	METHYLENE CHLORIDE	V	L	2.2E+01	1.9E+02
METHYLNAF	#METHYLNAPHTHALENE, 1-	V	S	5.9E+01	3.9E+02
METHYLNAF	#METHYLNAPHTHALENE, 2-	V	S	5.0E+01	3.7E+02
MOLYBDENU	MOLYBDENUM	NV	S		
NAPHTHALE	#NAPHTHALENE	V	S	7.0E+00	5.8E+01
NICKEL	NICKEL	NV	S		
NITROBENZ	NITROBENZENE	V	L	(Use soil gas)	(Use soil gas)
NITROGLYC	NITROGLYCERIN	NV	L		
NITROTOLU	NITROTOLUENE, 2-	V	S	(Use soil gas)	(Use soil gas)
NITROTOLU	NITROTOLUENE, 3-	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)

For VLOOKUP	CHEMICAL PARAMETER	Physical State		[1]Unrestricted Land Use (mg/kg)	Commercial/ Industrial Land Use Only (mg/kg)
NITROTOLU	NITROTOLUENE, 4-	NV	S		
PENTACHLO	PENTACHLOROPHENOL	NV	S		
PENTAERYT	PENTAERYTHRITOLTETRANITRATE (PETN)	NV	S		
PERCHLORA	PERCHLORATE	NV	S		
PHENANTHR	PHENANTHRENE	V	S	(Use soil gas)	(Use soil gas)
PHENOL	PHENOL	NV	S		
POLYCHLOR	POLYCHLORINATED BIPHENYLS (PCBs)	SV	S		
PROPICONA	PROPICONAZOLE	NV	L		
PYRENE	#PYRENE	V	S	4.4E+01	4.4E+01
SELENIUM	SELENIUM	NV	S		
SILVER	SILVER	NV	S		
SIMAZINE	SIMAZINE	NV	S		
STYRENE	#STYRENE	V	L	4.5E+02	8.7E+02
TERBACIL	TERBACIL	NV	S		
tert-BUTYL A	tert-BUTYL ALCOHOL	V	L	(Use soil gas)	(Use soil gas)
TETRACHLO	TETRACHLOROETHANE, 1,1,1,2-	V	L	(Use soil gas)	(Use soil gas)
TETRACHLO	TETRACHLOROETHANE, 1,1,2,2-	V	L	1.0E-02	7.5E-02
TETRACHLO	TETRACHLOROETHYLENE	V	L	9.8E-02	7.2E-01
TETRACHLO	TETRACHLOROPHENOL, 2,3,4,6-	NV	S		
TETRANITRO	TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	NV	S		
THALLIUM	THALLIUM	NV	S		
TOLUENE	#TOLUENE	V	L	8.2E+02	8.2E+02
TOXAPHENE	TOXAPHENE	NV	S		
TPH (gasolin	TPH (gasolines)	V	L	(Use soil gas)	(Use soil gas)
TPH (middle	TPH (middle distillates)	V	L	(Use soil gas)	(Use soil gas)
TPH (residua	TPH (residual fuels)	NV	L		
TRICHLORO	TRICHLOROBENZENE, 1,2,4-	V	S	1.6E-01	1.4E+00
TRICHLORO	TRICHLOROETHANE, 1,1,1-	V	L	2.2E+02	6.4E+02
TRICHLORO	TRICHLOROETHANE, 1,1,2-	V	L	8.9E-03	6.2E-02
TRICHLORO	TRICHLOROETHYLENE	V	L	8.9E-02	6.2E-01
TRICHLORO	TRICHLOROPHENOL, 2,4,5-	NV	S		
TRICHLORO	TRICHLOROPHENOL, 2,4,6-	NV	S		
TRICHLORO	TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	NV	S		
TRICHLORO	TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	NV	S		
TRICHLORO	TRICHLOROPROPANE, 1,2,3-	V	L	(Use soil gas)	(Use soil gas)
TRICHLORO	TRICHLOROPROPENE, 1,2,3-	V	L	(Use soil gas)	(Use soil gas)
TRIFLURALI	TRIFLURALIN	SV	S		
TRINITROBE	TRINITROBENZENE, 1,3,5-	NV	S		
TRINITROPH	TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	NV	S		
TRINITROTO	TRINITROTOLUENE, 2,4,6- (TNT)	NV	S		
VANADIUM	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)

For VLOOKUP	CHEMICAL PARAMETER	Physical State		[1]Unrestricted Land Use (mg/kg)	Commercial/ Industrial Land Use Only (mg/kg)
VINYL CHLO	VINYL CHLORIDE	V	G	3.6E-02	9.9E-01
XYLENES	#XYLENES	V	L	4.5E+01	2.6E+02
ZINC	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 VAPOR 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	1.0E+05		1.0E+05	8.4E+05		8.4E+05
ACENAPHTHYLENE	V	S	6.7E+04		6.7E+04	5.6E+05		5.6E+05
ACETONE	V	L	1.3E+07		1.3E+07	1.1E+08		1.1E+08
ALDRIN	SV	S	4.2E+02	6.6E+02	4.2E+02	3.5E+03	5.8E+03	3.5E+03
AMETRYN	NV	S						
AMINO,2- DINITROTOLUENE,4,6-	NV	S						
AMINO,4- DINITROTOLUENE,2,6-	NV	S						
ANTHRACENE	V	S	5.0E+05		5.0E+05	4.2E+06		4.2E+06
ANTIMONY	NV	S						
ARSENIC	NV	S						
ATRAZINE	NV	S						
BARIUM	NV	S						
BENOMYL	NV	S						
BENZENE	V	L	7.2E+02	7.2E+02	1.3E+04	6.3E+03	6.3E+03	1.1E+05
BENZO(a)ANTHRACENE	SV	S	1.8E+03	1.8E+03		4.5E+03	4.5E+03	
BENZO(a)PYRENE	NV	S						
BENZO(b)FLUORANTHENE	NV	S						
BENZO(g,h,i)PERYLENE	NV	S						
BENZO(k)FLUORANTHENE	NV	S						
BERYLLIUM	NV	S						
BIPHENYL, 1,1-	V	S	1.7E+02	2.8E+03	1.7E+02	1.4E+03	2.5E+04	1.4E+03
BIS(2-CHLOROETHYL)ETHER	V	L	1.7E+01	1.7E+01		1.5E+02	1.5E+02	
BIS(2-CHLORO-1-METHYLETHYL)ETHER	V	L	5.6E+02	5.6E+02	5.8E+04	4.9E+03	4.9E+03	4.9E+05
BIS(2-ETHYLHEXYL)PHTHALATE	NV	S						
BORON	NV	S						
BROMODICHLOROMETHANE	V	L	1.5E+02	1.5E+02	3.3E+04	1.3E+03	1.3E+03	2.8E+05
BROMOFORM	SV	S	5.1E+03	5.1E+03		4.5E+04	4.5E+04	
BROMOMETHANE	V	G	2.1E+03		2.1E+03	1.8E+04		1.8E+04
CADMIUM	NV	S						
CARBON TETRACHLORIDE	V	L	9.4E+02	9.4E+02	4.2E+04	8.2E+03	8.2E+03	3.5E+05
CHLORDANE (TECHNICAL)	SV	S	5.6E+02	5.6E+02	1.5E+03	4.9E+03	4.9E+03	1.2E+04
CHLOROANILINE, p-	NV	S						
CHLOROBENZENE	V	L	2.1E+04		2.1E+04	1.8E+05		1.8E+05
CHLOROETHANE	V	G	4.2E+06		4.2E+06	3.5E+07		3.5E+07
CHLOROFORM	V	L	2.4E+02	2.4E+02	4.1E+04	2.1E+03	2.1E+03	3.4E+05
CHLOROMETHANE	V	G	3.8E+04		3.8E+04	3.2E+05		3.2E+05
CHLOROPHENOL, 2-	V	L	8.3E+03		8.3E+03	7.0E+04		7.0E+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	3.3E+02		3.3E+02	2.8E+03		2.8E+03
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	NV	S						
DALAPON	NV	L						

TABLE C-2. [1]SHALLOW SOIL VAPOR 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)
DIBENZO(a,h)ANTHTRACENE	NV	S						
DIBROMO,1,2- CHLOROPROPANE,3-	V	L	3.4E-01	3.4E-01	8.3E+01	8.2E+00	8.2E+00	7.0E+02
DIBROMOCHLOROMETHANE	V	S	2.7E+02	2.7E+02	3.3E+04	2.3E+03	2.3E+03	2.8E+05
DIBROMOETHANE, 1,2-	V	S	9.4E+00	9.4E+00	3.8E+03	8.2E+01	8.2E+01	3.2E+04
DICHLOROBENZENE, 1,2-	V	L	8.3E+04		8.3E+04	7.0E+05		7.0E+05
DICHLOROBENZENE, 1,3-	V	L	5.0E+04		5.0E+04	4.2E+05		4.2E+05
DICHLOROBENZENE, 1,4-	V	S	5.1E+02	5.1E+02	3.3E+05	4.5E+03	4.5E+03	2.8E+06
DICHLOROBENZIDINE, 3,3-	NV	S						
DICHLORODIPHENYLDICHLOROETHANE (DDD)	NV	S						
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	SV	S	5.8E+01	5.8E+01		5.1E+02	5.1E+02	
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	NV	S						
DICHLOROETHANE, 1,1-	V	L	3.5E+03	3.5E+03	3.3E+05	3.1E+04	3.1E+04	2.8E+06
DICHLOROETHANE, 1,2-	V	L	2.2E+02	2.2E+02	2.9E+03	1.9E+03	1.9E+03	2.5E+04
DICHLOROETHYLENE, 1,1-	V	L	8.3E+04		8.3E+04	7.0E+05		7.0E+05
DICHLOROETHYLENE, Cis 1,2-	V	L	3.3E+03		3.3E+03	2.8E+04		2.8E+04
DICHLOROETHYLENE, Trans 1,2-	V	L	3.3E+04		3.3E+04	2.8E+05		2.8E+05
DICHLOROPHENOL, 2,4-	NV	S						
DICHLOROPHENOXYACETIC ACID (2,4-D)	NV	S						
DICHLOROPROPANE, 1,2-	V	L	5.6E+02	5.6E+02	1.7E+03	4.9E+03	4.9E+03	1.4E+04
DICHLOROPROPENE, 1,3-	V	L	1.4E+03	1.4E+03	8.3E+03	1.2E+04	1.2E+04	7.0E+04
DIELDRIN	NV	S						
DIETHYLPHTHALATE	NV	S						
DIMETHYLPHENOL, 2,4-	NV	S						
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-	V	L	1.1E+03	1.1E+03	1.3E+04	9.8E+03	9.8E+03	1.1E+05
DIOXINS (TEQ)	SV	S	1.5E-02	1.5E-02	2.8E-02	1.3E-01	1.3E-01	2.3E-01
DIURON	NV	S						
ENDOSULFAN	SV	S						
ENDRIN	NV	S						
ETHANOL	V	L						
ETHYLBENZENE	V	L	2.2E+04	2.2E+04	4.2E+05	2.0E+05	2.0E+05	3.5E+06
FLUORANTHENE	NV	S						
FLUORENE	V	S	6.7E+04		6.7E+04	5.6E+05		5.6E+05
GLYPHOSATE	NV	S						
HEPTACHLOR	SV	S	4.3E+00	4.3E+00		3.8E+01	3.8E+01	
HEPTACHLOR EPOXIDE	SV	S	2.2E+00	2.2E+00		1.9E+01	1.9E+01	
HEXACHLOROBENZENE	SV	S	1.2E+01	1.2E+01		1.1E+02	1.1E+02	
HEXACHLOROBUTADIENE	SV	S	2.6E+02	2.6E+02		2.2E+03	2.2E+03	
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	NV	S						
HEXACHLOROETHANE	SV	S	5.1E+02	5.1E+02	1.3E+04	4.5E+03	4.5E+03	1.1E+05
HEXAZINONE	NV	S						
INDENO(1,2,3-cd)PYRENE	NV	S						

TABLE C-2. [1]SHALLOW SOIL VAPOR 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)
ISOPHORONE	NV	L						
LEAD	NV	S						
MERCURY	NV	S						
METHOXYCHLOR	NV	S						
METHYL ETHYL KETONE	V	L	2.1E+06		2.1E+06	1.8E+07		1.8E+07
METHYL ISOBUTYL KETONE	V	L	1.3E+06		1.3E+06	1.1E+07		1.1E+07
METHYL MERCURY	NV	S						
METHYL TERT BUTYL ETHER	V	L	2.2E+04	2.2E+04	1.3E+06	1.9E+05	1.9E+05	1.1E+07
METHYLENE CHLORIDE	V	L	2.0E+05	2.0E+05	2.5E+05	2.1E+06	4.9E+06	2.1E+06
METHYLNAPHTHALENE, 1-	V	S	7.7E+03	7.7E+03	1.2E+05	6.8E+04	6.8E+04	9.8E+05
METHYLNAPHTHALENE, 2-	V	S	6.7E+03		6.7E+03	5.6E+04		5.6E+04
MOLYBDENUM	NV	S						
NAPHTHALENE	V	S	1.3E+03	1.7E+03	1.3E+03	1.1E+04	1.4E+04	1.1E+04
NICKEL	NV	S						
NITROBENZENE	V	L	1.4E+02	1.4E+02	3.8E+03	1.2E+03	1.2E+03	3.2E+04
NITROGLYCERIN	NV	L						
NITROTOLUENE, 2-	V	S	1.0E+02	1.0E+02	1.5E+03	8.9E+02	8.9E+02	1.3E+04
NITROTOLUENE, 3-	NV	S						
NITROTOLUENE, 4-	NV	S						
PENTACHLOROPHENOL	NV	S						
PENTAERYTHRITOLTETRANITRATE (PETN)	NV	S						
PERCHLORATE	NV	S						
PHENANTHRENE	V	S	6.7E+04		6.7E+04	5.6E+05		5.6E+05
PHENOL	NV	S						
POLYCHLORINATED BIPHENYLS (PCBs)	SV	S	9.9E+01	9.9E+01		8.6E+02	8.6E+02	
PROPICONAZOLE	NV	L						
PYRENE	V	S	5.0E+04		5.0E+04	4.2E+05		4.2E+05
SELENIUM	NV	S						
SILVER	NV	S						
SIMAZINE	NV	S						
STYRENE	V	L	4.2E+05		4.2E+05	3.5E+06		3.5E+06
TERBACIL	NV	S						
tert-BUTYL ALCOHOL	V	L	7.5E+03	7.5E+03		6.5E+04	6.5E+04	
TETRACHLOROETHANE, 1,1,1,2-	V	L	7.6E+02	7.6E+02	5.0E+04	6.6E+03	6.6E+03	4.2E+05
TETRACHLOROETHANE, 1,1,2,2-	V	L	9.7E+01	9.7E+01		8.5E+02	8.5E+02	
TETRACHLOROETHYLENE	V	L	9.2E+02	9.2E+02	1.7E+04	8.0E+03	8.0E+03	1.4E+05
TETRACHLOROPHENOL, 2,3,4,6-	NV	S						
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	NV	S						
THALLIUM	NV	S						
TOLUENE	V	L	2.1E+06		2.1E+06	1.8E+07		1.8E+07
TOXAPHENE	NV	S						
TPH (gasolines)	V	L	5.9E+05		5.9E+05	4.9E+06		4.9E+06
TPH (middle distillates)	V	L	2.6E+05		2.6E+05	2.2E+06		2.2E+06
TPH (residual fuels)	NV	L						
TRICHLOROBENZENE, 1,2,4-	V	S	7.7E+02	7.7E+02	8.3E+02	6.8E+03	6.8E+03	7.0E+03
TRICHLOROETHANE, 1,1,1-	V	L	2.1E+06		2.1E+06	1.8E+07		1.8E+07

TABLE C-2. [1]SHALLOW SOIL VAPOR 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)
TRICHLOROETHANE, 1,1,2-	V	L	8.3E+01	3.5E+02	8.3E+01	7.0E+02	3.1E+03	7.0E+02
TRICHLOROETHYLENE	V	L	8.3E+02	9.6E+02	8.3E+02	7.0E+03	1.2E+04	7.0E+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	2.7E-01	2.7E-01	1.3E+02	6.5E+00	6.5E+00	1.1E+03
TRICHLOROPROPENE, 1,2,3-	V	L	1.3E+02		1.3E+02	1.1E+03		1.1E+03
TRIFLURALIN	SV	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	3.4E+02	3.4E+02	4.2E+04	1.1E+04	1.1E+04	3.5E+05
XYLENES	V	L	4.2E+04		4.2E+04	3.5E+05		3.5E+05
ZINC	NV	S						

Notes:

1. Shallow soil gas defined as soil gas sample data collected within 1.5 meters (five feet) from a building foundation or the ground surface. Assumes very permeable (e.g., sandy) fill material 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 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/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)	
ACENAPHTHENE	V	S		2.4E+02	5.0E+01		5.0E+01	2.1E+02		2.1E+02	5.13E+02
ACENAPHTHYLENE	V	S		1.6E+02	3.3E+01		3.3E+01	1.4E+02		1.4E+02	-
ACETONE	V	L		3.1E+04	6.5E+03		6.5E+03	2.7E+04		2.7E+04	3.09E+04
ALDRIN	SV	S	8.5E-04	4.0E-01	2.1E-01	3.3E-01	2.1E-01	8.8E-01	1.4E+00	8.8E-01	2.63E+02
AMETRYN	NV	S									-
AMINO,2- DINITROTOLUENE,4,6-	NV	S									-
AMINO,4- DINITROTOLUENE,2,6-	NV	S									-
ANTHRACENE	V	S		1.2E+03	2.5E+02		2.5E+02	1.1E+03		1.1E+03	-
ANTIMONY	NV	S									-
ARSENIC	NV	S									-
ATRAZINE	NV	S									-
BARIUM	NV	S									-
BENOMYL	NV	S									-
BENZENE	V	L	7.8E-06	3.0E+01	3.6E-01	3.6E-01	6.3E+00	1.6E+00	1.6E+00	2.6E+01	4.89E+03
BENZO(a)ANTHRACENE	SV	S	1.1E-04		9.2E-01	9.2E-01		1.1E+00	1.1E+00		-
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	2.0E-06	4.0E-01	8.3E-02	1.4E+00	8.3E-02	3.5E-01	6.1E+00	3.5E-01	6.00E+01
BIS(2-CHLOROETHYL)ETHER	V	L	3.3E-04		8.5E-03	8.5E-03		3.7E-02	3.7E-02		2.87E+02
BIS(2-CHLORO-1-METHYLETHYL)ETHER	V	L	1.0E-05	1.4E+02	2.8E-01	2.8E-01	2.9E+01	1.2E+00	1.2E+00	1.2E+02	2.24E+03
BIS(2-ETHYLHEXYL)PHTHALATE	NV	S									-
BORON	NV	S									-
BROMODICHLOROMETHANE	V	L	3.7E-05	8.0E+01	7.6E-02	7.6E-02	1.7E+01	3.3E-01	3.3E-01	7.0E+01	1.10E+07
BROMOFORM	SV	S	1.1E-06		2.6E+00	2.6E+00		1.1E+01	1.1E+01		1.35E+04
BROMOMETHANE	V	G		5.0E+00	1.0E+00		1.0E+00	4.4E+00		4.4E+00	8.00E+04
CADMIUM	NV	S									-
CARBON TETRACHLORIDE	V	L	6.0E-06	1.0E+02	4.7E-01	4.7E-01	2.1E+01	2.0E+00	2.0E+00	8.8E+01	6.30E+04
CHLORDANE (TECHNICAL)	SV	S	1.0E-04	7.0E-01	2.8E-01	2.8E-01	7.3E-01	1.2E+00	1.2E+00	3.1E+00	8.40E+00
CHLOROANILINE, p-	NV	S									-
CHLOROBENZENE	V	L		5.0E+01	1.0E+01		1.0E+01	4.4E+01		4.4E+01	1.00E+03
CHLOROETHANE	V	G		1.0E+04	2.1E+03		2.1E+03	8.8E+03		8.8E+03	3.80E+05
CHLOROFORM	V	L	2.3E-05	9.8E+01	1.2E-01	1.2E-01	2.0E+01	5.3E-01	5.3E-01	8.6E+01	4.22E+05
CHLOROMETHANE	V	G		9.0E+01	1.9E+01		1.9E+01	7.9E+01		7.9E+01	-
CHLOROPHENOL, 2-	V	L		2.0E+01	4.2E+00		4.2E+00	1.8E+01		1.8E+01	1.90E+01
CHROMIUM (Total)	NV	S									-
CHROMIUM III	NV	S									-
CHROMIUM VI	NV	S									-
CHRYSENE	NV	S									-
COBALT	NV	S									-
COPPER	NV	S									-
CYANIDE (Free)	V	S		8.0E-01	1.7E-01		1.7E-01	7.0E-01		7.0E-01	6.52E+02
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	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)	
DALAPON	NV	L									-
DIBENZO(a,h)ANTHTRACENE	NV	S									-
DIBROMO,1,2- CHLOROPROPANE,3-	V	L	6.0E-03	2.0E-01	1.7E-04	1.7E-04	4.2E-02	2.0E-03	2.0E-03	1.8E-01	-
DIBROMOCHLOROMETHANE	V	S	2.1E-05	8.0E+01	1.3E-01	1.3E-01	1.7E+01	5.8E-01	5.8E-01	7.0E+01	-
DIBROMOETHANE, 1,2-	V	S	6.0E-04	9.0E+00	4.7E-03	4.7E-03	1.9E+00	2.0E-02	2.0E-02	7.9E+00	2.00E+05
DICHLOROBENZENE, 1,2-	V	L		2.0E+02	4.2E+01		4.2E+01	1.8E+02		1.8E+02	3.05E+05
DICHLOROBENZENE, 1,3-	V	L		1.2E+02	2.5E+01		2.5E+01	1.1E+02		1.1E+02	-
DICHLOROBENZENE, 1,4-	V	S	1.1E-05	8.0E+02	2.6E-01	2.6E-01	1.7E+02	1.1E+00	1.1E+00	7.0E+02	1.10E+03
DICHLOROBENZIDINE, 3,3-	NV	S									-
DICHLORODIPHENYLDICHLOROETHANE (DDD)	NV	S									-
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	SV	S	9.7E-05		2.9E-02	2.9E-02		1.3E-01	1.3E-01		-
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	NV	S									-
DICHLOROETHANE, 1,1-	V	L	1.6E-06	8.0E+02	1.8E+00	1.8E+00	1.7E+02	7.7E+00	7.7E+00	7.0E+02	1.25E+05
DICHLOROETHANE, 1,2-	V	L	2.6E-05	7.0E+00	1.1E-01	1.1E-01	1.5E+00	4.7E-01	4.7E-01	6.1E+00	2.42E+03
DICHLOROETHYLENE, 1,1-	V	L		2.0E+02	4.2E+01		4.2E+01	1.8E+02		1.8E+02	2.00E+06
DICHLOROETHYLENE, Cis 1,2-	V	L		8.0E+00	1.7E+00		1.7E+00	7.0E+00		7.0E+00	-
DICHLOROETHYLENE, Trans 1,2-	V	L		8.0E+01	1.7E+01		1.7E+01	7.0E+01		7.0E+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	2.8E-01	2.8E-01	8.3E-01	1.2E+00	1.2E+00	3.5E+00	1.19E+03
DICHLOROPROPENE, 1,3-	V	L	4.0E-06	2.0E+01	7.0E-01	7.0E-01	4.2E+00	3.1E+00	3.1E+00	1.8E+01	4.16E+03
DIELDRIN	NV	S									-
DIETHYLPHTHALATE	NV	S									-
DIMETHYLPHENOL, 2,4-	NV	S									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-	V	L	5.0E-06	3.0E+01	5.6E-01	5.6E-01	6.3E+00	2.5E+00	2.5E+00	2.6E+01	6.12E+05
DIOXINS (TEQ)	SV	S	3.8E+01	1.3E-05	7.4E-06	7.4E-06	1.4E-05	3.2E-05	3.2E-05	5.8E-05	-
DIURON	NV	S									-
ENDOSULFAN	SV	S									-
ENDRIN	NV	S									-
ETHANOL	V	L									1.92E+04
ETHYLBENZENE	V	L	2.5E-06	1.0E+03	1.1E+01	1.1E+01	2.1E+02	4.9E+01	4.9E+01	8.8E+02	2.00E+03
FLUORANTHENE	NV	S									-
FLUORENE	V	S		1.6E+02	3.3E+01		3.3E+01	1.4E+02		1.4E+02	-
GLYPHOSATE	NV	S									-
HEPTACHLOR	SV	S	1.3E-03		2.2E-03	2.2E-03		9.4E-03	9.4E-03		3.00E+02
HEPTACHLOR EPOXIDE	SV	S	2.6E-03		1.1E-03	1.1E-03		4.7E-03	4.7E-03		3.00E+02
HEXACHLOROBENZENE	SV	S	4.6E-04		6.1E-03	6.1E-03		2.7E-02	2.7E-02		-
HEXACHLOROBUTADIENE	SV	S	2.2E-05		1.3E-01	1.3E-01		5.6E-01	5.6E-01		1.20E+04
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	NV	S									-
HEXACHLOROETHANE	SV	S	1.1E-05	3.0E+01	2.6E-01	2.6E-01	6.3E+00	1.1E+00	1.1E+00	2.6E+01	-

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)	
HEXAZINONE	NV	S									-
INDENO(1,2,3-cd)PYRENE	NV	S									-
ISOPHORONE	NV	L									-
LEAD	NV	S									-
MERCURY	NV	S									-
METHOXYCHLOR	NV	S									-
METHYL ETHYL KETONE	V	L		5.0E+03	1.0E+03		1.0E+03	4.4E+03		4.4E+03	3.20E+04
METHYL ISOBUTYL KETONE	V	L		3.0E+03	6.3E+02		6.3E+02	2.6E+03		2.6E+03	4.20E+02
METHYL MERCURY	NV	S									-
METHYL TERT BUTYL ETHER	V	L	2.6E-07	3.0E+03	1.1E+01	1.1E+01	6.3E+02	4.7E+01	4.7E+01	2.6E+03	5.30E+02
METHYLENE CHLORIDE	V	L	1.0E-08	6.0E+02	1.0E+02	1.0E+02	1.3E+02	5.3E+02	1.2E+03	5.3E+02	5.60E+05
METHYLNAPHTHALENE, 1-	V	S	7.3E-06	2.8E+02	3.9E+00	3.9E+00	5.8E+01	1.7E+01	1.7E+01	2.5E+02	6.80E+01
METHYLNAPHTHALENE, 2-	V	S		1.6E+01	3.3E+00		3.3E+00	1.4E+01		1.4E+01	6.80E+01
MOLYBDENUM	NV	S									-
NAPHTHALENE	V	S	3.4E-05	3.0E+00	6.3E-01	8.3E-01	6.3E-01	2.6E+00	3.6E+00	2.6E+00	4.40E+02
NICKEL	NV	S									-
NITROBENZENE	V	L	4.0E-05	9.0E+00	7.0E-02	7.0E-02	1.9E+00	3.1E-01	3.1E-01	7.9E+00	-
NITROGLYCERIN	NV	L									-
NITROTOLUENE, 2-	V	S	5.5E-05	3.6E+00	5.1E-02	5.1E-02	7.5E-01	2.2E-01	2.2E-01	3.2E+00	-
NITROTOLUENE, 3-	NV	S									-
NITROTOLUENE, 4-	NV	S									-
PENTACHLOROPHENOL	NV	S									-
PENTAERYTHRITOLTETRANITRATE (PETN)	NV	S									-
PERCHLORATE	NV	S									-
PHENANTHRENE	V	S		1.6E+02	3.3E+01		3.3E+01	1.4E+02		1.4E+02	5.50E+01
PHENOL	NV	S									1.56E+02
POLYCHLORINATED BIPHENYLS (PCBs)	SV	S	5.7E-04		4.9E-02	4.9E-02		2.2E-01	2.2E-01		-
PROPICONAZOLE	NV	L									-
PYRENE	V	S		1.2E+02	2.5E+01		2.5E+01	1.1E+02		1.1E+02	-
SELENIUM	NV	S									-
SILVER	NV	S									-
SIMAZINE	NV	S									-
STYRENE	V	L		1.0E+03	2.1E+02		2.1E+02	8.8E+02		8.8E+02	1.36E+03
TERBACIL	NV	S									-
tert-BUTYL ALCOHOL	V	L	7.5E-07		3.7E+00	3.7E+00		1.6E+01	1.6E+01		-
TETRACHLOROETHANE, 1,1,1,2-	V	L	7.4E-06	1.2E+02	3.8E-01	3.8E-01	2.5E+01	1.7E+00	1.7E+00	1.1E+02	-
TETRACHLOROETHANE, 1,1,2,2-	V	L	5.8E-05		4.8E-02	4.8E-02		2.1E-01	2.1E-01		1.05E+04
TETRACHLOROETHYLENE	V	L	6.1E-06	4.0E+01	4.6E-01	4.6E-01	8.3E+00	2.0E+00	2.0E+00	3.5E+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	4.4E+03		4.4E+03	3.00E+04
TOXAPHENE	NV	S									-
TPH (gasolines)	V	L		2.8E+02	2.9E+02		2.9E+02	1.2E+03		1.2E+03	1.10E+03
TPH (middle distillates)	V	L		1.3E+02	1.3E+02		1.3E+02	5.5E+02		5.5E+02	5.00E+03

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)	
TPH (residual fuels)	NV	L									-
TRICHLOROBENZENE, 1,2,4-	V	S	7.3E-06	2.0E+00	3.9E-01	3.9E-01	4.2E-01	1.7E+00	1.7E+00	1.8E+00	2.20E+04
TRICHLOROETHANE, 1,1,1-	V	L		5.0E+03	1.0E+03		1.0E+03	4.4E+03		4.4E+03	6.51E+04
TRICHLOROETHANE, 1,1,2-	V	L	1.6E-05	2.0E-01	4.2E-02	1.8E-01	4.2E-02	1.8E-01	7.7E-01	1.8E-01	-
TRICHLOROETHYLENE	V	L	4.1E-06	2.0E+00	4.2E-01	4.8E-01	4.2E-01	1.8E+00	3.0E+00	1.8E+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	7.5E-03	3.0E-01	1.4E-04	1.4E-04	6.3E-02	1.6E-03	1.6E-03	2.6E-01	-
TRICHLOROPROPENE, 1,2,3-	V	L		3.0E-01	6.3E-02		6.3E-02	2.6E-01		2.6E-01	-
TRIFLURALIN	SV	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	1.7E-01	1.7E-01	2.1E+01	2.8E+00	2.8E+00	8.8E+01	7.71E+05
XYLENES	V	L		1.0E+02	2.1E+01		2.1E+01	8.8E+01		8.8E+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).
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	1.5E+01	Aquatic Habitat Goal	2.0E+01	3.5E+02	3.9E+03	1.5E+01
ACENAPHTHYLENE	1.3E+01	Aquatic Habitat Goal	2.0E+03	2.4E+02	(Use soil gas)	1.3E+01
ACETONE	1.5E+03	Aquatic Habitat Goal	2.0E+04	1.4E+04	6.2E+08	1.5E+03
ALDRIN	1.4E-04	Aquatic Habitat Goal	8.5E+00	5.1E-03		1.4E-04
AMETRYN	1.8E+02	Drinking Water Toxicity	5.0E+04	1.8E+02		7.0E+02
AMINO,2- DINITROTOLUENE,4,6-	1.8E+01	Aquatic Habitat Goal	5.0E+04	4.0E+01		1.8E+01
AMINO,4- DINITROTOLUENE,2,6-	1.1E+01	Aquatic Habitat Goal	5.0E+04	4.0E+01		1.1E+01
ANTHRACENE	2.0E-02	Aquatic Habitat Goal	2.2E+01	1.8E+03	4.3E+01	2.0E-02
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	2.2E+02	Aquatic Habitat Goal	5.0E+04	2.0E+03		2.2E+02
BENOMYL	1.4E-01	Aquatic Habitat Goal	1.9E+03	1.0E+03		1.4E-01
BENZENE	5.0E+00	Drinking Water Toxicity	1.7E+02	5.0E+00	2.3E+03	7.1E+01
BENZO(a)ANTHRACENE	1.1E-02	Drinking Water Toxicity	4.7E+00	1.1E-02		2.7E-02
BENZO(a)PYRENE	6.0E-02	Aquatic Habitat Goal	8.0E-01	2.0E-01		6.0E-02
BENZO(b)FLUORANTHENE	2.9E-02	Drinking Water Toxicity	7.5E-01	2.9E-02		6.8E-01
BENZO(g,h,i)PERYLENE	1.3E-01	Gross Contamination	1.3E-01	8.0E+02		4.4E-01
BENZO(k)FLUORANTHENE	2.9E-01	Drinking Water Toxicity	4.0E-01	2.9E-01		6.4E-01
BERYLLIUM	6.6E-01	Aquatic Habitat Goal	5.0E+04	4.0E+00		6.6E-01
BIPHENYL, 1,1-	5.0E-01	Gross Contamination	5.0E-01	8.3E-01	(Use soil gas)	6.5E+00
BIS(2-CHLOROETHYL)ETHER	1.4E-02	Drinking Water Toxicity	3.6E+02	1.4E-02	1.8E+02	2.4E+03
BIS(2-CHLORO-1-METHYLETHYL)ETHER	3.7E-01	Aquatic Habitat Goal	3.2E+02	3.7E-01	(Use soil gas)	3.7E-01
BIS(2-ETHYLHEXYL)PHTHALATE	3.0E+00	Aquatic Habitat Goal	1.4E+02	6.0E+00		3.0E+00
BORON	1.0E+03	Aquatic Habitat Goal	5.0E+04	4.0E+03		1.0E+03
BROMODICHLOROMETHANE	1.4E-01	Drinking Water Toxicity	5.0E+04	1.4E-01	1.1E+02	3.4E+02
BROMOFORM	8.0E+01	Drinking Water Toxicity	5.1E+02	8.0E+01		2.3E+02
BROMOMETHANE	7.6E+00	Drinking Water Toxicity	5.0E+04	7.6E+00	4.1E+02	1.6E+01
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	1.1E+02	9.8E+00
CHLORDANE (TECHNICAL)	4.0E-03	Aquatic Habitat Goal	2.5E+00	2.0E+00		4.0E-03
CHLOROANILINE, p-	3.9E-01	Drinking Water Toxicity	5.0E+04	3.9E-01		1.9E+01
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	6.0E+05	2.1E+04
CHLOROFORM	2.8E+01	Aquatic Habitat Goal	2.4E+03	7.0E+01	1.1E+02	2.8E+01
CHLOROMETHANE	1.9E+02	Aquatic Habitat Goal	5.0E+04	1.9E+02	5.2E+03	1.9E+02
CHLOROPHENOL, 2-	1.8E-01	Gross Contamination	1.8E-01	2.9E+01	1.0E+05	3.2E+01
CHROMIUM (Total)	1.1E+01	Aquatic Habitat Goal	5.0E+04	1.0E+02		1.1E+01
CHROMIUM III	2.0E+01	Aquatic Habitat Goal	5.0E+04	3.0E+04		2.0E+01
CHROMIUM VI	4.3E+00	Drinking Water Toxicity	5.0E+04	4.3E+00		1.1E+01
CHRYSENE	1.0E+00	Gross Contamination	1.0E+00	2.9E+00		2.0E+00
COBALT	6.0E+00	Drinking Water Toxicity	5.0E+04	6.0E+00		1.9E+01
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)	7.1E-01	Drinking Water Toxicity	3.0E+04	7.1E-01		7.9E+01
DALAPON	2.0E+02	Drinking Water Toxicity	5.0E+04	2.0E+02		3.0E+02

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

CONTAMINANT	[1]Final Groundwater Action Level	Basis	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
DIBENZO(a,h)ANTHTRACENE	2.9E-03	Drinking Water Toxicity	1.3E+00	2.9E-03		8.0E-01
DIBROMO,1,2- CHLOROPROPANE,3-	4.0E-02	Aquatic Habitat Goal	1.0E+01	4.0E-02	(Use soil gas)	4.0E-02
DIBROMOCHLOROMETHANE	2.1E-01	Drinking Water Toxicity	5.0E+04	2.1E-01	4.5E+02	3.4E+01
DIBROMOETHANE, 1,2-	4.0E-02	Drinking Water Toxicity	5.0E+04	4.0E-02	1.9E+01	1.4E+03
DICHLOROBENZENE, 1,2-	1.0E+01	Gross Contamination	1.0E+01	6.0E+02	8.3E+04	1.4E+01
DICHLOROBENZENE, 1,3-	5.0E+00	Gross Contamination	5.0E+00	1.8E+02	(Use soil gas)	2.2E+01
DICHLOROBENZENE, 1,4-	5.0E+00	Gross Contamination	5.0E+00	7.5E+01	4.5E+02	9.4E+00
DICHLOROBENZIDINE, 3,3-	1.7E-01	Drinking Water Toxicity	1.6E+03	1.7E-01		4.5E+00
DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.1E-02	Aquatic Habitat Goal	4.5E+01	3.2E-01		1.1E-02
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	4.6E-02	Drinking Water Toxicity	2.0E+01	4.6E-02		4.1E-01
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.0E-03	Aquatic Habitat Goal	2.8E+00	2.3E-01		1.0E-03
DICHLOROETHANE, 1,1-	2.8E+00	Drinking Water Toxicity	5.0E+04	2.8E+00	1.1E+03	4.7E+01
DICHLOROETHANE, 1,2-	5.0E+00	Drinking Water Toxicity	7.0E+03	5.0E+00	1.8E+02	9.1E+02
DICHLOROETHYLENE, 1,1-	7.0E+00	Drinking Water Toxicity	1.5E+03	7.0E+00	6.6E+03	2.5E+01
DICHLOROETHYLENE, Cis 1,2-	7.0E+01	Drinking Water Toxicity	5.0E+04	7.0E+01	1.3E+03	6.2E+02
DICHLOROETHYLENE, Trans 1,2-	1.0E+02	Drinking Water Toxicity	2.6E+02	1.0E+02	6.6E+03	5.6E+02
DICHLOROPHENOL, 2,4-	3.0E-01	Gross Contamination	3.0E-01	6.0E+01		1.1E+01
DICHLOROPHENOXYACETIC ACID (2,4-D)	7.0E+01	Aquatic Habitat Goal	5.0E+04	7.0E+01		7.0E+01
DICHLOROPROPANE, 1,2-	5.0E+00	Drinking Water Toxicity	1.0E+01	5.0E+00	3.4E+02	5.2E+02
DICHLOROPROPENE, 1,3-	6.0E-02	Aquatic Habitat Goal	5.0E+04	5.0E-01	6.7E+02	6.0E-02
DIELDRIN	1.9E-03	Aquatic Habitat Goal	4.1E+01	1.1E-02		1.9E-03
DIETHYLPHTHALATE	2.1E+02	Aquatic Habitat Goal	5.0E+04	1.6E+04		2.1E+02
DIMETHYLPHENOL, 2,4-	1.2E+02	Aquatic Habitat Goal	4.0E+02	4.0E+02		1.2E+02
DIMETHYLPHTHALATE	1.1E+03	Aquatic Habitat Goal	5.0E+04	2.0E+05		1.1E+03
DINITROBENZENE, 1,3-	2.0E+00	Drinking Water Toxicity	5.0E+04	2.0E+00		1.0E+01
DINITROPHENOL, 2,4-	1.4E+01	Aquatic Habitat Goal	5.0E+04	4.0E+01		1.4E+01
DINITROTOLUENE, 2,4- (2,4-DNT)	2.5E-01	Drinking Water Toxicity	5.0E+04	2.5E-01		9.1E+00
DINITROTOLUENE, 2,6- (2,6-DNT)	5.2E-02	Drinking Water Toxicity	5.0E+04	5.2E-02		8.1E+01
DIOXANE, 1,4-	4.6E-01	Drinking Water Toxicity	5.0E+04	4.6E-01	(Use soil gas)	3.4E+05
DIOXINS (TEQ)	3.1E-09	Aquatic Habitat Goal	1.0E-01	3.0E-05		3.1E-09
DIURON	4.0E+01	Drinking Water Toxicity	2.1E+04	4.0E+01		6.0E+01
ENDOSULFAN	8.7E-03	Aquatic Habitat Goal	1.6E+02	1.2E+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		(Use soil gas)	
ETHYLBENZENE	7.3E+00	Aquatic Habitat Goal	3.0E+01	7.0E+02	7.6E+04	7.3E+00
FLUORANTHENE	8.0E-01	Aquatic Habitat Goal	1.3E+02	8.0E+02		8.0E-01
FLUORENE	3.9E+00	Aquatic Habitat Goal	8.5E+02	2.4E+02	1.7E+03	3.9E+00
GLYPHOSATE	7.0E+02	Drinking Water Toxicity	5.0E+04	7.0E+02		1.8E+03
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	3.0E-04	Aquatic Habitat Goal	3.1E+00	1.0E+00		3.0E-04
HEXACHLOROBUTADIENE	2.0E-01	Drinking Water Toxicity	6.0E+00	2.0E-01		3.0E-01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	6.3E-02	Aquatic Habitat Goal	3.7E+03	2.0E-01		6.3E-02
HEXACHLOROETHANE	4.0E-01	Drinking Water Toxicity	1.0E+01	4.0E-01		1.2E+01
HEXAZINONE	6.6E+02	Drinking Water Toxicity	5.0E+04	6.6E+02		1.7E+04

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
INDENO(1,2,3-cd)PYRENE	2.9E-02	Drinking Water Toxicity	9.5E-02	2.9E-02		2.8E-01
ISOPHORONE	8.2E+01	Drinking Water Toxicity	5.0E+04	8.2E+01		9.2E+02
LEAD	5.6E+00	Aquatic Habitat Goal	5.0E+04	1.5E+01		5.6E+00
MERCURY	2.5E-02	Aquatic Habitat Goal	5.0E+04	2.0E+00		2.5E-02
METHOXYCHLOR	3.0E-02	Aquatic Habitat Goal	5.0E+01	4.0E+01		3.0E-02
METHYL ETHYL KETONE	5.6E+03	Drinking Water Toxicity	8.4E+03	5.6E+03	2.2E+08	1.4E+04
METHYL ISOBUTYL KETONE	1.7E+02	Aquatic Habitat Goal	1.3E+03	6.3E+03	1.9E+07	1.7E+02
METHYL MERCURY	2.8E-03	Aquatic Habitat Goal	5.0E+04	2.0E+00		2.8E-03
METHYL TERT BUTYL ETHER	5.0E+00	Gross Contamination	5.0E+00	1.4E+01	3.1E+04	7.3E+02
METHYLENE CHLORIDE	5.0E+00	Drinking Water Toxicity	9.1E+03	5.0E+00	7.6E+04	1.5E+03
METHYLNAPHTHALENE, 1-	2.1E+00	Aquatic Habitat Goal	1.0E+01	6.0E+00	2.6E+04	2.1E+00
METHYLNAPHTHALENE, 2-	4.7E+00	Aquatic Habitat Goal	1.0E+01	2.4E+01	2.5E+04	4.7E+00
MOLYBDENUM	1.0E+02	Drinking Water Toxicity	5.0E+04	1.0E+02		3.7E+02
NAPHTHALENE	1.2E+01	Aquatic Habitat Goal	2.1E+01	1.7E+01	2.9E+04	1.2E+01
NICKEL	5.0E+00	Aquatic Habitat Goal	5.0E+04	4.0E+02		5.0E+00
NITROBENZENE	1.4E-01	Drinking Water Toxicity	5.0E+04	1.4E-01	(Use soil gas)	3.8E+02
NITROGLYCERIN	2.0E+00	Drinking Water Toxicity	5.0E+04	2.0E+00		1.8E+01
NITROTOLUENE, 2-	7.9E-02	Drinking Water Toxicity	5.0E+04	7.9E-02	(Use soil gas)	7.1E+01
NITROTOLUENE, 3-	2.0E+00	Drinking Water Toxicity	5.0E+04	2.0E+00		4.2E+01
NITROTOLUENE, 4-	4.9E+00	Drinking Water Toxicity	5.0E+04	4.9E+00		4.6E+01
PENTACHLOROPHENOL	1.0E+00	Drinking Water Toxicity	3.0E+01	1.0E+00		7.9E+00
PENTAERYTHRITOLTETRANITRATE (PETN)	1.9E+01	Drinking Water Toxicity	2.2E+04	1.9E+01		8.5E+05
PERCHLORATE	1.5E+01	Drinking Water Toxicity	5.0E+04	1.5E+01		6.0E+02
PHENANTHRENE	2.3E+00	Aquatic Habitat Goal	4.1E+02	2.4E+02	(Use soil gas)	2.3E+00
PHENOL	5.8E+01	Aquatic Habitat Goal	7.9E+03	6.0E+03		5.8E+01
POLYCHLORINATED BIPHENYLS (PCBs)	1.4E-02	Aquatic Habitat Goal	2.2E+01	5.0E-01		1.4E-02
PROPICONAZOLE	9.5E+01	Aquatic Habitat Goal	5.0E+04	2.6E+02		9.5E+01
PYRENE	4.6E+00	Aquatic Habitat Goal	6.8E+01	1.8E+02	1.4E+02	4.6E+00
SELENIUM	5.0E+00	Aquatic Habitat Goal	5.0E+04	5.0E+01		5.0E+00
SILVER	1.0E-01	Aquatic Habitat Goal	1.0E+02	1.0E+02		1.0E-01
SIMAZINE	4.0E+00	Drinking Water Toxicity	3.1E+03	4.0E+00		9.0E+00
STYRENE	1.0E+01	Gross Contamination	1.0E+01	1.0E+02	3.1E+05	3.2E+01
TERBACIL	2.6E+02	Aquatic Habitat Goal	5.0E+04	2.6E+02		2.6E+02
tert-BUTYL ALCOHOL	5.8E+00	Drinking Water Toxicity	5.0E+04	5.8E+00	(Use soil gas)	1.8E+04
TETRACHLOROETHANE, 1,1,1,2-	6.1E-01	Drinking Water Toxicity	5.0E+04	6.1E-01	(Use soil gas)	1.1E+01
TETRACHLOROETHANE, 1,1,2,2-	7.8E-02	Drinking Water Toxicity	5.0E+02	7.8E-02	2.4E+02	2.0E+02
TETRACHLOROETHYLENE	5.0E+00	Drinking Water Toxicity	1.7E+02	5.0E+00	1.9E+02	5.3E+01
TETRACHLOROPHENOL, 2,3,4,6-	1.2E+00	Aquatic Habitat Goal	1.2E+04	6.0E+02		1.2E+00
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	2.2E+02	Aquatic Habitat Goal	2.5E+03	1.0E+03		2.2E+02
THALLIUM	2.0E+00	Drinking Water Toxicity	5.0E+04	2.0E+00		6.0E+00
TOLUENE	9.8E+00	Aquatic Habitat Goal	4.0E+01	1.0E+03	5.3E+05	9.8E+00
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	3.0E+02	(Use soil gas)	5.0E+02
TPH (middle distillates)	1.0E+02	Gross Contamination	1.0E+02	1.6E+02	(Use soil gas)	6.4E+02
TPH (residual fuels)	1.0E+02	Gross Contamination	1.0E+02	2.4E+03		6.4E+02

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

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Taste & Odors, etc.) Table G-1	Drinking Water Toxicity Table D-3a	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (chronic) Table D-4a
TRICHLOROBENZENE, 1,2,4-	7.0E+01	Drinking Water Toxicity	3.0E+03	7.0E+01	1.2E+03	1.1E+02
TRICHLOROETHANE, 1,1,1-	1.1E+01	Aquatic Habitat Goal	9.7E+02	2.0E+02	3.4E+05	1.1E+01
TRICHLOROETHANE, 1,1,2-	5.0E+00	Drinking Water Toxicity	5.0E+04	5.0E+00	1.1E+02	7.3E+02
TRICHLOROETHYLENE	5.0E+00	Drinking Water Toxicity	3.1E+02	5.0E+00	2.1E+02	4.7E+01
TRICHLOROPHENOL, 2,4,5-	1.9E+00	Aquatic Habitat Goal	2.0E+02	2.0E+03		1.9E+00
TRICHLOROPHENOL, 2,4,6-	4.9E+00	Aquatic Habitat Goal	1.0E+02	7.1E+00		4.9E+00
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	2.0E+02	Drinking Water Toxicity	5.0E+04	2.0E+02		6.9E+02
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	3.0E+01	Aquatic Habitat Goal	3.6E+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	1.1E+00	Aquatic Habitat Goal	9.0E+01	1.0E+01		1.1E+00
TRINITROBENZENE, 1,3,5-	1.0E+01	Aquatic Habitat Goal	5.0E+04	6.0E+02		1.0E+01
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.0E+01	Aquatic Habitat Goal	3.7E+04	4.0E+01		4.0E+01
TRINITROTOLUENE, 2,4,6- (TNT)	2.6E+00	Drinking Water Toxicity	5.0E+04	2.6E+00		1.3E+01
VANADIUM	2.7E+01	Aquatic Habitat Goal	5.0E+04	1.0E+02		2.7E+01
VINYL CHLORIDE	2.0E+00	Drinking Water Toxicity	3.4E+03	2.0E+00	1.8E+01	9.3E+02
XYLENES	1.3E+01	Aquatic Habitat Goal	2.0E+01	1.0E+04	1.1E+05	1.3E+01
ZINC	2.2E+01	Aquatic Habitat Goal	5.0E+03	6.0E+03		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 ecotoxicity data for ethanol underway. Based on preliminary review of available data, chronic toxicity screening levels likely to be significantly greater than ceiling level of 50,000 ug/L (refer to USEPA 2003b, ECOTOX database).

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

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

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Taste & Odors, etc.) Table G-1	Drinking Water Toxicity Table D-3a	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (acute) Table D-4a
ACENAPHTHENE	2.0E+01	Gross Contamination	2.0E+01	3.5E+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	1.4E+04	Drinking Water Toxicity	2.0E+04	1.4E+04	6.2E+08	1.5E+04
ALDRIN	5.1E-03	Drinking Water Toxicity	8.5E+00	5.1E-03		1.3E+00
AMETRYN	1.8E+02	Drinking Water Toxicity	5.0E+04	1.8E+02		1.8E+03
AMINO,2- DINITROTOLUENE,4,6-	4.0E+01	Drinking Water Toxicity	5.0E+04	4.0E+01		1.6E+02
AMINO,4- DINITROTOLUENE,2,6-	4.0E+01	Drinking Water Toxicity	5.0E+04	4.0E+01		9.8E+01
ANTHRACENE	1.8E-01	Aquatic Habitat Goal	2.2E+01	1.8E+03	4.3E+01	1.8E-01
ANTIMONY	6.0E+00	Drinking Water Toxicity	5.0E+04	6.0E+00		1.8E+02
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		3.3E+02
BARIUM	2.0E+03	Aquatic Habitat Goal	5.0E+04	2.0E+03		2.0E+03
BENOMYL	2.8E+00	Aquatic Habitat Goal	1.9E+03	1.0E+03		2.8E+00
BENZENE	5.0E+00	Drinking Water Toxicity	1.7E+02	5.0E+00	2.3E+03	1.7E+03
BENZO(a)ANTHRACENE	1.1E-02	Drinking Water Toxicity	4.7E+00	1.1E-02		3.0E+02
BENZO(a)PYRENE	2.0E-01	Drinking Water Toxicity	8.0E-01	2.0E-01		3.0E+02
BENZO(b)FLUORANTHENE	2.9E-02	Drinking Water Toxicity	7.5E-01	2.9E-02		3.0E+02
BENZO(g,h,i)PERYLENE	1.3E-01	Gross Contamination	1.3E-01	8.0E+02		3.0E+02
BENZO(k)FLUORANTHENE	2.9E-01	Drinking Water Toxicity	4.0E-01	2.9E-01		3.0E+02
BERYLLIUM	4.0E+00	Drinking Water Toxicity	5.0E+04	4.0E+00		3.5E+01
BIPHENYL, 1,1-	5.0E-01	Gross Contamination	5.0E-01	8.3E-01	(Use soil gas)	2.6E+01
BIS(2-CHLOROETHYL)ETHER	1.4E-02	Drinking Water Toxicity	3.6E+02	1.4E-02	1.8E+02	2.4E+04
BIS(2-CHLORO-1-METHYLETHYL)ETHER	3.7E-01	Aquatic Habitat Goal	3.2E+02	3.7E-01	(Use soil gas)	3.7E-01
BIS(2-ETHYLHEXYL)PHTHALATE	6.0E+00	Drinking Water Toxicity	1.4E+02	6.0E+00		2.7E+01
BORON	4.0E+03	Drinking Water Toxicity	5.0E+04	4.0E+03		3.4E+04
BROMODICHLOROMETHANE	1.4E-01	Drinking Water Toxicity	5.0E+04	1.4E-01	1.1E+02	3.1E+03
BROMOFORM	8.0E+01	Drinking Water Toxicity	5.1E+02	8.0E+01		1.1E+03
BROMOMETHANE	7.6E+00	Drinking Water Toxicity	5.0E+04	7.6E+00	4.1E+02	3.8E+01
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	1.1E+02	1.2E+04
CHLORDANE (TECHNICAL)	9.0E-02	Aquatic Habitat Goal	2.5E+00	2.0E+00		9.0E-02
CHLOROANILINE, p-	3.9E-01	Drinking Water Toxicity	5.0E+04	3.9E-01		4.6E+02
CHLOROBENZENE	5.0E+01	Gross Contamination	5.0E+01	1.0E+02	1.2E+04	2.2E+02
CHLOROETHANE	1.6E+01	Gross Contamination	1.6E+01	2.1E+04	6.0E+05	2.1E+04
CHLOROFORM	7.0E+01	Drinking Water Toxicity	2.4E+03	7.0E+01	1.1E+02	4.9E+02
CHLOROMETHANE	1.9E+02	Aquatic Habitat Goal	5.0E+04	1.9E+02	5.2E+03	1.9E+02
CHLOROPHENOL, 2-	1.8E-01	Gross Contamination	1.8E-01	2.9E+01	1.0E+05	4.0E+02
CHROMIUM (Total)	1.6E+01	Aquatic Habitat Goal	5.0E+04	1.0E+02		1.6E+01
CHROMIUM III	5.7E+02	Aquatic Habitat Goal	5.0E+04	3.0E+04		5.7E+02
CHROMIUM VI	4.3E+00	Drinking Water Toxicity	5.0E+04	4.3E+00		1.6E+01
CHRYSENE	1.0E+00	Gross Contamination	1.0E+00	2.9E+00		3.0E+02
COBALT	6.0E+00	Drinking Water Toxicity	5.0E+04	6.0E+00		1.2E+02
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)	7.1E-01	Drinking Water Toxicity	3.0E+04	7.1E-01		5.2E+02
DALAPON	2.0E+02	Drinking Water Toxicity	5.0E+04	2.0E+02		3.0E+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
DIBENZO(a,h)ANTHTRACENE	2.9E-03	Drinking Water Toxicity	1.3E+00	2.9E-03		3.0E+02
DIBROMO,1,2- CHLOROPROPANE,3-	4.0E-02	Aquatic Habitat Goal	1.0E+01	4.0E-02	(Use soil gas)	4.0E-02
DIBROMOCHLOROMETHANE	2.1E-01	Drinking Water Toxicity	5.0E+04	2.1E-01	4.5E+02	2.9E+03
DIBROMOETHANE, 1,2-	4.0E-02	Drinking Water Toxicity	5.0E+04	4.0E-02	1.9E+01	1.4E+03
DICHLOROBENZENE, 1,2-	1.0E+01	Gross Contamination	1.0E+01	6.0E+02	8.3E+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	4.5E+02	3.7E+02
DICHLOROBENZIDINE, 3,3-	1.7E-01	Drinking Water Toxicity	1.6E+03	1.7E-01		4.1E+01
DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.9E-01	Aquatic Habitat Goal	4.5E+01	3.2E-01		1.9E-01
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	4.6E-02	Drinking Water Toxicity	2.0E+01	4.6E-02		7.0E+00
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.3E-02	Aquatic Habitat Goal	2.8E+00	2.3E-01		1.3E-02
DICHLOROETHANE, 1,1-	2.8E+00	Drinking Water Toxicity	5.0E+04	2.8E+00	1.1E+03	8.3E+02
DICHLOROETHANE, 1,2-	5.0E+00	Drinking Water Toxicity	7.0E+03	5.0E+00	1.8E+02	3.8E+04
DICHLOROETHYLENE, 1,1-	7.0E+00	Drinking Water Toxicity	1.5E+03	7.0E+00	6.6E+03	3.9E+03
DICHLOROETHYLENE, Cis 1,2-	7.0E+01	Drinking Water Toxicity	5.0E+04	7.0E+01	1.3E+03	5.5E+03
DICHLOROETHYLENE, Trans 1,2-	1.0E+02	Drinking Water Toxicity	2.6E+02	1.0E+02	6.6E+03	1.0E+04
DICHLOROPHENOL, 2,4-	3.0E-01	Gross Contamination	3.0E-01	6.0E+01		6.7E+02
DICHLOROPHENOXYACETIC ACID (2,4-D)	7.0E+01	Drinking Water Toxicity	5.0E+04	7.0E+01		1.3E+02
DICHLOROPROPANE, 1,2-	5.0E+00	Drinking Water Toxicity	1.0E+01	5.0E+00	3.4E+02	3.4E+03
DICHLOROPROPENE, 1,3-	5.0E-01	Drinking Water Toxicity	5.0E+04	5.0E-01	6.7E+02	2.6E+02
DIELDRIN	1.1E-02	Drinking Water Toxicity	4.1E+01	1.1E-02		7.1E-01
DIETHYLPHTHALATE	9.8E+02	Aquatic Habitat Goal	5.0E+04	1.6E+04		9.8E+02
DIMETHYLPHENOL, 2,4-	4.0E+02	Gross Contamination	4.0E+02	4.0E+02		7.0E+02
DIMETHYLPHTHALATE	3.2E+03	Aquatic Habitat Goal	5.0E+04	2.0E+05		3.2E+03
DINITROBENZENE, 1,3-	2.0E+00	Drinking Water Toxicity	5.0E+04	2.0E+00		1.0E+02
DINITROPHENOL, 2,4-	4.0E+01	Drinking Water Toxicity	5.0E+04	4.0E+01		3.8E+02
DINITROTOLUENE, 2,4- (2,4-DNT)	2.5E-01	Drinking Water Toxicity	5.0E+04	2.5E-01		1.1E+02
DINITROTOLUENE, 2,6- (2,6-DNT)	5.2E-02	Drinking Water Toxicity	5.0E+04	5.2E-02		1.1E+02
DIOXANE, 1,4-	4.6E-01	Drinking Water Toxicity	5.0E+04	4.6E-01	(Use soil gas)	3.4E+06
DIOXINS (TEQ)	3.0E-05	Drinking Water Toxicity	1.0E-01	3.0E-05		3.0E-03
DIURON	4.0E+01	Drinking Water Toxicity	2.1E+04	4.0E+01		2.0E+02
ENDOSULFAN	3.4E-02	Aquatic Habitat Goal	1.6E+02	1.2E+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		(Use soil gas)	
ETHYLBENZENE	3.0E+01	Gross Contamination	3.0E+01	7.0E+02	7.6E+04	1.4E+02
FLUORANTHENE	1.3E+01	Aquatic Habitat Goal	1.3E+02	8.0E+02		1.3E+01
FLUORENE	2.4E+02	Drinking Water Toxicity	8.5E+02	2.4E+02	1.7E+03	3.0E+02
GLYPHOSATE	7.0E+02	Drinking Water Toxicity	5.0E+04	7.0E+02		2.2E+04
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	3.0E-04	Aquatic Habitat Goal	3.1E+00	1.0E+00		3.0E-04
HEXACHLOROBUTADIENE	2.0E-01	Drinking Water Toxicity	6.0E+00	2.0E-01		1.1E+01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	1.6E-01	Aquatic Habitat Goal	3.7E+03	2.0E-01		1.6E-01
HEXACHLOROETHANE	4.0E-01	Drinking Water Toxicity	1.0E+01	4.0E-01		3.1E+02
HEXAZINONE	6.6E+02	Drinking Water Toxicity	5.0E+04	6.6E+02		1.4E+05
INDENO(1,2,3-cd)PYRENE	2.9E-02	Drinking Water Toxicity	9.5E-02	2.9E-02		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
ISOPHORONE	8.2E+01	Drinking Water Toxicity	5.0E+04	8.2E+01		4.3E+03
LEAD	1.5E+01	Drinking Water Toxicity	5.0E+04	1.5E+01		2.9E+01
MERCURY	2.0E+00	Drinking Water Toxicity	5.0E+04	2.0E+00		2.1E+00
METHOXYCHLOR	7.0E-01	Aquatic Habitat Goal	5.0E+01	4.0E+01		7.0E-01
METHYL ETHYL KETONE	5.6E+03	Drinking Water Toxicity	8.4E+03	5.6E+03	2.2E+08	2.0E+05
METHYL ISOBUTYL KETONE	1.3E+03	Gross Contamination	1.3E+03	6.3E+03	1.9E+07	2.2E+03
METHYL MERCURY	9.9E-02	Aquatic Habitat Goal	5.0E+04	2.0E+00		9.9E-02
METHYL TERT BUTYL ETHER	5.0E+00	Gross Contamination	5.0E+00	1.4E+01	3.1E+04	6.5E+03
METHYLENE CHLORIDE	5.0E+00	Drinking Water Toxicity	9.1E+03	5.0E+00	7.6E+04	8.5E+03
METHYLNAPHTHALENE, 1-	6.0E+00	Drinking Water Toxicity	1.0E+01	6.0E+00	2.6E+04	3.7E+01
METHYLNAPHTHALENE, 2-	1.0E+01	Gross Contamination	1.0E+01	2.4E+01	2.5E+04	4.2E+01
MOLYBDENUM	1.0E+02	Drinking Water Toxicity	5.0E+04	1.0E+02		7.2E+03
NAPHTHALENE	1.7E+01	Drinking Water Toxicity	2.1E+01	1.7E+01	2.9E+04	7.7E+02
NICKEL	5.0E+00	Aquatic Habitat Goal	5.0E+04	4.0E+02		5.0E+00
NITROBENZENE	1.4E-01	Drinking Water Toxicity	5.0E+04	1.4E-01	(Use soil gas)	2.0E+03
NITROGLYCERIN	2.0E+00	Drinking Water Toxicity	5.0E+04	2.0E+00		1.6E+02
NITROTOLUENE, 2-	7.9E-02	Drinking Water Toxicity	5.0E+04	7.9E-02	(Use soil gas)	6.4E+02
NITROTOLUENE, 3-	2.0E+00	Drinking Water Toxicity	5.0E+04	2.0E+00		3.8E+02
NITROTOLUENE, 4-	4.9E+00	Drinking Water Toxicity	5.0E+04	4.9E+00		4.1E+02
PENTACHLOROPHENOL	1.0E+00	Drinking Water Toxicity	3.0E+01	1.0E+00		1.3E+01
PENTAERYTHRITOLTETRANITRATE (PETN)	1.9E+01	Drinking Water Toxicity	2.2E+04	1.9E+01		8.5E+05
PERCHLORATE	1.5E+01	Drinking Water Toxicity	5.0E+04	1.5E+01		5.0E+03
PHENANTHRENE	2.4E+02	Drinking Water Toxicity	4.1E+02	2.4E+02	(Use soil gas)	3.0E+02
PHENOL	3.0E+02	Aquatic Habitat Goal	7.9E+03	6.0E+03		3.0E+02
POLYCHLORINATED BIPHENYLS (PCBs)	5.0E-01	Drinking Water Toxicity	2.2E+01	5.0E-01		2.0E+00
PROPICONAZOLE	2.6E+02	Drinking Water Toxicity	5.0E+04	2.6E+02		4.3E+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	1.0E+02		1.0E+00
SIMAZINE	4.0E+00	Drinking Water Toxicity	3.1E+03	4.0E+00		8.0E+01
STYRENE	1.0E+01	Gross Contamination	1.0E+01	1.0E+02	3.1E+05	2.9E+02
TERBACIL	2.6E+02	Aquatic Habitat Goal	5.0E+04	2.6E+02		2.6E+02
tert-BUTYL ALCOHOL	5.8E+00	Drinking Water Toxicity	5.0E+04	5.8E+00	(Use soil gas)	1.8E+05
TETRACHLOROETHANE, 1,1,1,2-	6.1E-01	Drinking Water Toxicity	5.0E+04	6.1E-01	(Use soil gas)	7.7E+02
TETRACHLOROETHANE, 1,1,2,2-	7.8E-02	Drinking Water Toxicity	5.0E+02	7.8E-02	2.4E+02	9.1E+02
TETRACHLOROETHYLENE	5.0E+00	Drinking Water Toxicity	1.7E+02	5.0E+00	1.9E+02	1.8E+03
TETRACHLOROPHENOL, 2,3,4,6-	1.1E+01	Aquatic Habitat Goal	1.2E+04	6.0E+02		1.1E+01
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	1.0E+03	Drinking Water Toxicity	2.5E+03	1.0E+03		1.2E+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	2.1E+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	3.0E+02	(Use soil gas)	5.0E+03
TPH (middle distillates)	1.0E+02	Gross Contamination	1.0E+02	1.6E+02	(Use soil gas)	2.5E+03
TPH (residual fuels)	1.0E+02	Gross Contamination	1.0E+02	2.4E+03		2.5E+03
TRICHLOROBENZENE, 1,2,4-	7.0E+01	Drinking Water Toxicity	3.0E+03	7.0E+01	1.2E+03	4.2E+02
TRICHLOROETHANE, 1,1,1-	2.0E+02	Drinking Water Toxicity	9.7E+02	2.0E+02	3.4E+05	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
TRICHLOROETHANE, 1,1,2-	5.0E+00	Drinking Water Toxicity	5.0E+04	5.0E+00	1.1E+02	5.2E+03
TRICHLOROETHYLENE	5.0E+00	Drinking Water Toxicity	3.1E+02	5.0E+00	2.1E+02	7.0E+02
TRICHLOROPHENOL, 2,4,5-	1.7E+01	Aquatic Habitat Goal	2.0E+02	2.0E+03		1.7E+01
TRICHLOROPHENOL, 2,4,6-	7.1E+00	Drinking Water Toxicity	1.0E+02	7.1E+00		3.9E+01
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	2.0E+02	Drinking Water Toxicity	5.0E+04	2.0E+02		6.9E+02
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	5.0E+01	Drinking Water Toxicity	3.6E+04	5.0E+01		2.7E+02
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	1.0E+01	Drinking Water Toxicity	9.0E+01	1.0E+01		2.1E+01
TRINITROBENZENE, 1,3,5-	2.7E+01	Aquatic Habitat Goal	5.0E+04	6.0E+02		2.7E+01
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.0E+01	Aquatic Habitat Goal	3.7E+04	4.0E+01		4.0E+01
TRINITROTOLUENE, 2,4,6- (TNT)	2.6E+00	Drinking Water Toxicity	5.0E+04	2.6E+00		2.1E+02
VANADIUM	9.0E+01	Aquatic Habitat Goal	5.0E+04	1.0E+02		9.0E+01
VINYL CHLORIDE	2.0E+00	Drinking Water Toxicity	3.4E+03	2.0E+00	1.8E+01	8.4E+03
XYLENES	2.0E+01	Gross Contamination	2.0E+01	1.0E+04	1.1E+05	2.3E+02
ZINC	2.2E+01	Aquatic Habitat Goal	5.0E+03	6.0E+03		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 ecotoxicity 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	1.5E+01	Aquatic Habitat Goal	2.0E+02	3.9E+03	1.5E+01
ACENAPHTHYLENE	1.3E+01	Aquatic Habitat Goal	2.0E+03	(Use soil gas)	1.3E+01
ACETONE	1.5E+03	Aquatic Habitat Goal	5.0E+04	6.2E+08	1.5E+03
ALDRIN	1.4E-04	Aquatic Habitat Goal	8.5E+00		1.4E-04
AMETRYN	7.0E+02	Aquatic Habitat Goal	5.0E+04		7.0E+02
AMINO,2- DINITROTOLUENE,4,6-	1.8E+01	Aquatic Habitat Goal	5.0E+04		1.8E+01
AMINO,4- DINITROTOLUENE,2,6-	1.1E+01	Aquatic Habitat Goal	5.0E+04		1.1E+01
ANTHRACENE	2.0E-02	Aquatic Habitat Goal	2.2E+01	4.3E+01	2.0E-02
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	1.8E+04		1.2E+01
BARIUM	2.2E+02	Aquatic Habitat Goal	5.0E+04		2.2E+02
BENOMYL	1.4E-01	Aquatic Habitat Goal	1.9E+03		1.4E-01
BENZENE	7.1E+01	Aquatic Habitat Goal	2.0E+04	2.3E+03	7.1E+01
BENZO(a)ANTHRACENE	2.7E-02	Aquatic Habitat Goal	4.7E+00		2.7E-02
BENZO(a)PYRENE	6.0E-02	Aquatic Habitat Goal	8.0E-01		6.0E-02
BENZO(b)FLUORANTHENE	6.8E-01	Aquatic Habitat Goal	7.5E-01		6.8E-01
BENZO(g,h,i)PERYLENE	1.3E-01	Gross Contamination	1.3E-01		4.4E-01
BENZO(k)FLUORANTHENE	4.0E-01	Gross Contamination	4.0E-01		6.4E-01
BERYLLIUM	6.6E-01	Aquatic Habitat Goal	5.0E+04		6.6E-01
BIPHENYL, 1,1-	5.0E+00	Gross Contamination	5.0E+00	(Use soil gas)	6.5E+00
BIS(2-CHLOROETHYL)ETHER	1.8E+02	Vapor Intrusion	3.6E+03	1.8E+02	2.4E+03
BIS(2-CHLORO-1-METHYLETHYL)ETHER	3.7E-01	Aquatic Habitat Goal	3.2E+03	(Use soil gas)	3.7E-01
BIS(2-ETHYLHEXYL)PHTHALATE	3.0E+00	Aquatic Habitat Goal	1.4E+02		3.0E+00
BORON	1.0E+03	Aquatic Habitat Goal	5.0E+04		1.0E+03
BROMODICHLOROMETHANE	1.1E+02	Vapor Intrusion	5.0E+04	1.1E+02	3.4E+02
BROMOFORM	2.3E+02	Aquatic Habitat Goal	5.1E+03		2.3E+02
BROMOMETHANE	1.6E+01	Aquatic Habitat Goal	5.0E+04	4.1E+02	1.6E+01
CADMIUM	3.0E+00	Aquatic Habitat Goal	5.0E+04		3.0E+00
CARBON TETRACHLORIDE	9.8E+00	Aquatic Habitat Goal	5.2E+03	1.1E+02	9.8E+00
CHLORDANE (TECHNICAL)	4.0E-03	Aquatic Habitat Goal	2.5E+01		4.0E-03
CHLOROANILINE, p-	1.9E+01	Aquatic Habitat Goal	5.0E+04		1.9E+01
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	6.0E+05	2.1E+04
CHLOROFORM	2.8E+01	Aquatic Habitat Goal	2.4E+04	1.1E+02	2.8E+01
CHLOROMETHANE	1.9E+02	Aquatic Habitat Goal	5.0E+04	5.2E+03	1.9E+02
CHLOROPHENOL, 2-	1.8E+00	Gross Contamination	1.8E+00	1.0E+05	3.2E+01
CHROMIUM (Total)	1.1E+01	Aquatic Habitat Goal	5.0E+04		1.1E+01
CHROMIUM III	2.0E+01	Aquatic Habitat Goal	5.0E+04		2.0E+01
CHROMIUM VI	1.1E+01	Aquatic Habitat Goal	5.0E+04		1.1E+01
CHRYSENE	1.0E+00	Gross Contamination	1.0E+00		2.0E+00
COBALT	1.9E+01	Aquatic Habitat Goal	5.0E+04		1.9E+01
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)	7.9E+01	Aquatic Habitat Goal	3.0E+04		7.9E+01
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	8.0E-01	Aquatic Habitat Goal	1.3E+00		8.0E-01
DIBROMO,1,2- CHLOROPROPANE,3-	4.0E-02	Aquatic Habitat Goal	1.0E+02	(Use soil gas)	4.0E-02
DIBROMOCHLOROMETHANE	3.4E+01	Aquatic Habitat Goal	5.0E+04	4.5E+02	3.4E+01
DIBROMOETHANE, 1,2-	1.9E+01	Vapor Intrusion	5.0E+04	1.9E+01	1.4E+03
DICHLOROBENZENE, 1,2-	1.4E+01	Aquatic Habitat Goal	1.0E+02	8.3E+04	1.4E+01
DICHLOROBENZENE, 1,3-	2.2E+01	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	2.2E+01
DICHLOROBENZENE, 1,4-	9.4E+00	Aquatic Habitat Goal	1.1E+02	4.5E+02	9.4E+00
DICHLOROBENZIDINE, 3,3-	4.5E+00	Aquatic Habitat Goal	1.6E+03		4.5E+00
DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.1E-02	Aquatic Habitat Goal	4.5E+01		1.1E-02
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	4.1E-01	Aquatic Habitat Goal	2.0E+01		4.1E-01
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	1.1E+03	4.7E+01
DICHLOROETHANE, 1,2-	1.8E+02	Vapor Intrusion	5.0E+04	1.8E+02	9.1E+02
DICHLOROETHYLENE, 1,1-	2.5E+01	Aquatic Habitat Goal	1.5E+04	6.6E+03	2.5E+01
DICHLOROETHYLENE, Cis 1,2-	6.2E+02	Aquatic Habitat Goal	5.0E+04	1.3E+03	6.2E+02
DICHLOROETHYLENE, Trans 1,2-	5.6E+02	Aquatic Habitat Goal	2.6E+03	6.6E+03	5.6E+02
DICHLOROPHENOL, 2,4-	3.0E+00	Gross Contamination	3.0E+00		1.1E+01
DICHLOROPHENOXYACETIC ACID (2,4-D)	7.0E+01	Aquatic Habitat Goal	5.0E+04		7.0E+01
DICHLOROPROPANE, 1,2-	1.0E+02	Gross Contamination	1.0E+02	3.4E+02	5.2E+02
DICHLOROPROPENE, 1,3-	6.0E-02	Aquatic Habitat Goal	5.0E+04	6.7E+02	6.0E-02
DIELDRIN	1.9E-03	Aquatic Habitat Goal	9.8E+01		1.9E-03
DIETHYLPHTHALATE	2.1E+02	Aquatic Habitat Goal	5.0E+04		2.1E+02
DIMETHYLPHENOL, 2,4-	1.2E+02	Aquatic Habitat Goal	4.0E+03		1.2E+02
DIMETHYLPHTHALATE	1.1E+03	Aquatic Habitat Goal	5.0E+04		1.1E+03
DINITROBENZENE, 1,3-	1.0E+01	Aquatic Habitat Goal	5.0E+04		1.0E+01
DINITROPHENOL, 2,4-	1.4E+01	Aquatic Habitat Goal	5.0E+04		1.4E+01
DINITROTOLUENE, 2,4- (2,4-DNT)	9.1E+00	Aquatic Habitat Goal	5.0E+04		9.1E+00
DINITROTOLUENE, 2,6- (2,6-DNT)	8.1E+01	Aquatic Habitat Goal	5.0E+04		8.1E+01
DIOXANE, 1,4-	5.0E+04	Gross Contamination	5.0E+04	(Use soil gas)	3.4E+05
DIOXINS (TEQ)	3.1E-09	Aquatic Habitat Goal	1.0E-01		3.1E-09
DIURON	6.0E+01	Aquatic Habitat Goal	2.1E+04		6.0E+01
ENDOSULFAN	8.7E-03	Aquatic Habitat Goal	1.6E+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	(Use soil gas)	
ETHYLBENZENE	7.3E+00	Aquatic Habitat Goal	3.0E+02	7.6E+04	7.3E+00
FLUORANTHENE	8.0E-01	Aquatic Habitat Goal	1.3E+02		8.0E-01
FLUORENE	3.9E+00	Aquatic Habitat Goal	8.5E+02	1.7E+03	3.9E+00
GLYPHOSATE	1.8E+03	Aquatic Habitat Goal	5.0E+04		1.8E+03
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	3.0E-04	Aquatic Habitat Goal	3.1E+00		3.0E-04
HEXACHLOROBUTADIENE	3.0E-01	Aquatic Habitat Goal	6.0E+01		3.0E-01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	6.3E-02	Aquatic Habitat Goal	3.7E+03		6.3E-02
HEXACHLOROETHANE	1.2E+01	Aquatic Habitat Goal	1.0E+02		1.2E+01
HEXAZINONE	1.7E+04	Aquatic Habitat Goal	5.0E+04		1.7E+04
INDENO(1,2,3-cd)PYRENE	9.5E-02	Gross Contamination	9.5E-02		2.8E-01

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

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Odors, etc.) Table G-2	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (chronic) Table D-4a
ISOPHORONE	9.2E+02	Aquatic Habitat Goal	5.0E+04		9.2E+02
LEAD	5.6E+00	Aquatic Habitat Goal	5.0E+04		5.6E+00
MERCURY	2.5E-02	Aquatic Habitat Goal	5.0E+04		2.5E-02
METHOXYCHLOR	3.0E-02	Aquatic Habitat Goal	5.0E+01		3.0E-02
METHYL ETHYL KETONE	1.4E+04	Aquatic Habitat Goal	5.0E+04	2.2E+08	1.4E+04
METHYL ISOBUTYL KETONE	1.7E+02	Aquatic Habitat Goal	1.3E+04	1.9E+07	1.7E+02
METHYL MERCURY	2.8E-03	Aquatic Habitat Goal	5.0E+04		2.8E-03
METHYL TERT BUTYL ETHER	7.3E+02	Aquatic Habitat Goal	1.8E+03	3.1E+04	7.3E+02
METHYLENE CHLORIDE	1.5E+03	Aquatic Habitat Goal	5.0E+04	7.6E+04	1.5E+03
METHYLNAPHTHALENE, 1-	2.1E+00	Aquatic Habitat Goal	1.0E+02	2.6E+04	2.1E+00
METHYLNAPHTHALENE, 2-	4.7E+00	Aquatic Habitat Goal	1.0E+02	2.5E+04	4.7E+00
MOLYBDENUM	3.7E+02	Aquatic Habitat Goal	5.0E+04		3.7E+02
NAPHTHALENE	1.2E+01	Aquatic Habitat Goal	2.1E+02	2.9E+04	1.2E+01
NICKEL	5.0E+00	Aquatic Habitat Goal	5.0E+04		5.0E+00
NITROBENZENE	3.8E+02	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	3.8E+02
NITROGLYCERIN	1.8E+01	Aquatic Habitat Goal	5.0E+04		1.8E+01
NITROTOLUENE, 2-	7.1E+01	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	7.1E+01
NITROTOLUENE, 3-	4.2E+01	Aquatic Habitat Goal	5.0E+04		4.2E+01
NITROTOLUENE, 4-	4.6E+01	Aquatic Habitat Goal	5.0E+04		4.6E+01
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+05
PERCHLORATE	6.0E+02	Aquatic Habitat Goal	5.0E+04		6.0E+02
PHENANTHRENE	2.3E+00	Aquatic Habitat Goal	4.1E+02	(Use soil gas)	2.3E+00
PHENOL	5.8E+01	Aquatic Habitat Goal	5.0E+04		5.8E+01
POLYCHLORINATED BIPHENYLS (PCBs)	1.4E-02	Aquatic Habitat Goal	2.2E+01		1.4E-02
PROPICONAZOLE	9.5E+01	Aquatic Habitat Goal	5.0E+04		9.5E+01
PYRENE	4.6E+00	Aquatic Habitat Goal	6.8E+01	1.4E+02	4.6E+00
SELENIUM	5.0E+00	Aquatic Habitat Goal	5.0E+04		5.0E+00
SILVER	1.0E-01	Aquatic Habitat Goal	5.0E+04		1.0E-01
SIMAZINE	9.0E+00	Aquatic Habitat Goal	3.1E+03		9.0E+00
STYRENE	3.2E+01	Aquatic Habitat Goal	1.1E+02	3.1E+05	3.2E+01
TERBACIL	2.6E+02	Aquatic Habitat Goal	5.0E+04		2.6E+02
tert-BUTYL ALCOHOL	1.8E+04	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	1.8E+04
TETRACHLOROETHANE, 1,1,1,2-	1.1E+01	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	1.1E+01
TETRACHLOROETHANE, 1,1,2,2-	2.0E+02	Aquatic Habitat Goal	5.0E+03	2.4E+02	2.0E+02
TETRACHLOROETHYLENE	5.3E+01	Aquatic Habitat Goal	3.0E+03	1.9E+02	5.3E+01
TETRACHLOROPHENOL, 2,3,4,6-	1.2E+00	Aquatic Habitat Goal	1.2E+04		1.2E+00
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	2.2E+02	Aquatic Habitat Goal	2.5E+03		2.2E+02
THALLIUM	6.0E+00	Aquatic Habitat Goal	5.0E+04		6.0E+00
TOLUENE	9.8E+00	Aquatic Habitat Goal	4.0E+02	5.3E+05	9.8E+00
TOXAPHENE	2.0E-04	Aquatic Habitat Goal	1.4E+02		2.0E-04
TPH (gasolines)	5.0E+02	Aquatic Habitat Goal	5.0E+03	(Use soil gas)	5.0E+02
TPH (middle distillates)	6.4E+02	Aquatic Habitat Goal	2.5E+03	(Use soil gas)	6.4E+02
TPH (residual fuels)	6.4E+02	Aquatic Habitat Goal	2.5E+03		6.4E+02
TRICHLOROBENZENE, 1,2,4-	1.1E+02	Aquatic Habitat Goal	2.5E+04	1.2E+03	1.1E+02
TRICHLOROETHANE, 1,1,1-	1.1E+01	Aquatic Habitat Goal	5.0E+04	3.4E+05	1.1E+01

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

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Odors, etc.) Table G-2	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (chronic) Table D-4a
TRICHLOROETHANE, 1,1,2-	1.1E+02	Vapor Intrusion	5.0E+04	1.1E+02	7.3E+02
TRICHLOROETHYLENE	4.7E+01	Aquatic Habitat Goal	5.0E+04	2.1E+02	4.7E+01
TRICHLOROPHENOL, 2,4,5-	1.9E+00	Aquatic Habitat Goal	2.0E+03		1.9E+00
TRICHLOROPHENOL, 2,4,6-	4.9E+00	Aquatic Habitat Goal	1.0E+03		4.9E+00
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	3.6E+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	1.1E+00	Aquatic Habitat Goal	9.0E+01		1.1E+00
TRINITROBENZENE, 1,3,5-	1.0E+01	Aquatic Habitat Goal	5.0E+04		1.0E+01
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.0E+01	Aquatic Habitat Goal	3.7E+04		4.0E+01
TRINITROTOLUENE, 2,4,6- (TNT)	1.3E+01	Aquatic Habitat Goal	5.0E+04		1.3E+01
VANADIUM	2.7E+01	Aquatic Habitat Goal	5.0E+04		2.7E+01
VINYL CHLORIDE	1.8E+01	Vapor Intrusion	3.4E+04	1.8E+01	9.3E+02
XYLENES	1.3E+01	Aquatic Habitat Goal	5.3E+03	1.1E+05	1.3E+01
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 ecotoxicity 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+04	Aquatic Habitat Goal	5.0E+04	6.2E+08	1.5E+04
ALDRIN	1.3E+00	Aquatic Habitat Goal	8.5E+00		1.3E+00
AMETRYN	1.8E+03	Aquatic Habitat Goal	5.0E+04		1.8E+03
AMINO,2- DINITROTOLUENE,4,6-	1.6E+02	Aquatic Habitat Goal	5.0E+04		1.6E+02
AMINO,4- DINITROTOLUENE,2,6-	9.8E+01	Aquatic Habitat Goal	5.0E+04		9.8E+01
ANTHRACENE	1.8E-01	Aquatic Habitat Goal	2.2E+01	4.3E+01	1.8E-01
ANTIMONY	1.8E+02	Aquatic Habitat Goal	5.0E+04		1.8E+02
ARSENIC	6.9E+01	Aquatic Habitat Goal	5.0E+04		6.9E+01
ATRAZINE	3.3E+02	Aquatic Habitat Goal	1.8E+04		3.3E+02
BARIUM	2.0E+03	Aquatic Habitat Goal	5.0E+04		2.0E+03
BENOMYL	2.8E+00	Aquatic Habitat Goal	1.9E+03		2.8E+00
BENZENE	1.7E+03	Aquatic Habitat Goal	2.0E+04	2.3E+03	1.7E+03
BENZO(a)ANTHRACENE	4.7E+00	Gross Contamination	4.7E+00		3.0E+02
BENZO(a)PYRENE	8.0E-01	Gross Contamination	8.0E-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	3.5E+01	Aquatic Habitat Goal	5.0E+04		3.5E+01
BIPHENYL, 1,1-	5.0E+00	Gross Contamination	5.0E+00	(Use soil gas)	2.6E+01
BIS(2-CHLOROETHYL)ETHER	1.8E+02	Vapor Intrusion	3.6E+03	1.8E+02	2.4E+04
BIS(2-CHLORO-1-METHYLETHYL)ETHER	3.7E-01	Aquatic Habitat Goal	3.2E+03	(Use soil gas)	3.7E-01
BIS(2-ETHYLHEXYL)PHTHALATE	2.7E+01	Aquatic Habitat Goal	1.4E+02		2.7E+01
BORON	3.4E+04	Aquatic Habitat Goal	5.0E+04		3.4E+04
BROMODICHLOROMETHANE	1.1E+02	Vapor Intrusion	5.0E+04	1.1E+02	3.1E+03
BROMOFORM	1.1E+03	Aquatic Habitat Goal	5.1E+03		1.1E+03
BROMOMETHANE	3.8E+01	Aquatic Habitat Goal	5.0E+04	4.1E+02	3.8E+01
CADMIUM	3.0E+00	Aquatic Habitat Goal	5.0E+04		3.0E+00
CARBON TETRACHLORIDE	1.1E+02	Vapor Intrusion	5.2E+03	1.1E+02	1.2E+04
CHLORDANE (TECHNICAL)	9.0E-02	Aquatic Habitat Goal	2.5E+01		9.0E-02
CHLOROANILINE, p-	4.6E+02	Aquatic Habitat Goal	5.0E+04		4.6E+02
CHLOROBENZENE	2.2E+02	Aquatic Habitat Goal	5.0E+02	1.2E+04	2.2E+02
CHLOROETHANE	1.6E+02	Gross Contamination	1.6E+02	6.0E+05	2.1E+04
CHLOROFORM	1.1E+02	Vapor Intrusion	2.4E+04	1.1E+02	4.9E+02
CHLOROMETHANE	1.9E+02	Aquatic Habitat Goal	5.0E+04	5.2E+03	1.9E+02
CHLOROPHENOL, 2-	1.8E+00	Gross Contamination	1.8E+00	1.0E+05	4.0E+02
CHROMIUM (Total)	1.6E+01	Aquatic Habitat Goal	5.0E+04		1.6E+01
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	1.2E+02	Aquatic Habitat Goal	5.0E+04		1.2E+02
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)	5.2E+02	Aquatic Habitat Goal	3.0E+04		5.2E+02

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

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Odors, etc.) Table G-2	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (acute) Table D-4a
DALAPON	3.0E+03	Aquatic Habitat Goal	5.0E+04		3.0E+03
DIBENZO(a,h)ANTHTRACENE	1.3E+00	Gross Contamination	1.3E+00		3.0E+02
DIBROMO,1,2- CHLOROPROPANE,3-	4.0E-02	Aquatic Habitat Goal	1.0E+02	(Use soil gas)	4.0E-02
DIBROMOCHLOROMETHANE	4.5E+02	Vapor Intrusion	5.0E+04	4.5E+02	2.9E+03
DIBROMOETHANE, 1,2-	1.9E+01	Vapor Intrusion	5.0E+04	1.9E+01	1.4E+03
DICHLOROBENZENE, 1,2-	1.0E+02	Gross Contamination	1.0E+02	8.3E+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	4.5E+02	3.7E+02
DICHLOROBENZIDINE, 3,3-	4.1E+01	Aquatic Habitat Goal	1.6E+03		4.1E+01
DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.9E-01	Aquatic Habitat Goal	4.5E+01		1.9E-01
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	7.0E+00	Aquatic Habitat Goal	2.0E+01		7.0E+00
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.3E-02	Aquatic Habitat Goal	2.8E+00		1.3E-02
DICHLOROETHANE, 1,1-	8.3E+02	Aquatic Habitat Goal	5.0E+04	1.1E+03	8.3E+02
DICHLOROETHANE, 1,2-	1.8E+02	Vapor Intrusion	5.0E+04	1.8E+02	3.8E+04
DICHLOROETHYLENE, 1,1-	3.9E+03	Aquatic Habitat Goal	1.5E+04	6.6E+03	3.9E+03
DICHLOROETHYLENE, Cis 1,2-	1.3E+03	Vapor Intrusion	5.0E+04	1.3E+03	5.5E+03
DICHLOROETHYLENE, Trans 1,2-	2.6E+03	Gross Contamination	2.6E+03	6.6E+03	1.0E+04
DICHLOROPHENOL, 2,4-	3.0E+00	Gross Contamination	3.0E+00		6.7E+02
DICHLOROPHENOXYACETIC ACID (2,4-D)	1.3E+02	Aquatic Habitat Goal	5.0E+04		1.3E+02
DICHLOROPROPANE, 1,2-	1.0E+02	Gross Contamination	1.0E+02	3.4E+02	3.4E+03
DICHLOROPROPENE, 1,3-	2.6E+02	Aquatic Habitat Goal	5.0E+04	6.7E+02	2.6E+02
DIELDRIN	7.1E-01	Aquatic Habitat Goal	9.8E+01		7.1E-01
DIETHYLPHTHALATE	9.8E+02	Aquatic Habitat Goal	5.0E+04		9.8E+02
DIMETHYLPHENOL, 2,4-	7.0E+02	Aquatic Habitat Goal	4.0E+03		7.0E+02
DIMETHYLPHTHALATE	3.2E+03	Aquatic Habitat Goal	5.0E+04		3.2E+03
DINITROBENZENE, 1,3-	1.0E+02	Aquatic Habitat Goal	5.0E+04		1.0E+02
DINITROPHENOL, 2,4-	3.8E+02	Aquatic Habitat Goal	5.0E+04		3.8E+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	(Use soil gas)	3.4E+06
DIOXINS (TEQ)	3.0E-03	Aquatic Habitat Goal	1.0E-01		3.0E-03
DIURON	2.0E+02	Aquatic Habitat Goal	2.1E+04		2.0E+02
ENDOSULFAN	3.4E-02	Aquatic Habitat Goal	1.6E+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	(Use soil gas)	
ETHYLBENZENE	1.4E+02	Aquatic Habitat Goal	3.0E+02	7.6E+04	1.4E+02
FLUORANTHENE	1.3E+01	Aquatic Habitat Goal	1.3E+02		1.3E+01
FLUORENE	3.0E+02	Aquatic Habitat Goal	8.5E+02	1.7E+03	3.0E+02
GLYPHOSATE	2.2E+04	Aquatic Habitat Goal	5.0E+04		2.2E+04
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	3.0E-04	Aquatic Habitat Goal	3.1E+00		3.0E-04
HEXACHLOROBUTADIENE	1.1E+01	Aquatic Habitat Goal	6.0E+01		1.1E+01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	1.6E-01	Aquatic Habitat Goal	3.7E+03		1.6E-01
HEXACHLOROETHANE	1.0E+02	Gross Contamination	1.0E+02		3.1E+02

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

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Odors, etc.) Table G-2	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (acute) Table D-4a
HEXAZINONE	5.0E+04	Gross Contamination	5.0E+04		1.4E+05
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	5.0E+04		2.1E+00
METHOXYCHLOR	7.0E-01	Aquatic Habitat Goal	5.0E+01		7.0E-01
METHYL ETHYL KETONE	5.0E+04	Gross Contamination	5.0E+04	2.2E+08	2.0E+05
METHYL ISOBUTYL KETONE	2.2E+03	Aquatic Habitat Goal	1.3E+04	1.9E+07	2.2E+03
METHYL MERCURY	9.9E-02	Aquatic Habitat Goal	5.0E+04		9.9E-02
METHYL TERT BUTYL ETHER	1.8E+03	Gross Contamination	1.8E+03	3.1E+04	6.5E+03
METHYLENE CHLORIDE	8.5E+03	Aquatic Habitat Goal	5.0E+04	7.6E+04	8.5E+03
METHYLNAPHTHALENE, 1-	3.7E+01	Aquatic Habitat Goal	1.0E+02	2.6E+04	3.7E+01
METHYLNAPHTHALENE, 2-	4.2E+01	Aquatic Habitat Goal	1.0E+02	2.5E+04	4.2E+01
MOLYBDENUM	7.2E+03	Aquatic Habitat Goal	5.0E+04		7.2E+03
NAPHTHALENE	2.1E+02	Gross Contamination	2.1E+02	2.9E+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	1.6E+02	Aquatic Habitat Goal	5.0E+04		1.6E+02
NITROTOLUENE, 2-	6.4E+02	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	6.4E+02
NITROTOLUENE, 3-	3.8E+02	Aquatic Habitat Goal	5.0E+04		3.8E+02
NITROTOLUENE, 4-	4.1E+02	Aquatic Habitat Goal	5.0E+04		4.1E+02
PENTACHLOROPHENOL	1.3E+01	Aquatic Habitat Goal	5.9E+03		1.3E+01
PENTAERYTHRITOLTETRANITRATE (PETN)	2.2E+04	Gross Contamination	2.2E+04		8.5E+05
PERCHLORATE	5.0E+03	Aquatic Habitat Goal	5.0E+04		5.0E+03
PHENANTHRENE	3.0E+02	Aquatic Habitat Goal	4.1E+02	(Use soil gas)	3.0E+02
PHENOL	3.0E+02	Aquatic Habitat Goal	5.0E+04		3.0E+02
POLYCHLORINATED BIPHENYLS (PCBs)	2.0E+00	Aquatic Habitat Goal	2.2E+01		2.0E+00
PROPICONAZOLE	4.3E+02	Aquatic Habitat Goal	5.0E+04		4.3E+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	8.0E+01	Aquatic Habitat Goal	3.1E+03		8.0E+01
STYRENE	1.1E+02	Gross Contamination	1.1E+02	3.1E+05	2.9E+02
TERBACIL	2.6E+02	Aquatic Habitat Goal	5.0E+04		2.6E+02
tert-BUTYL ALCOHOL	5.0E+04	Gross Contamination	5.0E+04	(Use soil gas)	1.8E+05
TETRACHLOROETHANE, 1,1,1,2-	7.7E+02	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	7.7E+02
TETRACHLOROETHANE, 1,1,2,2-	2.4E+02	Vapor Intrusion	5.0E+03	2.4E+02	9.1E+02
TETRACHLOROETHYLENE	1.9E+02	Vapor Intrusion	3.0E+03	1.9E+02	1.8E+03
TETRACHLOROPHENOL, 2,3,4,6-	1.1E+01	Aquatic Habitat Goal	1.2E+04		1.1E+01
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	1.2E+03	Aquatic Habitat Goal	2.5E+03		1.2E+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	2.1E+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

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
TPH (residual fuels)	2.5E+03	Aquatic Habitat Goal	2.5E+03		2.5E+03
TRICHLOROBENZENE, 1,2,4-	4.2E+02	Aquatic Habitat Goal	2.5E+04	1.2E+03	4.2E+02
TRICHLOROETHANE, 1,1,1-	6.0E+03	Aquatic Habitat Goal	5.0E+04	3.4E+05	6.0E+03
TRICHLOROETHANE, 1,1,2-	1.1E+02	Vapor Intrusion	5.0E+04	1.1E+02	5.2E+03
TRICHLOROETHYLENE	2.1E+02	Vapor Intrusion	5.0E+04	2.1E+02	7.0E+02
TRICHLOROPHENOL, 2,4,5-	1.7E+01	Aquatic Habitat Goal	2.0E+03		1.7E+01
TRICHLOROPHENOL, 2,4,6-	3.9E+01	Aquatic Habitat Goal	1.0E+03		3.9E+01
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)	2.7E+02	Aquatic Habitat Goal	3.6E+04		2.7E+02
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	2.1E+01	Aquatic Habitat Goal	9.0E+01		2.1E+01
TRINITROBENZENE, 1,3,5-	2.7E+01	Aquatic Habitat Goal	5.0E+04		2.7E+01
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.0E+01	Aquatic Habitat Goal	3.7E+04		4.0E+01
TRINITROTOLUENE, 2,4,6- (TNT)	2.1E+02	Aquatic Habitat Goal	5.0E+04		2.1E+02
VANADIUM	9.0E+01	Aquatic Habitat Goal	5.0E+04		9.0E+01
VINYL CHLORIDE	1.8E+01	Vapor Intrusion	3.4E+04	1.8E+01	8.4E+03
XYLENES	2.3E+02	Aquatic Habitat Goal	5.3E+03	1.1E+05	2.3E+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 ecotoxicity 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	1.5E+01	Aquatic Habitat Chronic Toxicity	2.0E+01	3.5E+02	1.5E+01	9.9E+02
ACENAPHTHYLENE	1.3E+01	Aquatic Habitat Chronic Toxicity	2.0E+03	2.4E+02	1.3E+01	
ACETONE	1.7E+03	Aquatic Habitat Chronic Toxicity	2.0E+04	1.4E+04	1.7E+03	
ALDRIN	2.6E-05	Bioaccumulation/Human Consumption	8.5E+00	5.1E-03	3.5E-02	2.6E-05
AMETRYN	1.8E+02	Drinking Water Toxicity	5.0E+04	1.8E+02	7.0E+02	
AMINO,2- DINITROTOLUENE,4,6-	1.8E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	4.0E+01	1.8E+01	
AMINO,4- DINITROTOLUENE,2,6-	1.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	4.0E+01	1.1E+01	
ANTHRACENE	2.0E-02	Aquatic Habitat Chronic Toxicity	2.2E+01	1.8E+03	2.0E-02	4.0E+04
ANTIMONY	6.0E+00	Drinking Water Toxicity	5.0E+04	6.0E+00	1.3E+02	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	2.2E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	2.0E+03	2.2E+02	
BENOMYL	1.4E-01	Aquatic Habitat Chronic Toxicity	1.9E+03	1.0E+03	1.4E-01	
BENZENE	5.0E+00	Drinking Water Toxicity	1.7E+02	5.0E+00	1.6E+02	1.3E+01
BENZO(a)ANTHRACENE	1.1E-02	Drinking Water Toxicity	4.7E+00	1.1E-02	4.7E+00	1.8E-02
BENZO(a)PYRENE	1.8E-02	Bioaccumulation/Human Consumption	8.0E-01	2.0E-01	6.0E-02	1.8E-02
BENZO(b)FLUORANTHENE	1.8E-02	Bioaccumulation/Human Consumption	7.5E-01	2.9E-02	2.6E+00	1.8E-02
BENZO(g,h,i)PERYLENE	1.3E-01	Ceiling Value	1.3E-01	8.0E+02	4.4E-01	
BENZO(k)FLUORANTHENE	1.8E-02	Bioaccumulation/Human Consumption	4.0E-01	2.9E-01	6.4E-01	1.8E-02
BERYLLIUM	3.8E-02	Bioaccumulation/Human Consumption	5.0E+04	4.0E+00	1.1E+01	3.8E-02
BIPHENYL, 1,1-	5.0E-01	Ceiling Value	5.0E-01	8.3E-01	6.5E+00	
BIS(2-CHLOROETHYL)ETHER	1.4E-02	Drinking Water Toxicity	3.6E+02	1.4E-02	2.4E+03	4.4E-01
BIS(2-CHLORO-1-METHYLETHYL)ETHER	3.7E-01	Drinking Water Toxicity	3.2E+02	3.7E-01	3.7E-01	1.4E+03
BIS(2-ETHYLHEXYL)PHTHALATE	2.2E+00	Bioaccumulation/Human Consumption	1.4E+02	6.0E+00	3.0E+00	2.2E+00
BORON	4.0E+03	Drinking Water Toxicity	5.0E+04	4.0E+03	7.2E+03	
BROMODICHLOROMETHANE	1.4E-01	Drinking Water Toxicity	5.0E+04	1.4E-01	3.4E+02	
BROMOFORM	8.0E+01	Drinking Water Toxicity	5.1E+02	8.0E+01	2.3E+02	1.4E+02
BROMOMETHANE	7.6E+00	Drinking Water Toxicity	5.0E+04	7.6E+00	1.6E+01	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	7.7E+01	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-	3.9E-01	Drinking Water Toxicity	5.0E+04	3.9E-01	1.9E+01	
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	1.4E+02	5.1E+00
CHLOROMETHANE	1.9E+02	Drinking Water Toxicity	5.0E+04	1.9E+02	1.9E+02	
CHLOROPHENOL, 2-	1.8E-01	Ceiling Value	1.8E-01	2.9E+01	3.2E+01	1.5E+02
CHROMIUM (Total)	1.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.0E+02	1.1E+01	
CHROMIUM III	7.4E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	3.0E+04	7.4E+01	
CHROMIUM VI	4.3E+00	Drinking Water Toxicity	5.0E+04	4.3E+00	1.1E+01	
CHRYSENE	1.8E-02	Bioaccumulation/Human Consumption	1.0E+00	2.9E+00	4.7E+00	1.8E-02
COBALT	6.0E+00	Drinking Water Toxicity	5.0E+04	6.0E+00	1.9E+01	
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)	7.1E-01	Drinking Water Toxicity	3.0E+04	7.1E-01	7.9E+01	
DALAPON	2.0E+02	Drinking Water Toxicity	5.0E+04	2.0E+02	3.0E+02	
DIBENZO(a,h)ANTHTRACENE	2.9E-03	Drinking Water Toxicity	1.3E+00	2.9E-03	8.0E-01	1.8E-02
DIBROMO,1,2- CHLOROPROPANE,3-	4.0E-02	Drinking Water Toxicity	1.0E+01	4.0E-02	4.0E-02	
DIBROMOCHLOROMETHANE	2.1E-01	Drinking Water Toxicity	5.0E+04	2.1E-01	3.2E+02	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	2.3E+01	8.5E+02
DICHLOROBENZENE, 1,3-	2.2E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.8E+02	2.2E+01	8.5E+02
DICHLOROBENZENE, 1,4-	5.0E+00	Ceiling Value	5.0E+00	7.5E+01	9.4E+00	8.5E+02
DICHLOROBENZIDINE, 3,3-	7.0E-03	Bioaccumulation/Human Consumption	1.6E+03	1.7E-01	4.5E+00	7.0E-03
DICHLORODIPHENYLDICHLOROETHANE (DDD)	3.1E-04	Bioaccumulation/Human Consumption	4.5E+01	3.2E-01	1.1E-02	3.1E-04
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.2E-04	Bioaccumulation/Human Consumption	2.0E+01	4.6E-02	4.1E-01	2.2E-04
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	8.0E-06	Bioaccumulation/Human Consumption	2.8E+00	2.3E-01	1.0E-03	8.0E-06
DICHLOROETHANE, 1,1-	2.8E+00	Drinking Water Toxicity	5.0E+04	2.8E+00	4.1E+02	
DICHLOROETHANE, 1,2-	5.0E+00	Drinking Water Toxicity	7.0E+03	5.0E+00	2.0E+03	7.9E+01
DICHLOROETHYLENE, 1,1-	6.0E-01	Bioaccumulation/Human Consumption	1.5E+03	7.0E+00	1.3E+02	6.0E-01
DICHLOROETHYLENE, Cis 1,2-	7.0E+01	Drinking Water Toxicity	5.0E+04	7.0E+01	6.2E+02	
DICHLOROETHYLENE, Trans 1,2-	1.0E+02	Drinking Water Toxicity	2.6E+02	1.0E+02	5.6E+02	140000
DICHLOROPHENOL, 2,4-	3.0E-01	Ceiling Value	3.0E-01	6.0E+01	1.1E+01	2.9E+02
DICHLOROPHENOXYACETIC ACID (2,4-D)	7.0E+01	Drinking Water Toxicity	5.0E+04	7.0E+01	7.9E+01	
DICHLOROPROPANE, 1,2-	5.0E+00	Drinking Water Toxicity	1.0E+01	5.0E+00	5.2E+02	1.5E+01
DICHLOROPROPENE, 1,3-	5.0E-01	Drinking Water Toxicity	5.0E+04	5.0E-01	1.7E+00	4.6E+00
DIELDRIN	2.5E-05	Bioaccumulation/Human Consumption	4.1E+01	1.1E-02	1.9E-03	2.5E-05
DIETHYLPHTHALATE	2.2E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	1.6E+04	2.2E+02	4.4E+04
DIMETHYLPHENOL, 2,4-	1.2E+02	Aquatic Habitat Chronic Toxicity	4.0E+02	4.0E+02	1.2E+02	8.5E+02
DIMETHYLPHTHALATE	1.1E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	2.0E+05	1.1E+03	1.1E+06
DINITROBENZENE, 1,3-	2.0E+00	Drinking Water Toxicity	5.0E+04	2.0E+00	2.2E+01	
DINITROPHENOL, 2,4-	4.0E+01	Drinking Water Toxicity	5.0E+04	4.0E+01	7.1E+01	5.3E+03
DINITROTOLUENE, 2,4- (2,4-DNT)	2.5E-01	Drinking Water Toxicity	5.0E+04	2.5E-01	4.4E+01	3.0E+00
DINITROTOLUENE, 2,6- (2,6-DNT)	5.2E-02	Drinking Water Toxicity	5.0E+04	5.2E-02	8.1E+01	
DIOXANE, 1,4-	4.6E-01	Drinking Water Toxicity	5.0E+04	4.6E-01	3.4E+05	
DIOXINS (TEQ)	3.1E-09	Aquatic Habitat Chronic Toxicity	1.0E-01	3.0E-05	3.1E-09	5.0E-09
DIURON	4.0E+01	Drinking Water Toxicity	2.1E+04	4.0E+01	6.0E+01	
ENDOSULFAN	5.6E-02	Aquatic Habitat Chronic Toxicity	1.6E+02	1.2E+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	6.1E+01	1.1E+03
FLUORANTHENE	8.0E-01	Aquatic Habitat Chronic Toxicity	1.3E+02	8.0E+02	8.0E-01	1.8E+01
FLUORENE	1.9E+01	Aquatic Habitat Chronic Toxicity	8.5E+02	2.4E+02	1.9E+01	5.3E+03
GLYPHOSATE	7.0E+02	Drinking Water Toxicity	5.0E+04	7.0E+02	1.8E+03	
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	3.0E-04	2.4E-04
HEXACHLOROBUTADIENE	2.0E-01	Drinking Water Toxicity	6.0E+00	2.0E-01	1.0E+00	1.6E+01

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
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	2.0E-02	Bioaccumulation/Human Consumption	3.7E+03	2.0E-01	8.0E-02	2.0E-02
HEXACHLOROETHANE	4.0E-01	Drinking Water Toxicity	1.0E+01	4.0E-01	1.2E+01	2.9E+00
HEXAZINONE	6.6E+02	Drinking Water Toxicity	5.0E+04	6.6E+02	1.7E+04	
INDENO(1,2,3-cd)PYRENE	1.8E-02	Bioaccumulation/Human Consumption	9.5E-02	2.9E-02	2.8E-01	1.8E-02
ISOPHORONE	8.2E+01	Drinking Water Toxicity	5.0E+04	8.2E+01	9.2E+02	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	5.0E+04	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	5.6E+03	Drinking Water Toxicity	8.4E+03	5.6E+03	2.2E+04	
METHYL ISOBUTYL KETONE	1.7E+02	Aquatic Habitat Chronic Toxicity	1.3E+03	6.3E+03	1.7E+02	
METHYL MERCURY	2.8E-03	Aquatic Habitat Chronic Toxicity	5.0E+04	2.0E+00	2.8E-03	
METHYL TERT BUTYL ETHER	5.0E+00	Ceiling Value	5.0E+00	1.4E+01	7.3E+02	
METHYLENE CHLORIDE	5.0E+00	Drinking Water Toxicity	9.1E+03	5.0E+00	1.5E+03	5.9E+02
METHYLNAPHTHALENE, 1-	2.1E+00	Aquatic Habitat Chronic Toxicity	1.0E+01	6.0E+00	2.1E+00	
METHYLNAPHTHALENE, 2-	4.7E+00	Aquatic Habitat Chronic Toxicity	1.0E+01	2.4E+01	4.7E+00	
MOLYBDENUM	1.0E+02	Drinking Water Toxicity	5.0E+04	1.0E+02	8.0E+02	
NAPHTHALENE	1.7E+01	Drinking Water Toxicity	2.1E+01	1.7E+01	2.1E+01	
NICKEL	5.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	4.0E+02	5.0E+00	3.3E+01
NITROBENZENE	1.4E-01	Drinking Water Toxicity	5.0E+04	1.4E-01	3.8E+02	
NITROGLYCERIN	2.0E+00	Drinking Water Toxicity	5.0E+04	2.0E+00	1.8E+01	
NITROTOLUENE, 2-	7.9E-02	Drinking Water Toxicity	5.0E+04	7.9E-02	7.1E+01	
NITROTOLUENE, 3-	2.0E+00	Drinking Water Toxicity	5.0E+04	2.0E+00	4.2E+01	
NITROTOLUENE, 4-	4.9E+00	Drinking Water Toxicity	5.0E+04	4.9E+00	4.6E+01	
PENTACHLOROPHENOL	1.0E+00	Drinking Water Toxicity	3.0E+01	1.0E+00	1.3E+01	3.0E+00
PENTAERYTHRITOLTETRANITRATE (PETN)	1.9E+01	Drinking Water Toxicity	2.2E+04	1.9E+01	8.5E+05	
PERCHLORATE	1.5E+01	Drinking Water Toxicity	5.0E+04	1.5E+01	6.0E+02	
PHENANTHRENE	2.3E+00	Aquatic Habitat Chronic Toxicity	4.1E+02	2.4E+02	2.3E+00	
PHENOL	1.6E+02	Aquatic Habitat Chronic Toxicity	7.9E+03	6.0E+03	1.6E+02	1.7E+06
POLYCHLORINATED BIPHENYLS (PCBs)	7.9E-05	Bioaccumulation/Human Consumption	2.2E+01	5.0E-01	1.4E-02	7.9E-05
PROPICONAZOLE	9.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	2.6E+02	9.5E+01	
PYRENE	4.6E+00	Aquatic Habitat Chronic Toxicity	6.8E+01	1.8E+02	4.6E+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	1.0E+02	1.0E+00	
SIMAZINE	4.0E+00	Drinking Water Toxicity	3.1E+03	4.0E+00	9.0E+00	
STYRENE	1.0E+01	Ceiling Value	1.0E+01	1.0E+02	3.2E+01	
TERBACIL	2.6E+02	Drinking Water Toxicity	5.0E+04	2.6E+02	1.2E+03	
tert-BUTYL ALCOHOL	5.8E+00	Drinking Water Toxicity	5.0E+04	5.8E+00	1.8E+04	
TETRACHLOROETHANE, 1,1,1,2-	6.1E-01	Drinking Water Toxicity	5.0E+04	6.1E-01	8.5E+01	
TETRACHLOROETHANE, 1,1,2,2-	7.8E-02	Drinking Water Toxicity	5.0E+02	7.8E-02	2.0E+02	3.5E+00
TETRACHLOROETHYLENE	2.9E+00	Bioaccumulation/Human Consumption	1.7E+02	5.0E+00	5.3E+01	2.9E+00
TETRACHLOROPHENOL, 2,3,4,6-	1.2E+00	Aquatic Habitat Chronic Toxicity	1.2E+04	6.0E+02	1.2E+00	
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	2.2E+02	Aquatic Habitat Chronic Toxicity	2.5E+03	1.0E+03	2.2E+02	
THALLIUM	2.0E+00	Drinking Water Toxicity	5.0E+04	2.0E+00	6.0E+00	1.6E+01
TOLUENE	4.0E+01	Ceiling Value	4.0E+01	1.0E+03	6.2E+01	1.4E+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
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	3.0E+02	5.0E+02	
TPH (middle distillates)	1.0E+02	Ceiling Value	1.0E+02	1.6E+02	6.4E+02	
TPH (residual fuels)	1.0E+02	Ceiling Value	1.0E+02	2.4E+03	6.4E+02	
TRICHLOROBENZENE, 1,2,4-	7.0E+01	Drinking Water Toxicity	3.0E+03	7.0E+01	1.3E+02	
TRICHLOROETHANE, 1,1,1-	7.6E+01	Aquatic Habitat Chronic Toxicity	9.7E+02	2.0E+02	7.6E+01	3.4E+05
TRICHLOROETHANE, 1,1,2-	5.0E+00	Drinking Water Toxicity	5.0E+04	5.0E+00	7.3E+02	1.4E+01
TRICHLOROETHYLENE	5.0E+00	Drinking Water Toxicity	3.1E+02	5.0E+00	2.0E+02	2.6E+01
TRICHLOROPHENOL, 2,4,5-	1.9E+00	Aquatic Habitat Chronic Toxicity	2.0E+02	2.0E+03	1.9E+00	3.6E+03
TRICHLOROPHENOL, 2,4,6-	1.2E+00	Bioaccumulation/Human Consumption	1.0E+02	7.1E+00	4.9E+00	1.2E+00
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	2.0E+02	Drinking Water Toxicity	5.0E+04	2.0E+02	6.9E+02	-
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	3.0E+01	Aquatic Habitat Chronic Toxicity	3.6E+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	1.1E+00	Aquatic Habitat Chronic Toxicity	9.0E+01	1.0E+01	1.1E+00	
TRINITROBENZENE, 1,3,5-	1.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	6.0E+02	1.1E+01	
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.0E+01	Drinking Water Toxicity	3.7E+04	4.0E+01	4.0E+01	
TRINITROTOLUENE, 2,4,6- (TNT)	2.6E+00	Drinking Water Toxicity	5.0E+04	2.6E+00	1.3E+01	
VANADIUM	2.7E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.0E+02	2.7E+01	
VINYL CHLORIDE	2.0E+00	Drinking Water Toxicity	3.4E+03	2.0E+00	9.3E+02	1.7E+02
XYLENES	2.0E+01	Ceiling Value	2.0E+01	1.0E+04	2.7E+01	
ZINC	2.2E+01	Aquatic Habitat Chronic Toxicity	5.0E+03	6.0E+03	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 ecotoxicity 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	2.0E+01	9.9E+02
ACENAPHTHYLENE	3.1E+02	Aquatic Habitat Chronic Toxicity	2.0E+03	3.1E+02	
ACETONE	1.5E+03	Aquatic Habitat Chronic Toxicity	2.0E+04	1.5E+03	
ALDRIN	2.6E-05	Bioaccumulation/Human Consumption	8.5E+00	1.4E-04	2.6E-05
AMETRYN	7.0E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	7.0E+02	
AMINO,2- DINITROTOLUENE,4,6-	2.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	2.0E+01	
AMINO,4- DINITROTOLUENE,2,6-	1.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.1E+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	1.8E+04	1.2E+01	
BARIUM	2.2E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	2.2E+02	
BENOMYL	1.4E-01	Aquatic Habitat Chronic Toxicity	1.9E+03	1.4E-01	
BENZENE	1.3E+01	Bioaccumulation/Human Consumption	2.0E+03	7.1E+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	1.8E-02	Bioaccumulation/Human Consumption	8.0E-01	3.0E-01	1.8E-02
BENZO(b)FLUORANTHENE	1.8E-02	Bioaccumulation/Human Consumption	7.5E-01	6.8E-01	1.8E-02
BENZO(g,h,i)PERYLENE	1.3E-01	Ceiling Level	1.3E-01	4.4E-01	
BENZO(k)FLUORANTHENE	1.8E-02	Bioaccumulation/Human Consumption	4.0E-01	6.4E-01	1.8E-02
BERYLLIUM	3.8E-02	Bioaccumulation/Human Consumption	5.0E+04	6.6E-01	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	2.4E+03	4.4E-01
BIS(2-CHLORO-1-METHYLETHYL)ETHER	3.7E-01	Aquatic Habitat Chronic Toxicity	3.2E+02	3.7E-01	1.4E+03
BIS(2-ETHYLHEXYL)PHTHALATE	2.2E+00	Bioaccumulation/Human Consumption	1.4E+02	3.0E+00	2.2E+00
BORON	1.0E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	1.0E+03	
BROMODICHLOROMETHANE	3.4E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	3.4E+02	
BROMOFORM	1.4E+02	Bioaccumulation/Human Consumption	5.1E+02	3.2E+02	1.4E+02
BROMOMETHANE	1.6E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.6E+01	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	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-	1.9E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.9E+01	
CHLOROBENZENE	5.0E+01	Ceiling Level	5.0E+01	6.4E+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	2.8E+01	5.1E+00
CHLOROMETHANE	1.9E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	1.9E+02	
CHLOROPHENOL, 2-	1.8E-01	Ceiling Level	1.8E-01	4.0E+02	1.5E+02
CHROMIUM (Total)	5.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	5.0E+01	
CHROMIUM III	2.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	2.0E+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	2.0E+00	1.8E-02
COBALT	2.3E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	2.3E+01	
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

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
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	1.9E+02	Aquatic Habitat Chronic Toxicity	3.0E+04	1.9E+02	
DALAPON	3.0E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	3.0E+02	
DIBENZO(a,h)ANTHTRACENE	1.8E-02	Bioaccumulation/Human Consumption	1.3E+00	7.1E+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	3.4E+01	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-	7.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	7.1E+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	4.5E+00	7.0E-03
DICHLORODIPHENYLDICHLOROETHANE (DDD)	3.1E-04	Bioaccumulation/Human Consumption	4.5E+01	1.1E-02	3.1E-04
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.2E-04	Bioaccumulation/Human Consumption	2.0E+01	4.1E-01	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	9.1E+02	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-	6.2E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	6.2E+02	
DICHLOROETHYLENE, Trans 1,2-	2.6E+02	Ceiling Level	2.6E+02	5.6E+02	140000
DICHLOROPHENOL, 2,4-	3.0E-01	Ceiling Level	3.0E-01	7.9E+02	2.9E+02
DICHLOROPHENOXYACETIC ACID (2,4-D)	7.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	7.0E+01	
DICHLOROPROPANE, 1,2-	1.0E+01	Ceiling Level	1.0E+01	5.2E+02	1.5E+01
DICHLOROPROPENE, 1,3-	6.0E-02	Aquatic Habitat Chronic Toxicity	5.0E+04	6.0E-02	4.6E+00
DIELDRIN	2.5E-05	Bioaccumulation/Human Consumption	4.1E+01	1.9E-03	2.5E-05
DIETHYLPHTHALATE	2.1E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	2.1E+02	4.4E+04
DIMETHYLPHENOL, 2,4-	1.2E+02	Aquatic Habitat Chronic Toxicity	4.0E+02	1.2E+02	8.5E+02
DIMETHYLPHTHALATE	2.9E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	2.9E+03	1.1E+06
DINITROBENZENE, 1,3-	1.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.0E+01	
DINITROPHENOL, 2,4-	1.4E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.4E+01	5.3E+03
DINITROTOLUENE, 2,4- (2,4-DNT)	3.0E+00	Bioaccumulation/Human Consumption	5.0E+04	9.1E+00	3.0E+00
DINITROTOLUENE, 2,6- (2,6-DNT)	8.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	8.1E+01	
DIOXANE, 1,4-	5.0E+04	Ceiling Level	5.0E+04	5.0E+05	
DIOXINS (TEQ)	3.1E-09	Aquatic Habitat Chronic Toxicity	1.0E-01	3.1E-09	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	1.6E+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	7.3E+00	Aquatic Habitat Chronic Toxicity	3.0E+01	7.3E+00	1.1E+03
FLUORANTHENE	7.1E+00	Aquatic Habitat Chronic Toxicity	1.3E+02	7.1E+00	1.8E+01
FLUORENE	3.9E+00	Aquatic Habitat Chronic Toxicity	8.5E+02	3.9E+00	5.3E+03
GLYPHOSATE	1.8E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	1.8E+03	
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	3.0E-04	2.4E-04
HEXACHLOROBUTADIENE	3.0E-01	Aquatic Habitat Chronic Toxicity	6.0E+00	3.0E-01	1.6E+01

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
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	2.0E-02	Bioaccumulation/Human Consumption	3.7E+03	6.3E-02	2.0E-02
HEXACHLOROETHANE	2.9E+00	Bioaccumulation/Human Consumption	1.0E+01	1.2E+01	2.9E+00
HEXAZINONE	1.7E+04	Aquatic Habitat Chronic Toxicity	5.0E+04	1.7E+04	
INDENO(1,2,3-cd)PYRENE	1.8E-02	Bioaccumulation/Human Consumption	9.5E-02	2.8E-01	1.8E-02
ISOPHORONE	9.2E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	9.2E+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	5.0E+04	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	2.8E-03	Aquatic Habitat Chronic Toxicity	5.0E+04	2.8E-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-	1.0E+01	Ceiling Level	1.0E+01	7.2E+01	
MOLYBDENUM	3.7E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	3.7E+02	
NAPHTHALENE	1.2E+01	Aquatic Habitat Chronic Toxicity	2.1E+01	1.2E+01	
NICKEL	8.3E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	8.3E+00	3.3E+01
NITROBENZENE	3.8E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	3.8E+02	
NITROGLYCERIN	1.8E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.8E+01	
NITROTOLUENE, 2-	7.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	7.1E+01	
NITROTOLUENE, 3-	4.2E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	4.2E+01	
NITROTOLUENE, 4-	4.6E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	4.6E+01	
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+05	
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	5.8E+01	Aquatic Habitat Chronic Toxicity	7.9E+03	5.8E+01	1.7E+06
POLYCHLORINATED BIPHENYLS (PCBs)	7.9E-05	Bioaccumulation/Human Consumption	2.2E+01	3.0E-02	7.9E-05
PROPICONAZOLE	9.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	9.5E+01	
PYRENE	1.0E+01	Aquatic Habitat Chronic Toxicity	6.8E+01	1.0E+01	4.0E+03
SELENIUM	7.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	7.1E+01	
SILVER	1.0E-01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.0E-01	
SIMAZINE	9.0E+00	Aquatic Habitat Chronic Toxicity	3.1E+03	9.0E+00	
STYRENE	1.1E+01	Ceiling Level	1.1E+01	3.2E+01	
TERBACIL	2.6E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	2.6E+02	
tert-BUTYL ALCOHOL	1.8E+04	Aquatic Habitat Chronic Toxicity	5.0E+04	1.8E+04	
TETRACHLOROETHANE, 1,1,1,2-	1.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.1E+01	
TETRACHLOROETHANE, 1,1,2,2-	3.5E+00	Bioaccumulation/Human Consumption	5.0E+02	6.1E+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-	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	2.5E+03	3.3E+02	
THALLIUM	1.2E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.2E+01	1.6E+01
TOLUENE	9.8E+00	Aquatic Habitat Chronic Toxicity	4.0E+01	9.8E+00	1.4E+05

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
TOXAPHENE	2.0E-04	Aquatic Habitat Chronic Toxicity	1.4E+02	2.0E-04	2.4E-04
TPH (gasolines)	3.7E+03	Aquatic Habitat Chronic Toxicity	5.0E+03	3.7E+03	
TPH (middle distillates)	6.4E+02	Aquatic Habitat Chronic Toxicity	2.5E+03	6.4E+02	
TPH (residual fuels)	6.4E+02	Aquatic Habitat Chronic Toxicity	2.5E+03	6.4E+02	
TRICHLOROBENZENE, 1,2,4-	1.1E+02	Aquatic Habitat Chronic Toxicity	3.0E+03	1.1E+02	
TRICHLOROETHANE, 1,1,1-	1.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.1E+01	3.4E+05
TRICHLOROETHANE, 1,1,2-	1.4E+01	Bioaccumulation/Human Consumption	5.0E+04	1.2E+03	1.4E+01
TRICHLOROETHYLENE	2.6E+01	Bioaccumulation/Human Consumption	1.0E+04	4.7E+01	2.6E+01
TRICHLOROPHENOL, 2,4,5-	1.2E+01	Aquatic Habitat Chronic Toxicity	2.0E+02	1.2E+01	3.6E+03
TRICHLOROPHENOL, 2,4,6-	1.2E+00	Bioaccumulation/Human Consumption	1.0E+02	6.5E+00	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)	5.0E+01	Aquatic Habitat Chronic Toxicity	3.6E+04	5.0E+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	1.1E+00	Aquatic Habitat Chronic Toxicity	9.0E+01	1.1E+00	
TRINITROBENZENE, 1,3,5-	1.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.0E+01	
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.0E+01	Aquatic Habitat Chronic Toxicity	3.7E+04	4.0E+01	
TRINITROTOLUENE, 2,4,6- (TNT)	2.0E+01	Ceiling Level	2.0E+01	9.0E+01	
VANADIUM	8.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	8.1E+01	
VINYL CHLORIDE	1.7E+02	Bioaccumulation/Human Consumption	3.4E+03	9.3E+02	1.7E+02
XYLENES	1.3E+01	Aquatic Habitat Chronic Toxicity	5.3E+02	1.3E+01	
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 ecotoxicity 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	1.5E+01	Aquatic Habitat Chronic Toxicity	2.0E+01	1.5E+01	9.9E+02
ACENAPHTHYLENE	1.3E+01	Aquatic Habitat Chronic Toxicity	2.0E+03	1.3E+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	1.4E-04	2.6E-05
AMETRYN	7.0E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	7.0E+02	
AMINO,2- DINITROTOLUENE,4,6-	1.8E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.8E+01	
AMINO,4- DINITROTOLUENE,2,6-	1.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.1E+01	
ANTHRACENE	2.0E-02	Aquatic Habitat Chronic Toxicity	2.2E+01	2.0E-02	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	1.8E+04	1.2E+01	
BARIUM	2.2E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	2.2E+02	
BENOMYL	1.4E-01	Aquatic Habitat Chronic Toxicity	1.9E+03	1.4E-01	
BENZENE	1.3E+01	Bioaccumulation/Human Consumption	2.0E+03	7.1E+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	1.8E-02	Bioaccumulation/Human Consumption	8.0E-01	6.0E-02	1.8E-02
BENZO(b)FLUORANTHENE	1.8E-02	Bioaccumulation/Human Consumption	7.5E-01	6.8E-01	1.8E-02
BENZO(g,h,i)PERYLENE	1.3E-01	Ceiling Level	1.3E-01	4.4E-01	
BENZO(k)FLUORANTHENE	1.8E-02	Bioaccumulation/Human Consumption	4.0E-01	6.4E-01	1.8E-02
BERYLLIUM	3.8E-02	Bioaccumulation/Human Consumption	5.0E+04	6.6E-01	3.8E-02
BIPHENYL, 1,1-	5.0E-01	Ceiling Level	5.0E-01	6.5E+00	
BIS(2-CHLOROETHYL)ETHER	4.4E-01	Bioaccumulation/Human Consumption	3.6E+02	2.4E+03	4.4E-01
BIS(2-CHLORO-1-METHYLETHYL)ETHER	3.7E-01	Aquatic Habitat Chronic Toxicity	3.2E+02	3.7E-01	1.4E+03
BIS(2-ETHYLHEXYL)PHTHALATE	2.2E+00	Bioaccumulation/Human Consumption	1.4E+02	3.0E+00	2.2E+00
BORON	1.0E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	1.0E+03	
BROMODICHLOROMETHANE	3.4E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	3.4E+02	
BROMOFORM	1.4E+02	Bioaccumulation/Human Consumption	5.1E+02	2.3E+02	1.4E+02
BROMOMETHANE	1.6E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.6E+01	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-	1.9E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.9E+01	
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	2.8E+01	5.1E+00
CHLOROMETHANE	1.9E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	1.9E+02	
CHLOROPHENOL, 2-	1.8E-01	Ceiling Level	1.8E-01	3.2E+01	1.5E+02
CHROMIUM (Total)	1.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.1E+01	
CHROMIUM III	2.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	2.0E+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	2.0E+00	1.8E-02
COBALT	1.9E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.9E+01	
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

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
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	7.9E+01	Aquatic Habitat Chronic Toxicity	3.0E+04	7.9E+01	
DALAPON	3.0E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	3.0E+02	
DIBENZO(a,h)ANTHTRACENE	1.8E-02	Bioaccumulation/Human Consumption	1.3E+00	8.0E-01	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	3.4E+01	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-	2.2E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	2.2E+01	8.5E+02
DICHLOROBENZENE, 1,4-	9.4E+00	Aquatic Habitat Chronic Toxicity	1.1E+01	9.4E+00	8.5E+02
DICHLOROBENZIDINE, 3,3-	7.0E-03	Bioaccumulation/Human Consumption	1.6E+03	4.5E+00	7.0E-03
DICHLORODIPHENYLDICHLOROETHANE (DDD)	3.1E-04	Bioaccumulation/Human Consumption	4.5E+01	1.1E-02	3.1E-04
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.2E-04	Bioaccumulation/Human Consumption	2.0E+01	4.1E-01	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	9.1E+02	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-	6.2E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	6.2E+02	
DICHLOROETHYLENE, Trans 1,2-	2.6E+02	Ceiling Level	2.6E+02	5.6E+02	140000
DICHLOROPHENOL, 2,4-	3.0E-01	Ceiling Level	3.0E-01	1.1E+01	2.9E+02
DICHLOROPHENOXYACETIC ACID (2,4-D)	7.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	7.0E+01	
DICHLOROPROPANE, 1,2-	1.0E+01	Ceiling Level	1.0E+01	5.2E+02	1.5E+01
DICHLOROPROPENE, 1,3-	6.0E-02	Aquatic Habitat Chronic Toxicity	5.0E+04	6.0E-02	4.6E+00
DIELDRIN	2.5E-05	Bioaccumulation/Human Consumption	4.1E+01	1.9E-03	2.5E-05
DIETHYLPHTHALATE	2.1E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	2.1E+02	4.4E+04
DIMETHYLPHENOL, 2,4-	1.2E+02	Aquatic Habitat Chronic Toxicity	4.0E+02	1.2E+02	8.5E+02
DIMETHYLPHTHALATE	1.1E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	1.1E+03	1.1E+06
DINITROBENZENE, 1,3-	1.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.0E+01	
DINITROPHENOL, 2,4-	1.4E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.4E+01	5.3E+03
DINITROTOLUENE, 2,4- (2,4-DNT)	3.0E+00	Bioaccumulation/Human Consumption	5.0E+04	9.1E+00	3.0E+00
DINITROTOLUENE, 2,6- (2,6-DNT)	8.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	8.1E+01	
DIOXANE, 1,4-	5.0E+04	Ceiling Level	5.0E+04	3.4E+05	
DIOXINS (TEQ)	3.1E-09	Aquatic Habitat Chronic Toxicity	1.0E-01	3.1E-09	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	1.6E+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	7.3E+00	Aquatic Habitat Chronic Toxicity	3.0E+01	7.3E+00	1.1E+03
FLUORANTHENE	8.0E-01	Aquatic Habitat Chronic Toxicity	1.3E+02	8.0E-01	1.8E+01
FLUORENE	3.9E+00	Aquatic Habitat Chronic Toxicity	8.5E+02	3.9E+00	5.3E+03
GLYPHOSATE	1.8E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	1.8E+03	
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	3.0E-04	2.4E-04
HEXACHLOROBUTADIENE	3.0E-01	Aquatic Habitat Chronic Toxicity	6.0E+00	3.0E-01	1.6E+01

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
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	2.0E-02	Bioaccumulation/Human Consumption	3.7E+03	6.3E-02	2.0E-02
HEXACHLOROETHANE	2.9E+00	Bioaccumulation/Human Consumption	1.0E+01	1.2E+01	2.9E+00
HEXAZINONE	1.7E+04	Aquatic Habitat Chronic Toxicity	5.0E+04	1.7E+04	
INDENO(1,2,3-cd)PYRENE	1.8E-02	Bioaccumulation/Human Consumption	9.5E-02	2.8E-01	1.8E-02
ISOPHORONE	9.2E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	9.2E+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	5.0E+04	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	2.8E-03	Aquatic Habitat Chronic Toxicity	5.0E+04	2.8E-03	
METHYL TERT BUTYL ETHER	1.8E+02	Ceiling Level	1.8E+02	7.3E+02	
METHYLENE CHLORIDE	5.9E+02	Bioaccumulation/Human Consumption	9.1E+03	1.5E+03	5.9E+02
METHYLNAPHTHALENE, 1-	2.1E+00	Aquatic Habitat Chronic Toxicity	1.0E+01	2.1E+00	
METHYLNAPHTHALENE, 2-	4.7E+00	Aquatic Habitat Chronic Toxicity	1.0E+01	4.7E+00	
MOLYBDENUM	3.7E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	3.7E+02	
NAPHTHALENE	1.2E+01	Aquatic Habitat Chronic Toxicity	2.1E+01	1.2E+01	
NICKEL	5.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	5.0E+00	3.3E+01
NITROBENZENE	3.8E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	3.8E+02	
NITROGLYCERIN	1.8E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.8E+01	
NITROTOLUENE, 2-	7.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	7.1E+01	
NITROTOLUENE, 3-	4.2E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	4.2E+01	
NITROTOLUENE, 4-	4.6E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	4.6E+01	
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+05	
PERCHLORATE	6.0E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	6.0E+02	
PHENANTHRENE	2.3E+00	Aquatic Habitat Chronic Toxicity	4.1E+02	2.3E+00	
PHENOL	5.8E+01	Aquatic Habitat Chronic Toxicity	7.9E+03	5.8E+01	1.7E+06
POLYCHLORINATED BIPHENYLS (PCBs)	7.9E-05	Bioaccumulation/Human Consumption	2.2E+01	1.4E-02	7.9E-05
PROPICONAZOLE	9.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	9.5E+01	
PYRENE	4.6E+00	Aquatic Habitat Chronic Toxicity	6.8E+01	4.6E+00	4.0E+03
SELENIUM	5.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	5.0E+00	
SILVER	1.0E-01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.0E-01	
SIMAZINE	9.0E+00	Aquatic Habitat Chronic Toxicity	3.1E+03	9.0E+00	
STYRENE	1.1E+01	Ceiling Level	1.1E+01	3.2E+01	
TERBACIL	2.6E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	2.6E+02	
tert-BUTYL ALCOHOL	1.8E+04	Aquatic Habitat Chronic Toxicity	5.0E+04	1.8E+04	
TETRACHLOROETHANE, 1,1,1,2-	1.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.1E+01	
TETRACHLOROETHANE, 1,1,2,2-	3.5E+00	Bioaccumulation/Human Consumption	5.0E+02	2.0E+02	3.5E+00
TETRACHLOROETHYLENE	2.9E+00	Bioaccumulation/Human Consumption	3.0E+02	5.3E+01	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)	2.2E+02	Aquatic Habitat Chronic Toxicity	2.5E+03	2.2E+02	
THALLIUM	6.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	6.0E+00	1.6E+01
TOLUENE	9.8E+00	Aquatic Habitat Chronic Toxicity	4.0E+01	9.8E+00	1.4E+05

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
TOXAPHENE	2.0E-04	Aquatic Habitat Chronic Toxicity	1.4E+02	2.0E-04	2.4E-04
TPH (gasolines)	5.0E+02	Aquatic Habitat Chronic Toxicity	5.0E+03	5.0E+02	
TPH (middle distillates)	6.4E+02	Aquatic Habitat Chronic Toxicity	2.5E+03	6.4E+02	
TPH (residual fuels)	6.4E+02	Aquatic Habitat Chronic Toxicity	2.5E+03	6.4E+02	
TRICHLOROBENZENE, 1,2,4-	1.1E+02	Aquatic Habitat Chronic Toxicity	3.0E+03	1.1E+02	
TRICHLOROETHANE, 1,1,1-	1.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.1E+01	3.4E+05
TRICHLOROETHANE, 1,1,2-	1.4E+01	Bioaccumulation/Human Consumption	5.0E+04	7.3E+02	1.4E+01
TRICHLOROETHYLENE	2.6E+01	Bioaccumulation/Human Consumption	1.0E+04	4.7E+01	2.6E+01
TRICHLOROPHENOL, 2,4,5-	1.9E+00	Aquatic Habitat Chronic Toxicity	2.0E+02	1.9E+00	3.6E+03
TRICHLOROPHENOL, 2,4,6-	1.2E+00	Bioaccumulation/Human Consumption	1.0E+02	4.9E+00	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	3.6E+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	1.1E+00	Aquatic Habitat Chronic Toxicity	9.0E+01	1.1E+00	
TRINITROBENZENE, 1,3,5-	1.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.0E+01	
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.0E+01	Aquatic Habitat Chronic Toxicity	3.7E+04	4.0E+01	
TRINITROTOLUENE, 2,4,6- (TNT)	1.3E+01	Aquatic Habitat Chronic Toxicity	2.0E+01	1.3E+01	
VANADIUM	2.7E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	2.7E+01	
VINYL CHLORIDE	1.7E+02	Bioaccumulation/Human Consumption	3.4E+03	9.3E+02	1.7E+02
XYLENES	1.3E+01	Aquatic Habitat Chronic Toxicity	5.3E+02	1.3E+01	
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 ecotoxicity 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	3.5E+02	noncarcinogenic effects				3.5E+02	noncarcinogenic effects
ACENAPHTHYLENE	2.4E+02	noncarcinogenic effects				2.4E+02	noncarcinogenic effects
ACETONE	1.4E+04	noncarcinogenic effects				1.4E+04	noncarcinogenic effects
ALDRIN	5.1E-03	carcinogenic effects				5.1E-03	carcinogenic effects
AMETRYN	1.8E+02	noncarcinogenic effects				1.8E+02	noncarcinogenic effects
AMINO,2- DINITROTOLUENE,4,6-	4.0E+01	noncarcinogenic effects				4.0E+01	noncarcinogenic effects
AMINO,4- DINITROTOLUENE,2,6-	4.0E+01	noncarcinogenic effects				4.0E+01	noncarcinogenic effects
ANTHRACENE	1.8E+03	noncarcinogenic effects				1.8E+03	noncarcinogenic effects
ANTIMONY	6.0E+00	HDOH Primary MCL	6.0E+00			8.0E+00	noncarcinogenic effects
ARSENIC	1.0E+01	HDOH Primary MCL	1.0E+01			5.2E-02	carcinogenic effects
ATRAZINE	3.0E+00	HDOH Primary MCL	3.0E+00			3.4E-01	carcinogenic effects
BARIUM	2.0E+03	HDOH Primary MCL	2.0E+03			4.0E+03	noncarcinogenic effects
BENOMYL	1.0E+03	noncarcinogenic effects				1.0E+03	noncarcinogenic effects
BENZENE	5.0E+00	HDOH Primary MCL	5.0E+00			4.8E-01	carcinogenic effects
BENZO(a)ANTHRACENE	1.1E-02	mutagenic effects				1.1E-02	mutagenic effects
BENZO(a)PYRENE	2.0E-01	HDOH Primary MCL	2.0E-01			2.9E-03	mutagenic effects
BENZO(b)FLUORANTHENE	2.9E-02	mutagenic effects				2.9E-02	mutagenic effects
BENZO(g,h,i)PERYLENE	8.0E+02	noncarcinogenic effects				8.0E+02	noncarcinogenic effects
BENZO(k)FLUORANTHENE	2.9E-01	mutagenic effects				2.9E-01	mutagenic effects
BERYLLIUM	4.0E+00	HDOH Primary MCL	4.0E+00			4.0E+01	noncarcinogenic effects
BIPHENYL, 1,1-	8.3E-01	noncarcinogenic effects				8.3E-01	noncarcinogenic effects
BIS(2-CHLOROETHYL)ETHER	1.4E-02	carcinogenic effects				1.4E-02	carcinogenic effects
BIS(2-CHLORO-1-METHYLETHYL)ETHER	3.7E-01	carcinogenic effects				3.7E-01	carcinogenic effects
BIS(2-ETHYLHEXYL)PHTHALATE	6.0E+00	HDOH Primary MCL	6.0E+00			5.6E+00	carcinogenic effects
BORON	4.0E+03	noncarcinogenic effects				4.0E+03	noncarcinogenic effects
BROMODICHLOROMETHANE	1.4E-01	carcinogenic effects				1.4E-01	carcinogenic effects
BROMOFORM	8.0E+01	HDOH Primary MCL	8.0E+01		Total Trihalomethanes	3.4E+00	carcinogenic effects
BROMOMETHANE	7.6E+00	noncarcinogenic effects				7.6E+00	noncarcinogenic effects
CADMIUM	5.0E+00	HDOH Primary MCL	5.0E+00			2.0E+01	noncarcinogenic effects
CARBON TETRACHLORIDE	5.0E+00	HDOH Primary MCL	5.0E+00			5.1E-01	carcinogenic effects
CHLORDANE (TECHNICAL)	2.0E+00	HDOH Primary MCL	2.0E+00			4.5E-02	carcinogenic effects
CHLOROANILINE, p-	3.9E-01	carcinogenic effects				3.9E-01	carcinogenic effects
CHLOROBENZENE	1.0E+02	HDOH Primary MCL	1.0E+02			8.3E+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	2.2E-01	carcinogenic effects
CHLOROMETHANE	1.9E+02	noncarcinogenic effects				1.9E+02	noncarcinogenic effects
CHLOROPHENOL, 2-	2.9E+01	noncarcinogenic effects				2.9E+01	noncarcinogenic effects
CHROMIUM (Total)	1.0E+02	HDOH Primary MCL	1.0E+02				not applicable
CHROMIUM III	3.0E+04	noncarcinogenic effects				3.0E+04	noncarcinogenic effects
CHROMIUM VI	4.3E+00	mutagenic effects				4.3E+00	mutagenic effects
CHRYSENE	2.9E+00	mutagenic effects				2.9E+00	mutagenic effects
COBALT	6.0E+00	noncarcinogenic effects				6.0E+00	noncarcinogenic effects
COPPER	1.3E+03	HDOH Primary MCL	1.3E+03			8.0E+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
CYANIDE (Free)	2.0E+02	HDOH Primary MCL	2.0E+02			1.5E+00	noncarcinogenic effects
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	7.1E-01	carcinogenic effects				7.1E-01	carcinogenic effects
DALAPON	2.0E+02	HDOH Primary MCL	2.0E+02			6.0E+02	noncarcinogenic effects
DIBENZO(a,h)ANTHTRACENE	2.9E-03	mutagenic effects				2.9E-03	mutagenic effects
DIBROMO,1,2- CHLOROPROPANE,3-	4.0E-02	HDOH Primary MCL	4.0E-02			3.3E-04	mutagenic effects
DIBROMOCHLOROMETHANE	2.1E-01	carcinogenic effects				2.1E-01	carcinogenic effects
DIBROMOETHANE, 1,2-	4.0E-02	HDOH Primary MCL	4.0E-02			7.5E-03	carcinogenic effects
DICHLOROBENZENE, 1,2-	6.0E+02	HDOH Primary MCL	6.0E+02			3.4E+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			4.9E-01	carcinogenic effects
DICHLOROBENZIDINE, 3,3-	1.7E-01	carcinogenic effects				1.7E-01	carcinogenic effects
DICHLORODIPHENYLDICHLOROETHANE (DDD)	3.2E-01	carcinogenic effects				3.2E-01	carcinogenic effects
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	4.6E-02	carcinogenic effects				4.6E-02	carcinogenic effects
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	2.3E-01	carcinogenic effects				2.3E-01	carcinogenic effects
DICHLOROETHANE, 1,1-	2.8E+00	carcinogenic effects				2.8E+00	carcinogenic effects
DICHLOROETHANE, 1,2-	5.0E+00	USEPA MCL		5.0E+00	USEPA MCL	1.7E-01	carcinogenic effects
DICHLOROETHYLENE, 1,1-	7.0E+00	HDOH Primary MCL	7.0E+00			2.9E+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			1.2E+02	noncarcinogenic effects
DICHLOROPHENOL, 2,4-	6.0E+01	noncarcinogenic effects				6.0E+01	noncarcinogenic effects
DICHLOROPHENOXYACETIC ACID (2,4-D)	7.0E+01	HDOH Primary MCL	7.0E+01			2.0E+02	noncarcinogenic effects
DICHLOROPROPANE, 1,2-	5.0E+00	HDOH Primary MCL	5.0E+00			4.5E-01	carcinogenic effects
DICHLOROPROPENE, 1,3-	5.0E-01	carcinogenic effects				5.0E-01	carcinogenic effects
DIELDRIN	1.1E-02	carcinogenic effects				1.1E-02	carcinogenic effects
DIETHYLPHTHALATE	1.6E+04	noncarcinogenic effects				1.6E+04	noncarcinogenic effects
DIMETHYLPHENOL, 2,4-	4.0E+02	noncarcinogenic effects				4.0E+02	noncarcinogenic effects
DIMETHYLPHTHALATE	2.0E+05	noncarcinogenic effects				2.0E+05	noncarcinogenic effects
DINITROBENZENE, 1,3-	2.0E+00	noncarcinogenic effects				2.0E+00	noncarcinogenic effects
DINITROPHENOL, 2,4-	4.0E+01	noncarcinogenic effects				4.0E+01	noncarcinogenic effects
DINITROTOLUENE, 2,4- (2,4-DNT)	2.5E-01	carcinogenic effects				2.5E-01	carcinogenic effects
DINITROTOLUENE, 2,6- (2,6-DNT)	5.2E-02	carcinogenic effects				5.2E-02	carcinogenic effects
DIOXANE, 1,4-	4.6E-01	carcinogenic effects				4.6E-01	carcinogenic effects
DIOXINS (TEQ)	3.0E-05	HDOH Primary MCL	3.0E-05			1.2E-07	carcinogenic effects
DIURON	4.0E+01	noncarcinogenic effects				4.0E+01	noncarcinogenic effects
ENDOSULFAN	1.2E+02	noncarcinogenic effects				1.2E+02	noncarcinogenic effects
ENDRIN	2.0E+00	HDOH Primary MCL	2.0E+00			6.0E+00	noncarcinogenic effects
ETHANOL		not available					
ETHYLBENZENE	7.0E+02	HDOH Primary MCL	7.0E+02			1.7E+00	carcinogenic effects
FLUORANTHENE	8.0E+02	noncarcinogenic effects				8.0E+02	noncarcinogenic effects
FLUORENE	2.4E+02	noncarcinogenic effects				2.4E+02	noncarcinogenic effects
GLYPHOSATE	7.0E+02	HDOH Primary MCL	7.0E+02			2.0E+03	noncarcinogenic effects
HEPTACHLOR	4.0E-01	HDOH Primary MCL	4.0E-01			3.5E-03	carcinogenic effects
HEPTACHLOR EPOXIDE	2.0E-01	HDOH Primary MCL	2.0E-01			1.7E-03	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
HEXACHLOROBENZENE	1.0E+00	HDOH Primary MCL	1.0E+00			9.8E-03	carcinogenic effects
HEXACHLOROBUTADIENE	2.0E-01	carcinogenic effects				2.0E-01	carcinogenic effects
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	2.0E-01	HDOH Primary MCL	2.0E-01			7.1E-02	carcinogenic effects
HEXACHLOROETHANE	4.0E-01	carcinogenic effects				4.0E-01	carcinogenic effects
HEXAZINONE	6.6E+02	noncarcinogenic effects				6.6E+02	noncarcinogenic effects
INDENO(1,2,3-cd)PYRENE	2.9E-02	mutagenic effects				2.9E-02	mutagenic effects
ISOPHORONE	8.2E+01	carcinogenic effects				8.2E+01	carcinogenic effects
LEAD	1.5E+01	HDOH Primary MCL	1.5E+01				
MERCURY	2.0E+00	HDOH Primary MCL	2.0E+00			6.0E+00	noncarcinogenic effects
METHOXYCHLOR	4.0E+01	HDOH Primary MCL	4.0E+01			1.0E+02	noncarcinogenic effects
METHYL ETHYL KETONE	5.6E+03	noncarcinogenic effects				5.6E+03	noncarcinogenic effects
METHYL ISOBUTYL KETONE	6.3E+03	noncarcinogenic effects				6.3E+03	noncarcinogenic effects
METHYL MERCURY	2.0E+00	noncarcinogenic effects				2.0E+00	noncarcinogenic effects
METHYL TERT BUTYL ETHER	1.4E+01	carcinogenic effects				1.4E+01	carcinogenic effects
METHYLENE CHLORIDE	5.0E+00	USEPA MCL		5.0E+00	USEPA MCL	1.0E+01	mutagenic effects
METHYLNAPHTHALENE, 1-	6.0E+00	carcinogenic effects				6.0E+00	carcinogenic effects
METHYLNAPHTHALENE, 2-	2.4E+01	noncarcinogenic effects				2.4E+01	noncarcinogenic effects
MOLYBDENUM	1.0E+02	noncarcinogenic effects				1.0E+02	noncarcinogenic effects
NAPHTHALENE	1.7E+01	CDPH notification level		1.7E+01	CDPH notification level	1.7E-01	carcinogenic effects
NICKEL	4.0E+02	noncarcinogenic effects				4.0E+02	noncarcinogenic effects
NITROBENZENE	1.4E-01	carcinogenic effects				1.4E-01	carcinogenic effects
NITROGLYCERIN	2.0E+00	noncarcinogenic effects				2.0E+00	noncarcinogenic effects
NITROTOLUENE, 2-	7.9E-02	carcinogenic effects				7.9E-02	carcinogenic effects
NITROTOLUENE, 3-	2.0E+00	noncarcinogenic effects				2.0E+00	noncarcinogenic effects
NITROTOLUENE, 4-	4.9E+00	carcinogenic effects				4.9E+00	carcinogenic effects
PENTACHLOROPHENOL	1.0E+00	HDOH Primary MCL	1.0E+00			1.9E-01	carcinogenic effects
PENTAERYTHRITOLTETRANITRATE (PETN)	1.9E+01	carcinogenic effects				1.9E+01	carcinogenic effects
PERCHLORATE	1.5E+01	USEPA MCL		1.5E+01	USEPA MCL	1.4E+01	noncarcinogenic effects
PHENANTHRENE	2.4E+02	noncarcinogenic effects				2.4E+02	noncarcinogenic effects
PHENOL	6.0E+03	noncarcinogenic effects				6.0E+03	noncarcinogenic effects
POLYCHLORINATED BIPHENYLS (PCBs)	5.0E-01	HDOH Primary MCL	5.0E-01			7.9E-03	carcinogenic effects
PROPICONAZOLE	2.6E+02	noncarcinogenic effects				2.6E+02	noncarcinogenic effects
PYRENE	1.8E+02	noncarcinogenic effects				1.8E+02	noncarcinogenic effects
SELENIUM	5.0E+01	HDOH Primary MCL	5.0E+01			1.0E+02	noncarcinogenic effects
SILVER	1.0E+02	noncarcinogenic effects				1.0E+02	noncarcinogenic effects
SIMAZINE	4.0E+00	HDOH Primary MCL	4.0E+00			6.5E-01	carcinogenic effects
STYRENE	1.0E+02	HDOH Primary MCL	1.0E+02			1.4E+03	noncarcinogenic effects
TERBACIL	2.6E+02	noncarcinogenic effects				2.6E+02	noncarcinogenic effects
tert-BUTYL ALCOHOL	5.8E+00	carcinogenic effects				5.8E+00	carcinogenic effects
TETRACHLOROETHANE, 1,1,1,2-	6.1E-01	carcinogenic effects				6.1E-01	carcinogenic effects
TETRACHLOROETHANE, 1,1,2,2-	7.8E-02	carcinogenic effects				7.8E-02	carcinogenic effects
TETRACHLOROETHYLENE	5.0E+00	HDOH Primary MCL	5.0E+00			7.4E-01	carcinogenic effects
TETRACHLOROPHENOL, 2,3,4,6-	6.0E+02	noncarcinogenic effects				6.0E+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
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	1.0E+03	noncarcinogenic effects				1.0E+03	noncarcinogenic effects
THALLIUM	2.0E+00	HDOH Primary MCL	2.0E+00			2.0E-01	noncarcinogenic effects
TOLUENE	1.0E+03	HDOH Primary MCL	1.0E+03			1.4E+03	noncarcinogenic effects
TOXAPHENE	3.0E+00	HDOH Primary MCL	3.0E+00			7.1E-02	carcinogenic effects
TPH (gasolines)	3.0E+02	noncarcinogenic effects				3.0E+02	noncarcinogenic effects
TPH (middle distillates)	1.6E+02	noncarcinogenic effects				1.6E+02	noncarcinogenic effects
TPH (residual fuels)	2.4E+03	noncarcinogenic effects				2.4E+03	noncarcinogenic effects
TRICHLOROBENZENE, 1,2,4-	7.0E+01	HDOH Primary MCL	7.0E+01			6.0E-01	carcinogenic effects
TRICHLOROETHANE, 1,1,1-	2.0E+02	HDOH Primary MCL	2.0E+02			8.3E+03	noncarcinogenic effects
TRICHLOROETHANE, 1,1,2-	5.0E+00	HDOH Primary MCL	5.0E+00			2.8E-01	carcinogenic effects
TRICHLOROETHYLENE	5.0E+00	HDOH Primary MCL	5.0E+00			2.4E-01	mutagenic effects
TRICHLOROPHENOL, 2,4,5-	2.0E+03	noncarcinogenic effects				2.0E+03	noncarcinogenic effects
TRICHLOROPHENOL, 2,4,6-	7.1E+00	carcinogenic effects				7.1E+00	carcinogenic effects
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	2.0E+02	noncarcinogenic effects				2.0E+02	noncarcinogenic effects
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	5.0E+01	HDOH Primary MCL	5.0E+01			1.6E+02	noncarcinogenic effects
TRICHLOROPROPANE, 1,2,3-	6.0E-01	HDOH Primary MCL	6.0E-01			2.0E-04	mutagenic effects
TRICHLOROPROPENE, 1,2,3-	6.2E-01	noncarcinogenic effects				6.2E-01	noncarcinogenic effects
TRIFLURALIN	1.0E+01	carcinogenic effects				1.0E+01	carcinogenic effects
TRINITROBENZENE, 1,3,5-	6.0E+02	noncarcinogenic effects				6.0E+02	noncarcinogenic effects
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.0E+01	noncarcinogenic effects				4.0E+01	noncarcinogenic effects
TRINITROTOLUENE, 2,4,6- (TNT)	2.6E+00	carcinogenic effects				2.6E+00	carcinogenic effects
VANADIUM	1.0E+02	noncarcinogenic effects				1.0E+02	noncarcinogenic effects
VINYL CHLORIDE	2.0E+00	HDOH Primary MCL	2.0E+00			2.0E-02	carcinogenic effects
XYLENES	1.0E+04	HDOH Primary MCL	1.0E+04			2.0E+02	noncarcinogenic effects
ZINC	6.0E+03	noncarcinogenic effects				6.0E+03	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	3.5E+02	noncarcinogenic effects			3.5E+02
ACENAPHTHYLENE	2.4E+02	noncarcinogenic effects			2.4E+02
ACETONE	1.4E+04	noncarcinogenic effects			1.4E+04
ALDRIN	5.1E-03	carcinogenic effects	5.1E-03		5.9E-01
AMETRYN	1.8E+02	noncarcinogenic effects			1.8E+02
AMINO,2- DINITROTOLUENE,4,6-	4.0E+01	noncarcinogenic effects			4.0E+01
AMINO,4- DINITROTOLUENE,2,6-	4.0E+01	noncarcinogenic effects			4.0E+01
ANTHRACENE	1.8E+03	noncarcinogenic effects			1.8E+03
ANTIMONY	8.0E+00	noncarcinogenic effects			8.0E+00
ARSENIC	5.2E-02	carcinogenic effects	5.2E-02		6.0E+00
ATRAZINE	3.4E-01	carcinogenic effects	3.4E-01		7.0E+02
BARIUM	4.0E+03	noncarcinogenic effects			4.0E+03
BENOMYL	1.0E+03	noncarcinogenic effects			1.0E+03
BENZENE	4.8E-01	carcinogenic effects	4.8E-01		3.5E+01
BENZO(a)ANTHRACENE	1.1E-02	mutagenic effects	3.5E-02	1.1E-02	
BENZO(a)PYRENE	2.9E-03	mutagenic effects	1.1E-02	2.9E-03	
BENZO(b)FLUORANTHENE	2.9E-02	mutagenic effects	1.1E-01	2.9E-02	
BENZO(g,h,i)PERYLENE	8.0E+02	noncarcinogenic effects			8.0E+02
BENZO(k)FLUORANTHENE	2.9E-01	mutagenic effects	1.1E+00	2.9E-01	
BERYLLIUM	4.0E+01	noncarcinogenic effects			4.0E+01
BIPHENYL, 1,1-	8.3E-01	noncarcinogenic effects	2.2E+00		8.3E-01
BIS(2-CHLOROETHYL)ETHER	1.4E-02	carcinogenic effects	1.4E-02		
BIS(2-CHLORO-1-METHYLETHYL)ETHER	3.7E-01	carcinogenic effects	3.7E-01		2.1E+02
BIS(2-ETHYLHEXYL)PHTHALATE	5.6E+00	carcinogenic effects	5.6E+00		4.0E+02
BORON	4.0E+03	noncarcinogenic effects			4.0E+03
BROMODICHLOROMETHANE	1.4E-01	carcinogenic effects	1.4E-01		1.2E+02
BROMOFORM	3.4E+00	carcinogenic effects	3.4E+00		4.0E+02
BROMOMETHANE	7.6E+00	noncarcinogenic effects			7.6E+00
CADMIUM	2.0E+01	noncarcinogenic effects			2.0E+01
CARBON TETRACHLORIDE	5.1E-01	carcinogenic effects	5.1E-01		5.8E+01
CHLORDANE (TECHNICAL)	4.5E-02	carcinogenic effects	4.5E-02		1.3E+00
CHLOROANILINE, p-	3.9E-01	carcinogenic effects	3.9E-01		8.0E+01
CHLOROBENZENE	8.3E+01	noncarcinogenic effects			8.3E+01
CHLOROETHANE	2.1E+04	noncarcinogenic effects			2.1E+04
CHLOROFORM	2.2E-01	carcinogenic effects	2.2E-01		1.0E+02
CHLOROMETHANE	1.9E+02	noncarcinogenic effects			1.9E+02
CHLOROPHENOL, 2-	2.9E+01	noncarcinogenic effects			2.9E+01
CHROMIUM (Total)		not applicable			
CHROMIUM III	3.0E+04	noncarcinogenic effects			3.0E+04
CHROMIUM VI	4.3E+00	mutagenic effects	1.6E+01	4.3E+00	6.0E+01
CHRYSENE	2.9E+00	mutagenic effects	1.1E+01	2.9E+00	
COBALT	6.0E+00	noncarcinogenic effects			6.0E+00
COPPER	8.0E+02	noncarcinogenic effects			8.0E+02
CYANIDE (Free)	1.5E+00	noncarcinogenic effects			1.5E+00
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	7.1E-01	carcinogenic effects	7.1E-01		6.0E+01
DALAPON	6.0E+02	noncarcinogenic effects			6.0E+02
DIBENZO(a,h)ANTHTRACENE	2.9E-03	mutagenic effects	1.1E-02	2.9E-03	
DIBROMO,1,2- CHLOROPROPANE,3-	3.3E-04	mutagenic effects	9.3E-04	3.3E-04	3.8E-01
DIBROMOCHLOROMETHANE	2.1E-01	carcinogenic effects	2.1E-01		1.2E+02
DIBROMOETHANE, 1,2-	7.5E-03	carcinogenic effects	7.5E-03		1.7E+01
DICHLOROBENZENE, 1,2-	3.4E+02	noncarcinogenic effects			3.4E+02
DICHLOROBENZENE, 1,3-	1.8E+02	noncarcinogenic effects			1.8E+02
DICHLOROBENZENE, 1,4-	4.9E-01	carcinogenic effects	4.9E-01		7.6E+02
DICHLOROBENZIDINE, 3,3-	1.7E-01	carcinogenic effects	1.7E-01		
DICHLORODIPHENYLDICHLOROETHANE (DDD)	3.2E-01	carcinogenic effects	3.2E-01		
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	4.6E-02	carcinogenic effects	4.6E-02		
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	2.3E-01	carcinogenic effects	2.3E-01		1.0E+01
DICHLOROETHANE, 1,1-	2.8E+00	carcinogenic effects	2.8E+00		1.2E+03
DICHLOROETHANE, 1,2-	1.7E-01	carcinogenic effects	1.7E-01		1.3E+01
DICHLOROETHYLENE, 1,1-	2.9E+02	noncarcinogenic effects			2.9E+02
DICHLOROETHYLENE, Cis 1,2-	1.2E+01	noncarcinogenic effects			1.2E+01
DICHLOROETHYLENE, Trans 1,2-	1.2E+02	noncarcinogenic effects			1.2E+02
DICHLOROPHENOL, 2,4-	6.0E+01	noncarcinogenic effects			6.0E+01
DICHLOROPHENOXYACETIC ACID (2,4-D)	2.0E+02	noncarcinogenic effects			2.0E+02
DICHLOROPROPANE, 1,2-	4.5E-01	carcinogenic effects	4.5E-01		8.3E+00
DICHLOROPROPENE, 1,3-	5.0E-01	carcinogenic effects	5.0E-01		3.9E+01
DIELDRIN	1.1E-02	carcinogenic effects	1.1E-02		1.6E+00
DIETHYLPHTHALATE	1.6E+04	noncarcinogenic effects			1.6E+04
DIMETHYLPHENOL, 2,4-	4.0E+02	noncarcinogenic effects			4.0E+02
DIMETHYLPHTHALATE	2.0E+05	noncarcinogenic effects			2.0E+05
DINITROBENZENE, 1,3-	2.0E+00	noncarcinogenic effects			2.0E+00
DINITROPHENOL, 2,4-	4.0E+01	noncarcinogenic effects			4.0E+01
DINITROTOLUENE, 2,4- (2,4-DNT)	2.5E-01	carcinogenic effects	2.5E-01		4.0E+01
DINITROTOLUENE, 2,6- (2,6-DNT)	5.2E-02	carcinogenic effects	5.2E-02		6.0E+00

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
DIOXANE, 1,4-	4.6E-01	carcinogenic effects	4.6E-01		5.7E+01
DIOXINS (TEQ)	1.2E-07	carcinogenic effects	1.2E-07		1.9E-05
DIURON	4.0E+01	noncarcinogenic effects			4.0E+01
ENDOSULFAN	1.2E+02	noncarcinogenic effects			1.2E+02
ENDRIN	6.0E+00	noncarcinogenic effects			6.0E+00
ETHANOL					
ETHYLBENZENE	1.7E+00	carcinogenic effects	1.7E+00		1.0E+03
FLUORANTHENE	8.0E+02	noncarcinogenic effects			8.0E+02
FLUORENE	2.4E+02	noncarcinogenic effects			2.4E+02
GLYPHOSATE	2.0E+03	noncarcinogenic effects			2.0E+03
HEPTACHLOR	3.5E-03	carcinogenic effects	3.5E-03		1.0E+01
HEPTACHLOR EPOXIDE	1.7E-03	carcinogenic effects	1.7E-03		2.6E-01
HEXACHLOROBENZENE	9.8E-03	carcinogenic effects	9.8E-03		1.6E+01
HEXACHLOROBUTADIENE	2.0E-01	carcinogenic effects	2.0E-01		2.0E+01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	7.1E-02	carcinogenic effects	7.1E-02		6.0E+00
HEXACHLOROETHANE	4.0E-01	carcinogenic effects	4.0E-01		1.1E+01
HEXAZINONE	6.6E+02	noncarcinogenic effects			6.6E+02
INDENO(1,2,3-cd)PYRENE	2.9E-02	mutagenic effects	1.1E-01	2.9E-02	
ISOPHORONE	8.2E+01	carcinogenic effects	8.2E+01		4.0E+03
LEAD					
MERCURY	6.0E+00	noncarcinogenic effects			6.0E+00
METHOXYCHLOR	1.0E+02	noncarcinogenic effects			1.0E+02
METHYL ETHYL KETONE	5.6E+03	noncarcinogenic effects			5.6E+03
METHYL ISOBUTYL KETONE	6.3E+03	noncarcinogenic effects			6.3E+03
METHYL MERCURY	2.0E+00	noncarcinogenic effects			2.0E+00
METHYL TERT BUTYL ETHER	1.4E+01	carcinogenic effects	1.4E+01		6.3E+03
METHYLENE CHLORIDE	1.0E+01	mutagenic effects	3.6E+01	1.0E+01	1.1E+02
METHYLNAPHTHALENE, 1-	6.0E+00	carcinogenic effects	6.0E+00		4.1E+02
METHYLNAPHTHALENE, 2-	2.4E+01	noncarcinogenic effects			2.4E+01
MOLYBDENUM	1.0E+02	noncarcinogenic effects			1.0E+02
NAPHTHALENE	1.7E-01	carcinogenic effects	1.7E-01		6.2E+00
NICKEL	4.0E+02	noncarcinogenic effects			4.0E+02
NITROBENZENE	1.4E-01	carcinogenic effects	1.4E-01		1.3E+01
NITROGLYCERIN	2.0E+00	noncarcinogenic effects	4.6E+00		2.0E+00
NITROTOLUENE, 2-	7.9E-02	carcinogenic effects	7.9E-02		5.3E+00
NITROTOLUENE, 3-	2.0E+00	noncarcinogenic effects			2.0E+00
NITROTOLUENE, 4-	4.9E+00	carcinogenic effects	4.9E+00		8.0E+01
PENTACHLOROPHENOL	1.9E-01	carcinogenic effects	1.9E-01		1.0E+02
PENTAERYTHRITOLTETRANITRATE (PETN)	1.9E+01	carcinogenic effects	1.9E+01		4.0E+01
PERCHLORATE	1.4E+01	noncarcinogenic effects			1.4E+01
PHENANTHRENE	2.4E+02	noncarcinogenic effects			2.4E+02
PHENOL	6.0E+03	noncarcinogenic effects			6.0E+03
POLYCHLORINATED BIPHENYLS (PCBs)	7.9E-03	carcinogenic effects	7.9E-03		4.0E-01
PROPICONAZOLE	2.6E+02	noncarcinogenic effects			2.6E+02
PYRENE	1.8E+02	noncarcinogenic effects			1.8E+02
SELENIUM	1.0E+02	noncarcinogenic effects			1.0E+02
SILVER	1.0E+02	noncarcinogenic effects			1.0E+02
SIMAZINE	6.5E-01	carcinogenic effects	6.5E-01		1.0E+02
STYRENE	1.4E+03	noncarcinogenic effects			1.4E+03
TERBACIL	2.6E+02	noncarcinogenic effects			2.6E+02
tert-BUTYL ALCOHOL	5.8E+00	carcinogenic effects	5.8E+00		
TETRACHLOROETHANE, 1,1,1,2-	6.1E-01	carcinogenic effects	6.1E-01		1.8E+02
TETRACHLOROETHANE, 1,1,2,2-	7.8E-02	carcinogenic effects	7.8E-02		4.0E+02
TETRACHLOROETHYLENE	7.4E-01	carcinogenic effects	7.4E-01		4.9E+01
TETRACHLOROPHENOL, 2,3,4,6-	6.0E+02	noncarcinogenic effects			6.0E+02
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	1.0E+03	noncarcinogenic effects			1.0E+03
THALLIUM	2.0E-01	noncarcinogenic effects			2.0E-01
TOLUENE	1.4E+03	noncarcinogenic effects			1.4E+03
TOXAPHENE	7.1E-02	carcinogenic effects	7.1E-02		
TPH (gasolines)	3.0E+02	noncarcinogenic effects			3.0E+02
TPH (middle distillates)	1.6E+02	noncarcinogenic effects			1.6E+02
TPH (residual fuels)	2.4E+03	noncarcinogenic effects			2.4E+03
TRICHLOROBENZENE, 1,2,4-	6.0E-01	carcinogenic effects	6.0E-01		4.1E+00
TRICHLOROETHANE, 1,1,1-	8.3E+03	noncarcinogenic effects			8.3E+03
TRICHLOROETHANE, 1,1,2-	2.8E-01	carcinogenic effects	2.8E-01		4.1E-01
TRICHLOROETHYLENE	2.4E-01	mutagenic effects	7.6E-01	2.4E-01	2.9E+00
TRICHLOROPHENOL, 2,4,5-	2.0E+03	noncarcinogenic effects			2.0E+03
TRICHLOROPHENOL, 2,4,6-	7.1E+00	carcinogenic effects	7.1E+00		2.0E+01
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	2.0E+02	noncarcinogenic effects			2.0E+02
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	1.6E+02	noncarcinogenic effects			1.6E+02
TRICHLOR+A38OPROPANE, 1,2,3-	2.0E-04	mutagenic effects	5.8E-04	2.0E-04	6.2E-01
TRICHLOROPROPENE, 1,2,3-	6.2E-01	noncarcinogenic effects			6.2E-01
TRIFLURALIN	1.0E+01	carcinogenic effects	1.0E+01		1.5E+02
TRINITROBENZENE, 1,3,5-	6.0E+02	noncarcinogenic effects			6.0E+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
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.0E+01	noncarcinogenic effects			4.0E+01
TRINITROTOLUENE, 2,4,6- (TNT)	2.6E+00	carcinogenic effects	2.6E+00		1.0E+01
VANADIUM	1.0E+02	noncarcinogenic effects			1.0E+02
VINYL CHLORIDE	2.0E-02	carcinogenic effects	2.0E-02	2.8E-02	4.7E+01
XYLENES	2.0E+02	noncarcinogenic effects			2.0E+02
ZINC	6.0E+03	noncarcinogenic effects			6.0E+03

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	1.5E+01	3.2E+02	1.5E+01	5.7E+02	2.0E+01	3.2E+02
ACENAPHTHYLENE	1.3E+01	3.0E+02	1.3E+01	3.0E+02	3.1E+02	3.0E+02
ACETONE	1.5E+03	1.5E+04	1.7E+03	1.5E+04	1.5E+03	2.8E+04
ALDRIN	1.4E-04	1.3E+00	3.5E-02	3.0E+00	1.4E-04	1.3E+00
AMETRYN	7.0E+02	1.8E+03	7.0E+02	1.8E+03	7.0E+02	1.8E+03
AMINO,2- DINITROTOLUENE,4,6-	1.8E+01	1.6E+02	1.8E+01	1.6E+02	2.0E+01	1.8E+02
AMINO,4- DINITROTOLUENE,2,6-	1.1E+01	9.8E+01	1.1E+01	9.8E+01	1.1E+01	9.8E+01
ANTHRACENE	2.0E-02	1.8E-01	2.0E-02	1.8E-01	7.3E-01	1.3E+01
ANTIMONY	3.0E+01	1.8E+02	1.3E+02	3.0E+03	3.0E+01	1.8E+02
ARSENIC	3.6E+01	6.9E+01	1.9E+02	3.6E+02	3.6E+01	6.9E+01
ATRAZINE	1.2E+01	3.3E+02	1.2E+01	3.3E+02	1.2E+01	3.3E+02
BARIUM	2.2E+02	2.0E+03	2.2E+02	2.0E+03	2.2E+02	2.0E+03
BENOMYL	1.4E-01	2.8E+00	1.4E-01	2.8E+00	1.4E-01	2.8E+00
BENZENE	7.1E+01	1.7E+03	1.6E+02	1.8E+03	7.1E+01	1.7E+03
BENZO(a)ANTHRACENE	2.7E-02	3.0E+02	4.7E+00	3.0E+02	2.7E-02	3.0E+02
BENZO(a)PYRENE	6.0E-02	3.0E+02	6.0E-02	3.0E+02	3.0E-01	3.0E+02
BENZO(b)FLUORANTHENE	6.8E-01	3.0E+02	2.6E+00	3.0E+02	6.8E-01	3.0E+02
BENZO(g,h,i)PERYLENE	4.4E-01	3.0E+02	4.4E-01	3.0E+02	4.4E-01	3.0E+02
BENZO(k)FLUORANTHENE	6.4E-01	3.0E+02	6.4E-01	3.0E+02	6.4E-01	3.0E+02
BERYLLIUM	6.6E-01	3.5E+01	1.1E+01	4.3E+01	6.6E-01	3.5E+01
BIPHENYL, 1,1-	6.5E+00	2.6E+01	6.5E+00	2.6E+01	1.4E+01	2.6E+01
BIS(2-CHLOROETHYL)ETHER	2.4E+03	2.4E+04	2.4E+03	2.4E+04	2.4E+03	2.4E+04
BIS(2-CHLORO-1-METHYLETHYL)ETHER	3.7E-01	3.7E-01	3.7E-01	3.7E-01	3.7E-01	3.7E-01
BIS(2-ETHYLHEXYL)PHTHALATE	3.0E+00	2.7E+01	3.0E+00	2.7E+01	3.0E+00	2.7E+01
BORON	1.0E+03	3.4E+04	7.2E+03	3.4E+04	1.0E+03	3.4E+04
BROMODICHLOROMETHANE	3.4E+02	3.1E+03	3.4E+02	3.1E+03	3.4E+02	3.1E+03
BROMOFORM	2.3E+02	1.1E+03	2.3E+02	1.1E+03	3.2E+02	2.3E+03
BROMOMETHANE	1.6E+01	3.8E+01	1.6E+01	3.8E+01	1.6E+01	3.8E+01
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	7.7E+01	1.2E+04	9.8E+00	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-	1.9E+01	4.6E+02	1.9E+01	4.6E+02	1.9E+01	4.6E+02
CHLOROBENZENE	2.5E+01	2.2E+02	2.5E+01	2.2E+02	6.4E+01	1.1E+03
CHLOROETHANE	2.1E+04	2.1E+04	2.1E+04	2.1E+04	2.1E+04	2.1E+04
CHLOROFORM	2.8E+01	4.9E+02	1.4E+02	9.6E+03	2.8E+01	4.9E+02
CHLOROMETHANE	1.9E+02	1.9E+02	1.9E+02	1.9E+02	1.9E+02	1.9E+02
CHLOROPHENOL, 2-	3.2E+01	4.0E+02	3.2E+01	1.4E+03	4.0E+02	4.0E+02
CHROMIUM (Total)	1.1E+01	1.6E+01	1.1E+01	1.6E+01	5.0E+01	1.0E+03
CHROMIUM III	2.0E+01	5.7E+02	7.4E+01	5.7E+02	2.0E+01	5.7E+02
CHROMIUM VI	1.1E+01	1.6E+01	1.1E+01	1.6E+01	5.0E+01	1.1E+03
CHRYSENE	2.0E+00	3.0E+02	4.7E+00	3.0E+02	2.0E+00	3.0E+02
COBALT	1.9E+01	1.2E+02	1.9E+01	1.2E+02	2.3E+01	1.5E+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)**
COPPER	2.9E+00	2.9E+00	6.0E+00	6.0E+00	2.9E+00	2.9E+00
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)	7.9E+01	5.2E+02	7.9E+01	5.2E+02	1.9E+02	7.0E+02
DALAPON	3.0E+02	3.0E+03	3.0E+02	3.0E+03	3.0E+02	3.0E+03
DIBENZO(a,h)ANTHTRACENE	8.0E-01	3.0E+02	8.0E-01	3.0E+02	7.1E+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	3.4E+01	2.9E+03	3.2E+02	2.9E+03	3.4E+01	2.9E+03
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	2.3E+01	3.7E+02	1.4E+01	6.6E+02
DICHLOROBENZENE, 1,3-	2.2E+01	3.7E+02	2.2E+01	3.7E+02	7.1E+01	6.6E+02
DICHLOROBENZENE, 1,4-	9.4E+00	3.7E+02	9.4E+00	3.7E+02	1.5E+01	6.6E+02
DICHLOROBENZIDINE, 3,3-	4.5E+00	4.1E+01	4.5E+00	4.1E+01	4.5E+00	4.1E+01
DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.1E-02	1.9E-01	1.1E-02	1.9E-01	1.1E-02	1.9E-01
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	4.1E-01	7.0E+00	4.1E-01	7.0E+00	4.1E-01	7.0E+00
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	8.3E+02	4.1E+02	3.7E+03	4.7E+01	8.3E+02
DICHLOROETHANE, 1,2-	9.1E+02	3.8E+04	2.0E+03	3.9E+04	9.1E+02	3.8E+04
DICHLOROETHYLENE, 1,1-	2.5E+01	3.9E+03	1.3E+02	3.9E+03	2.5E+01	7.5E+04
DICHLOROETHYLENE, Cis 1,2-	6.2E+02	5.5E+03	6.2E+02	5.5E+03	6.2E+02	5.5E+03
DICHLOROETHYLENE, Trans 1,2-	5.6E+02	1.0E+04	5.6E+02	1.0E+04	5.6E+02	1.0E+04
DICHLOROPHENOL, 2,4-	1.1E+01	6.7E+02	1.1E+01	6.7E+02	7.9E+02	7.9E+02
DICHLOROPHENOXYACETIC ACID (2,4-D)	7.0E+01	1.3E+02	7.9E+01	1.3E+02	7.0E+01	1.3E+02
DICHLOROPROPANE, 1,2-	5.2E+02	3.4E+03	5.2E+02	7.7E+03	5.2E+02	3.4E+03
DICHLOROPROPENE, 1,3-	6.0E-02	2.6E+02	1.7E+00	2.0E+03	6.0E-02	2.6E+02
DIELDRIN	1.9E-03	7.1E-01	1.9E-03	2.5E+00	1.9E-03	7.1E-01
DIETHYLPHTHALATE	2.1E+02	9.8E+02	2.2E+02	9.8E+02	2.1E+02	1.8E+03
DIMETHYLPHENOL, 2,4-	1.2E+02	7.0E+02	1.2E+02	7.0E+02	1.2E+02	1.1E+03
DIMETHYLPHTHALATE	1.1E+03	3.2E+03	1.1E+03	3.2E+03	2.9E+03	3.2E+03
DINITROBENZENE, 1,3-	1.0E+01	1.0E+02	2.2E+01	1.0E+02	1.0E+01	1.1E+02
DINITROPHENOL, 2,4-	1.4E+01	3.8E+02	7.1E+01	3.8E+02	1.4E+01	3.8E+02
DINITROTOLUENE, 2,4- (2,4-DNT)	9.1E+00	1.1E+02	4.4E+01	1.1E+02	9.1E+00	2.0E+02
DINITROTOLUENE, 2,6- (2,6-DNT)	8.1E+01	1.1E+02	8.1E+01	1.1E+02	8.1E+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)	3.1E-09	3.0E-03	3.1E-09	3.0E-03	3.1E-09	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	7.3E+00	1.4E+02	6.1E+01	1.1E+04	7.3E+00	1.4E+02
FLUORANTHENE	8.0E-01	1.3E+01	8.0E-01	1.3E+03	7.1E+00	1.3E+01
FLUORENE	3.9E+00	3.0E+02	1.9E+01	3.0E+02	3.9E+00	3.0E+02
GLYPHOSATE	1.8E+03	2.2E+04	1.8E+03	2.2E+04	1.8E+03	2.2E+04

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	3.6E-03	5.3E-02	3.8E-03	5.2E-01	3.6E-03	5.3E-02
HEPTACHLOR EPOXIDE	3.6E-03	5.3E-02	3.8E-03	5.2E-01	3.6E-03	5.3E-02
HEXACHLOROBENZENE	3.0E-04	3.0E-04	3.0E-04	3.0E-04	3.0E-04	3.0E-04
HEXACHLOROBUTADIENE	3.0E-01	1.1E+01	1.0E+00	3.0E+01	3.0E-01	1.1E+01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	6.3E-02	1.6E-01	8.0E-02	2.0E+00	6.3E-02	1.6E-01
HEXACHLOROETHANE	1.2E+01	3.1E+02	1.2E+01	3.3E+02	1.2E+01	3.1E+02
HEXAZINONE	1.7E+04	1.4E+05	1.7E+04	1.4E+05	1.7E+04	1.4E+05
INDENO(1,2,3-cd)PYRENE	2.8E-01	3.0E+02	2.8E-01	3.0E+02	2.8E-01	3.0E+02
ISOPHORONE	9.2E+02	4.3E+03	9.2E+02	3.9E+04	9.2E+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	7.0E-01	3.0E-02	7.0E-01	3.0E-02	7.0E-01
METHYL ETHYL KETONE	1.4E+04	2.0E+05	2.2E+04	2.0E+05	1.4E+04	2.4E+05
METHYL ISOBUTYL KETONE	1.7E+02	2.2E+03	1.7E+02	2.2E+03	1.7E+02	2.2E+03
METHYL MERCURY	2.8E-03	9.9E-02	2.8E-03	9.9E-02	2.8E-03	9.9E-02
METHYL TERT BUTYL ETHER	7.3E+02	6.5E+03	7.3E+02	6.5E+03	1.8E+04	5.3E+04
METHYLENE CHLORIDE	1.5E+03	8.5E+03	1.5E+03	8.5E+03	2.2E+03	2.6E+04
METHYLNAPHTHALENE, 1-	2.1E+00	3.7E+01	2.1E+00	3.7E+01	2.1E+00	3.7E+01
METHYLNAPHTHALENE, 2-	4.7E+00	4.2E+01	4.7E+00	4.2E+01	7.2E+01	8.6E+01
MOLYBDENUM	3.7E+02	7.2E+03	8.0E+02	7.2E+03	3.7E+02	1.6E+04
NAPHTHALENE	1.2E+01	7.7E+02	2.1E+01	7.7E+02	1.2E+01	7.8E+02
NICKEL	5.0E+00	5.0E+00	5.0E+00	5.0E+00	8.3E+00	7.5E+01
NITROBENZENE	3.8E+02	2.0E+03	3.8E+02	9.0E+03	3.8E+02	2.0E+03
NITROGLYCERIN	1.8E+01	1.6E+02	1.8E+01	1.6E+02	1.8E+01	1.6E+02
NITROTOLUENE, 2-	7.1E+01	6.4E+02	7.1E+01	6.4E+02	7.1E+01	6.4E+02
NITROTOLUENE, 3-	4.2E+01	3.8E+02	4.2E+01	3.8E+02	4.2E+01	3.8E+02
NITROTOLUENE, 4-	4.6E+01	4.1E+02	4.6E+01	4.1E+02	4.6E+01	4.1E+02
PENTACHLOROPHENOL	7.9E+00	1.3E+01	1.3E+01	2.0E+01	7.9E+00	1.3E+01
PENTAERYTHRITOLTETRANITRATE (PETN)	8.5E+05	8.5E+05	8.5E+05	8.5E+05	8.5E+05	8.5E+05
PERCHLORATE	6.0E+02	5.0E+03	6.0E+02	5.0E+03	6.0E+02	5.0E+03
PHENANTHRENE	2.3E+00	3.0E+02	2.3E+00	3.0E+02	4.6E+00	3.0E+02
PHENOL	5.8E+01	3.0E+02	1.6E+02	4.7E+03	5.8E+01	3.0E+02
POLYCHLORINATED BIPHENYLS (PCBs)	1.4E-02	2.0E+00	1.4E-02	2.0E+00	3.0E-02	1.0E+01
PROPICONAZOLE	9.5E+01	4.3E+02	9.5E+01	4.3E+02	9.5E+01	4.3E+02
PYRENE	4.6E+00	3.0E+02	4.6E+00	3.0E+02	1.0E+01	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-01	1.0E+00	1.0E+00	1.0E+00	1.0E-01	2.3E+00
SIMAZINE	9.0E+00	8.0E+01	9.0E+00	8.0E+01	9.0E+00	8.0E+01
STYRENE	3.2E+01	2.9E+02	3.2E+01	2.9E+02	3.2E+01	2.9E+02
TERBACIL	2.6E+02	2.6E+02	1.2E+03	2.3E+04	2.6E+02	2.6E+02
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-	1.1E+01	7.7E+02	8.5E+01	3.1E+03	1.1E+01	7.7E+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)**
TETRACHLOROETHANE, 1,1,2,2-	2.0E+02	9.1E+02	2.0E+02	9.1E+02	6.1E+02	3.0E+03
TETRACHLOROETHYLENE	5.3E+01	1.8E+03	5.3E+01	1.8E+03	1.5E+02	3.4E+03
TETRACHLOROPHENOL, 2,3,4,6-	1.2E+00	1.1E+01	1.2E+00	1.1E+01	1.2E+00	1.1E+01
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	2.2E+02	1.2E+03	2.2E+02	1.2E+03	3.3E+02	1.9E+03
THALLIUM	6.0E+00	4.7E+02	6.0E+00	4.7E+02	1.2E+01	7.1E+02
TOLUENE	9.8E+00	2.1E+03	6.2E+01	5.8E+03	9.8E+00	2.1E+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-	1.1E+02	4.2E+02	1.3E+02	4.2E+02	1.1E+02	7.0E+02
TRICHLOROETHANE, 1,1,1-	1.1E+01	6.0E+03	7.6E+01	6.0E+03	1.1E+01	1.0E+04
TRICHLOROETHANE, 1,1,2-	7.3E+02	5.2E+03	7.3E+02	6.0E+03	1.2E+03	5.2E+03
TRICHLOROETHYLENE	4.7E+01	7.0E+02	2.0E+02	1.5E+04	4.7E+01	7.0E+02
TRICHLOROPHENOL, 2,4,5-	1.9E+00	1.7E+01	1.9E+00	1.7E+01	1.2E+01	2.6E+02
TRICHLOROPHENOL, 2,4,6-	4.9E+00	3.9E+01	4.9E+00	3.9E+01	6.5E+00	3.9E+01
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	2.7E+02	3.0E+01	2.7E+02	5.0E+01	2.7E+02
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	1.1E+00	2.1E+01	1.1E+00	2.1E+01	1.1E+00	2.1E+01
TRINITROBENZENE, 1,3,5-	1.0E+01	2.7E+01	1.1E+01	2.7E+01	1.0E+01	3.0E+01
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.0E+01	4.0E+01	4.0E+01	4.0E+01	4.0E+01	4.0E+01
TRINITROTOLUENE, 2,4,6- (TNT)	1.3E+01	2.1E+02	1.3E+01	2.1E+02	9.0E+01	5.7E+02
VANADIUM	2.7E+01	9.0E+01	2.7E+01	1.2E+02	8.1E+01	9.0E+01
VINYL CHLORIDE	9.3E+02	8.4E+03	9.3E+02	8.4E+03	9.3E+02	8.4E+03
XYLENES	1.3E+01	2.3E+02	2.7E+01	2.4E+02	1.3E+01	2.3E+02
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	1.5E+01	USEPA Chronic FW	1.5E+01	USEPA Chronic FW	2.0E+01	USEPA Chronic SW
ACENAPHTHYLENE	1.3E+01	USEPA Chronic FW	1.3E+01	USEPA Chronic FW	3.1E+02	USEPA Chronic SW
ACETONE	1.5E+03	USEPA Chronic SW	1.7E+03	USEPA Chronic FW	1.5E+03	USEPA Chronic SW
ALDRIN	1.4E-04	USEPA Chronic SW	3.5E-02	USEPA Chronic FW	1.4E-04	USEPA Chronic SW
AMETRYN	7.0E+02	USEPA Off Pesticides (FW)	7.0E+02	USEPA Off Pesticides	7.0E+02	USEPA Off Pesticides (FW)
AMINO,2- DINITROTOLUENE,4,6-	1.8E+01	USEPA Chronic FW	1.8E+01	USEPA Chronic FW	2.0E+01	USEPA Chronic SW
AMINO,4- DINITROTOLUENE,2,6-	1.1E+01	USEPA Reg IV (FW)	1.1E+01	USEPA Chronic FW	1.1E+01	USEPA Reg IV (FW)
ANTHRACENE	2.0E-02	USEPA Chronic FW	2.0E-02	USEPA Chronic FW	7.3E-01	USEPA Chronic SW
ANTIMONY	3.0E+01	USEPA Chronic SW	1.3E+02	USEPA Chronic FW	3.0E+01	USEPA Chronic SW
ARSENIC	3.6E+01	Hawaii Chronic SW WQS	1.9E+02	Hawaii Chronic FW WQS	3.6E+01	Hawaii Chronic SW WQS
ATRAZINE	1.2E+01	USEPA Reg IV (FW)	1.2E+01	USEPA Chronic FW	1.2E+01	USEPA Reg IV (FW)
BARIUM	2.2E+02	USEPA Chronic SW	2.2E+02	USEPA Chronic FW	2.2E+02	USEPA Chronic SW
BENOMYL	1.4E-01	5% USGS 2012 FW acute	1.4E-01	5% USGS 2012 acute	1.4E-01	5% USGS 2012 FW acute
BENZENE	7.1E+01	USEPA Chronic SW	1.6E+02	USEPA Chronic FW	7.1E+01	USEPA Chronic SW
BENZO(a)ANTHRACENE	2.7E-02	USEPA Chronic SW	4.7E+00	USEPA Chronic FW	2.7E-02	USEPA Chronic SW
BENZO(a)PYRENE	6.0E-02	USEPA Chronic FW	6.0E-02	USEPA Chronic FW	3.0E-01	USEPA Chronic SW
BENZO(b)FLUORANTHENE	6.8E-01	USEPA Chronic SW	2.6E+00	USEPA Chronic FW	6.8E-01	USEPA Chronic SW
BENZO(g,h,i)PERYLENE	4.4E-01	USEPA Chronic SW	4.4E-01	USEPA Chronic FW	4.4E-01	USEPA Chronic SW
BENZO(k)FLUORANTHENE	6.4E-01	USEPA Chronic SW	6.4E-01	USEPA Chronic FW	6.4E-01	USEPA Chronic SW
BERYLLIUM	6.6E-01	USEPA Chronic SW	1.1E+01	USEPA Chronic FW	6.6E-01	USEPA Chronic SW
BIPHENYL, 1,1-	6.5E+00	USEPA Chronic FW	6.5E+00	USEPA Chronic FW	1.4E+01	USEPA Chronic SW
BIS(2-CHLOROETHYL)ETHER	2.4E+03	USDOE Chronic (FW)	2.4E+03	USDOE Chronic	2.4E+03	USDOE Chronic (FW)
BIS(2-CHLORO-1-METHYLETHYL)ETHER	3.7E-01	=Drinking Water Toxicity	3.7E-01	=Drinking Water Toxicity)	3.7E-01	=Drinking Water Toxicity
BIS(2-ETHYLHEXYL)PHTHALATE	3.0E+00	USEPA Chronic SW	3.0E+00	USEPA Chronic FW	3.0E+00	USEPA Chronic SW
BORON	1.0E+03	USEPA Chronic SW	7.2E+03	USEPA Chronic FW	1.0E+03	USEPA Chronic SW
BROMODICHLOROMETHANE	3.4E+02	USEPA Reg IV (FW)	3.4E+02	USEPA Chronic FW	3.4E+02	USEPA Reg IV (FW)
BROMOFORM	2.3E+02	USEPA Chronic FW	2.3E+02	USEPA Chronic FW	3.2E+02	USEPA Chronic SW
BROMOMETHANE	1.6E+01	USEPA Reg IV (FW)	1.6E+01	USEPA Chronic FW	1.6E+01	USEPA Reg IV (FW)
CADMIUM	3.0E+00	Hawaii Chronic FW WQS	3.0E+00	Hawaii Chronic FW WQS	9.3E+00	Hawaii Chronic SW WQS
CARBON TETRACHLORIDE	9.8E+00	USEPA Chronic SW	7.7E+01	USEPA Chronic FW	9.8E+00	USEPA Chronic SW
CHLORDANE (TECHNICAL)	4.0E-03	Hawaii Chronic SW WQS	4.3E-03	Hawaii Chronic FW WQS	4.0E-03	Hawaii Chronic SW WQS
CHLOROANILINE, p-	1.9E+01	USEPA Reg IV (FW)	1.9E+01	USEPA Chronic FW	1.9E+01	USEPA Reg IV (FW)
CHLOROBENZENE	2.5E+01	USEPA Chronic FW	2.5E+01	USEPA Chronic FW	6.4E+01	USEPA Chronic SW
CHLOROETHANE	2.1E+04	=Drinking Water Toxicity	2.1E+04	=Drinking Water Toxicity)	2.1E+04	=Drinking Water Toxicity
CHLOROFORM	2.8E+01	USEPA Chronic SW	1.4E+02	USEPA Chronic FW	2.8E+01	USEPA Chronic SW
CHLOROMETHANE	1.9E+02	=Drinking Water Toxicity	1.9E+02	=Drinking Water Toxicity)	1.9E+02	=Drinking Water Toxicity
CHLOROPHENOL, 2-	3.2E+01	USEPA Chronic FW	3.2E+01	USEPA Chronic FW	4.0E+02	USEPA Chronic SW
CHROMIUM (Total)	1.1E+01	Reg IV Cr VI	1.1E+01	Reg IV Cr VI	5.0E+01	Reg IV Cr VI
CHROMIUM III	2.0E+01	USEPA Chronic SW	7.4E+01	USEPA Chronic FW	2.0E+01	USEPA Chronic SW
CHROMIUM VI	1.1E+01	Hawaii Chronic FW WQS	1.1E+01	Hawaii Chronic FW WQS	5.0E+01	Hawaii Chronic SW WQS
CHRYSENE	2.0E+00	USEPA Chronic SW	4.7E+00	USEPA Chronic FW	2.0E+00	USEPA Chronic SW
COBALT	1.9E+01	USEPA Chronic FW	1.9E+01	USEPA Chronic FW	2.3E+01	USEPA Chronic SW

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	Hawaii Chronic SW WQS	6.0E+00	Hawaii Chronic FW WQS	2.9E+00	Hawaii Chronic SW WQS
CYANIDE (Free)	1.0E+00	Hawaii Chronic SW WQS	5.2E+00	Hawaii Chronic FW WQS	1.0E+00	Hawaii Chronic SW WQS
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	7.9E+01	USEPA Chronic FW	7.9E+01	USEPA Chronic FW	1.9E+02	USEPA Chronic SW
DALAPON	3.0E+02	USEPA AQUIRE (5% FW LC50)	3.0E+02	USEPA AQUIRE (5% FW LC50)	3.0E+02	USEPA AQUIRE (5% FW LC50)
DIBENZO(a,h)ANTHTRACENE	8.0E-01	USEPA Chronic FW	8.0E-01	USEPA Chronic FW	7.1E+00	USEPA Chronic SW
DIBROMO,1,2- CHLOROPROPANE,3-	4.0E-02	=Drinking Water Toxicity	4.0E-02	=Drinking Water Toxicity)	4.0E-02	=Drinking Water Toxicity
DIBROMOCHLOROMETHANE	3.4E+01	USEPA Chronic SW	3.2E+02	USEPA Chronic FW	3.4E+01	USEPA Chronic SW
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 Chronic SW	2.3E+01	USEPA Chronic FW	1.4E+01	USEPA Chronic SW
DICHLOROBENZENE, 1,3-	2.2E+01	USEPA Chronic FW	2.2E+01	USEPA Chronic FW	7.1E+01	USEPA Chronic SW
DICHLOROBENZENE, 1,4-	9.4E+00	USEPA Chronic FW	9.4E+00	USEPA Chronic FW	1.5E+01	USEPA Chronic SW
DICHLOROBENZIDINE, 3,3-	4.5E+00	USEPA Reg IV (FW)	4.5E+00	USEPA Chronic FW	4.5E+00	USEPA Reg IV (FW)
DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.1E-02	USEPA Chronic SW	1.1E-02	USEPA Chronic FW	1.1E-02	USEPA Chronic SW
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	4.1E-01	USEPA Reg IV (FW)	4.1E-01	USEPA Chronic FW	4.1E-01	USEPA Reg IV (FW)
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.0E-03	Hawaii Chronic SW WQS	1.0E-03	Hawaii Chronic FW WQS	1.0E-03	Hawaii Chronic SW WQS
DICHLOROETHANE, 1,1-	4.7E+01	USEPA Chronic SW	4.1E+02	USEPA Chronic FW	4.7E+01	USEPA Chronic SW
DICHLOROETHANE, 1,2-	9.1E+02	USEPA Chronic SW	2.0E+03	USEPA Chronic FW	9.1E+02	USEPA Chronic SW
DICHLOROETHYLENE, 1,1-	2.5E+01	USEPA Chronic SW	1.3E+02	USEPA Chronic FW	2.5E+01	USEPA Chronic SW
DICHLOROETHYLENE, Cis 1,2-	6.2E+02	USEPA Reg IV (FW)	6.2E+02	USEPA Chronic FW	6.2E+02	USEPA Reg IV (FW)
DICHLOROETHYLENE, Trans 1,2-	5.6E+02	USEPA Reg IV (FW)	5.6E+02	USEPA Chronic FW	5.6E+02	USEPA Reg IV (FW)
DICHLOROPHENOL, 2,4-	1.1E+01	USEPA Chronic FW	1.1E+01	USEPA Chronic FW	7.9E+02	USEPA Chronic SW
DICHLOROPHENOXYACETIC ACID (2,4-D)	7.0E+01	USEPA Chronic SW	7.9E+01	USEPA Chronic FW	7.0E+01	USEPA Chronic SW
DICHLOROPROPANE, 1,2-	5.2E+02	USEPA Reg IV (FW)	5.2E+02	USEPA Chronic FW	5.2E+02	USEPA Reg IV (FW)
DICHLOROPROPENE, 1,3-	6.0E-02	USEPA Chronic SW	1.7E+00	USEPA Chronic FW	6.0E-02	USEPA Chronic SW
DIELDRIN	1.9E-03	Hawaii Chronic SW WQS	1.9E-03	Hawaii Chronic FW WQS	1.9E-03	Hawaii Chronic SW WQS
DIETHYLPHTHALATE	2.1E+02	USEPA Chronic SW	2.2E+02	USEPA Chronic FW	2.1E+02	USEPA Chronic SW
DIMETHYLPHENOL, 2,4-	1.2E+02	USEPA Reg IV (FW)	1.2E+02	USEPA Chronic FW	1.2E+02	USEPA Reg IV (FW)
DIMETHYLPHTHALATE	1.1E+03	USEPA Chronic FW	1.1E+03	USEPA Chronic FW	2.9E+03	USEPA Chronic SW
DINITROBENZENE, 1,3-	1.0E+01	USEPA Chronic SW	2.2E+01	USEPA Chronic FW	1.0E+01	USEPA Chronic SW
DINITROPHENOL, 2,4-	1.4E+01	USEPA Chronic SW	7.1E+01	USEPA Chronic FW	1.4E+01	USEPA Chronic SW
DINITROTOLUENE, 2,4- (2,4-DNT)	9.1E+00	USEPA Chronic SW	4.4E+01	USEPA Chronic FW	9.1E+00	USEPA Chronic SW
DINITROTOLUENE, 2,6- (2,6-DNT)	8.1E+01	USEPA Reg IV (FW)	8.1E+01	USEPA Chronic FW	8.1E+01	USEPA Reg IV (FW)
DIOXANE, 1,4-	3.4E+05	Mohr (5% Acute FW LC 50)	3.4E+05	Mohr (5% Acute FW LC 50)	5.0E+05	Mohr (5% Acute SW LC 50)
DIOXINS (TEQ)	3.1E-09	USEPA Reg IV (FW)	3.1E-09	USEPA Chronic FW	3.1E-09	USEPA Reg IV (FW)
DIURON	6.0E+01	USEPA AQUIRE (50% FW EC50)	6.0E+01	USEPA AQUIRE (50% FW EC50)	6.0E+01	USEPA AQUIRE (50% FW EC50)
ENDOSULFAN	8.7E-03	Hawaii Chronic SW WQS	5.6E-02	Hawaii Chronic FW WQS	8.7E-03	Hawaii Chronic SW WQS
ENDRIN	2.3E-03	Hawaii Chronic SW WQS	2.3E-03	Hawaii Chronic FW WQS	2.3E-03	Hawaii Chronic SW WQS
ETHANOL		not available		not available		
ETHYLBENZENE	7.3E+00	USEPA Chronic SW	6.1E+01	USEPA Chronic FW	7.3E+00	USEPA Chronic SW
FLUORANTHENE	8.0E-01	USEPA Chronic FW	8.0E-01	USEPA Chronic FW	7.1E+00	USEPA Chronic SW
FLUORENE	3.9E+00	USEPA Chronic SW	1.9E+01	USEPA Chronic FW	3.9E+00	USEPA Chronic SW
GLYPHOSATE	1.8E+03	USEPA Off Pesticides (FW)	1.8E+03	USEPA Off Pesticides	1.8E+03	USEPA Off Pesticides (FW)

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
HEPTACHLOR	3.6E-03	Hawaii Chronic SW WQS	3.8E-03	Hawaii Chronic FW WQS	3.6E-03	Hawaii Chronic SW WQS
HEPTACHLOR EPOXIDE	3.6E-03	USEPA Chronic SW	3.8E-03	USEPA Chronic FW	3.6E-03	USEPA Chronic SW
HEXACHLOROBENZENE	3.0E-04	USEPA Reg IV (FW)	3.0E-04	USEPA Chronic FW	3.0E-04	USEPA Reg IV (FW)
HEXACHLOROBUTADIENE	3.0E-01	USEPA Chronic SW	1.0E+00	USEPA Chronic FW	3.0E-01	USEPA Chronic SW
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	6.3E-02	USEPA Chronic SW	8.0E-02	Hawaii Chronic FW WQS	6.3E-02	USEPA Chronic SW
HEXACHLOROETHANE	1.2E+01	USEPA Chronic SW	1.2E+01	USEPA Chronic FW	1.2E+01	USEPA Chronic SW
HEXAZINONE	1.7E+04	USEPA Off Pesticides (FW)	1.7E+04	USEPA Off Pesticides	1.7E+04	USEPA Off Pesticides (FW)
INDENO(1,2,3-cd)PYRENE	2.8E-01	USEPA Chronic SW	2.8E-01	USEPA Chronic FW	2.8E-01	USEPA Chronic SW
ISOPHORONE	9.2E+02	USEPA Reg IV (FW)	9.2E+02	USEPA Chronic FW	9.2E+02	USEPA Reg IV (FW)
LEAD	5.6E+00	Hawaii Chronic SW WQS	2.9E+01	Hawaii Chronic FW WQS	5.6E+00	Hawaii Chronic SW WQS
MERCURY	2.5E-02	Hawaii Chronic SW WQS	5.5E-01	Hawaii Chronic FW WQS	2.5E-02	Hawaii Chronic SW WQS
METHOXYCHLOR	3.0E-02	Hawaii Chronic SW WQS	3.0E-02	Hawaii Chronic FW WQS	3.0E-02	Hawaii Chronic SW WQS
METHYL ETHYL KETONE	1.4E+04	USEPA Chronic SW	2.2E+04	USEPA Chronic FW	1.4E+04	USEPA Chronic SW
METHYL ISOBUTYL KETONE	1.7E+02	USEPA Chronic SW	1.7E+02	USEPA Chronic FW	1.7E+02	USEPA Chronic SW
METHYL MERCURY	2.8E-03	USEPA Chronic SW	2.8E-03	USEPA Chronic FW	2.8E-03	USEPA Chronic SW
METHYL TERT BUTYL ETHER	7.3E+02	USEPA Chronic FW	7.3E+02	USEPA Chronic FW	1.8E+04	USEPA Chronic SW
METHYLENE CHLORIDE	1.5E+03	USEPA Chronic FW	1.5E+03	USEPA Chronic FW	2.2E+03	USEPA Chronic SW
METHYLNAPHTHALENE, 1-	2.1E+00	USEPA Chronic SW	2.1E+00	USEPA Chronic FW	2.1E+00	USEPA Chronic SW
METHYLNAPHTHALENE, 2-	4.7E+00	USEPA Chronic FW	4.7E+00	USEPA Chronic FW	7.2E+01	USEPA Chronic SW
MOLYBDENUM	3.7E+02	USEPA Chronic SW	8.0E+02	USEPA Chronic FW	3.7E+02	USEPA Chronic SW
NAPHTHALENE	1.2E+01	USEPA Chronic SW	2.1E+01	USEPA Chronic FW	1.2E+01	USEPA Chronic SW
NICKEL	5.0E+00	Hawaii Chronic FW WQS	5.0E+00	Hawaii Chronic FW WQS	8.3E+00	Hawaii Chronic SW WQS
NITROBENZENE	3.8E+02	USEPA Reg IV (FW)	3.8E+02	USEPA Chronic FW	3.8E+02	USEPA Reg IV (FW)
NITROGLYCERIN	1.8E+01	USEPA Reg IV (FW)	1.8E+01	USEPA Chronic FW	1.8E+01	USEPA Reg IV (FW)
NITROTOLUENE, 2-	7.1E+01	USEPA Reg IV (FW)	7.1E+01	USEPA Chronic FW	7.1E+01	USEPA Reg IV (FW)
NITROTOLUENE, 3-	4.2E+01	USEPA Reg IV (FW)	4.2E+01	USEPA Chronic FW	4.2E+01	USEPA Reg IV (FW)
NITROTOLUENE, 4-	4.6E+01	USEPA Reg IV (FW)	4.6E+01	USEPA Chronic FW	4.6E+01	USEPA Reg IV (FW)
PENTACHLOROPHENOL	7.9E+00	USEPA Chronic SW	1.3E+01	Hawaii Chronic FW WQS	7.9E+00	USEPA Chronic SW
PENTAERYTHRITOLTETRANITRATE (PETN)	8.5E+05	Pascoe et al. (chronic FW)	8.5E+05	Pascoe et al. (chronic FW)	8.5E+05	Pascoe et al. (chronic FW)
PERCHLORATE	6.0E+02	USEPA 2002	6.0E+02	USEPA 2002	6.0E+02	USEPA 2002
PHENANTHRENE	2.3E+00	USEPA Chronic FW	2.3E+00	USEPA Chronic FW	4.6E+00	USEPA Chronic SW
PHENOL	5.8E+01	USEPA Chronic SW	1.6E+02	USEPA Chronic FW	5.8E+01	USEPA Chronic SW
POLYCHLORINATED BIPHENYLS (PCBs)	1.4E-02	Hawaii Chronic FW WQS	1.4E-02	Hawaii Chronic FW WQS	3.0E-02	Hawaii Chronic SW WQS
PROPICONAZOLE	9.5E+01	USEPA Off Pesticides (FW)	9.5E+01	USEPA Off Pesticides	9.5E+01	USEPA Off Pesticides (FW)
PYRENE	4.6E+00	USEPA Chronic FW	4.6E+00	USEPA Chronic FW	1.0E+01	USEPA Chronic SW
SELENIUM	5.0E+00	Hawaii Chronic FW WQS	5.0E+00	Hawaii Chronic FW WQS	7.1E+01	Hawaii Chronic SW WQS
SILVER	1.0E-01	USEPA Chronic SW	1.0E+00	Hawaii Chronic FW WQS	1.0E-01	USEPA Chronic SW
SIMAZINE	9.0E+00	USEPA Reg IV (FW)	9.0E+00	USEPA Chronic FW	9.0E+00	USEPA Reg IV (FW)
STYRENE	3.2E+01	USEPA Reg IV (FW)	3.2E+01	USEPA Chronic FW	3.2E+01	USEPA Reg IV (FW)
TERBACIL	2.6E+02	=Drinking Water Toxicity	1.2E+03	USEPA Off Pesticides	2.6E+02	=Drinking Water Toxicity
tert-BUTYL ALCOHOL	1.8E+04	USEPA AQUIRE (10% FW LC0)	1.8E+04	USEPA AQUIRE (10% FW LC0)	1.8E+04	USEPA AQUIRE (10% FW LC0)
TETRACHLOROETHANE, 1,1,1,2-	1.1E+01	USEPA Chronic SW	8.5E+01	USEPA Chronic FW	1.1E+01	USEPA Chronic SW

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
TETRACHLOROETHANE, 1,1,2,2-	2.0E+02	USEPA Chronic FW	2.0E+02	USEPA Chronic FW	6.1E+02	USEPA Chronic SW
TETRACHLOROETHYLENE	5.3E+01	USEPA Chronic FW	5.3E+01	USEPA Chronic FW	1.5E+02	Hawaii Chronic SW WQS
TETRACHLOROPHENOL, 2,3,4,6-	1.2E+00	USEPA Reg IV (FW)	1.2E+00	USEPA Chronic FW	1.2E+00	USEPA Reg IV (FW)
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	2.2E+02	USEPA Chronic FW	2.2E+02	USEPA Chronic FW	3.3E+02	USEPA Chronic SW
THALLIUM	6.0E+00	USEPA Chronic FW	6.0E+00	USEPA Chronic FW	1.2E+01	USEPA Chronic SW
TOLUENE	9.8E+00	USEPA Chronic SW	6.2E+01	USEPA Chronic FW	9.8E+00	USEPA Chronic SW
TOXAPHENE	2.0E-04	Hawaii Chronic SW WQS	2.0E-04	Hawaii Chronic FW WQS	2.0E-04	Hawaii Chronic SW WQS
TPH (gasolines)	5.0E+02	CalEPA FW Chronic	5.0E+02	CalEPA FW Chronic	3.7E+03	CalEPA Chronic (SW)
TPH (middle distillates)	6.4E+02	CalEPA Chronic (FW)	6.4E+02	CalEPA FW Chronic	6.4E+02	CalEPA Chronic (FW)
TPH (residual fuels)	6.4E+02	CalEPA Chronic (FW)	6.4E+02	CaEPA FW Chronic	6.4E+02	CalEPA Chronic (FW)
TRICHLOROBENZENE, 1,2,4-	1.1E+02	USEPA Chronic SW	1.3E+02	USEPA Chronic FW	1.1E+02	USEPA Chronic SW
TRICHLOROETHANE, 1,1,1-	1.1E+01	USEPA Chronic SW	7.6E+01	USEPA Chronic FW	1.1E+01	USEPA Chronic SW
TRICHLOROETHANE, 1,1,2-	7.3E+02	USEPA Chronic FW	7.3E+02	USEPA Chronic FW	1.2E+03	USEPA Chronic SW
TRICHLOROETHYLENE	4.7E+01	USEPA Chronic SW	2.0E+02	USEPA Chronic FW	4.7E+01	USEPA Chronic SW
TRICHLOROPHENOL, 2,4,5-	1.9E+00	USEPA Chronic FW	1.9E+00	USEPA Chronic FW	1.2E+01	USEPA Chronic SW
TRICHLOROPHENOL, 2,4,6-	4.9E+00	USEPA Chronic FW	4.9E+00	USEPA Chronic FW	6.5E+00	USEPA Chronic SW
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 Chronic FW	3.0E+01	USEPA Chronic FW	5.0E+01	USEPA Chronic SW
TRICHLOROPROPANE, 1,2,3-	1.4E+01	USEPA AQUIRE (50% FW EC50)	1.4E+01	USEPA AQUIRE (50% FW EC50)	1.4E+01	USEPA AQUIRE (50% FW EC50)
TRICHLOROPROPENE, 1,2,3-	6.2E-01	=Drinking Water Toxicity	6.2E-01	=Drinking Water Toxicity)	6.2E-01	=Drinking Water Toxicity
TRIFLURALIN	1.1E+00	USEPA Reg IV (FW)	1.1E+00	USEPA Chronic FW	1.1E+00	USEPA Reg IV (FW)
TRINITROBENZENE, 1,3,5-	1.0E+01	USEPA Chronic SW	1.1E+01	USEPA Chronic FW	1.0E+01	USEPA Chronic SW
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.0E+01	=Drinking Water Toxicity	4.0E+01	=Drinking Water Toxicity)	4.0E+01	=Drinking Water Toxicity
TRINITROTOLUENE, 2,4,6- (TNT)	1.3E+01	USEPA Chronic FW	1.3E+01	USEPA Chronic FW	9.0E+01	USEPA Chronic SW
VANADIUM	2.7E+01	USEPA Chronic FW	2.7E+01	USEPA Chronic FW	8.1E+01	USEPA Chronic SW

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	9.3E+02	USEPA Reg. IV SW Chronic	9.3E+02	USEPA Chronic FW	9.3E+02	USEPA Reg. IV SW Chronic
XYLENES	1.3E+01	USEPA Chronic SW	2.7E+01	USEPA Chronic FW	1.3E+01	USEPA Chronic SW
ZINC	2.2E+01	Hawaii Chronic FW WQS	2.2E+01	Hawaii Chronic FW WQS	8.6E+01	Hawaii Chronic SW WQS

Notes:

1. Refer to Table D-4d and D-4e for summary of aquatic habitat goal sources. Used for selection of groundwater action levels.
2. Estuarine Goal = Lowest of Freshwater vs Saltwater chronic goals.
3. Drinking water goal substituted as aquatic habitat goal if latter was not available (see text).

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	Hawaii Acute SW WQS	5.7E+02	Hawaii Acute FW WQS	3.2E+02	Hawaii Acute SW WQS
ACENAPHTHYLENE	3.0E+02	CCME 2002	3.0E+02	CCME 2002	3.0E+02	CCME 2002
ACETONE	1.5E+04	USEPA Acute FW	1.5E+04	USEPA Acute FW	2.8E+04	USEPA Acute SW
ALDRIN	1.3E+00	Hawaii Acute SW WQS	3.0E+00	Hawaii Acute FW WQS	1.3E+00	Hawaii Acute SW WQS
AMETRYN	1.8E+03	USEPA Off Pesticides (FW)	1.8E+03	USEPA Off Pesticides	1.8E+03	USEPA Off Pesticides (FW)
AMINO,2- DINITROTOLUENE,4,6-	1.6E+02	USEPA Acute FW	1.6E+02	USEPA Acute FW	1.8E+02	USEPA Acute SW
AMINO,4- DINITROTOLUENE,2,6-	9.8E+01	USEPA Reg IV (FW)	9.8E+01	USEPA Acute FW	9.8E+01	USEPA Reg IV (FW)
ANTHRACENE	1.8E-01	USEPA Acute FW	1.8E-01	USEPA Acute FW	1.3E+01	USEPA Acute SW
ANTIMONY	1.8E+02	USEPA Acute SW	3.0E+03	Hawaii Acute FW WQS	1.8E+02	USEPA Acute SW
ARSENIC	6.9E+01	Hawaii Acute SW WQS	3.6E+02	Hawaii Acute FW WQS	6.9E+01	Hawaii Acute SW WQS
ATRAZINE	3.3E+02	USEPA Reg IV (FW)	3.3E+02	USEPA Acute FW	3.3E+02	USEPA Reg IV (FW)
BARIUM	2.0E+03	USEPA Acute SW	2.0E+03	USEPA Acute FW	2.0E+03	USEPA Acute SW
BENOMYL	2.8E+00	USGS Acute (FW)	2.8E+00	USGS 2012	2.8E+00	USGS Acute (FW)
BENZENE	1.7E+03	Hawaii Acute SW WQS	1.8E+03	Hawaii Acute FW WQS	1.7E+03	Hawaii Acute SW WQS
BENZO(a)ANTHRACENE	3.0E+02	CCME 2002	3.0E+02	CCME 2002	3.0E+02	CCME 2002
BENZO(a)PYRENE	3.0E+02	CCME 2002	3.0E+02	CCME 2002	3.0E+02	CCME 2002
BENZO(b)FLUORANTHENE	3.0E+02	CCME 2002	3.0E+02	CCME 2002	3.0E+02	CCME 2002
BENZO(g,h,i)PERYLENE	3.0E+02	CCME 2002	3.0E+02	CCME 2002	3.0E+02	CCME 2002
BENZO(k)FLUORANTHENE	3.0E+02	CCME 2002	3.0E+02	CCME 2002	3.0E+02	CCME 2002
BERYLLIUM	3.5E+01	USEPA Acute SW	4.3E+01	Hawaii Acute FW WQS	3.5E+01	USEPA Acute SW
BIPHENYL, 1,1-	2.6E+01	USEPA Reg IV (FW)	2.6E+01	USEPA Acute FW	2.6E+01	USEPA Reg IV (FW)
BIS(2-CHLOROETHYL)ETHER	2.4E+04	USDOE Acute (FW)	2.4E+04	USDOE Acute	2.4E+04	USDOE Acute (FW)
BIS(2-CHLORO-1-METHYLETHYL)ETHER	3.7E-01	=Drinking Water Toxicity	3.7E-01	=Drinking Water Toxicity	3.7E-01	=Drinking Water Toxicity
BIS(2-ETHYLHEXYL)PHTHALATE	2.7E+01	USEPA Acute SW	2.7E+01	USEPA Acute FW	2.7E+01	USEPA Acute SW
BORON	3.4E+04	USEPA Reg IV (FW)	3.4E+04	USEPA Acute FW	3.4E+04	USEPA Reg IV (FW)
BROMODICHLOROMETHANE	3.1E+03	USEPA Reg IV (FW)	3.1E+03	USEPA Acute FW	3.1E+03	USEPA Reg IV (FW)
BROMOFORM	1.1E+03	USEPA Acute FW	1.1E+03	USEPA Acute FW	2.3E+03	USEPA Acute SW
BROMOMETHANE	3.8E+01	USEPA Reg IV (FW)	3.8E+01	USEPA Acute FW	3.8E+01	USEPA Reg IV (FW)
CADMIUM	3.0E+00	Hawaii Acute FW WQS	3.0E+00	Hawaii Acute FW WQS	4.3E+01	Hawaii Acute SW WQS
CARBON TETRACHLORIDE	1.2E+04	Hawaii Acute FW WQS	1.2E+04	Hawaii Acute FW WQS	1.6E+04	Hawaii Acute SW WQS
CHLORDANE (TECHNICAL)	9.0E-02	Hawaii Acute SW WQS	2.4E+00	Hawaii Acute FW WQS	9.0E-02	Hawaii Acute SW WQS
CHLOROANILINE, p-	4.6E+02	USEPA Reg IV (FW)	4.6E+02	USEPA Acute FW	4.6E+02	USEPA Reg IV (FW)
CHLOROBENZENE	2.2E+02	USEPA Acute FW	2.2E+02	USEPA Acute FW	1.1E+03	USEPA Acute SW
CHLOROETHANE	2.1E+04	=Drinking Water Toxicity	2.1E+04	=Drinking Water Toxicity	2.1E+04	=Drinking Water Toxicity
CHLOROFORM	4.9E+02	USEPA Acute SW	9.6E+03	Hawaii Acute FW WQS	4.9E+02	USEPA Acute SW
CHLOROMETHANE	1.9E+02	=Drinking Water Toxicity	1.9E+02	=Drinking Water Toxicity	1.9E+02	=Drinking Water Toxicity
CHLOROPHENOL, 2-	4.0E+02	USEPA Reg IV (SW chronic)	1.4E+03	Hawaii Acute FW WQS	4.0E+02	USEPA Reg IV (SW chronic)
CHROMIUM (Total)	1.6E+01	Reg IV Cr VI	1.6E+01	Reg IV Cr VI	1.0E+03	Reg IV Cr VI
CHROMIUM III	5.7E+02	USEPA Reg IV (FW)	5.7E+02	USEPA Acute FW	5.7E+02	USEPA Reg IV (FW)
CHROMIUM VI	1.6E+01	Hawaii Acute FW WQS	1.6E+01	Hawaii Acute FW WQS	1.1E+03	Hawaii Acute SW WQS
CHRYSENE	3.0E+02	CCME 2002	3.0E+02	CCME 2002	3.0E+02	CCME 2002
COBALT	1.2E+02	USEPA Acute FW	1.2E+02	USEPA Acute FW	1.5E+03	USEPA Acute SW
COPPER	2.9E+00	Hawaii Acute SW WQS	6.0E+00	Hawaii Acute FW WQS	2.9E+00	Hawaii Acute SW WQS
CYANIDE (Free)	1.0E+00	Hawaii Acute SW WQS	2.2E+01	Hawaii Acute FW WQS	1.0E+00	Hawaii 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
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	5.2E+02	USEPA Acute FW	5.2E+02	USEPA Acute FW	7.0E+02	USEPA Acute SW
DALAPON	3.0E+03	USEPA AQUIRE (50% FW LC50)	3.0E+03	USEPA AQUIRE (50% FW LC50)	3.0E+03	USEPA AQUIRE (50% FW LC50)
DIBENZO(a,h)ANTHTRACENE	3.0E+02	CCME 2002	3.0E+02	CCME 2002	3.0E+02	CCME 2002
DIBROMO-3-CHLOROPROPANE, 1,2-	4.0E-02	=Drinking Water Toxicity	4.0E-02	=Drinking Water Toxicity	4.0E-02	=Drinking Water Toxicity
DIBROMOCHLOROMETHANE	2.9E+03	USEPA Reg IV (FW)	2.9E+03	USEPA Acute FW	2.9E+03	USEPA Reg IV (FW)
DIBROMOETHANE, 1,2-	1.4E+03	50% MOEE FW Chronic AWQC	1.4E+03	50% MOEE FW Chronic AWQC	1.4E+03	50% MOEE FW Chronic AWQC
DICHLOROBENZENE, 1,2-	3.7E+02	Hawaii Acute FW WQS	3.7E+02	Hawaii Acute FW WQS	6.6E+02	Hawaii Acute SW WQS
DICHLOROBENZENE, 1,3-	3.7E+02	Hawaii Acute FW WQS	3.7E+02	Hawaii Acute FW WQS	6.6E+02	Hawaii Acute SW WQS
DICHLOROBENZENE, 1,4-	3.7E+02	Hawaii Acute FW WQS	3.7E+02	Hawaii Acute FW WQS	6.6E+02	Hawaii Acute SW WQS
DICHLOROBENZIDINE, 3,3-	4.1E+01	USEPA Reg IV (FW)	4.1E+01	USEPA Acute FW	4.1E+01	USEPA Reg IV (FW)
DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.9E-01	USEPA Acute SW	1.9E-01	USEPA Acute FW	1.9E-01	USEPA Acute SW
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	7.0E+00	USEPA Reg IV (FW)	7.0E+00	USEPA Acute FW	7.0E+00	USEPA Reg IV (FW)
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.3E-02	Hawaii Acute SW WQS	1.1E+00	Hawaii Acute FW WQS	1.3E-02	Hawaii Acute SW WQS
DICHLOROETHANE, 1,1-	8.3E+02	USEPA Acute SW	3.7E+03	USEPA Acute FW	8.3E+02	USEPA Acute SW
DICHLOROETHANE, 1,2-	3.8E+04	Hawaii Acute SW WQS	3.9E+04	Hawaii Acute FW WQS	3.8E+04	Hawaii Acute SW WQS
DICHLOROETHYLENE, 1,1-	3.9E+03	Hawaii Acute FW WQS	3.9E+03	Hawaii Acute FW WQS	7.5E+04	Hawaii Acute SW WQS
DICHLOROETHYLENE, Cis 1,2-	5.5E+03	USEPA Reg IV (FW)	5.5E+03	USEPA Acute FW	5.5E+03	USEPA Reg IV (FW)
DICHLOROETHYLENE, Trans 1,2-	1.0E+04	USEPA Reg IV (FW)	1.0E+04	USEPA Acute FW	1.0E+04	USEPA Reg IV (FW)
DICHLOROPHENOL, 2,4-	6.7E+02	Hawaii Acute FW WQS	6.7E+02	Hawaii Acute FW WQS	7.9E+02	USEPA Reg IV (SW chronic)
DICHLOROPHENOXYACETIC ACID (2,4-D)	1.3E+02	USEPA Reg IV (FW)	1.3E+02	USEPA Acute FW	1.3E+02	USEPA Reg IV (FW)
DICHLOROPROPANE, 1,2-	3.4E+03	Hawaii Acute SW WQS	7.7E+03	Hawaii Acute FW WQS	3.4E+03	Hawaii Acute SW WQS
DICHLOROPROPENE, 1,3-	2.6E+02	Hawaii Acute SW WQS	2.0E+03	Hawaii Acute FW WQS	2.6E+02	Hawaii Acute SW WQS
DIELDRIN	7.1E-01	Hawaii Acute SW WQS	2.5E+00	Hawaii Acute FW WQS	7.1E-01	Hawaii Acute SW WQS
DIETHYLPHTHALATE	9.8E+02	USEPA Acute FW	9.8E+02	USEPA Acute FW	1.8E+03	USEPA Acute SW
DIMETHYLPHENOL, 2,4-	7.0E+02	Hawaii Acute FW WQS	7.0E+02	Hawaii Acute FW WQS	1.1E+03	USEPA Reg IV (FW)
DIMETHYLPHTHALATE	3.2E+03	USEPA Reg IV (FW)	3.2E+03	USEPA Acute FW	3.2E+03	USEPA Reg IV (FW)
DINITROBENZENE, 1,3-	1.0E+02	USEPA Acute FW	1.0E+02	USEPA Acute FW	1.1E+02	USEPA Acute SW
DINITROPHENOL, 2,4-	3.8E+02	0.0E+00	3.8E+02	USEPA Acute FW	3.8E+02	0.0E+00
DINITROTOLUENE, 2,4- (2,4-DNT)	1.1E+02	Hawaii Acute FW WQS	1.1E+02	Hawaii Acute FW WQS	2.0E+02	Hawaii Acute SW WQS
DINITROTOLUENE, 2,6- (2,6-DNT)	1.1E+02	Hawaii Acute FW WQS	1.1E+02	Hawaii Acute FW WQS	2.0E+02	Hawaii Acute SW WQS
DIOXANE, 1,4-	3.4E+06	Mohr (50% FW LC50)	3.4E+06	Mohr (50% FW LC50)	5.0E+06	Mohr (50% SW LC50)
DIOXINS (TEQ)	3.0E-03	USEPA Reg IV (FW)	3.0E-03	Hawaii Acute FW WQS	3.0E-03	USEPA Reg IV (FW)
DIURON	2.0E+02	USEPA AQUIRE (50% FW LC50)	2.0E+02	USEPA AQUIRE (50% FW LC50)	5.5E+02	USEPA AQUIRE (50% SW LC50)
ENDOSULFAN	3.4E-02	Hawaii Acute SW WQS	2.2E-01	Hawaii Acute FW WQS	3.4E-02	Hawaii Acute SW WQS
ENDRIN	3.7E-02	Hawaii Acute SW WQS	1.8E-01	Hawaii Acute FW WQS	3.7E-02	Hawaii Acute SW WQS
ETHANOL		not available		not available		
ETHYLBENZENE	1.4E+02	Hawaii Acute SW WQS	1.1E+04	Hawaii Acute FW WQS	1.4E+02	Hawaii Acute SW WQS
FLUORANTHENE	1.3E+01	Hawaii Acute SW WQS	1.3E+03	Hawaii Acute FW WQS	1.3E+01	Hawaii Acute SW WQS
FLUORENE	3.0E+02	CCME 2002	3.0E+02	CCME 2002	3.0E+02	CCME 2002
GLYPHOSATE	2.2E+04	USEPA Off Pesticides (FW)	2.2E+04	USEPA Off Pesticides	2.2E+04	USEPA Off Pesticides (FW)
HEPTACHLOR	5.3E-02	Hawaii Acute SW WQS	5.2E-01	Hawaii Acute FW WQS	5.3E-02	Hawaii Acute SW WQS
HEPTACHLOR EPOXIDE	5.3E-02	USEPA Acute SW	5.2E-01	USEPA Acute FW	5.3E-02	USEPA Acute SW
HEXACHLOROBENZENE	3.0E-04	USEPA Reg IV (FW chronic)	3.0E-04	USEPA Reg IV (FW chronic)	3.0E-04	USEPA Reg IV (FW chronic)
HEXACHLOROBUTADIENE	1.1E+01	Hawaii Acute SW WQS	3.0E+01	Hawaii Acute FW WQS	1.1E+01	Hawaii 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
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	1.6E-01	Hawaii Acute SW WQS	2.0E+00	Hawaii Acute FW WQS	1.6E-01	Hawaii Acute SW WQS
HEXACHLOROETHANE	3.1E+02	Hawaii Acute SW WQS	3.3E+02	Hawaii Acute FW WQS	3.1E+02	Hawaii Acute SW WQS
HEXAZINONE	1.4E+05	USEPA Off Pesticides (FW)	1.4E+05	USEPA Off Pesticides	1.4E+05	USEPA Off Pesticides (FW)
INDENO(1,2,3-cd)PYRENE	3.0E+02	CCME 2002	3.0E+02	CCME 2002	3.0E+02	CCME 2002
ISOPHORONE	4.3E+03	Hawaii Acute SW WQS	3.9E+04	Hawaii Acute FW WQS	4.3E+03	Hawaii Acute SW WQS
LEAD	2.9E+01	Hawaii Acute FW WQS	2.9E+01	Hawaii Acute FW WQS	1.4E+02	Hawaii Acute SW WQS
MERCURY	2.1E+00	Hawaii Acute SW WQS	2.4E+00	Hawaii Acute FW WQS	2.1E+00	Hawaii Acute SW WQS
METHOXYCHLOR	7.0E-01	USEPA Reg IV (FW)	7.0E-01	USEPA Acute FW	7.0E-01	USEPA Reg IV (FW)
METHYL ETHYL KETONE	2.0E+05	USEPA Acute FW	2.0E+05	USEPA Acute FW	2.4E+05	USEPA Acute SW
METHYL ISOBUTYL KETONE	2.2E+03	USEPA Acute SW	2.2E+03	USEPA Acute FW	2.2E+03	USEPA Acute SW
METHYL MERCURY	9.9E-02	USEPA Acute SW	9.9E-02	USEPA Acute FW	9.9E-02	USEPA Acute SW
METHYL TERT BUTYL ETHER	6.5E+03	USEPA Acute FW	6.5E+03	USEPA Acute FW	5.3E+04	USEPA Acute SW
METHYLENE CHLORIDE	8.5E+03	USEPA Acute FW	8.5E+03	USEPA Acute FW	2.6E+04	USEPA Acute SW
METHYLNAPHTHALENE, 1-	3.7E+01	USEPA Acute SW	3.7E+01	USEPA Acute FW	3.7E+01	USEPA Acute SW
METHYLNAPHTHALENE, 2-	4.2E+01	USEPA Acute FW	4.2E+01	USEPA Acute FW	8.6E+01	USEPA Acute SW
MOLYBDENUM	7.2E+03	USEPA Acute FW	7.2E+03	USEPA Acute FW	1.6E+04	USEPA Acute SW
NAPHTHALENE	7.7E+02	Hawaii Acute FW WQS	7.7E+02	Hawaii Acute FW WQS	7.8E+02	Hawaii Acute SW WQS
NICKEL	5.0E+00	Hawaii Acute FW WQS	5.0E+00	Hawaii Acute FW WQS	7.5E+01	Hawaii Acute SW WQS
NITROBENZENE	2.0E+03	Hawaii Acute SW WQS	9.0E+03	Hawaii Acute FW WQS	2.0E+03	Hawaii Acute SW WQS
NITROGLYCERIN	1.6E+02	USEPA Reg IV (FW)	1.6E+02	USEPA Acute FW	1.6E+02	USEPA Reg IV (FW)
NITROTOLUENE, 2-	6.4E+02	USEPA Reg IV (FW)	6.4E+02	USEPA Acute FW	6.4E+02	USEPA Reg IV (FW)
NITROTOLUENE, 3-	3.8E+02	USEPA Reg IV (FW)	3.8E+02	USEPA Acute FW	3.8E+02	USEPA Reg IV (FW)
NITROTOLUENE, 4-	4.1E+02	USEPA Reg IV (FW)	4.1E+02	USEPA Acute FW	4.1E+02	USEPA Reg IV (FW)
PENTACHLOROPHENOL	1.3E+01	Hawaii Acute SW WQS	2.0E+01	Hawaii Acute FW WQS	1.3E+01	Hawaii Acute SW WQS
PENTAERYTHRITOLTETRANITRATE (PETN)	8.5E+05	Pascoe et al. (chronic FW)	8.5E+05	Pascoe et al. (chronic FW)	8.5E+05	Pascoe et al. (chronic FW)
PERCHLORATE	5.0E+03	USEPA 2002	5.0E+03	USEPA 2002	5.0E+03	USEPA 2002
PHENANTHRENE	3.0E+02	CCME 2002	3.0E+02	CCME 2002	3.0E+02	CCME 2002
PHENOL	3.0E+02	USEPA Acute SW	4.7E+03	Hawaii Acute FW WQS	3.0E+02	USEPA Acute SW
POLYCHLORINATED BIPHENYLS (PCBs)	2.0E+00	Hawaii Acute FW WQS	2.0E+00	Hawaii Acute FW WQS	1.0E+01	Hawaii Acute SW WQS
PROPICONAZOLE	4.3E+02	USEPA Off Pesticides (FW)	4.3E+02	USEPA Off Pesticides	4.3E+02	USEPA Off Pesticides (FW)
PYRENE	3.0E+02	CCME 2002	3.0E+02	CCME 2002	3.0E+02	CCME 2002
SELENIUM	2.0E+01	Hawaii Acute FW WQS	2.0E+01	Hawaii Acute FW WQS	3.0E+02	Hawaii Acute SW WQS
SILVER	1.0E+00	Hawaii Acute FW WQS	1.0E+00	Hawaii Acute FW WQS	2.3E+00	Hawaii Acute SW WQS
SIMAZINE	8.0E+01	USEPA Reg IV (FW)	8.0E+01	USEPA Acute FW	8.0E+01	USEPA Reg IV (FW)
STYRENE	2.9E+02	USEPA Reg IV (FW)	2.9E+02	USEPA Acute FW	2.9E+02	USEPA Reg IV (FW)
TERBACIL	2.6E+02	=Drinking Water Toxicity	2.3E+04	USEPA Off Pesticides	2.6E+02	=Drinking Water Toxicity
tert-BUTYL ALCOHOL	1.8E+05	USEPA AQUIRE (FW LC0)	1.8E+05	USEPA AQUIRE (FW LC0)	1.8E+05	USEPA AQUIRE (FW LC0)
TETRACHLOROETHANE, 1,1,1,2-	7.7E+02	USEPA Reg IV (FW)	3.1E+03	Hawaii Acute FW WQS	7.7E+02	USEPA Reg IV (FW)
TETRACHLOROETHANE, 1,1,2,2-	9.1E+02	USEPA Acute FW	9.1E+02	USEPA Acute FW	3.0E+03	Hawaii Acute SW WQS
TETRACHLOROETHYLENE	1.8E+03	Hawaii Acute FW WQS	1.8E+03	Hawaii Acute FW WQS	3.4E+03	Hawaii Acute SW WQS
TETRACHLOROPHENOL, 2,3,4,6-	1.1E+01	USEPA Reg IV (FW)	1.1E+01	USEPA Acute FW	1.1E+01	USEPA Reg IV (FW)
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	1.2E+03	USEPA Acute FW	1.2E+03	USEPA Acute FW	1.9E+03	USEPA Acute SW
THALLIUM	4.7E+02	Hawaii Acute FW WQS	4.7E+02	Hawaii Acute FW WQS	7.1E+02	Hawaii Acute SW WQS
TOLUENE	2.1E+03	Hawaii Acute SW WQS	5.8E+03	Hawaii Acute FW WQS	2.1E+03	Hawaii 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
TOXAPHENE	2.1E-01	Hawaii Acute SW WQS	7.3E-01	Hawaii Acute FW WQS	2.1E-01	Hawaii 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-	4.2E+02	USEPA Acute FW	4.2E+02	USEPA Acute FW	7.0E+02	USEPA Acute SW
TRICHLOROETHANE, 1,1,1-	6.0E+03	Hawaii Acute FW WQS	6.0E+03	Hawaii Acute FW WQS	1.0E+04	Hawaii Acute SW WQS
TRICHLOROETHANE, 1,1,2-	5.2E+03	USEPA Acute SW	6.0E+03	Hawaii Acute FW WQS	5.2E+03	USEPA Acute SW
TRICHLOROETHYLENE	7.0E+02	Hawaii Acute SW WQS	1.5E+04	Hawaii Acute FW WQS	7.0E+02	Hawaii Acute SW WQS
TRICHLOROPHENOL, 2,4,5-	1.7E+01	USEPA Acute FW	1.7E+01	USEPA Acute FW	2.6E+02	USEPA Acute SW
TRICHLOROPHENOL, 2,4,6-	3.9E+01	USEPA Reg IV (FW)	3.9E+01	USEPA Acute FW	3.9E+01	USEPA Reg IV (FW)
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)	2.7E+02	USEPA Reg IV (FW)	2.7E+02	USEPA Acute FW	2.7E+02	USEPA Reg IV (FW)
TRICHLOROPROPANE, 1,2,3-	1.4E+02	USEPA AQUIRE (5xFW EC50)	1.4E+02	USEPA AQUIRE (5xFW EC50)	1.4E+02	USEPA AQUIRE (5xFW EC50)
TRICHLOROPROPENE, 1,2,3-	6.2E-01	=Drinking Water Toxicity	6.2E-01	=Drinking Water Toxicity	6.2E-01	=Drinking Water Toxicity
TRIFLURALIN	2.1E+01	USEPA Reg IV (FW)	2.1E+01	USEPA Acute FW	2.1E+01	USEPA Reg IV (FW)
TRINITROBENZENE, 1,3,5-	2.7E+01	USEPA Acute FW	2.7E+01	USEPA Acute FW	3.0E+01	USEPA Acute SW
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.0E+01	=Drinking Water Toxicity	4.0E+01	=Drinking Water Toxicity	4.0E+01	=Drinking Water Toxicity
TRINITROTOLUENE, 2,4,6- (TNT)	2.1E+02	USEPA Acute FW	2.1E+02	USEPA Acute FW	5.7E+02	USEPA Acute SW
VANADIUM	9.0E+01	USEPA Acute SW	1.2E+02	USEPA Acute FW	9.0E+01	USEPA Acute SW
VINYL CHLORIDE	8.4E+03	USEPA Reg IV SW Acute	8.4E+03	USEPA Acute FW	8.4E+03	USEPA Reg IV SW Acute
XYLENES	2.3E+02	USEPA Acute SW	2.4E+02	USEPA Acute FW	2.3E+02	USEPA Acute SW
ZINC	2.2E+01	Hawaii Acute FW WQS	2.2E+01	Hawaii Acute FW WQS	9.5E+01	Hawaii Acute SW WQS

Notes:

1. Refer to Table D-4d and D-4e for summary of aquatic habitat goal sources. Used for selection of groundwater action levels.
2. Estuarine Goal = Lowest of Freshwater vs Saltwater chronic goals.
3. Drinking water goal substituted as aquatic habitat goal if latter was not available (see text).

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				
BENOMYL				
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-CHLORO-1-METHYLETHYL)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

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, 1,3-		3.7E+02		6.6E+02
DICHLOROBENZENE, 1,4-		3.7E+02		6.6E+02
DICHLOROBENZIDINE, 3,3-				
DICHLORODIPHENYLDICHLOROETHANE (DDD)				
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)				
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.0E-03	1.1E+00	1.0E-03	1.3E-02
DICHLOROETHANE, 1,1-				
DICHLOROETHANE, 1,2-		3.9E+04		3.8E+04
DICHLOROETHYLENE, 1,1-		3.9E+03		7.5E+04
DICHLOROETHYLENE, Cis 1,2-				
DICHLOROETHYLENE, Trans 1,2-				
DICHLOROPHENOL, 2,4-		6.7E+02		
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		1.4E+02
FLUORANTHENE		1.3E+03		1.3E+01
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

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**
NITROBENZENE		9.0E+03		2.0E+03
NITROGLYCERIN				
NITROTOLUENE, 2-				
NITROTOLUENE, 3-				
NITROTOLUENE, 4-				
PENTACHLOROPHENOL	1.3E+01	2.0E+01		1.3E+01
PENTAERYTHRITOLTETRANITRATE (PETN)				
PERCHLORATE				
PHENANTHRENE				
PHENOL		4.7E+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, October 2012.

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

	Freshwater						Marine					
CONTAMINANT	**USEPA Reg IV Chronic**	**USEPA Reg IV Acute**	**Other Chronic**	**Basis**	**Other Acute**	**Basis**	**USEPA Reg IV Chronic**	**USEPA Reg IV Acute**	**Other Chronic**	**Basis**	**Other Acute**	**Basis**
ACENAPHTHENE	1.5E+01				3.0E+02	CCME 2002	2.0E+01				3.0E+02	CCME 2002
ACENAPHTHYLENE	1.3E+01				3.0E+02	CCME 2002	3.1E+02				3.0E+02	CCME 2002
ACETONE	1.7E+03	1.5E+04					1.5E+03	2.8E+04				
ALDRIN	3.5E-02	3.0E+00					1.4E-04	1.3E+00				
AMETRYN			7.0E+02	USEPA Off Pesticides	1.8E+03	USEPA Off Pesticides			7.0E+02	USEPA Off Pesticides (FW)	1.8E+03	USEPA Off Pesticides (FW)
AMINO,2- DINITROTOLUENE,4,6-	1.8E+01	1.6E+02					2.0E+01	1.8E+02				
AMINO,4- DINITROTOLUENE,2,6-	1.1E+01	9.8E+01							1.1E+01	USEPA Reg IV (FW)	9.8E+01	USEPA Reg IV (FW)
ANTHRACENE	2.0E-02	1.8E-01					7.3E-01	1.3E+01			3.0E+02	CCME 2002
ANTIMONY	1.3E+02	3.0E+02					3.0E+01	1.8E+02				
ARSENIC	1.5E+02	3.4E+02					3.6E+01	6.9E+01				
ATRAZINE	1.2E+01	3.3E+02							1.2E+01	USEPA Reg IV (FW)	3.3E+02	USEPA Reg IV (FW)
BARIUM	2.2E+02	2.0E+03					2.2E+02	2.0E+03				
BENOMYL			1.4E-01	5% USGS 2012 acute	2.8E+00	USGS 2012			1.4E-01	5% USGS 2012 FW acute	2.8E+00	USGS Acute (FW)
BENZENE	1.6E+02	7.0E+02					7.1E+01				7.0E+02	USEPA Reg IV (FW)
BENZO(a)ANTHRACENE	4.7E+00				3.0E+02	CCME 2002	2.7E-02				3.0E+02	CCME 2002
BENZO(a)PYRENE	6.0E-02				3.0E+02	CCME 2002	3.0E-01				3.0E+02	CCME 2002
BENZO(b)FLUORANTHENE	2.6E+00				3.0E+02	CCME 2002	6.8E-01				3.0E+02	CCME 2002
BENZO(g,h,i)PERYLENE	4.4E-01				3.0E+02	CCME 2002	4.4E-01				3.0E+02	CCME 2002
BENZO(k)FLUORANTHENE	6.4E-01				3.0E+02	CCME 2002	6.4E-01				3.0E+02	CCME 2002
BERYLLIUM	1.1E+01	9.3E+01					6.6E-01	3.5E+01				
BIPHENYL, 1,1-	6.5E+00	2.6E+01					1.4E+01				2.6E+01	USEPA Reg IV (FW)
BIS(2-CHLOROETHYL)ETHER			2.4E+03	USDOE Chronic	2.4E+04	USDOE Acute			2.4E+03	USDOE Chronic (FW)	2.4E+04	USDOE Acute (FW)
BIS(2-CHLORO-1-METHYLETHYL)ETHER												
BIS(2-ETHYLHEXYL)PHTHALATE	3.0E+00	2.7E+01					3.0E+00	2.7E+01				
BORON	7.2E+03	3.4E+04					1.0E+03				3.4E+04	USEPA Reg IV (FW)
BROMODICHLOROMETHANE	3.4E+02	3.1E+03							3.4E+02	USEPA Reg IV (FW)	3.1E+03	USEPA Reg IV (FW)
BROMOFORM	2.3E+02	1.1E+03					3.2E+02	2.3E+03				
BROMOMETHANE	1.6E+01	3.8E+01							1.6E+01	USEPA Reg IV (FW)	3.8E+01	USEPA Reg IV (FW)
CADMIUM	2.5E-01	2.0E+00					8.8E+00	4.0E+01				
CARBON TETRACHLORIDE	7.7E+01	6.9E+02					9.8E+00	1.8E+02				
CHLORDANE (TECHNICAL)	4.3E-03	2.4E+00					5.9E-04	4.0E-03				
CHLOROANILINE, p-	1.9E+01	4.6E+02							1.9E+01	USEPA Reg IV (FW)	4.6E+02	USEPA Reg IV (FW)
CHLOROBENZENE	2.5E+01	2.2E+02					6.4E+01	1.1E+03				
CHLOROETHANE												
CHLOROFORM	1.4E+02	1.3E+03					2.8E+01	4.9E+02				
CHLOROMETHANE												
CHLOROPHENOL, 2-	3.2E+01	2.9E+02					4.0E+02				4.0E+02	USEPA Reg IV (SW chronic)
CHROMIUM (Total)			1.1E+01	Reg IV Cr VI	1.6E+01	Reg IV Cr VI			5.0E+01	Reg IV Cr VI	1.0E+03	Reg IV Cr VI
CHROMIUM III	7.4E+01	5.7E+02					2.0E+01				5.7E+02	USEPA Reg IV (FW)
CHROMIUM VI	1.1E+01	1.6E+01					5.0E+01	1.1E+03				
CHRYSENE	4.7E+00				3.0E+02	CCME 2002	2.0E+00				3.0E+02	CCME 2002
COBALT	1.9E+01	1.2E+02					2.3E+01	1.5E+03				
COPPER	9.0E+00	1.3E+01					3.1E+00	4.8E+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)	7.9E+01	5.2E+02					1.9E+02	7.0E+02				
DALAPON			3.0E+02	USEPA AQUIRE (5% FW LC50)	3.0E+03	USEPA AQUIRE (50% FW LC50)			3.0E+02	USEPA AQUIRE (5% FW LC50)	3.0E+03	USEPA AQUIRE (50% FW LC50)
DIBENZO(a,h)ANTHTRACENE	8.0E-01			\	3.0E+02	CCME 2002	7.1E+00				3.0E+02	CCME 2002
DIBROMO-3-CHLOROPROPANE, 1,2-												
DIBROMOCHLOROMETHANE	3.2E+02	2.9E+03					3.4E+01				2.9E+03	USEPA Reg IV (FW)
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	1.4E+03	50% MOEE FW Chronic AWQC
DICHLOROBENZENE, 1,2-	2.3E+01	1.3E+02					1.4E+01	2.6E+02				
DICHLOROBENZENE, 1,3-	2.2E+01	7.9E+01					7.1E+01	6.3E+02				
DICHLOROBENZENE, 1,4-	9.4E+00	5.7E+01					1.5E+01	1.8E+02				
DICHLOROBENZIDINE, 3,3-	4.5E+00	4.1E+01							4.5E+00	USEPA Reg IV (FW)	4.1E+01	USEPA Reg IV (FW)
DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.1E-02	1.9E-01					1.1E-02	1.9E-01				
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	4.1E-01	7.0E+00							4.1E-01	USEPA Reg IV (FW)	7.0E+00	USEPA Reg IV (FW)
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	3.2E-03	1.1E+00					1.0E-03	1.3E-01				
DICHLOROETHANE, 1,1-	4.1E+02	3.7E+03					4.7E+01	8.3E+02				
DICHLOROETHANE, 1,2-	2.0E+03	8.2E+03					9.1E+02	8.8E+03				
DICHLOROETHYLENE, 1,1-	1.3E+02	1.2E+03					2.5E+01	4.5E+02				
DICHLOROETHYLENE, Cis 1,2-	6.2E+02	5.5E+03							6.2E+02	USEPA Reg IV (FW)	5.5E+03	USEPA Reg IV (FW)
DICHLOROETHYLENE, Trans 1,2-	5.6E+02	1.0E+04							5.6E+02	USEPA Reg IV (FW)	1.0E+04	USEPA Reg IV (FW)
DICHLOROPHENOL, 2,4-	1.1E+01	1.1E+02					7.9E+02				7.9E+02	USEPA Reg IV (SW chronic)
DICHLOROPHENOXYACETIC ACID (2,4-D)	7.9E+01	1.3E+02					7.0E+01				1.3E+02	USEPA Reg IV (FW)
DICHLOROPROPANE, 1,2-	5.2E+02	3.3E+03						3.4E+03	5.2E+02	USEPA Reg IV (FW)		
DICHLOROPROPENE, 1,3-	1.7E+00	1.5E+01					6.0E-02	9.9E-01				

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

	Freshwater						Marine					
CONTAMINANT	**USEPA Reg IV Chronic**	**USEPA Reg IV Acute**	**Other Chronic**	**Basis**	**Other Acute**	**Basis**	**USEPA Reg IV Chronic**	**USEPA Reg IV Acute**	**Other Chronic**	**Basis**	**Other Acute**	**Basis**
DIELDRIN	5.6E-02	2.4E-01					1.9E-03	7.1E-01				
DIETHYLPHTHALATE	2.2E+02	9.8E+02					2.1E+02	1.8E+03				
DIMETHYLPHENOL, 2,4-	1.2E+02	1.1E+03							1.2E+02	USEPA Reg IV (FW)	1.1E+03	USEPA Reg IV (FW)
DIMETHYLPHTHALATE	1.1E+03	3.2E+03					2.9E+03				3.2E+03	USEPA Reg IV (FW)
DINITROBENZENE, 1,3-	2.2E+01	1.0E+02					1.0E+01	1.1E+02				USEPA Reg IV (FW)
DINITROPHENOL, 2,4-	7.1E+01	3.8E+02					1.4E+01				3.8E+02	
DINITROTOLUENE, 2,4- (2,4-DNT)	4.4E+01	3.9E+02					9.1E+00	2.0E+02				
DINITROTOLUENE, 2,6- (2,6-DNT)	8.1E+01	7.3E+02						2.0E+02	8.1E+01	USEPA Reg IV (FW)		
DIOXANE, 1,4-			3.4E+05	Mohr (5% Acute FW LC 50)	3.4E+06	Mohr (50% FW LC50)			5.0E+05	Mohr (5% Acute SW LC 50)	5.0E+06	Mohr (50% SW LC50)
DIOXINS (TEQ)	3.1E-09	3.0E-03							3.1E-09	USEPA Reg IV (FW)	3.0E-03	USEPA Reg IV (FW)
DIURON			6.0E+01	USEPA AQUIRE (50% FW EC50)	2.0E+02	USEPA AQUIRE (50% FW LC50)			6.0E+01	USEPA AQUIRE (50% FW EC50)	5.5E+02	USEPA AQUIRE (50% SW LC50)
ENDOSULFAN	1.0E-02	1.1E-01					8.7E-03	3.4E-02				
ENDRIN	3.6E-02	8.6E-02					2.3E-03	3.7E-02				
ETHANOL												
ETHYLBENZENE	6.1E+01	5.5E+02					7.3E+00	1.3E+02				
FLUORANTHENE	8.0E-01				3.0E+02	CCME 2002	7.1E+00				3.0E+02	CCME 2002
FLUORENE	1.9E+01				3.0E+02	CCME 2002	3.9E+00				3.0E+02	CCME 2002
GLYPHOSATE			1.8E+03	USEPA Off Pesticides	2.2E+04	USEPA Off Pesticides			1.8E+03	USEPA Off Pesticides (FW)	2.2E+04	USEPA Off Pesticides (FW)
HEPTACHLOR	3.8E-03	5.2E-01					3.6E-03	5.3E-02				
HEPTACHLOR EPOXIDE	3.8E-03	5.2E-01					3.6E-03	5.3E-02				
HEXACHLOROBENZENE	3.0E-04				3.0E-04	USEPA Reg IV (FW chronic)			3.0E-04	USEPA Reg IV (FW)	3.0E-04	USEPA Reg IV (FW chronic)
HEXACHLOROBUTADIENE	1.0E+00	1.0E+01					3.0E-01	3.0E+00				
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	1.1E-01	9.5E-01					6.3E-02	1.6E-01				
HEXACHLOROETHANE	1.2E+01	2.1E+02					1.2E+01	2.1E+02				
HEXAZINONE			1.7E+04	USEPA Off Pesticides	1.4E+05	USEPA Off Pesticides			1.7E+04	USEPA Off Pesticides (FW)	1.4E+05	USEPA Off Pesticides (FW)
INDENO(1,2,3-cd)PYRENE	2.8E-01				3.0E+02	CCME 2002	2.8E-01				3.0E+02	CCME 2002
ISOPHORONE	9.2E+02	7.5E+03							9.2E+02	USEPA Reg IV (FW)	7.5E+03	USEPA Reg IV (FW)
LEAD	2.5E+00	6.5E+01					8.1E+00	2.1E+02				
MERCURY	7.7E-01	1.4E+00					9.4E-01	1.8E+00				
METHOXYCHLOR	3.0E-02	7.0E-01					1.9E-02				7.0E-01	USEPA Reg IV (FW)
METHYL ETHYL KETONE	2.2E+04	2.0E+05					1.4E+04	2.4E+05				
METHYL ISOBUTYL KETONE	1.7E+02	2.2E+03					1.7E+02	2.2E+03				
METHYL MERCURY	2.8E-03	9.9E-02					2.8E-03	9.9E-02				
METHYL TERT BUTYL ETHER	7.3E+02	6.5E+03					1.8E+04	5.3E+04				
METHYLENE CHLORIDE	1.5E+03	8.5E+03					2.2E+03	2.6E+04				
METHYLNAPHTHALENE, 1-	2.1E+00	3.7E+01					2.1E+00	3.7E+01				
METHYLNAPHTHALENE, 2-	4.7E+00	4.2E+01					7.2E+01	8.6E+01				
MOLYBDENUM	8.0E+02	7.2E+03					3.7E+02	1.6E+04				
NAPHTHALENE	2.1E+01	1.7E+02					1.2E+01	1.9E+02				
NICKEL	5.2E+01	4.7E+02					8.2E+00	7.4E+01				
NITROBENZENE	3.8E+02	2.0E+03						2.0E+03	3.8E+02	USEPA Reg IV (FW)		
NITROGLYCERIN	1.8E+01	1.6E+02							1.8E+01	USEPA Reg IV (FW)	1.6E+02	USEPA Reg IV (FW)
NITROTOLUENE, 2-	7.1E+01	6.4E+02							7.1E+01	USEPA Reg IV (FW)	6.4E+02	USEPA Reg IV (FW)
NITROTOLUENE, 3-	4.2E+01	3.8E+02							4.2E+01	USEPA Reg IV (FW)	3.8E+02	USEPA Reg IV (FW)
NITROTOLUENE, 4-	4.6E+01	4.1E+02							4.6E+01	USEPA Reg IV (FW)	4.1E+02	USEPA Reg IV (FW)
PENTACHLOROPHENOL	1.5E+01	1.9E+01					7.9E+00	1.3E+01				
PENTAERYTHRITOLTETRANITRATE (PETN)			8.5E+05	Pascoe et al. (chronic FW)	8.5E+05	Pascoe et al. (chronic FW)			8.5E+05	Pascoe et al. (chronic FW)	8.5E+05	Pascoe et al. (chronic FW)
PERCHLORATE			6.0E+02	USEPA 2002	5.0E+03	USEPA 2002			6.0E+02	USEPA 2002	5.0E+03	USEPA 2002
PHENANTHRENE	2.3E+00				3.0E+02	CCME 2002	4.6E+00				3.0E+02	CCME 2002
PHENOL	1.6E+02	4.7E+03					5.8E+01	3.0E+02				
POLYCHLORINATED BIPHENYLS (PCBs)	7.4E-05	1.4E-02							7.4E-05	USEPA Reg IV (FW)	1.4E-02	USEPA Reg IV (FW)
PROPICONAZOLE			9.5E+01	USEPA Off Pesticides	4.3E+02	USEPA Off Pesticides			9.5E+01	USEPA Off Pesticides (FW)	4.3E+02	USEPA Off Pesticides (FW)
PYRENE	4.6E+00				3.0E+02	CCME 2002	1.0E+01				3.0E+02	CCME 2002
SELENIUM	5.0E+00	2.0E+01					7.1E+01	2.9E+02				
SILVER	6.0E-02	3.2E+00					1.0E-01	1.9E+00				
SIMAZINE	9.0E+00	8.0E+01							9.0E+00	USEPA Reg IV (FW)	8.0E+01	USEPA Reg IV (FW)
STYRENE	3.2E+01	2.9E+02							3.2E+01	USEPA Reg IV (FW)	2.9E+02	USEPA Reg IV (FW)
TERBACIL			1.2E+03	USEPA Off Pesticides	2.3E+04	USEPA Off Pesticides						
tert-BUTYL ALCOHOL			1.8E+04	USEPA AQUIRE (10% FW LC0)	1.8E+05	USEPA AQUIRE (FW LC0)			1.8E+04	USEPA AQUIRE (10% FW LC0)	1.8E+05	USEPA AQUIRE (FW LC0)
TETRACHLOROETHANE, 1,1,1,2-	8.5E+01	7.7E+02					1.1E+01				7.7E+02	USEPA Reg IV (FW)
TETRACHLOROETHANE, 1,1,2,2-	2.0E+02	9.1E+02					6.1E+02	2.1E+03				
TETRACHLOROETHYLENE	5.3E+01	4.3E+02					9.8E+01	8.3E+02				
TETRACHLOROPHENOL, 2,3,4,6-	1.2E+00	1.1E+01							1.2E+00	USEPA Reg IV (FW)	1.1E+01	USEPA Reg IV (FW)
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	2.2E+02	1.2E+03					3.3E+02	1.9E+03				
THALLIUM	6.0E+00	5.4E+01					1.2E+01	1.1E+02				
TOLUENE	6.2E+01	5.6E+02					9.8E+00	1.2E+02				

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

	Freshwater						Marine					
CONTAMINANT	**USEPA Reg IV Chronic**	**USEPA Reg IV Acute**	**Other Chronic**	**Basis**	**Other Acute**	**Basis**	**USEPA Reg IV Chronic**	**USEPA Reg IV Acute**	**Other Chronic**	**Basis**	**Other Acute**	**Basis**
TOXAPHENE	2.0E-04	7.3E-01					2.0E-04	2.1E-01				
TPH (gasolines)			5.0E+02	CalEPA FW Chronic	5.0E+03	Ceiling Level			3.7E+03	CalEPA Chronic (SW)	5.0E+03	Ceiling Level
TPH (middle distillates)			6.4E+02	CalEPA FW Chronic	2.5E+03	Ceiling Level			6.4E+02	CalEPA Chronic (FW)	2.5E+03	Ceiling Level
TPH (residual fuels)			6.4E+02	CaEPA FW Chronic	2.5E+03	Ceiling Level			6.4E+02	CalEPA Chronic (FW)	2.5E+03	Ceiling Level
TRICHLOROBENZENE, 1,2,4-	1.3E+02	4.2E+02					1.1E+02	7.0E+02				
TRICHLOROETHANE, 1,1,1-	7.6E+01	6.9E+02					1.1E+01	2.0E+02				
TRICHLOROETHANE, 1,1,2-	7.3E+02	3.2E+03					1.2E+03	5.2E+03				
TRICHLOROETHYLENE	2.0E+02	2.0E+03					4.7E+01	4.4E+02				
TRICHLOROPHENOL, 2,4,5-	1.9E+00	1.7E+01					1.2E+01	2.6E+02				
TRICHLOROPHENOL, 2,4,6-	4.9E+00	3.9E+01					6.5E+00				3.9E+01	USEPA Reg IV (FW)
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	6.9E+02	USEPA Reg. V FW Chronic
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	3.0E+01	2.7E+02					5.0E+01				2.7E+02	USEPA Reg IV (FW)
TRICHLOROPROPANE, 1,2,3-			1.4E+01	USEPA AQUIRE (50% FW EC50)	1.4E+02	USEPA AQUIRE (5xFW EC50)			1.4E+01	USEPA AQUIRE (50% FW EC50)	1.4E+02	USEPA AQUIRE (5xFW EC50)
TRICHLOROPROPENE, 1,2,3-												
TRIFLURALIN	1.1E+00	2.1E+01							1.1E+00	USEPA Reg IV (FW)	2.1E+01	USEPA Reg IV (FW)
TRINITROBENZENE, 1,3,5-	1.1E+01	2.7E+01					1.0E+01	3.0E+01				
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)												
TRINITROTOLUENE, 2,4,6- (TNT)	1.3E+01	2.1E+02					9.0E+01	5.7E+02				
VANADIUM	2.7E+01	1.2E+02					8.1E+01	9.0E+01				
VINYL CHLORIDE	9.3E+02	8.4E+03							9.3E+02	USEPA Reg. IV SW Chronic	8.4E+03	USEPA Reg IV SW Acute
XYLENES	2.7E+01	2.4E+02					1.3E+01	2.3E+02	1.0E+02	5% Acute SW LC 50	1.0E+03	50% SW LC50
ZINC	1.2E+02	1.2E+02					8.1E+01	9.0E+01				

References:

Primary sources USEPA Region IV (2015) and USEPA Office of Pesticides Aquatic Life Benchmarks database (USEPA 2016b; accessed July 2016). See also USDOE (1997), MOEE (1996), USEPA (2002), USEPA Reg 5 (2003), Pascoe et al. (2010). USEPA AQUIRE ecotox database refered to for pesticides that lacked published, aquatic toxicity screening levels (USEPA 2008b).

Notes:

Used for development of groundwater and soil action levels.
See text for prioritization and selection of surface water quality action levels.
Red: Screening level based on bioaccumulation.
1,4 Dioxane: LC 50 values for presented in "Solvent Stabilizers White Paper" (Mohr 2001).
Perchlorate: Chronic and acute goals from "Perchlorate Environmental Contamination" (USEPA 2002).
tert Buytl Alcohol (TBA): Chronic aquatic goal based on in-house review of USEPA ECOTOX database for TBA (USEPA 2008b). Ten percent of LC0 concentration for Lepomis macrochirus (Bluegill) selected as most conservative goal of data presented.
AWQC: Aquatic Water Quality Criteria
EC50: 50% Effects Concentration
LC0: 0% Lethal Concentration
LC50: 50% Lethal Concentration
FW: Freshwater
SW: Saltwater
TPH Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.
USDOE: US Dept of Energy (Oak Ridge National Laboratories)
USDOE: US Dept of Energy (Oak Ridge National Laboratories)
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				
BENOMYL				
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-CHLORO-1-METHYLETHYL)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				

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
COPPER				
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				

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	9.0E-05	HI DOH Fish Consumption	9.0E-05	7.9E-05
HEPTACHLOR EPOXIDE	3.9E-05	USEPA Aquatic Organism Consumption		3.9E-05
HEXACHLOROBENZENE	2.4E-04	HI DOH Fish Consumption	2.4E-04	2.9E-04
HEXACHLOROBUTADIENE	1.6E+01	HI DOH Fish Consumption	1.6E+01	1.8E+01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	2.0E-02	HI DOH Fish Consumption	2.0E-02	6.3E-02
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-				

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
TETRACHLOROETHANE, 1,1,2,2-	3.5E+00	HI DOH Fish Consumption	3.5E+00	4.0E+00
TETRACHLOROETHYLENE	2.9E+00	HI DOH Fish Consumption	2.90E+00	3.3E+00
TETRACHLOROPHENOL, 2,3,4,6-				
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)				
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	-
BENOMYL	
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-CHLORO-1-METHYLETHYL)ETHER	-
BIS(2-ETHYLHEXYL)PHTHALATE	-
BORON	7.0E+02
BROMODICHLOROMETHANE	-
BROMOFORM	-
BROMOMETHANE	-
CADMIUM	1.0E+01
CARBON TETRACHLORIDE	-
CHLORDANE (TECHNICAL)	-
CHLOROANILINE, p-	-
CHLOROBENZENE	-
CHLOROETHANE	-
CHLOROFORM	-
CHLOROMETHANE	-
CHLOROPHENOL, 2-	-
CHROMIUM (Total)	-
CHROMIUM III	-
CHROMIUM VI	1.0E+02
CHRYSENE	-
COBALT	5.0E+01
COPPER	2.0E+02
CYANIDE (Free)	-
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	-
DALAPON	-
DIBENZO(a,h)ANTHTRACENE	-
DIBROMO,1,2- CHLOROPROPANE,3-	-
DIBROMOCHLOROMETHANE	-
DIBROMOETHANE, 1,2-	-
DICHLOROBENZENE, 1,2-	-
DICHLOROBENZENE, 1,3-	-
DICHLOROBENZENE, 1,4-	-
DICHLOROBENZIDINE, 3,3-	-

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

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

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

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

References:

A Compiliation of Water Quality Goals (RWQCBCV 2007).

Notes:

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

TABLE E. SOIL ACTION LEVELS FOR LEACHING CONCERNS

					Target Groundwater Concentrations				Soil Leaching Action Levels			
					Drinking Water IS Threatened		Drinking Water NOT Threatened		Drinking Water IS Threatened		Drinking Water NOT Threatened	
CONTAMINANT	Organic Carbon Coefficient (Koc) (cm^3/g)	Henry's Law Constant (H) ($atm\text{-}m^3/mol$)	Dilution/ Atenuation Factor (DAF)	Saturation Limit (mg/kg)	Target Groundwater Concentration (Surface Water Within 150m; Table D-1a) (ug/L)	Target Groundwater Concentration (Surface Water NOT Within 150m; Table D-1b) (ug/L)	Target Groundwater Concentration (Surface Water Within 150m; Table D-1c) (ug/L)	Target Groundwater Concentration (Surface Water NOT Within 150m; Table D-1d) (ug/L)	Soil Leaching Action Level (Surface Water Within 150m) (mg/kg)	Soil Leaching Action Level (Surface Water NOT Within 150m) (mg/kg)	Soil Leaching Action Level (Surface Water Within 150m) (mg/kg)	Soil Leaching Action Level (Surface Water NOT Within 150m) (mg/kg)
#ACENAPHTHENE	5.03E+03	1.80E-04	8.36E+02	1.2E+02	1.5E+01	2.0E+01	1.5E+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	1.3E+01	2.4E+02	1.3E+01	3.0E+02	5.5E+00	1.0E+02	5.5E+00	1.3E+02
ACETONE	2.40E+00	3.50E-05	6.16E-01	1.1E+05	1.5E+03	1.4E+04	1.5E+03	1.5E+04	9.2E-01	8.7E+00	9.2E-01	9.2E+00
#ALDRIN	8.20E+04	4.40E-05	1.36E+04	8.4E+00	1.4E-04	5.1E-03	1.4E-04	1.3E+00	8.4E+00	8.4E+00	8.4E+00	1.8E+01
AMETRYN	4.28E+02	2.40E-09	7.11E+01	5.6E+02	1.8E+02	1.8E+02	7.0E+02	1.8E+03	1.3E+01	1.3E+01	5.0E+01	1.3E+02
AMINO,2- DINITROTOLUENE,4,6-	2.83E+02	3.30E-11	4.70E+01	2.2E+03	1.8E+01	4.0E+01	1.8E+01	1.6E+02	8.5E-01	1.9E+00	8.5E-01	7.5E+00
AMINO,4- DINITROTOLUENE,2,6-	2.83E+02	3.30E-11	4.70E+01	2.2E+03	1.1E+01	4.0E+01	1.1E+01	9.8E+01	5.2E-01	1.9E+00	5.2E-01	4.6E+00
#ANTHRACENE	1.64E+04	5.60E-05	2.72E+03	4.2E+00	2.0E-02	1.8E-01	2.0E-02	1.8E-01	4.2E+00	4.2E+00	4.2E+00	4.2E+00
ANTIMONY					6.0E+00	6.0E+00	3.0E+01	1.8E+02	(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	2.40E-09	3.73E+01	5.1E+01	3.0E+00	3.0E+00	1.2E+01	3.3E+02	1.1E-01	1.1E-01	4.5E-01	1.2E+01
BARIUM					2.2E+02	2.0E+03	2.2E+02	2.0E+03	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
BENOMYL	3.36E+02	4.93E-12	5.58E+01	8.0E+00	1.4E-01	2.8E+00	1.4E-01	2.8E+00	7.8E-03	1.6E-01	7.8E-03	1.6E-01
BENZENE	1.50E+02	5.60E-03	5.97E+01	1.9E+03	5.0E+00	5.0E+00	7.1E+01	1.7E+03	3.0E-01	3.0E-01	4.3E+00	1.0E+02
#BENZO(a)ANTHRACENE	1.77E+05	1.20E-05	2.94E+04	1.0E+01	1.1E-02	1.1E-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	4.60E-07	9.75E+04	5.6E+00	6.0E-02	2.0E-01	6.0E-02	8.0E-01	5.9E+00	2.0E+01	5.9E+00	7.8E+01
#BENZO(b)FLUORANTHENE	5.99E+05	6.60E-07	9.95E+04	5.4E+00	2.9E-02	2.9E-02	6.8E-01	7.5E-01	5.4E+00	5.4E+00	6.8E+01	7.5E+01
#BENZO(g,h,i)PERYLENE	1.60E+06	1.44E-07	2.66E+05	2.5E+00	1.3E-01	1.3E-01	1.3E-01	1.3E-01	3.5E+01	3.5E+01	3.5E+01	3.5E+01
#BENZO(k)FLUORANTHENE	5.87E+05	5.80E-07	9.75E+04	2.8E+00	2.9E-01	2.9E-01	4.0E-01	4.0E-01	2.9E+01	2.9E+01	3.9E+01	3.9E+01
BERYLLIUM					6.6E-01	4.0E+00	6.6E-01	3.5E+01	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
#BIPHENYL, 1,1-	5.13E+03	3.10E-04	8.53E+02	2.3E+02	5.0E-01	5.0E-01	5.0E+00	5.0E+00	2.3E+02	2.3E+02	2.3E+02	2.3E+02
BIS(2-CHLOROETHYL)ETHER	3.22E+01	1.70E-05	5.45E+00	5.0E+03	1.4E-02	1.4E-02	1.8E+02	1.8E+02	7.5E-05	7.5E-05	9.6E-01	9.6E-01
BIS(2-CHLORO-1-METHYLETHYL)ETHER	6.10E+01	1.13E-04	1.08E+01	7.9E+02	3.7E-01	3.7E-01	3.7E-01	3.7E-01	4.0E-03	4.0E-03	4.0E-03	4.0E-03
BIS(2-ETHYLHEXYL)PHTHALATE	1.20E+05	2.70E-07	1.99E+04	1.9E+02	3.0E+00	6.0E+00	3.0E+00	2.7E+01	1.9E+02	1.9E+02	1.9E+02	5.4E+02
BORON					1.0E+03	4.0E+03	1.0E+03	3.4E+04	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
BROMODICHLOROMETHANE	3.18E+01	2.10E-03	1.83E+01	9.3E+02	1.4E-01	1.4E-01	1.1E+02	1.1E+02	2.5E-03	2.5E-03	2.1E+00	2.1E+00
BROMOFORM	3.18E+01	5.40E-04	8.63E+00	9.1E+02	8.0E+01	8.0E+01	2.3E+02	1.1E+03	6.9E-01	6.9E-01	2.0E+00	9.5E+00
BROMOMETHANE	1.32E+01	7.30E-03	4.75E+01	3.6E+03	7.6E+00	7.6E+00	1.6E+01	3.8E+01	3.6E-01	3.6E-01	7.6E-01	1.8E+00
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	2.80E-02	1.81E+02	4.5E+02	5.0E+00	5.0E+00	9.8E+00	1.1E+02	9.1E-01	9.1E-01	1.8E+00	2.0E+01
#CHLORDANE (TECHNICAL)	6.75E+04	4.90E-05	1.12E+04	2.3E+01	4.0E-03	9.0E-02	4.0E-03	9.0E-02	2.3E+01	2.3E+01	2.3E+01	2.3E+01
CHLOROANILINE, p-	1.13E+02	1.20E-06	1.87E+01	3.0E+03	3.9E-01	3.9E-01	1.9E+01	4.6E+02	7.3E-03	7.3E-03	3.6E-01	8.6E+00
CHLOROBENZENE	2.34E+02	3.10E-03	5.81E+01	7.6E+02	2.5E+01	5.0E+01	2.5E+01	2.2E+02	1.5E+00	2.9E+00	1.5E+00	1.3E+01
CHLOROETHANE	2.17E+01	1.10E-02	7.19E+01	2.1E+03	1.6E+01	1.6E+01	1.6E+02	1.6E+02	1.2E+00	1.2E+00	1.2E+01	1.2E+01
CHLOROFORM	3.18E+01	3.70E-03	2.82E+01	2.5E+03	2.8E+01	7.0E+01	2.8E+01	1.1E+02	7.9E-01	2.0E+00	7.9E-01	3.1E+00
CHLOROMETHANE	1.32E+01	8.80E-03	5.68E+01	1.3E+03	1.9E+02	1.9E+02	1.9E+02	1.9E+02	1.1E+01	1.1E+01	1.1E+01	1.1E+01
CHLOROPHENOL, 2-	3.88E+02	1.10E-05	6.45E+01	2.7E+04	1.8E-01	1.8E-01	1.8E+00	1.8E+00	1.2E-02	1.2E-02	1.2E-01	1.2E-01
CHROMIUM (Total)					1.1E+01	1.6E+01	1.1E+01	1.6E+01	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
CHROMIUM III					2.0E+01	5.7E+02	2.0E+01	5.7E+02	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
CHROMIUM VI					4.3E+00	4.3E+00	1.1E+01	1.6E+01	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
#CHRYSENE	1.81E+05	5.20E-06	3.00E+04	2.2E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	3.0E+01	3.0E+01	3.0E+01	3.0E+01
COBALT					6.0E+00	6.0E+00	1.9E+01	1.2E+02	(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)		1.01E-04			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	2.00E-11	1.48E+01	3.8E+01	7.1E-01	7.1E-01	7.9E+01	5.2E+02	1.0E-02	1.0E-02	1.2E+00	7.7E+00
DALAPON	3.20E+00	5.70E-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	1.40E-07	3.17E+05	2.9E+01	2.9E-03	2.9E-03	8.0E-01	1.3E+00	2.9E+01	2.9E+01	2.5E+02	4.0E+02
DIBROMO,1,2- CHLOROPROPANE,3-	1.16E+02	1.50E-04	2.02E+01	9.8E+02	4.0E-02	4.0E-02	4.0E-02	4.0E-02	8.1E-04	8.1E-04	8.1E-04	8.1E-04
DIBROMOCHLOROMETHANE	3.18E+01	7.80E-04	1.01E+01	8.0E+02	2.1E-01	2.1E-01	3.4E+01	4.5E+02	2.1E-03	2.1E-03	3.4E-01	4.6E+00
DIBROMOETHANE, 1,2-	3.96E+01	6.50E-04	1.06E+01	1.3E+03	4.0E-02	4.0E-02	1.9E+01	1.9E+01	4.2E-04	4.2E-04	2.0E-01	2.0E-01
DICHLOROBENZENE, 1,2-	3.83E+02	1.90E-03	7.54E+01	3.8E+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	2.2E+01	3.7E+02	5.7E-01	5.7E-01	2.5E+00	4.2E+01
DICHLOROBENZENE, 1,4-	3.75E+02	2.40E-03	7.72E+01	1.9E+02	5.0E+00	5.0E+00	9.4E+00	1.1E+02	3.9E-01	3.9E-01	7.3E-01	8.5E+00
DICHLOROBENZIDINE, 3,3-	3.19E+03	2.80E-11	5.30E+02	6.0E+01	1.7E-01	1.7E-01	4.5E+00	4.1E+01	9.2E-02	9.2E-02	2.4E+00	2.2E+01
#DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.18E+05	6.60E-06	1.95E+04	6.3E+01	1.1E-02	1.9E-01	1.1E-02	1.9E-01	6.3E+01	6.3E+01	6.3E+01	6.3E+01
#DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.18E+05	4.20E-05	1.95E+04	2.8E+01	4.6E-02	4.6E-02	4.1E-01	7.0E+00	2.8E+01	2.8E+01	2.8E+01	1.4E+02
#DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.69E+05	8.30E-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	5.60E-03	4.00E+01	1.7E+03	2.8E+00	2.8E+00	4.7E+01	8.3E+02	1.1E-01	1.1E-01	1.9E+00	3.3E+01
DICHLOROETHANE, 1,2-	3.96E+01	1.20E-03	1.40E+01	3.0E+03	5.0E+00	5.0E+00	1.8E+02	1.8E+02	7.0E-02	7.0E-02	2.6E+00	2.6E+00
DICHLOROETHYLENE, 1,1-	3.18E+01	2.60E-02	1.67E+02	1.2E+03	7.0E+00	7.0E+00	2.5E+01	3.9E+03	1.2E+00	1.2E+00	4.2E+00	6.5E+02
DICHLOROETHYLENE, Cis 1,2-	3.96E+01	4.10E-03	3.20E+01	2.4E+03	7.0E+01	7.0E+01	6.2E+02	1.3E+03	2.2E+00	2.2E+00	2.0E+01	4.1E+01
DICHLOROETHYLENE, Trans 1,2-	3.96E+01	9.40E-03	6.49E+01	1.9E+03	1.0E+02	1.0E+02	5.6E+02	2.6E+03	6.5E+00	6.5E+00	3.6E+01	1.7E+02
DICHLOROPHENOL, 2,4-	1.47E+02	4.30E-06	2.44E+01	5.5E+03	3.0E-01	3.0E-01	3.0E+00	3.0E+00	7.3E-03	7.3E-03	7.3E-02	7.3E-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)
DICHLOROPHENOXYACETIC ACID (2,4-D)	2.96E+01	3.50E-08	4.92E+00	1.9E+02	7.0E+01	7.0E+01	7.0E+01	1.3E+02	3.4E-01	3.4E-01	3.4E-01	6.4E-01
DICHLOROPROPANE, 1,2-	6.07E+01	2.80E-03	2.75E+01	1.4E+03	5.0E+00	5.0E+00	1.0E+02	1.0E+02	1.4E-01	1.4E-01	2.7E+00	2.7E+00
DICHLOROPROPENE, 1,3-	7.22E+01	3.60E-03	3.43E+01	1.6E+03	6.0E-02	5.0E-01	6.0E-02	2.6E+02	2.1E-03	1.7E-02	2.1E-03	8.9E+00
#DIELDRIN	2.01E+04	1.00E-05	3.34E+03	2.4E+01	1.9E-03	1.1E-02	1.9E-03	7.1E-01	2.4E+01	2.4E+01	2.4E+01	2.4E+01
DIETHYLPHTHALATE	1.05E+02	6.10E-07	1.74E+01	7.9E+02	2.1E+02	9.8E+02	2.1E+02	9.8E+02	3.7E+00	1.7E+01	3.7E+00	1.7E+01
DIMETHYLPHENOL, 2,4-	4.92E+02	9.50E-07	8.16E+01	2.4E+04	1.2E+02	4.0E+02	1.2E+02	7.0E+02	9.8E+00	3.3E+01	9.8E+00	5.7E+01
DIMETHYLPHTHALATE	1.40E+02	1.05E-07	2.32E+01	4.7E+03	1.1E+03	3.2E+03	1.1E+03	3.2E+03	2.6E+01	7.4E+01	2.6E+01	7.4E+01
DINITROBENZENE, 1,3-	3.52E+02	4.90E-08	5.84E+01	1.2E+03	2.0E+00	2.0E+00	1.0E+01	1.0E+02	1.2E-01	1.2E-01	5.8E-01	5.8E+00
DINITROPHENOL, 2,4-	4.61E+02	8.60E-08	7.65E+01	8.0E+03	1.4E+01	4.0E+01	1.4E+01	3.8E+02	1.1E+00	3.1E+00	1.1E+00	2.9E+01
DINITROTOLUENE, 2,4- (2,4-DNT)	5.76E+02	5.40E-08	9.55E+01	7.1E+02	2.5E-01	2.5E-01	9.1E+00	1.1E+02	2.4E-02	2.4E-02	8.7E-01	1.1E+01
DINITROTOLUENE, 2,6- (2,6-DNT)	5.87E+02	7.50E-07	9.75E+01	6.6E+02	5.2E-02	5.2E-02	8.1E+01	1.1E+02	5.1E-03	5.1E-03	7.9E+00	1.1E+01
DIOXANE, 1,4-	2.60E+00	4.80E-06	4.61E-01	1.2E+05	4.6E-01	4.6E-01	5.0E+04	5.0E+04	2.1E-04	2.1E-04	2.3E+01	2.3E+01
#DIOXINS (TEQ)	2.49E+05	5.00E-05	4.14E+04	3.0E-01	3.1E-09	3.0E-05	3.1E-09	3.0E-03	3.0E-01	3.0E-01	3.0E-01	3.0E-01
DIURON	1.09E+02	5.00E-10	1.81E+01	3.2E+01	4.0E+01	4.0E+01	6.0E+01	2.0E+02	7.3E-01	7.3E-01	1.1E+00	3.6E+00
#ENDOSULFAN	6.76E+03	6.50E-05	1.12E+03	1.3E+01	8.7E-03	3.4E-02	8.7E-03	3.4E-02	1.3E+01	1.3E+01	1.3E+01	1.3E+01
#ENDRIN	2.01E+04	6.40E-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	7.90E-03	1.23E+02	4.8E+02	7.3E+00	3.0E+01	7.3E+00	1.4E+02	9.0E-01	3.7E+00	9.0E-01	1.7E+01
#FLUORANTHENE	5.55E+04	8.90E-06	9.20E+03	8.7E+01	8.0E-01	1.3E+01	8.0E-01	1.3E+01	8.7E+01	1.2E+02	8.7E+01	1.2E+02
#FLUORENE	9.16E+03	9.60E-05	1.52E+03	9.3E+01	3.9E+00	2.4E+02	3.9E+00	3.0E+02	9.3E+01	3.6E+02	9.3E+01	4.6E+02
GLYPHOSATE	2.10E+03	2.10E-12	3.49E+02	1.3E+05	7.0E+02	7.0E+02	1.8E+03	2.2E+04	2.4E+02	2.4E+02	6.3E+02	7.5E+03
#HEPTACHLOR	4.13E+04	2.90E-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	1.70E-03	1.04E+03	2.3E-01	3.0E-04	3.0E-04	3.0E-04	3.0E-04	2.3E-01	2.3E-01	2.3E-01	2.3E-01
HEXACHLOROBUTADIENE	8.45E+02	1.00E-02	2.02E+02	1.7E+01	2.0E-01	2.0E-01	3.0E-01	1.1E+01	4.1E-02	4.1E-02	6.1E-02	2.2E+00
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	2.81E+03	5.10E-06	4.66E+02	1.2E+02	6.3E-02	1.6E-01	6.3E-02	1.6E-01	2.9E-02	7.5E-02	2.9E-02	7.5E-02
HEXACHLOROETHANE	1.97E+02	3.90E-03	5.69E+01	6.6E+01	4.0E-01	4.0E-01	1.2E+01	1.0E+02	2.3E-02	2.3E-02	6.8E-01	5.7E+00
HEXAZINONE	1.29E+02	2.30E-12	2.15E+01	2.9E+04	6.6E+02	6.6E+02	1.7E+04	5.0E+04	1.4E+01	1.4E+01	3.7E+02	1.1E+03
#INDENO(1,2,3-cd)PYRENE	1.95E+06	3.50E-07	3.24E+05	2.2E+00	2.9E-02	2.9E-02	9.5E-02	9.5E-02	9.6E+00	9.6E+00	3.1E+01	3.1E+01
ISOPHORONE	6.50E+01	6.60E-06	1.08E+01	5.9E+03	8.2E+01	8.2E+01	9.2E+02	4.3E+03	8.9E-01	8.9E-01	1.0E+01	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	2.00E-07	4.46E+03	1.6E+01	3.0E-02	7.0E-01	3.0E-02	7.0E-01	1.6E+01	1.6E+01	1.6E+01	1.6E+01
METHYL ETHYL KETONE	4.51E+00	5.70E-05	1.10E+00	2.8E+04	5.6E+03	5.6E+03	1.4E+04	5.0E+04	6.2E+00	6.2E+00	1.5E+01	5.5E+01
METHYL ISOBUTYL KETONE	1.26E+01	1.40E-04	2.96E+00	3.4E+03	1.7E+02	1.3E+03	1.7E+02	2.2E+03	5.0E-01	3.8E+00	5.0E-01	6.5E+00
METHYL MERCURY					2.8E-03	9.9E-02	2.8E-03	9.9E-02	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
METHYL TERT BUTYL ETHER	1.16E+01	5.90E-04	5.58E+00	8.9E+03	5.0E+00	5.0E+00	7.3E+02	1.8E+03	2.8E-02	2.8E-02	4.1E+00	1.0E+01
METHYLENE CHLORIDE	2.17E+01	3.30E-03	2.41E+01	3.3E+03	5.0E+00	5.0E+00	1.5E+03	8.5E+03	1.2E-01	1.2E-01	3.6E+01	2.0E+02
METHYLNAPHTHALENE, 1-	2.53E+03	5.10E-04	4.23E+02	3.9E+02	2.1E+00	6.0E+00	2.1E+00	3.7E+01	8.9E-01	2.5E+00	8.9E-01	1.6E+01
METHYLNAPHTHALENE, 2-	2.48E+03	5.20E-04	4.15E+02	3.7E+02	4.7E+00	1.0E+01	4.7E+00	4.2E+01	1.9E+00	4.1E+00	1.9E+00	1.7E+01
MOLYBDENUM					1.0E+02	1.0E+02	3.7E+02	7.2E+03	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
NAPHTHALENE	1.54E+03	4.40E-04	2.59E+02	2.9E+02	1.2E+01	1.7E+01	1.2E+01	2.1E+02	3.1E+00	4.4E+00	3.1E+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	2.40E-05	3.77E+01	3.0E+03	1.4E-01	1.4E-01	3.8E+02	2.0E+03	5.3E-03	5.3E-03	1.4E+01	7.5E+01
NITROGLYCERIN	1.16E+02	8.70E-08	1.92E+01	1.1E+03	2.0E+00	2.0E+00	1.8E+01	1.6E+02	3.9E-02	3.9E-02	3.5E-01	3.1E+00
NITROTOLUENE, 2-	3.71E+02	1.30E-05	6.16E+01	1.5E+03	7.9E-02	7.9E-02	7.1E+01	6.4E+02	4.9E-03	4.9E-03	4.4E+00	3.9E+01
NITROTOLUENE, 3-	3.63E+02	9.30E-06	6.03E+01	1.1E+03	2.0E+00	2.0E+00	4.2E+01	3.8E+02	1.2E-01	1.2E-01	2.5E+00	2.3E+01
NITROTOLUENE, 4-	3.63E+02	5.60E-06	6.03E+01	1.0E+03	4.9E+00	4.9E+00	4.6E+01	4.1E+02	2.9E-01	2.9E-01	2.8E+00	2.5E+01
PENTACHLOROPHENOL	5.92E+02	2.50E-08	9.83E+01	5.1E+01	1.0E+00	1.0E+00	7.9E+00	1.3E+01	9.8E-02	9.8E-02	7.8E-01	1.3E+00
PENTAERYTHRITOLTETRANITRATE (PETN)	6.48E+02	1.30E-09	1.08E+02	1.7E+02	1.9E+01	1.9E+01	2.2E+04	2.2E+04	2.1E+00	2.1E+00	2.3E+03	2.3E+03
PERCHLORATE					1.5E+01	1.5E+01	6.0E+02	5.0E+03	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	2.3E+00	2.4E+02	2.3E+00	3.0E+02	6.9E+01	5.5E+02	6.9E+01	7.0E+02
PHENOL	1.87E+02	3.30E-07	3.11E+01	1.0E+05	5.8E+01	3.0E+02	5.8E+01	3.0E+02	1.8E+00	9.3E+00	1.8E+00	9.3E+00
#POLYCHLORINATED BIPHENYLS (PCBs)	1.31E+05	2.83E-04	2.17E+04	3.4E+01	1.4E-02	5.0E-01	1.4E-02	2.0E+00	3.4E+01	3.4E+01	3.4E+01	4.3E+01
PROPICONAZOLE	1.56E+03	1.70E-09	2.58E+02	1.0E+03	9.5E+01	2.6E+02	9.5E+01	4.3E+02	2.5E+01	6.7E+01	2.5E+01	1.1E+02
#PYRENE	5.43E+04	1.20E-05	9.02E+03	4.4E+01	4.6E+00	6.8E+01	4.6E+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-01	1.0E+00	1.0E-01	1.0E+00	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
SIMAZINE	1.47E+02	9.40E-10	2.43E+01	6.1E+00	4.0E+00	4.0E+00	9.0E+00	8.0E+01	9.7E-02	9.7E-02	2.2E-01	1.9E+00
STYRENE	4.46E+02	2.80E-03	9.14E+01	8.7E+02	1.0E+01	1.0E+01	3.2E+01	1.1E+02	9.1E-01	9.1E-01	2.9E+00	1.0E+01
TERBACIL	5.01E+01	1.20E-10	8.32E+00	2.8E+02	2.6E+02	2.6E+02	2.6E+02	2.6E+02	2.2E+00	2.2E+00	2.2E+00	2.2E+00
tert-BUTYL ALCOHOL	3.70E+01	1.17E-05	6.21E+00	3.2E+05	5.8E+00	5.8E+00	1.8E+04	5.0E+04	3.6E-02	3.6E-02	1.1E+02	3.1E+02
TETRACHLOROETHANE, 1,1,1,2-	8.60E+01	2.50E-03	2.98E+01	6.8E+02	6.1E-01	6.1E-01	1.1E+01	7.7E+02	1.8E-02	1.8E-02	3.2E-01	2.3E+01

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)
TETRACHLOROETHANE, 1,1,2,2-	9.49E+01	3.70E-04	1.81E+01	1.9E+03	7.8E-02	7.8E-02	2.0E+02	2.4E+02	1.4E-03	1.4E-03	3.6E+00	4.3E+00
TETRACHLOROETHYLENE	9.49E+01	1.80E-02	1.27E+02	1.7E+02	5.0E+00	5.0E+00	5.3E+01	1.9E+02	6.4E-01	6.4E-01	6.8E+00	2.5E+01
TETRACHLOROPHENOL, 2,3,4,6-	2.80E+02	8.80E-06	4.65E+01	4.1E+01	1.2E+00	1.1E+01	1.2E+00	1.1E+01	5.6E-02	5.1E-01	5.6E-02	5.1E-01
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	5.32E+02	8.70E-10	8.82E+01	1.6E+01	2.2E+02	1.0E+03	2.2E+02	1.2E+03	1.9E+01	8.8E+01	1.9E+01	1.1E+02
THALLIUM					2.0E+00	2.0E+00	6.0E+00	4.7E+02	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
TOLUENE	2.34E+02	6.60E-03	7.98E+01	8.2E+02	9.8E+00	4.0E+01	9.8E+00	4.0E+02	7.8E-01	3.2E+00	7.8E-01	3.2E+01
#TOXAPHENE	7.72E+04	6.00E-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	7.86E-01	5.71E+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	5.65E-01	4.34E+03	5.0E+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	1.40E-03	2.34E+02	4.0E+02	7.0E+01	7.0E+01	1.1E+02	4.2E+02	1.6E+01	1.6E+01	2.6E+01	9.8E+01
TRICHLOROETHANE, 1,1,1-	4.39E+01	1.70E-02	1.13E+02	6.4E+02	1.1E+01	2.0E+02	1.1E+01	6.0E+03	1.2E+00	2.3E+01	1.2E+00	6.8E+02
TRICHLOROETHANE, 1,1,2-	6.07E+01	8.20E-04	1.52E+01	2.2E+03	5.0E+00	5.0E+00	1.1E+02	1.1E+02	7.6E-02	7.6E-02	1.6E+00	1.6E+00
TRICHLOROETHYLENE	6.07E+01	9.90E-03	7.15E+01	6.9E+02	5.0E+00	5.0E+00	4.7E+01	2.1E+02	3.6E-01	3.6E-01	3.4E+00	1.5E+01
TRICHLOROPHENOL, 2,4,5-	1.60E+03	1.60E-06	2.65E+02	1.2E+04	1.9E+00	1.7E+01	1.9E+00	1.7E+01	5.0E-01	4.5E+00	5.0E-01	4.5E+00
TRICHLOROPHENOL, 2,4,6-	3.81E+02	2.60E-06	6.33E+01	1.9E+03	4.9E+00	7.1E+00	4.9E+00	3.9E+01	3.1E-01	4.5E-01	3.1E-01	2.5E+00
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	1.07E+02	8.70E-09	1.78E+01	2.1E+02	2.0E+02	2.0E+02	6.9E+02	6.9E+02	3.6E+00	3.6E+00	1.2E+01	1.2E+01
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	1.75E+02	9.10E-09	2.91E+01	8.2E+01	3.0E+01	5.0E+01	3.0E+01	2.7E+02	8.7E-01	1.5E+00	8.7E-01	7.9E+00
TRICHLOROPROPANE, 1,2,3-	1.16E+02	3.40E-04	2.13E+01	1.4E+03	6.0E-01	6.0E-01	1.4E+01	1.4E+02	1.3E-02	1.3E-02	3.0E-01	3.0E+00
TRICHLOROPROPENE, 1,2,3-	1.16E+02	1.80E-02	1.31E+02	3.1E+02	6.2E-01	6.2E-01	6.2E-01	6.2E-01	8.1E-02	8.1E-02	8.1E-02	8.1E-02
#TRIFLURALIN	1.64E+04	1.00E-04	2.72E+03	1.8E+01	1.1E+00	1.0E+01	1.1E+00	2.1E+01	1.8E+01	2.8E+01	1.8E+01	5.6E+01
TRINITROBENZENE, 1,3,5-	1.68E+03	6.50E-09	2.79E+02	2.8E+03	1.0E+01	2.7E+01	1.0E+01	2.7E+01	2.8E+00	7.5E+00	2.8E+00	7.5E+00
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.61E+03	2.70E-09	7.64E+02	2.1E+03	4.0E+01	4.0E+01	4.0E+01	4.0E+01	3.1E+01	3.1E+01	3.1E+01	3.1E+01
TRINITROTOLUENE, 2,4,6- (TNT)	2.81E+03	2.10E-08	4.67E+02	2.0E+03	2.6E+00	2.6E+00	1.3E+01	2.1E+02	1.2E+00	1.2E+00	6.1E+00	9.8E+01
VANADIUM					2.7E+01	9.0E+01	2.7E+01	9.0E+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	2.80E-02	1.77E+02	3.9E+03	2.0E+00	2.0E+00	1.8E+01	1.8E+01	3.5E-01	3.5E-01	3.3E+00	3.3E+00
XYLENES	3.83E+02	6.60E-03	1.05E+02	2.6E+02	1.3E+01	2.0E+01	1.3E+01	2.3E+02	1.4E+00	2.1E+00	1.4E+00	2.4E+01
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 Screening Levels guidance (USEPA 2016, see Appendix 2).

Physio-Chemical constants for chemicals from USEPA RSLs guidance (USEPA 2016) 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	1.1E+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	-	-	-	-
BENOMYL	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	1.9E+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-CHLORO-1-METHYLETHYL)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+03	2.5E+03	1.0E+03	2.5E+03	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	3.6E+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	2.7E+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	-	-	-

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
DIBROMO-3-CHLOROPROPANE, 1,2-	5.0E+02	9.8E+02	5.0E+02	1.0E+03	9.8E+02	8.00E-01	-	-	-
DIBROMOCHLOROMETHANE	1.0E+02	5.0E+02	1.0E+02	5.0E+02	NA	7.60E+01	-	-	-
DIBROMOETHANE, 1,2-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.20E+01	2.00E+05	2.60E+01	4.62E-01
DICHLOROBENZENE, 1,2-	3.8E+02	3.8E+02	1.0E+03	2.5E+03	3.8E+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	3.0E+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	2.4E+03	2.15E+02	-	-	-
DICHLOROETHYLENE, Trans 1,2-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	1.9E+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	1.2E+05	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	1.0E+05	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	-	-	-	-

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
MERCURY	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	2.0E-03	-	-	-
METHOXYCHLOR	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.4E-06	-	-	-
METHYL ETHYL KETONE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	2.8E+04	1.00E+02	3.20E+04	1.10E+01	9.09E+00
METHYL ISOBUTYL KETONE	1.0E+02	5.0E+02	1.0E+02	5.0E+02	3.4E+03	1.00E+01	4.20E+02	1.00E-01	1.00E+02
METHYL MERCURY	1.0E+02	5.0E+02	1.0E+02	5.0E+02	NA	-	-	-	-
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	1.10E+03	2.50E-01	1.20E+03
TPH (middle distillates)	5.0E+02	5.0E+02	5.0E+02	1.0E+03	5.0E+02	1.00E+00	5.00E+03	7.00E-01	1.43E+00
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	2.2E+03	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	-	-	-	-

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
TRICHLOROPHENOL, 2,4,6-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.2E-02	3.00E-01	3.60E-05	3.33E+02
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	3.75E-05	-	-	-
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	2.58E-06	-	-	-
TRICHLOROPROPANE, 1,2,3-	1.0E+02	5.0E+02	1.0E+02	5.0E+02	1.4E+03	3.69E+00	-	-	-
TRICHLOROPROPENE, 1,2,3-	1.0E+02	3.1E+02	1.0E+02	5.0E+02	3.1E+02	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	2.6E+02	2.6E+02	5.0E+02	1.0E+03	2.6E+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 and ORTs from New Jersey Dept of Health (NJDPH 2008, 2010); ORTs for TPHg (0.25ppm) and TPHmd (0.7ppm) adjusted to ug/m3 based assumed MWs noted for TPHg and TPHd in Table H.

References for vapor pressure and odor threshold data (in order of use, see USEPA (1992) for additiona ORT values):

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	1.1E+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	-	-	-	-
BENOMYL	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
BENZENE	1.0E+03	1.9E+03	1.0E+03	2.5E+03	1.9E+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-CHLORO-1-METHYLETHYL)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	2.5E+03	5.0E+03	2.5E+03	5.0E+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	3.6E+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	2.7E+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-	9.8E+02	9.8E+02	1.0E+03	2.5E+03	9.8E+02	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-	3.8E+02	3.8E+02	2.5E+03	5.0E+03	3.8E+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	2.5E+03	1.0E+03	2.5E+03	3.0E+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	2.4E+03	2.15E+02	-	-	-
DICHLOROETHYLENE, Trans 1,2-	1.0E+03	1.9E+03	1.0E+03	2.5E+03	1.9E+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	1.2E+05	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	1.0E+05	5.65E+01	1.92E+04	1.00E+01	5.65E+00
ETHYLBENZENE	4.8E+02	4.8E+02	1.0E+03	2.5E+03	4.8E+02	1.00E+01	2.00E+03	4.50E-01	2.22E+01
FLUORANTHENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	5.00E-06	-	-	-
FLUORENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	3.20E-04	-	-	-
GLYPHOSATE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	4.30E-10	-	-	-
HEPTACHLOR	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	3.00E-04	3.00E+02	2.00E-02	1.50E-02
HEPTACHLOR EPOXIDE	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	2.60E-06	3.00E+02	1.90E-02	1.37E-04
HEXACHLOROBENZENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.10E-05	-	-	-
HEXACHLOROBUTADIENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.50E-01	1.20E+04	1.10E+00	1.36E-01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	9.40E-06	-	-	-
HEXACHLOROETHANE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.10E-01	-	-	-
HEXAZINONE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.25E-07	-	-	-
INDENO(1,2,3-cd)PYRENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.00E-06	-	-	-
ISOPHORONE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	4.38E-01	-	-	-
LEAD	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
MERCURY	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.00E-03	-	-	-
METHOXYCHLOR	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.40E-06	-	-	-

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

CONTAMINANT	[2]Final Unrestricted Land Use Action Level	Final Industrial/ Commercial Land Use Action Level	[2]Raw Unrestricted Action Level	Raw Industrial/ Commercial Action Level	Soil Saturation Limit (mg/kg)	Vapor Pressure (VP) (Torr @ 20-30 °C)	50 Percentile Odor Recognition Threshold (ORT) (ug/m^3)	50 Percentile Odor Recognition Threshold (ORT) (ppm-v)	Odor Index
METHYL 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	2.50E-01	1.20E+03
TPH (middle distillates)	5.0E+03	5.0E+03	5.0E+03	5.0E+03	NA	5.00E+00	1.00E+03	7.00E-01	7.14E+00
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	1.0E+03	5.0E+02	1.0E+03	2.2E+03	2.25E+01	-	-	-
TRICHLOROETHYLENE	6.9E+02	6.9E+02	2.5E+03	5.0E+03	6.9E+02	7.70E+01	1.36E+06	2.49E+02	3.09E-01
TRICHLOROPHENOL, 2,4,5-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	-	-	-	-
TRICHLOROPHENOL, 2,4,6-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.20E-02	3.00E-01	3.60E-05	3.33E+02
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	3.75E-05	-	-	-
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.58E-06	-	-	-

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
TRICHLOROPROPANE, 1,2,3-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	1.4E+03	3.69E+00	-	-	-
TRICHLOROPROPENE, 1,2,3-	3.1E+02	3.1E+02	5.0E+02	1.0E+03	3.1E+02	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	2.6E+02	2.6E+02	1.0E+03	2.5E+03	2.6E+02	6.00E+00	4.41E+02	1.00E-01	6.00E+01
ZINC	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-

Notes:

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

Odor Index = VP/ORT in ppm-v

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

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

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

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

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

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

Ceiling Levels for TPH after guidance from Massachusetts Department of Environmental Protection (MADEP 1997a).

50% ORT of 0.13 ppm-v for MTBE from information in CaEPA Public Health Goal for MTBE (CalEPA 1999).

TPH VP values from NIOSH (2002); TPHd ORT value from ATSDR (2001a). TPHg ORT based on threshold of 0.2ppm (AHC 2004; worst-case gasoline with TAME) and assumed MW of 108 (refer to Table H); ORT in ug/m^3 = 200 ppbv x (104/24)= 900; rounded to 1,000 ug/m^3.

TPH(middle distillate fuels) gross contamination action level for isolated soils at commercial/industrial sites set at 5,000 mg/kg, based on profession judgement.

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

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

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

CHEMICAL PARAMETER	Final Action Level	Basis	Solubility (1/2)	Taste And Odor Threshold	Basis	Upper Limit
ACENAPHTHENE	2.0E+01	Taste & Odors	2.0E+03	2.0E+01	Ontario MOEE	5.0E+04
ACENAPHTHYLENE	2.0E+03	Solubility	2.0E+03	-	-	5.0E+04
ACETONE	2.0E+04	Taste & Odors	5.0E+08	2.0E+04	Amoore & Hautala	5.0E+04
ALDRIN	8.5E+00	Solubility	8.5E+00	1.7E+01	Ontario MOEE	5.0E+04
AMETRYN	5.0E+04	Upper Limit	1.0E+05	-	-	5.0E+04
AMINO,2- DINITROTOLUENE,4,6-	5.0E+04	Upper Limit	6.1E+05	-	-	5.0E+04
AMINO,4- DINITROTOLUENE,2,6-	5.0E+04	Upper Limit	6.1E+05	-	-	5.0E+04
ANTHRACENE	2.2E+01	Solubility	2.2E+01	-	-	5.0E+04
ANTIMONY	5.0E+04	Upper Limit		-	-	5.0E+04
ARSENIC	5.0E+04	Upper Limit		-	-	5.0E+04
ATRAZINE	2.0E+01	Taste & Odors	1.8E+04	2.0E+01	Young et al	5.0E+04
BARIUM	5.0E+04	Upper Limit		-	-	5.0E+04
BENOMYL	1.9E+03	Solubility	1.9E+03	-	-	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	8.0E-01	Solubility	8.0E-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	3.7E+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-CHLORO-1-METHYLETHYL)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	5.7E+06	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	4.8E+07	1.7E+02	Amoore & Hautala	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
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	1.3E+00	Solubility	1.3E+00	-	-	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	7.8E+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	4.3E+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	3.2E+06	-	-	5.0E+04
DICHLOROETHYLENE, Trans 1,2-	2.6E+02	Taste & Odors	2.3E+06	2.6E+02	Amoore & Hautala	5.0E+04
DICHLOROPHENOL, 2,4-	3.0E-01	Taste & Odors	2.8E+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	9.8E+01	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	1.0E+05	-	-	5.0E+04
DINITROTOLUENE, 2,6- (2,6-DNT)	5.0E+04	Upper Limit	9.1E+04	-	-	5.0E+04
DIOXANE, 1,4-	5.0E+04	Upper Limit	5.0E+08	2.3E+05	Amoore & Hautala	5.0E+04
DIOXINS (TEQ)	1.0E-01	Solubility	1.0E-01	-	-	5.0E+04
DIURON	2.1E+04	Solubility	2.1E+04	-	-	5.0E+04
ENDOSULFAN	1.6E+02	Solubility	1.6E+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	8.5E+02	Solubility	8.5E+02	-	-	5.0E+04
GLYPHOSATE	5.0E+04	Upper Limit	5.3E+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

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
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	3.7E+03	Solubility	3.7E+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	5.0E+04	Upper Limit		-	-	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	1.2E+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	2.5E+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	7.9E+03	Taste & Odors	4.1E+07	7.9E+03	Amoore & Hautala	5.0E+04
POLYCHLORINATED BIPHENYLS (PCBs)	2.2E+01	Solubility	2.2E+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)	2.5E+03	Solubility	2.5E+03	-	-	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

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
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	2.3E+06	-	-	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)	3.6E+04	Solubility	3.6E+04	-	-	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	1.7E+05	-	-	5.0E+04
TRIFLURALIN	9.0E+01	Solubility	9.0E+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	5.8E+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	5.3E+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	1.8E+04	Solubility	1.8E+04	-	-	5.0E+04
BARIUM	5.0E+04	Upper Limit		-	-	5.0E+04
BENOMYL	1.9E+03	Solubility	1.9E+03	-	-	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	8.0E-01	Solubility	8.0E-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	3.7E+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-CHLORO-1-METHYLETHYL)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	5.7E+06	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	4.8E+07	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	1.3E+00	Solubility	1.3E+00	-	-	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	7.8E+04	1.0E+02	Ontario MOEE	5.0E+04
DICHLOROBENZENE, 1,3-	5.0E+04	Upper Limit	7.8E+04	-	-	5.0E+04
DICHLOROBENZENE, 1,4-	1.1E+02	Nuisance Odors	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	4.3E+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	3.2E+06	-	-	5.0E+04
DICHLOROETHYLENE, Trans 1,2-	2.6E+03	Nuisance Odors	2.3E+06	2.6E+03	Ontario MOEE	5.0E+04
DICHLOROPHENOL, 2,4-	3.0E+00	Nuisance Odors	2.8E+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	9.8E+01	Solubility	9.8E+01	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	1.0E+05	-	-	5.0E+04
DINITROTOLUENE, 2,6- (2,6-DNT)	5.0E+04	Upper Limit	9.1E+04	-	-	5.0E+04
DIOXANE, 1,4-	5.0E+04	Upper Limit	5.0E+08	-	-	5.0E+04
DIOXINS (TEQ)	1.0E-01	Solubility	1.0E-01	-	-	5.0E+04
DIURON	2.1E+04	Solubility	2.1E+04	-	-	5.0E+04
ENDOSULFAN	1.6E+02	Solubility	1.6E+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	8.5E+02	Solubility	8.5E+02	-	-	5.0E+04
GLYPHOSATE	5.0E+04	Upper Limit	5.3E+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	3.7E+03	Solubility	3.7E+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	5.0E+04	Upper Limit		-	-	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	1.2E+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	2.5E+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	Amoore & Hautala	5.0E+04
POLYCHLORINATED BIPHENYLS (PCBs)	2.2E+01	Solubility	2.2E+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)	2.5E+03	Solubility	2.5E+03	-	-	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	2.3E+06	-	-	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)	3.6E+04	Solubility	3.6E+04	-	-	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	1.7E+05	-	-	5.0E+04
TRIFLURALIN	9.0E+01	Solubility	9.0E+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	5.8E+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	5.3E+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	1.8E+04	2.0E+01	Young et al	5.0E+04
BARIUM	5.0E+04	Upper Limit		-	-	5.0E+04
BENOMYL	1.9E+03	Solubility	1.9E+03	-	-	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	8.0E-01	Solubility	8.0E-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	3.7E+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-CHLORO-1-METHYLETHYL)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	5.7E+06	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	4.8E+07	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	1.3E+00	Solubility	1.3E+00	-	-	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	7.8E+04	1.0E+01	USEPA 2nd MCL	5.0E+04
DICHLOROBENZENE, 1,3-	5.0E+04	Upper Limit	7.8E+04	-	-	5.0E+04
DICHLOROBENZENE, 1,4-	5.0E+00	Taste & Odors	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	4.3E+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	3.2E+06	-	-	5.0E+04
DICHLOROETHYLENE, Trans 1,2-	2.6E+02	Taste & Odors	2.3E+06	2.6E+02	Amoore & Hautala	5.0E+04
DICHLOROPHENOL, 2,4-	3.0E-01	Taste & Odors	2.8E+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	9.8E+01	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	1.0E+05	-	-	5.0E+04
DINITROTOLUENE, 2,6- (2,6-DNT)	5.0E+04	Upper Limit	9.1E+04	-	-	5.0E+04
DIOXANE, 1,4-	5.0E+04	Upper Limit	5.0E+08	2.3E+05	Amoore & Hautala	5.0E+04
DIOXINS (TEQ)	1.0E-01	Solubility	1.0E-01	-	-	5.0E+04
DIURON	2.1E+04	Solubility	2.1E+04	-	-	5.0E+04
ENDOSULFAN	1.6E+02	Solubility	1.6E+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	8.5E+02	Solubility	8.5E+02	-	-	5.0E+04
GLYPHOSATE	5.0E+04	Upper Limit	5.3E+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

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
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	3.7E+03	Solubility	3.7E+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	5.0E+04	Upper Limit		-	-	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	1.2E+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	2.5E+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	7.9E+03	Taste & Odors	4.1E+07	7.9E+03	Amoore & Hautala	5.0E+04
POLYCHLORINATED BIPHENYLS (PCBs)	2.2E+01	Solubility	2.2E+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)	2.5E+03	Solubility	2.5E+03	-	-	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

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
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	2.3E+06	-	-	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)	3.6E+04	Solubility	3.6E+04	-	-	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	1.7E+05	-	-	5.0E+04
TRIFLURALIN	9.0E+01	Solubility	9.0E+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	5.8E+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	5.3E+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	1.8E+04	Solubility	1.8E+04	-	-	5.0E+04
BARIUM	5.0E+04	Upper Limit		-	-	5.0E+04
BENOMYL	1.9E+03	Solubility	1.9E+03	-	-	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	8.0E-01	Solubility	8.0E-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	3.7E+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-CHLORO-1-METHYLETHYL)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	5.7E+06	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	4.8E+07	1.7E+02	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
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	1.3E+00	Solubility	1.3E+00	-	-	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	7.8E+04	1.0E+01	Ontario MOEE	5.0E+04
DICHLOROBENZENE, 1,3-	5.0E+04	Upper Limit	7.8E+04	-	-	5.0E+04
DICHLOROBENZENE, 1,4-	1.1E+01	Nuisance Odors	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	4.3E+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	3.2E+06	-	-	5.0E+04
DICHLOROETHYLENE, Trans 1,2-	2.6E+02	Nuisance Odors	2.3E+06	2.6E+02	Ontario MOEE	5.0E+04
DICHLOROPHENOL, 2,4-	3.0E-01	Nuisance Odors	2.8E+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	9.8E+01	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	1.0E+05	-	-	5.0E+04
DINITROTOLUENE, 2,6- (2,6-DNT)	5.0E+04	Upper Limit	9.1E+04	-	-	5.0E+04
DIOXANE, 1,4-	5.0E+04	Upper Limit	5.0E+08	-	-	5.0E+04
DIOXINS (TEQ)	1.0E-01	Solubility	1.0E-01	-	-	5.0E+04
DIURON	2.1E+04	Solubility	2.1E+04	-	-	5.0E+04
ENDOSULFAN	1.6E+02	Solubility	1.6E+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	8.5E+02	Solubility	8.5E+02	-	-	5.0E+04
GLYPHOSATE	5.0E+04	Upper Limit	5.3E+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

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
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	3.7E+03	Solubility	3.7E+03	1.2E+04	Ontario MOEE	5.0E+04
HEXACHLOROETHANE	1.0E+01	Nuisance Odors	2.5E+04	1.0E+01	Ontario MOEE	5.0E+04
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	5.0E+04	Upper Limit		-	-	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	1.2E+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	2.5E+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	Amoore & Hautala	5.0E+04
POLYCHLORINATED BIPHENYLS (PCBs)	2.2E+01	Solubility	2.2E+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)	2.5E+03	Solubility	2.5E+03	-	-	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

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
TOXAPHENE	1.4E+02	Nuisance Odors	2.8E+02	1.4E+02	USEPA 2nd MCL	5.0E+04
TPH (gasolines)	5.0E+03	Nuisance Odors	7.5E+04	5.0E+03	MADEP	5.0E+04
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	2.3E+06	-	-	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)	3.6E+04	Solubility	3.6E+04	-	-	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	1.7E+05	-	-	5.0E+04
TRIFLURALIN	9.0E+01	Solubility	9.0E+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	5.8E+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	5.3E+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	Vapor Pressure	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)	(mm Hg)	(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	2.20E-03	1.80E-04	7.50E-03	1.0	0.13			6.0E-02	2.4E-01
ACENAPHTHYLENE	V	S	152	2.50E+03	6.08E-02	7.88E-06	3.93E+00	9.12E-04	1.45E-03	5.95E-02	1.0	0.13			4.0E-02	1.6E-01
ACETONE	V	L	58	2.40E+00	1.10E-01	1.20E-05	1.00E+06	2.32E+02	3.50E-05	1.40E-03	1.0				9.0E-01	3.1E+01
ALDRIN	SV	S	365	8.20E+04	2.30E-02	5.80E-06	1.70E-02	1.20E-04	4.40E-05	1.80E-03	1.0		3.4E+00	8.5E-04	1.0E-04	4.0E-04
AMETRYN	NV	S	227	4.28E+02	5.10E-02	6.00E-06	2.09E+02	2.70E-06	2.40E-09	9.90E-08	1.0	0.1			9.0E-03	
AMINO,2- DINITROTOLUENE,4,6-	NV	S	197	2.83E+02	5.60E-02	6.60E-06	1.22E+03	1.10E-05	3.30E-11	1.30E-09	1.0	0.006			2.0E-03	
AMINO,4- DINITROTOLUENE,2,6-	NV	S	197	2.83E+02	5.60E-02	6.60E-06	1.22E+03	1.10E-05	3.30E-11	1.30E-09	1.0	0.009			2.0E-03	
ANTHRACENE	V	S	178	1.64E+04	3.90E-02	7.90E-06	4.30E-02	6.50E-06	5.60E-05	2.30E-03	1.0	0.13			3.0E-01	1.2E+00
ANTIMONY	NV	S	122								0.15				4.0E-04	
ARSENIC	NV	S	75								1.0	0.03	1.5E+00	4.3E-03	3.0E-04	1.5E-05
ATRAZINE	NV	S	216	2.25E+02	2.60E-02	6.80E-06	3.50E+01	2.90E-07	2.40E-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
BENOMYL	NV	S	230	3.36E+02	4.33E-02	5.06E-06	3.80E+00	3.70E-09	4.93E-12	2.16E-10	1	0.1			5.0E-02	
BENZENE	V	L	78	1.50E+02	9.00E-02	1.00E-05	1.79E+03	9.48E+01	5.60E-03	2.30E-01	1.0		5.5E-02	7.8E-06	4.0E-03	3.0E-02
BENZO(a)ANTHRACENE	SV	S	228	1.77E+05	2.60E-02	6.70E-06	9.40E-03	2.10E-07	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	4.80E-02	5.60E-06	1.60E-03	5.50E-09	4.60E-07	1.90E-05	1.0	0.13	7.3E+00	1.1E-03		
BENZO(b)FLUORANTHENE	NV	S	252	5.99E+05	4.80E-02	5.60E-06	1.50E-03	5.00E-07	6.60E-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	4.80E-02	5.60E-06	2.60E-04	1.00E-10	1.44E-07	5.90E-06	1.0	0.13			4.0E-02	
BENZO(k)FLUORANTHENE	NV	S	252	5.87E+05	4.80E-02	5.60E-06	8.00E-04	9.70E-10	5.80E-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	7.48E+00	8.90E-03	3.10E-04	1.30E-02	1.0		8.0E-03	2.0E-06	5.0E-01	4.0E-04
BIS(2-CHLOROETHYL)ETHER	V	L	143	3.22E+01	5.70E-02	8.70E-06	1.72E+04	1.55E+00	1.70E-05	7.00E-04	1.0		1.1E+00	3.3E-04		
BIS(2-CHLORO-1-METHYLETHYL)ETHER	V	L	171	6.10E+01	6.31E-02	6.40E-06	1.70E+03	5.30E-01	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	1.70E-02	4.20E-06	2.70E-01	1.40E-07	2.70E-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	5.00E+01	2.10E-03	8.70E-02	1.0		6.2E-02	3.7E-05	2.0E-02	8.0E-02
BROMOFORM	SV	S	253	3.18E+01	3.60E-02	1.00E-05	3.10E+03	5.40E+00	5.40E-04	2.20E-02	1.0		7.9E-03	1.1E-06	2.0E-02	
BROMOMETHANE	V	G	95	1.32E+01	1.00E-01	1.40E-05	1.52E+04	1.62E+03	7.30E-03	3.00E-01	1.0				1.4E-03	5.0E-03
CADMIUM	NV	S	112								0.025	0.001		1.8E-03	1.0E-03	1.0E-05
CARBON TETRACHLORIDE	V	L	154	4.39E+01	5.70E-02	9.80E-06	7.93E+02	1.15E+02	2.80E-02	1.10E+00	1.0		7.0E-02	6.0E-06	4.0E-03	1.0E-01
CHLORDANE (TECHNICAL)	SV	S	410	6.75E+04	2.10E-02	5.40E-06	5.60E-02	1.00E-05	4.90E-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	2.70E-02	1.20E-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	1.20E+01	3.10E-03	1.30E-01	1.0				2.0E-02	5.0E-02
CHLOROETHANE	V	G	65	2.17E+01	1.00E-01	1.20E-05	6.71E+03	1.01E+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	1.97E+02	3.70E-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	4.30E+03	8.80E-03	3.60E-01	1.0					9.0E-02
CHLOROPHENOL, 2-	V	L	129	3.88E+02	6.60E-02	9.50E-06	1.13E+04	2.50E+00	1.10E-05	4.60E-04	1.0				5.0E-03	2.0E-02
CHROMIUM (Total)	NV	S	52								0.0					
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	2.60E-02	6.70E-06	2.00E-03	6.20E-09	5.20E-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		2.11E-01	2.46E-05	9.54E+04	3.08E+02	1.01E-04	4.15E-03	1.0				6.0E-04	8.00E-04
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	NV	S	222	8.91E+01	3.10E-02	8.50E-06	5.97E+01	4.10E-09	2.00E-11	8.20E-10	1.0	0.015	1.1E-01		3.0E-03	
DALAPON	NV	L	143	3.20E+00	6.00E-02	9.40E-06	5.02E+05	1.50E-01	5.70E-08	2.30E-06	1.0	0.1			3.0E-02	
DIBENZO(a,h)ANTHTRACENE	NV	S	278	1.91E+06	4.50E-02	5.20E-06	2.50E-03	9.60E-10	1.40E-07	5.80E-06	1.0	0.13	7.3E+00	1.2E-03		
DIBROMO,1,2- CHLOROPROPANE,3-	V	L	236	1.16E+02	3.20E-02	8.90E-06	1.23E+03	5.80E-01	1.50E-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	5.54E+00	7.80E-04	3.20E-02	1.0		8.4E-02	2.1E-05	2.0E-02	8.0E-02
DIBROMOETHANE, 1,2-	V	S	188	3.96E+01	4.30E-02	1.00E-05	3.91E+03	1.12E+01	6.50E-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	1.56E+02	1.36E+00	1.90E-03	7.80E-02	1.0				9.0E-02	2.0E-01

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	Vapor Pressure	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)	(mm Hg)	($atm-m^3/mol$)	(unitless)	(unitless)	(unitless)	$(mg/kg-d)^{-1}$	$(ug/m^3)^{-1}$	(mg/kg-d)	(mg/m^3)
DICHLOROBENZENE, 1,3-	V	L	147	6.17E+02	6.90E-02	7.90E-06	1.56E+02	2.15E+00	1.90E-03	7.79E-02	1.0				3.00E-02	1.2E-01
DICHLOROBENZENE, 1,4-	V	S	147	3.75E+02	5.50E-02	8.70E-06	8.13E+01	1.74E+00	2.40E-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	4.70E-02	5.50E-06	3.10E+00	2.60E-07	2.80E-11	1.20E-09	1.0	0.1	4.5E-01	3.4E-04		
DICHLORODIPHENYLDICHLOROETHANE (DDD)	NV	S	320	1.18E+05	4.10E-02	4.70E-06	9.00E-02	1.40E-06	6.60E-06	2.70E-04	1.0	0.1	2.4E-01	6.9E-05		
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	SV	S	318	1.18E+05	2.30E-02	5.90E-06	4.00E-02	6.00E-06	4.20E-05	1.70E-03	1.0		3.4E-01	9.7E-05		
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	NV	S	354	1.69E+05	3.80E-02	4.40E-06	5.50E-03	1.60E-07	8.30E-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	2.27E+02	5.60E-03	2.30E-01	1.0		5.7E-03	1.6E-06	2.0E-01	8.0E-01
DICHLOROETHANE, 1,2-	V	L	99	3.96E+01	8.60E-02	1.10E-05	8.60E+03	7.90E+01	1.20E-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	6.00E+02	2.60E-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	6.41E+03	2.00E+02	4.10E-03	1.70E-01	1.0				2.0E-03	8.0E-03
DICHLOROETHYLENE, Trans 1,2-	V	L	97	3.96E+01	8.80E-02	1.10E-05	4.52E+03	3.31E+02	9.40E-03	3.80E-01	1.0				2.0E-02	8.0E-02
DICHLOROPHENOL, 2,4-	NV	S	163	1.47E+02	4.90E-02	8.70E-06	5.55E+03	9.00E-02	4.30E-06	1.80E-04	1.0	0.1			3.0E-03	
DICHLOROPHENOXYACETIC ACID (2,4-D)	NV	S	221	2.96E+01	2.80E-02	7.30E-06	6.77E+02	8.30E-05	3.50E-08	1.40E-06	1.0	0.05			1.0E-02	
DICHLOROPROPANE, 1,2-	V	L	113	6.07E+01	7.30E-02	9.70E-06	2.80E+03	5.33E+01	2.80E-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	7.60E-02	1.00E-05	2.80E+03	3.40E+01	3.60E-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	2.30E-02	6.00E-06	1.95E-01	5.90E-06	1.00E-05	4.10E-04	1.0	0.1	7.0E+00	1.8E-03	8.0E-05	3.2E-04
DIETHYLPHTHALATE	NV	S	222	1.05E+02	2.60E-02	6.70E-06	1.08E+03	2.10E-03	6.10E-07	2.50E-05	1.0	0.1			8.0E-01	
DIMETHYLPHENOL, 2,4-	NV	S	122	4.92E+02	6.20E-02	8.30E-06	7.87E+03	1.00E-01	9.50E-07	3.90E-05	1.0	0.1			2.0E-02	8.0E-02
DIMETHYLPHTHALATE	NV	S	194	1.40E+02			5.00E+03	3.08E-01	1.05E-07	4.31E-06	1.0	0.10			1.00E+01	
DINITROBENZENE, 1,3-	NV	S	168	3.52E+02	4.80E-02	9.20E-06	5.33E+02	9.00E-04	4.90E-08	2.00E-06	1.0	0.1			1.0E-04	
DINITROPHENOL, 2,4-	NV	S	184	4.61E+02	4.10E-02	9.10E-06	2.79E+03	3.90E-04	8.60E-08	3.50E-06	1.0	0.1			2.0E-03	
DINITROTOLUENE, 2,4- (2,4-DNT)	NV	S	182	5.76E+02	3.80E-02	7.90E-06	2.00E+02	1.50E-04	5.40E-08	2.20E-06	1.0	0.102	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	1.82E+02	5.70E-04	7.50E-07	3.10E-05	1.0	0.099	1.5E+00		3.0E-04	
DIOXANE, 1,4-	V	L	88	2.60E+00	8.70E-02	1.10E-05	1.00E+06	3.80E+01	4.80E-06	2.00E-04	1.0		1.0E-01	5.0E-06	3.0E-02	3.0E-02
DIOXINS (TEQ)	SV	S	356	2.49E+05	4.70E-02	6.80E-06	2.00E-04	1.50E-09	5.00E-05	2.00E-03	1.0	0.03	1.3E+05	3.8E+01	3.3E-09	1.3E-08
DIURON	NV	S	233	1.09E+02	5.00E-02	5.90E-06	4.20E+01	6.90E-08	5.00E-10	2.10E-08	1.0	0.1			2.0E-03	
ENDOSULFAN	SV	S	407	6.76E+03	2.20E-02	5.80E-06	3.25E-01	1.70E-07	6.50E-05	2.70E-03	1.0				6.0E-03	
ENDRIN	NV	S	381	2.01E+04	3.60E-02	4.20E-06	2.50E-01	3.00E-06	6.40E-06	2.60E-04	1.0	0.1			3.0E-04	
ETHANOL	V	L	46	3.09E-01			1.00E+06	5.30E+01	6.29E-06	2.58E-04	1.0					
ETHYLBENZENE	V	L	106	4.46E+02	6.80E-02	8.50E-06	1.69E+02	9.60E+00	7.90E-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	2.80E-02	7.20E-06	2.60E-01	9.20E-06	8.90E-06	3.60E-04	1.0	0.13			4.0E-02	
FLUORENE	V	S	166	9.16E+03	4.40E-02	7.90E-06	1.69E+00	6.00E-04	9.60E-05	3.90E-03	1.0	0.13			4.0E-02	1.6E-01
GLYPHOSATE	NV	S	169	2.10E+03	6.20E-02	7.30E-06	1.05E+04	9.80E-08	2.10E-12	8.60E-11	1.0	0.1			1.0E-01	
HEPTACHLOR	SV	S	373	4.13E+04	2.20E-02	5.70E-06	1.80E-01	4.00E-04	2.90E-04	1.20E-02	1.0		4.5E+00	1.3E-03	5.0E-04	
HEPTACHLOR EPOXIDE	SV	S	389	1.01E+04	2.40E-02	6.20E-06	2.00E-01	2.00E-05	2.10E-05	8.60E-04	1.0		9.1E+00	2.6E-03	1.3E-05	
HEXACHLOROBENZENE	SV	S	285	6.20E+03	2.90E-02	7.80E-06	6.20E-03	1.80E-05	1.70E-03	7.00E-02	1.0		1.6E+00	4.6E-04	8.0E-04	
HEXACHLOROBUTADIENE	SV	S	261	8.45E+02	2.70E-02	7.00E-06	3.20E+00	2.20E-01	1.00E-02	4.20E-01	1.0		7.8E-02	2.2E-05	1.0E-03	
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	NV	S	291	2.81E+03	4.30E-02	5.10E-06	7.30E+00	4.20E-05	5.10E-06	2.10E-04	1.0	0.04	1.1E+00	3.1E-04	3.0E-04	
HEXACHLOROETHANE	SV	S	237	1.97E+02	3.20E-02	8.90E-06	5.00E+01	2.10E-01	3.90E-03	1.60E-01	1.0		4.0E-02	1.1E-05	7.0E-04	3.0E-02
HEXAZINONE	NV	S	252	1.29E+02	2.50E-02	6.30E-06	3.30E+04	2.30E-07	2.30E-12	9.20E-11	1.0	0.1			3.3E-02	
INDENO(1,2,3-cd)PYRENE	NV	S	276	1.95E+06	4.50E-02	5.20E-06	1.90E-04	1.30E-10	3.50E-07	1.40E-05	1.0	0.13	7.3E-01	1.1E-04		
ISOPHORONE	NV	L	138	6.50E+01	5.30E-02	7.50E-06	1.20E+04	4.40E-01	6.60E-06	2.70E-04	1.0	0.1	9.5E-04		2.0E-01	2.0E+00
LEAD	NV	S	207								1.0					
MERCURY	NV	S	201								1.0				3.0E-04	3.0E-04
METHOXYCHLOR	NV	S	346	2.69E+04	2.20E-02	5.60E-06	1.00E-01	2.60E-06	2.00E-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	9.06E+01	5.70E-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	1.99E+01	1.40E-04	5.60E-03	1.0					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	2.50E+02	5.90E-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	4.35E+02	3.30E-03	1.30E-01	1.0		2.0E-03	1.0E-08	6.0E-03	6.0E-01
METHYLNAPHTHALENE, 1-	V	S	142	2.53E+03	5.30E-02	7.80E-06	2.58E+01	6.70E-02	5.10E-04	2.10E-02	1.0	0.13	2.9E-02	7.3E-06	7.0E-02	2.8E-01
METHYLNAPHTHALENE, 2-	V	S	142	2.48E+03	5.20E-02	7.80E-06	2.46E+01	5.50E-02	5.20E-04	2.10E-02	1.0	0.13			4.0E-03	1.6E-02
MOLYBDENUM	NV	S	96								1.0				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	Vapor Pressure	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)	(mm Hg)	($atm-m^3/mol$)	(unitless)	(unitless)	(unitless)	$(mg/kg-d)^{-1}$	$(ug/m^3)^{-1}$	(mg/kg-d)	(mg/m^3)
NAPHTHALENE	V	S	128	1.54E+03	6.00E-02	8.40E-06	3.10E+01	8.50E-02	4.40E-04	1.80E-02	1.0	0.13		3.4E-05	2.0E-02	3.0E-03
NICKEL	NV	S	59								0.04				2.0E-02	9.0E-05
NITROBENZENE	V	L	123	2.26E+02	6.80E-02	9.40E-06	2.09E+03	2.45E-01	2.40E-05	9.80E-04	1.0			4.0E-05	2.0E-03	9.0E-03
NITROGLYCERIN	NV	L	227	1.16E+02	2.90E-02	7.70E-06	1.38E+03	4.00E-04	8.70E-08	3.50E-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	1.90E-01	1.30E-05	5.10E-04	1.0		2.2E-01	5.5E-05	9.0E-04	3.6E-03
NITROTOLUENE, 3-	NV	S	137	3.63E+02	5.90E-02	8.70E-06	5.00E+02	2.05E-01	9.30E-06	3.80E-04	1.0	0.10			1.00E-04	4.0E-04
NITROTOLUENE, 4-	NV	S	137	3.63E+02	5.70E-02	8.40E-06	4.42E+02	1.60E-02	5.60E-06	2.30E-04	1.0	0.1	1.6E-02		4.0E-03	
PENTACHLOROPHENOL	NV	S	266	5.92E+02	3.00E-02	8.00E-06	1.40E+01	1.10E-04	2.50E-08	1.00E-06	1.0	0.25	4.0E-01	5.1E-06	5.0E-03	
PENTAERYTHRITOLTETRANITRATE (PETN)	NV	S	316	6.48E+02	2.60E-02	6.80E-06	4.30E+01	5.50E-09	1.30E-09	5.40E-08	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	1.6E-01
PHENOL	NV	S	94	1.87E+02	8.30E-02	1.00E-05	8.28E+04	3.50E-01	3.30E-07	1.40E-05	1.0	0.1			3.0E-01	2.0E-01
POLYCHLORINATED BIPHENYLS (PCBs)	SV	S	326	1.31E+05	2.37E-02	6.10E-06	4.30E-02	7.70E-05	2.83E-04	1.16E-02	1.0	0.14	2.0E+00	5.7E-04	2.0E-05	
PROPICONAZOLE	NV	L	342	1.56E+03	2.10E-02	5.30E-06	1.10E+02	4.20E-07	1.70E-09	7.00E-08	1.0	0.1			1.3E-02	
PYRENE	V	S	202	5.43E+04	2.80E-02	7.20E-06	1.35E-01	4.50E-06	1.20E-05	4.90E-04	1.0	0.13			3.0E-02	1.2E-01
SELENIUM	NV	S	81					1.40E-10			1.0				5.0E-03	2.0E-02
SILVER	NV	S	108								0.04				5.0E-03	
SIMAZINE	NV	S	202	1.47E+02	2.80E-02	7.40E-06	6.20E+00	2.20E-08	9.40E-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	6.40E+00	2.80E-03	1.10E-01	1.0				2.0E-01	1.0E+00
TERBACIL	NV	S	217	5.01E+01	2.70E-02	7.20E-06	7.10E+02	4.70E-07	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	4.07E+01	1.17E-05	4.80E-04	1.0		3.0E-03	7.5E-07		
TETRACHLOROETHANE, 1,1,1,2-	V	L	168	8.60E+01	4.80E-02	9.10E-06	1.07E+03	1.20E+01	2.50E-03	1.00E-01	1.0		2.6E-02	7.4E-06	3.0E-02	1.2E-01
TETRACHLOROETHANE, 1,1,2,2-	V	L	168	9.49E+01	4.90E-02	9.30E-06	2.83E+03	4.62E+00	3.70E-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	1.85E+01	1.80E-02	7.20E-01	1.0		2.1E-02	6.1E-06	6.0E-03	4.0E-02
TETRACHLOROPHENOL, 2,3,4,6-	NV	S	232	2.80E+02	5.00E-02	5.90E-06	2.30E+01	6.70E-04	8.80E-06	3.60E-04	1.0	0.1			3.0E-02	
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	NV	S	296	5.32E+02	4.30E-02	5.00E-06	5.00E+00	3.30E-14	8.70E-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	2.84E+01	6.60E-03	2.70E-01	1.0				8.0E-02	5.0E+00
TOXAPHENE	NV	S	414	7.72E+04	3.20E-02	3.80E-06	5.50E-01	6.70E-06	6.00E-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	3.00E+02	7.86E-01	3.22E+01	1.0	0.10			3.00E-02	2.81E-01
TPH (middle distillates)	V	L	201	5.00E+03	7.00E-02	1.00E-05	5.00E+00	1.00E+00	5.65E-01	2.32E+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	
TRICHLOROBENZENE, 1,2,4-	V	S	181	1.36E+03	4.00E-02	8.40E-06	4.90E+01	4.60E-01	1.40E-03	5.80E-02	1.0		2.9E-02	7.3E-06	1.0E-02	2.0E-03
TRICHLOROETHANE, 1,1,1-	V	L	133	4.39E+01	6.50E-02	9.60E-06	1.29E+03	1.24E+02	1.70E-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	4.59E+03	2.30E+01	8.20E-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	6.90E+01	9.90E-03	4.00E-01	1.0		4.6E-02	4.1E-06	5.0E-04	2.0E-03
TRICHLOROPHENOL, 2,4,5-	NV	S	198	1.60E+03	3.10E-02	8.10E-06	1.20E+03	7.50E-03	1.60E-06	6.60E-05	1.0	0.1			1.0E-01	4.0E-01
TRICHLOROPHENOL, 2,4,6-	NV	S	198	3.81E+02	3.10E-02	8.10E-06	8.00E+02	8.00E-03	2.60E-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	2.90E-02	7.80E-06	2.78E+02	3.80E-05	8.70E-09	3.50E-07	1.0	0.1			1.0E-02	
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	NV	S	270	1.75E+02	2.30E-02	5.90E-06	7.10E+01	1.00E-05	9.10E-09	3.70E-07	1.0	0.1			8.0E-03	
TRICHLOROPROPANE, 1,2,3-	V	L	147	1.16E+02	5.70E-02	9.20E-06	1.75E+03	3.69E+00	3.40E-04	1.40E-02	1.0		3.0E+01	7.5E-03	4.0E-03	3.0E-04
TRICHLOROPROPENE, 1,2,3-	V	L	145	1.16E+02	5.90E-02	9.40E-06	3.34E+02	4.40E+00	1.80E-02	7.20E-01	1.0				3.00E-03	3.0E-04
TRIFLURALIN	SV	S	335	1.64E+04	2.20E-02	5.60E-06	1.80E-01	4.60E-05	1.00E-04	4.20E-03	1.0		7.7E-03		7.5E-03	
TRINITROBENZENE, 1,3,5-	NV	S	213	1.68E+03	2.90E-02	7.70E-06	2.78E+02	6.40E-06	6.50E-09	2.70E-07	1.0	0.019			3.0E-02	
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	NV	S	287	4.61E+03	2.60E-02	6.70E-06	7.40E+01	5.70E-08	2.70E-09	1.10E-07	1.0	0.00065			2.0E-03	
TRINITROTOLUENE, 2,4,6- (TNT)	NV	S	227	2.81E+03	3.00E-02	7.90E-06	1.15E+02	8.00E-06	2.10E-08	8.50E-07	1.0	0.032	3.0E-02		5.0E-04	
VANADIUM	NV	S	51								0.026				5.0E-03	1.0E-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	Vapor Pressure	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)	(mm Hg)	(atm-m^3/mol)	(unitless)	(unitless)	(unitless)	(mg/kg-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	2.98E+03	2.80E-02	1.10E+00	1.0		7.2E-01	4.4E-06	3.0E-03	1.0E-01
XYLENES	V	L	106	3.83E+02	6.90E-02	8.50E-06	1.06E+02	8.00E+00	6.60E-03	2.70E-01	1.0				2.0E-01	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, SV-semivolatile, NV - nonvolatile, S - solid, L - liquid, G - gas).

Chemical considered to be "volatile" if Henry's number (atm m3/mole) >0.00001 or VP >1 mm Hg and molecular weight <200, and "semi-volatile" if molecular weight >200.

Physio-chemical constants and toxicity factors primarily from USEPA RSL guidance (USEPA 2016). Other references include: 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).

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 (1/80kg) x (1mg/1,000ug). Resulting action levels may differ from those presented in the USEPA RSL guidance. Includes: 1,1 biphenyl, dibromochloromethane; 1-methylnaphthalene, 2-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 80kg 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, dibromomethane, 1,3 dichlorobenzene, 1,1 dichloroethane, cis 1,2-dichloroethylene, trans 1,2-dichloroethylene, 2,4-dimethylphenol, fluorene, 1 & 2-methylnaphthalene, 2-nitrotoluene, 3-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).

1,3 dichlorobenzene constants and toxicity factors after 2004 USEPA IX PRGs (USEPA 2004).

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.

CalEPA 2016; noncancer toxicity factors from USEPA 2016.

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). TPHg and TPHmd solubilities from USACE 1998. 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 (Final) (mg/kg)	[3]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
ACENAPHTHENE	6.6E+02	noncarcinogenic effects			6.6E+02	3.3E+03	NA
ACENAPHTHYLENE	3.4E+02	noncarcinogenic effects			3.4E+02	1.7E+03	NA
ACETONE	1.2E+04	noncarcinogenic effects			1.2E+04	6.1E+04	1.1E+05
ALDRIN	3.9E+00	noncarcinogenic effects	2.0E+01		3.9E+00	7.7E+00	NA
AMETRYN	1.1E+02	noncarcinogenic effects			1.1E+02	5.7E+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	3.5E+03	noncarcinogenic effects			3.5E+03	1.7E+04	NA
ANTIMONY	6.3E+00	noncarcinogenic effects			6.3E+00	3.1E+01	NA
ARSENIC	2.3E+01	HDOH 2010	2.3E+01		2.2E+01	2.2E+01	NA
ATRAZINE	2.4E+00	carcinogenic effects	2.4E+00		4.4E+02	2.2E+03	NA
BARIUM	3.1E+03	noncarcinogenic effects			3.1E+03	1.5E+04	NA
BENOMYL	6.3E+02	noncarcinogenic effects			6.3E+02	3.2E+03	NA
BENZENE	1.2E+00	carcinogenic effects	1.2E+00		1.7E+01	8.7E+01	1.9E+03
BENZO(a)ANTHRACENE	1.6E+01	mutagenic effects	6.9E+01	1.6E+01			NA
BENZO(a)PYRENE	1.6E+00	mutagenic effects	7.0E+00	1.6E+00			NA
BENZO(b)FLUORANTHENE	1.6E+01	mutagenic effects	7.0E+01	1.6E+01			NA
BENZO(g,h,i)PERYLENE	4.8E+02	noncarcinogenic effects			4.8E+02	2.4E+03	NA
BENZO(k)FLUORANTHENE	1.6E+02	mutagenic effects	7.0E+02	1.6E+02			NA
BERYLLIUM	3.1E+01	noncarcinogenic effects	1.6E+03		3.1E+01	1.6E+02	NA
BIPHENYL, 1,1-	1.0E+01	noncarcinogenic effects	5.8E+01		1.0E+01	5.1E+01	NA
BIS(2-CHLOROETHYL)ETHER	2.4E-01	carcinogenic effects	2.4E-01				5.0E+03
BIS(2-CHLORO-1-METHYLETHYL)ETHER	3.8E+00	carcinogenic effects	3.8E+00		3.1E+02	1.6E+03	7.9E+02
BIS(2-ETHYLHEXYL)PHTHALATE	3.9E+01	carcinogenic effects	3.9E+01		2.5E+02	1.3E+03	NA
BORON	3.1E+03	noncarcinogenic effects			3.1E+03	1.6E+04	NA
BROMODICHLOROMETHANE	3.2E-01	carcinogenic effects	3.2E-01		5.8E+01	2.9E+02	9.3E+02
BROMOFORM	2.0E+01	carcinogenic effects	2.0E+01		3.1E+02	1.6E+03	NA
BROMOMETHANE	1.5E+00	noncarcinogenic effects			1.5E+00	7.4E+00	3.6E+03
CADMIUM	1.4E+01	noncarcinogenic effects	2.1E+03		1.4E+01	7.1E+01	NA
CARBON TETRACHLORIDE	7.1E-01	carcinogenic effects	7.1E-01		2.2E+01	1.1E+02	4.5E+02
CHLORDANE (TECHNICAL)	1.7E+01	carcinogenic effects	1.7E+01		3.5E+01	3.5E+01	NA
CHLOROANILINE, p-	2.7E+00	carcinogenic effects	2.7E+00		5.1E+01	2.5E+02	NA
CHLOROBENZENE	5.9E+01	noncarcinogenic effects			5.9E+01	2.9E+02	7.6E+02
CHLOROETHANE	2.1E+03	saturation limit			3.0E+03	1.5E+04	2.1E+03
CHLOROFORM	3.4E-01	carcinogenic effects	3.4E-01		4.2E+01	2.1E+02	2.5E+03
CHLOROMETHANE	2.4E+01	noncarcinogenic effects			2.4E+01	1.2E+02	1.3E+03
CHLOROPHENOL, 2-	7.0E+01	noncarcinogenic effects			7.0E+01	3.5E+02	2.7E+04
CHROMIUM (Total)		not available					
CHROMIUM III	2.3E+04	noncarcinogenic effects			2.3E+04	1.2E+05	NA
CHROMIUM VI	3.0E+01	mutagenic effects	1.3E+02	3.0E+01	4.7E+01	2.3E+02	NA
CHRYSENE	1.6E+03	mutagenic effects	7.0E+03	1.6E+03			NA
COBALT	4.7E+00	noncarcinogenic effects	4.2E+02		4.7E+00	2.3E+01	NA
COPPER	6.3E+02	noncarcinogenic effects			6.3E+02	3.1E+03	NA
CYANIDE (Free)	4.8E+00	noncarcinogenic effects			4.8E+00	2.4E+01	NA
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	6.1E+00	carcinogenic effects	6.1E+00		4.5E+01	2.3E+02	NA
DALAPON	3.8E+02	noncarcinogenic effects			3.8E+02	1.9E+03	NA
DIBENZO(a,h)ANTHTRACENE	1.6E+00	mutagenic effects	7.0E+00	1.6E+00			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 (Final) (mg/kg)	[3]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
DIBROMO,1,2- CHLOROPROPANE,3-	5.7E-03	mutagenic effects	1.6E-02	5.7E-03	9.9E-01	5.0E+00	9.8E+02
DIBROMOCHLOROMETHANE	1.0E+00	carcinogenic effects	1.0E+00		9.8E+01	4.9E+02	NA
DIBROMOETHANE, 1,2-	3.9E-02	carcinogenic effects	3.9E-02		1.6E+01	7.8E+01	NA
DICHLOROBENZENE, 1,2-	3.8E+02	saturation limit			3.9E+02	1.9E+03	3.8E+02
DICHLOROBENZENE, 1,3-	2.0E+02	noncarcinogenic effects			2.0E+02	1.0E+03	6.0E+02
DICHLOROBENZENE, 1,4-	2.8E+00	carcinogenic effects	2.8E+00		6.9E+02	3.5E+03	NA
DICHLOROBENZIDINE, 3,3-	1.2E+00	carcinogenic effects	1.2E+00				NA
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.3E+00	carcinogenic effects	2.3E+00				NA
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.0E+00	carcinogenic effects	2.0E+00				NA
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.9E+00	carcinogenic effects	1.9E+00		7.3E+00	3.7E+01	NA
DICHLOROETHANE, 1,1-	3.8E+00	carcinogenic effects	3.8E+00		3.4E+02	1.7E+03	1.7E+03
DICHLOROETHANE, 1,2-	5.0E-01	carcinogenic effects	5.0E-01		6.7E+00	3.4E+01	3.0E+03
DICHLOROETHYLENE, 1,1-	4.9E+01	noncarcinogenic effects			4.9E+01	2.4E+02	1.2E+03
DICHLOROETHYLENE, Cis 1,2-	3.9E+00	noncarcinogenic effects			3.9E+00	2.0E+01	2.4E+03
DICHLOROETHYLENE, Trans 1,2-	2.9E+01	noncarcinogenic effects			2.9E+01	1.4E+02	1.9E+03
DICHLOROPHENOL, 2,4-	3.8E+01	noncarcinogenic effects			3.8E+01	1.9E+02	NA
DICHLOROPHENOXYACETIC ACID (2,4-D)	1.4E+02	noncarcinogenic effects			1.4E+02	7.0E+02	NA
DICHLOROPROPANE, 1,2-	1.1E+00	carcinogenic effects	1.1E+00		3.4E+00	1.7E+01	1.4E+03
DICHLOROPROPENE, 1,3-	1.9E+00	carcinogenic effects	1.9E+00		1.5E+01	7.7E+01	1.6E+03
DIELDRIN	2.5E+00	noncarcinogenic effects	7.8E+00		2.5E+00	5.1E+00	NA
DIETHYLPHTHALATE	1.0E+04	noncarcinogenic effects			1.0E+04	5.1E+04	NA
DIMETHYLPHENOL, 2,4-	2.5E+02	noncarcinogenic effects			2.5E+02	1.3E+03	NA
DIMETHYLPHTHALATE	1.3E+05	noncarcinogenic effects			1.3E+05	6.3E+05	NA
DINITROBENZENE, 1,3-	1.3E+00	noncarcinogenic effects			1.3E+00	6.3E+00	NA
DINITROPHENOL, 2,4-	2.5E+01	noncarcinogenic effects			2.5E+01	1.3E+02	NA
DINITROTOLUENE, 2,4- (2,4-DNT)	1.7E+00	carcinogenic effects	1.7E+00		2.5E+01	1.3E+02	NA
DINITROTOLUENE, 2,6- (2,6-DNT)	3.6E-01	carcinogenic effects	3.6E-01		3.8E+00	1.9E+01	NA
DIOXANE, 1,4-	5.4E+00	carcinogenic effects	5.4E+00		1.7E+02	8.5E+02	1.2E+05
DIOXINS (TEQ)	2.4E-04	HDOH 2010a					
DIURON	2.5E+01	noncarcinogenic effects			2.5E+01	1.3E+02	NA
ENDOSULFAN	9.4E+01	noncarcinogenic effects			9.4E+01	4.7E+02	NA
ENDRIN	3.8E+00	noncarcinogenic effects			3.8E+00	1.9E+01	NA
ETHANOL		not available					
ETHYLBENZENE	6.3E+01	carcinogenic effects	6.3E+01		7.1E+02	3.5E+03	4.8E+02
FLUORANTHENE	4.8E+02	noncarcinogenic effects			4.8E+02	2.4E+03	NA
FLUORENE	4.6E+02	noncarcinogenic effects			4.6E+02	2.3E+03	NA
GLYPHOSATE	1.3E+03	noncarcinogenic effects			1.3E+03	6.3E+03	NA
HEPTACHLOR	1.4E-01	carcinogenic effects	1.4E-01		7.8E+00	3.9E+01	NA
HEPTACHLOR EPOXIDE	7.1E-02	carcinogenic effects	7.1E-02		2.0E-01	1.0E+00	NA
HEXACHLOROBENZENE	2.2E-01	carcinogenic effects	2.2E-01		1.3E+01	6.3E+01	NA
HEXACHLOROBUTADIENE	1.3E+00	carcinogenic effects	1.3E+00		1.6E+01	7.8E+01	NA
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	5.7E-01	carcinogenic effects	5.7E-01		4.3E+00	2.1E+01	NA
HEXACHLOROETHANE	2.0E+00	carcinogenic effects	2.0E+00		9.1E+00	4.6E+01	NA
HEXAZINONE	4.2E+02	noncarcinogenic effects			4.2E+02	2.1E+03	NA
INDENO(1,2,3-cd)PYRENE	1.6E+01	mutagenic effects	7.0E+01	1.6E+01			NA
ISOPHORONE	5.7E+02	carcinogenic effects	5.7E+02		2.5E+03	1.3E+04	NA
LEAD	2.0E+02	noncarcinogenic effects			2.0E+02		NA

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

CHEMICAL	Final Action Level (mg/kg)	Basis	[2]Carcinogens (Risk = 10^{-6}) (mg/kg)	[2]Mutagens (Risk = 10^{-6}) (mg/kg)	[3]Noncarcinogens (Final) (mg/kg)	[3]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
MERCURY	4.7E+00	noncarcinogenic effects			4.7E+00	2.3E+01	NA
METHOXYCHLOR	6.3E+01	noncarcinogenic effects			6.3E+01	3.2E+02	NA
METHYL ETHYL KETONE	5.6E+03	noncarcinogenic effects			5.6E+03	2.8E+04	2.8E+04
METHYL ISOBUTYL KETONE	3.4E+03	saturation limit			7.2E+03	3.6E+04	3.4E+03
METHYL MERCURY	1.6E+00	noncarcinogenic effects			1.6E+00	7.8E+00	NA
METHYL TERT BUTYL ETHER	5.0E+01	carcinogenic effects	5.0E+01		3.3E+03	1.7E+04	8.9E+03
METHYLENE CHLORIDE	5.8E+01	mutagenic effects	2.3E+02	5.8E+01	7.2E+01	3.6E+02	3.3E+03
METHYLNAPHTHALENE, 1-	1.0E+02	carcinogenic effects	1.0E+02		6.8E+02	3.4E+03	NA
METHYLNAPHTHALENE, 2-	3.9E+01	noncarcinogenic effects			3.9E+01	2.0E+02	NA
MOLYBDENUM	7.8E+01	noncarcinogenic effects			7.8E+01	3.9E+02	NA
NAPHTHALENE	2.8E+01	noncarcinogenic effects	4.2E+01		2.8E+01	1.4E+02	NA
NICKEL	3.1E+02	noncarcinogenic effects			3.1E+02	1.5E+03	NA
NITROBENZENE	5.6E+00	carcinogenic effects	5.6E+00		2.6E+01	1.3E+02	3.0E+03
NITROGLYCERIN	1.3E+00	noncarcinogenic effects	3.2E+01		1.3E+00	6.3E+00	NA
NITROTOLUENE, 2-	2.2E+00	carcinogenic effects	2.2E+00		1.2E+01	6.2E+01	NA
NITROTOLUENE, 3-	1.3E+00	noncarcinogenic effects			1.3E+00	6.3E+00	NA
NITROTOLUENE, 4-	3.4E+01	carcinogenic effects	3.4E+01		5.1E+01	2.5E+02	NA
PENTACHLOROPHENOL	1.0E+00	carcinogenic effects	1.0E+00		4.9E+01	2.5E+02	NA
PENTAERYTHRITOLTETRANITRATE (PETN)	2.5E+01	noncarcinogenic effects	1.4E+02		2.5E+01	1.3E+02	NA
PERCHLORATE	1.1E+01	noncarcinogenic effects			1.1E+01	5.5E+01	NA
PHENANTHRENE	4.6E+02	noncarcinogenic effects			4.6E+02	2.3E+03	NA
PHENOL	3.8E+03	noncarcinogenic effects			3.8E+03	1.9E+04	NA
POLYCHLORINATED BIPHENYLS (PCBs)	1.2E+00	noncarcinogenic effects	2.4E+00		1.2E+00	1.2E+00	NA
PROPICONAZOLE	1.6E+02	noncarcinogenic effects			1.6E+02	8.2E+02	NA
PYRENE	3.6E+02	noncarcinogenic effects			3.6E+02	1.8E+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	4.5E+00	carcinogenic effects	4.5E+00		6.3E+01	3.2E+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	8.2E+02	NA
tert-BUTYL ALCOHOL	9.9E+01	carcinogenic effects	9.9E+01				3.2E+05
TETRACHLOROETHANE, 1,1,1,2-	2.2E+00	carcinogenic effects	2.2E+00		1.2E+02	5.9E+02	6.8E+02
TETRACHLOROETHANE, 1,1,2,2-	6.5E-01	carcinogenic effects	6.5E-01		3.1E+02	1.6E+03	1.9E+03
TETRACHLOROETHYLENE	1.1E+00	carcinogenic effects	1.1E+00		1.7E+01	8.7E+01	1.7E+02
TETRACHLOROPHENOL, 2,3,4,6-	3.8E+02	noncarcinogenic effects			3.8E+02	1.9E+03	NA
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	7.7E+02	noncarcinogenic effects			7.7E+02	3.9E+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	4.9E-01	carcinogenic effects	4.9E-01				NA
TPH (gasolines)	4.8E+02	noncarcinogenic effects			4.8E+02	4.8E+02	5.4E+03
TPH (middle distillates)	2.6E+02	noncarcinogenic effects			2.6E+02	2.6E+02	5.0E+02
TPH (residual fuels)	9.4E+03	noncarcinogenic effects			9.4E+03	9.4E+03	NA
TRICHLOROBENZENE, 1,2,4-	8.2E+00	carcinogenic effects	8.2E+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	1.2E+00		3.2E-01	1.6E+00	2.2E+03
TRICHLOROETHYLENE	8.9E-01	noncarcinogenic effects	-	9.4E-01	8.9E-01	4.4E+00	6.9E+02
TRICHLOROPHENOL, 2,4,5-	1.3E+03	noncarcinogenic effects			1.3E+03	6.3E+03	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 (Final) (mg/kg)	[3]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
TRICHLOROPHENOL, 2,4,6-	1.3E+01	noncarcinogenic effects	4.9E+01		1.3E+01	6.3E+01	NA
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	1.3E+02	noncarcinogenic effects			1.3E+02	6.3E+02	NA
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	1.0E+02	noncarcinogenic effects			1.0E+02	5.1E+02	NA
TRICHLOROPROPANE, 1,2,3-	1.6E-03	mutagenic effects	5.0E-03	1.6E-03	1.1E+00	5.3E+00	1.4E+03
TRICHLOROPROPENE, 1,2,3-	1.6E-01	noncarcinogenic effects			1.6E-01	7.9E-01	3.1E+02
TRIFLURALIN	9.0E+01	carcinogenic effects	9.0E+01		1.2E+02	5.9E+02	NA
TRINITROBENZENE, 1,3,5-	4.5E+02	noncarcinogenic effects			4.5E+02	2.2E+03	NA
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	3.1E+01	noncarcinogenic effects			3.1E+01	1.6E+02	NA
TRINITROTOLUENE, 2,4,6- (TNT)	7.3E+00	noncarcinogenic effects	2.1E+01		7.3E+00	3.6E+01	NA
VANADIUM	7.8E+01	noncarcinogenic effects			7.8E+01	3.9E+02	NA
VINYL CHLORIDE	5.9E-02	mutagenic effects	-	5.9E-02	1.5E+01	7.4E+01	3.9E+03
XYLENES	1.2E+02	noncarcinogenic effects			1.2E+02	6.2E+02	2.6E+02
ZINC	4.7E+03	noncarcinogenic effects			4.7E+03	2.3E+04	NA

Primary source: USEPA Regional Screening Levels (USEPA 2016), 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 (see Section 3). Target ECR of 10^{-5} used for Technical Chlordane and PCBs. Target risk of 10^{-4} applied to aldrin, dieldrin, TEQ dioxins, hexavalent chromium and nonvolatile, carcinogenic PAHs action levels to reflect on higher confidence in noncancer toxicity factors and/or background and other factors.

3. Noncarcinogens: Final action level based on default target hazard quotient = 0.2 unless otherwise noted. 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 - Action 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).

5. 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 (Final) (mg/kg)	[2]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
ACENAPHTHENE	7.1E+03	noncarcinogenic effects		7.1E+03	3.5E+04	NA
ACENAPHTHYLENE	2.7E+03	noncarcinogenic effects		2.7E+03	1.4E+04	NA
ACETONE	1.1E+05	saturation limit		1.4E+05	6.9E+05	1.1E+05
ALDRIN	5.6E+01	noncarcinogenic effects	9.3E+01	5.6E+01	1.1E+02	NA
AMETRYN	1.5E+03	noncarcinogenic effects		1.5E+03	7.4E+03	NA
AMINO,2- DINITROTOLUENE,4,6-	4.6E+02	noncarcinogenic effects		4.6E+02	2.3E+03	NA
AMINO,4- DINITROTOLUENE,2,6-	4.5E+02	noncarcinogenic effects		4.5E+02	2.3E+03	NA
ANTHRACENE	4.2E+04	noncarcinogenic effects		4.2E+04	2.1E+05	NA
ANTIMONY	9.3E+01	noncarcinogenic effects		9.3E+01	4.7E+02	NA
ARSENIC	9.5E+01	HDOH 2010	1.1E+02	3.1E+02	3.1E+02	NA
ATRAZINE	1.0E+01	carcinogenic effects	1.0E+01	5.7E+03	2.9E+04	NA
BARIUM	4.3E+03	trench/construction worker		4.3E+04	2.2E+05	NA
BENOMYL	8.2E+03	noncarcinogenic effects		8.2E+03	4.1E+04	NA
BENZENE	5.5E+00	carcinogenic effects	5.5E+00	9.1E+01	4.6E+02	1.9E+03
BENZO(a)ANTHRACENE	2.9E+01	carcinogenic effects	2.9E+01			NA
BENZO(a)PYRENE	2.9E+00	carcinogenic effects	2.9E+00			NA
BENZO(b)FLUORANTHENE	2.9E+01	carcinogenic effects	2.9E+01			NA
BENZO(g,h,i)PERYLENE	6.0E+03	noncarcinogenic effects		6.0E+03	3.0E+04	NA
BENZO(k)FLUORANTHENE	2.9E+02	carcinogenic effects	2.9E+02			NA
BERYLLIUM	1.5E+02	trench/construction worker	6.9E+03	4.6E+02	2.3E+03	NA
BIPHENYL, 1,1-	4.3E+01	noncarcinogenic effects	2.6E+02	4.3E+01	2.1E+02	NA
BIS(2-CHLOROETHYL)ETHER	1.1E+00	carcinogenic effects	1.1E+00			5.0E+03
BIS(2-CHLORO-1-METHYLETHYL)ETHER	1.7E+01	carcinogenic effects	1.7E+01	2.1E+03	1.0E+04	7.9E+02
BIS(2-ETHYLHEXYL)PHTHALATE	1.6E+02	carcinogenic effects	1.6E+02	3.3E+03	1.6E+04	NA
BORON	4.7E+04	noncarcinogenic effects		4.7E+04	2.3E+05	NA
BROMODICHLOROMETHANE	1.4E+00	carcinogenic effects	1.4E+00	2.8E+02	1.4E+03	9.3E+02
BROMOFORM	9.1E+01	carcinogenic effects	9.1E+01	4.7E+03	2.3E+04	NA
BROMOMETHANE	6.5E+00	noncarcinogenic effects		6.5E+00	3.3E+01	3.6E+03
CADMIUM	7.4E+01	trench/construction worker	9.3E+03	2.0E+02	9.8E+02	NA
CARBON TETRACHLORIDE	3.1E+00	carcinogenic effects	3.1E+00	1.2E+02	6.2E+02	4.5E+02
CHLORDANE (TECHNICAL)	7.7E+01	carcinogenic effects	7.7E+01		4.6E+02	NA
CHLOROANILINE, p-	1.1E+01	carcinogenic effects	1.1E+01	6.6E+02	3.3E+03	NA
CHLOROBENZENE	2.9E+02	noncarcinogenic effects		2.9E+02	1.4E+03	7.6E+02
CHLOROETHANE	2.1E+03	saturation limit		1.3E+04	6.3E+04	2.1E+03
CHLOROFORM	1.5E+00	carcinogenic effects	1.5E+00	2.2E+02	1.1E+03	2.5E+03
CHLOROMETHANE	1.0E+02	noncarcinogenic effects		1.0E+02	5.1E+02	1.3E+03
CHLOROPHENOL, 2-	8.1E+02	noncarcinogenic effects		8.1E+02	4.0E+03	2.7E+04
CHROMIUM (Total)		not available				
CHROMIUM III	3.5E+05	noncarcinogenic effects		3.5E+05	1.8E+06	NA
CHROMIUM VI	4.8E+02	trench/construction worker	6.3E+02	7.0E+02	3.5E+03	NA
CHRYSENE	2.9E+03	carcinogenic effects	2.9E+03			NA
COBALT	4.0E+01	trench/construction worker	1.9E+03	6.9E+01	3.5E+02	NA
COPPER	9.3E+03	noncarcinogenic effects		9.3E+03	4.7E+04	NA
CYANIDE (Free)	3.1E+01	noncarcinogenic effects		3.1E+01	1.6E+02	NA
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	2.8E+01	carcinogenic effects	2.8E+01	6.6E+02	3.3E+03	NA
DALAPON	4.9E+03	noncarcinogenic effects		4.9E+03	2.5E+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 (Final) (mg/kg)	[2]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
DIBENZO(a,h)ANTHTRACENE	2.9E+00	carcinogenic effects	2.9E+00			NA
DIBROMO,1,2- CHLOROPROPANE,3-	7.0E-02	carcinogenic effects	7.0E-02	5.4E+00	2.7E+01	9.8E+02
DIBROMOCHLOROMETHANE	4.4E+00	carcinogenic effects	4.4E+00	5.3E+02	2.7E+03	NA
DIBROMOETHANE, 1,2-	1.7E-01	carcinogenic effects	1.7E-01	7.1E+01	3.5E+02	NA
DICHLOROBENZENE, 1,2-	3.8E+02	saturation limit		2.0E+03	1.0E+04	3.8E+02
DICHLOROBENZENE, 1,3-	6.0E+02	saturation limit		1.2E+03	6.2E+03	6.0E+02
DICHLOROBENZENE, 1,4-	1.2E+01	carcinogenic effects	1.2E+01	5.3E+03	2.7E+04	NA
DICHLOROBENZIDINE, 3,3-	5.1E+00	carcinogenic effects	5.1E+00			NA
DICHLORODIPHENYLDICHLOROETHANE (DDD)	9.6E+00	carcinogenic effects	9.6E+00			NA
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	9.3E+00	carcinogenic effects	9.3E+00			NA
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	8.5E+00	carcinogenic effects	8.5E+00	1.0E+02	5.2E+02	NA
DICHLOROETHANE, 1,1-	1.7E+01	carcinogenic effects	1.7E+01	1.5E+03	7.7E+03	1.7E+03
DICHLOROETHANE, 1,2-	2.2E+00	carcinogenic effects	2.2E+00	3.0E+01	1.5E+02	3.0E+03
DICHLOROETHYLENE, 1,1-	2.1E+02	noncarcinogenic effects		2.1E+02	1.1E+03	1.2E+03
DICHLOROETHYLENE, Cis 1,2-	1.8E+01	noncarcinogenic effects		1.8E+01	9.1E+01	2.4E+03
DICHLOROETHYLENE, Trans 1,2-	1.3E+02	noncarcinogenic effects		1.3E+02	6.5E+02	1.9E+03
DICHLOROPHENOL, 2,4-	4.9E+02	noncarcinogenic effects		4.9E+02	2.5E+03	NA
DICHLOROPHENOXYACETIC ACID (2,4-D)	1.9E+03	noncarcinogenic effects		1.9E+03	9.6E+03	NA
DICHLOROPROPANE, 1,2-	4.7E+00	carcinogenic effects	4.7E+00	1.4E+01	7.1E+01	1.4E+03
DICHLOROPROPENE, 1,3-	8.6E+00	carcinogenic effects	8.6E+00	6.6E+01	3.3E+02	1.6E+03
DIELDRIN	3.3E+01	carcinogenic effects	3.3E+01	3.3E+01	6.6E+01	NA
DIETHYLPHTHALATE	1.3E+05	noncarcinogenic effects		1.3E+05	6.6E+05	NA
DIMETHYLPHENOL, 2,4-	3.3E+03	noncarcinogenic effects		3.3E+03	1.6E+04	NA
DIMETHYLPHTHALATE	1.0E+06	maximum		1.6E+06	8.2E+06	NA
DINITROBENZENE, 1,3-	1.6E+01	noncarcinogenic effects		1.6E+01	8.2E+01	NA
DINITROPHENOL, 2,4-	3.3E+02	noncarcinogenic effects		3.3E+02	1.6E+03	NA
DINITROTOLUENE, 2,4- (2,4-DNT)	7.4E+00	carcinogenic effects	7.4E+00	3.3E+02	1.6E+03	NA
DINITROTOLUENE, 2,6- (2,6-DNT)	1.5E+00	carcinogenic effects	1.5E+00	4.9E+01	2.5E+02	NA
DIOXANE, 1,4-	2.5E+01	carcinogenic effects	2.5E+01	9.7E+02	4.8E+03	1.2E+05
DIOXINS (TEQ)	1.5E-03	HDOH 2010a				
DIURON	3.3E+02	noncarcinogenic effects		3.3E+02	1.6E+03	NA
ENDOSULFAN	1.4E+03	noncarcinogenic effects		1.4E+03	7.0E+03	NA
ENDRIN	4.9E+01	noncarcinogenic effects		4.9E+01	2.5E+02	NA
ETHANOL		not available				
ETHYLBENZENE	1.5E+02	trench/construction worker	2.8E+02	4.4E+03	2.2E+04	4.8E+02
FLUORANTHENE	6.0E+03	noncarcinogenic effects		6.0E+03	3.0E+04	NA
FLUORENE	5.3E+03	noncarcinogenic effects		5.3E+03	2.6E+04	NA
GLYPHOSATE	1.6E+04	noncarcinogenic effects		1.6E+04	8.2E+04	NA
HEPTACHLOR	6.3E-01	carcinogenic effects	6.3E-01	1.2E+02	5.8E+02	NA
HEPTACHLOR EPOXIDE	3.3E-01	carcinogenic effects	3.3E-01	3.0E+00	1.5E+01	NA
HEXACHLOROBENZENE	1.0E+00	carcinogenic effects	1.0E+00	1.9E+02	9.3E+02	NA
HEXACHLOROBUTADIENE	5.6E+00	carcinogenic effects	5.6E+00	2.3E+02	1.2E+03	NA
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	2.5E+00	carcinogenic effects	2.5E+00	6.0E+01	3.0E+02	NA
HEXACHLOROETHANE	8.7E+00	carcinogenic effects	8.7E+00	9.5E+01	4.8E+02	NA
HEXAZINONE	5.4E+03	noncarcinogenic effects		5.4E+03	2.7E+04	NA
INDENO(1,2,3-cd)PYRENE	2.9E+01	carcinogenic effects	2.9E+01			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 (Final) (mg/kg)	[2]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
ISOPHORONE	2.4E+03	carcinogenic effects	2.4E+03	3.3E+04	1.6E+05	NA
LEAD	8.0E+02	commercial/industrial exposure		8.0E+02		NA
MERCURY	7.0E+01	noncarcinogenic effects		7.0E+01	3.5E+02	NA
METHOXYCHLOR	8.2E+02	noncarcinogenic effects		8.2E+02	4.1E+03	NA
METHYL ETHYL KETONE	2.8E+04	saturation limit		4.1E+04	2.1E+05	2.8E+04
METHYL ISOBUTYL KETONE	3.4E+03	saturation limit		3.0E+04	1.5E+05	3.4E+03
METHYL MERCURY	2.3E+01	noncarcinogenic effects		2.3E+01	1.2E+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	6.6E+02	noncarcinogenic effects	1.1E+03	6.6E+02	3.3E+03	3.3E+03
METHYLNAPHTHALENE, 1-	2.7E+02	trench/construction worker	4.3E+02	6.3E+03	3.1E+04	NA
METHYLNAPHTHALENE, 2-	3.6E+02	noncarcinogenic effects		3.6E+02	1.8E+03	NA
MOLYBDENUM	1.2E+03	noncarcinogenic effects		1.2E+03	5.8E+03	NA
NAPHTHALENE	9.6E+01	trench/construction worker	1.8E+02	1.3E+02	6.4E+02	NA
NICKEL	7.5E+02	trench/construction worker		4.5E+03	2.2E+04	NA
NITROBENZENE	2.4E+01	carcinogenic effects	2.4E+01	2.7E+02	1.3E+03	3.0E+03
NITROGLYCERIN	1.6E+01	noncarcinogenic effects	1.4E+02	1.6E+01	8.2E+01	NA
NITROTOLUENE, 2-	1.0E+01	carcinogenic effects	1.0E+01	1.5E+02	7.3E+02	NA
NITROTOLUENE, 3-	1.6E+01	noncarcinogenic effects		1.6E+01	8.2E+01	NA
NITROTOLUENE, 4-	1.4E+02	carcinogenic effects	1.4E+02	6.6E+02	3.3E+03	NA
PENTACHLOROPHENOL	4.0E+00	carcinogenic effects	4.0E+00	5.7E+02	2.8E+03	NA
PENTAERYTHRITOLTETRANITRATE (PETN)	3.3E+02	noncarcinogenic effects	5.7E+02	3.3E+02	1.6E+03	NA
PERCHLORATE	1.6E+02	noncarcinogenic effects		1.6E+02	8.2E+02	NA
PHENANTHRENE	5.6E+03	noncarcinogenic effects		5.6E+03	2.8E+04	NA
PHENOL	4.9E+04	noncarcinogenic effects		4.9E+04	2.5E+05	NA
POLYCHLORINATED BIPHENYLS (PCBs)	9.8E+00	carcinogenic effects	9.8E+00	1.5E+01	1.5E+01	NA
PROPICONAZOLE	2.1E+03	noncarcinogenic effects		2.1E+03	1.1E+04	NA
PYRENE	4.4E+03	noncarcinogenic effects		4.4E+03	2.2E+04	NA
SELENIUM	1.2E+03	noncarcinogenic effects		1.2E+03	5.8E+03	NA
SILVER	1.2E+03	noncarcinogenic effects		1.2E+03	5.8E+03	NA
SIMAZINE	1.9E+01	carcinogenic effects	1.9E+01	8.2E+02	4.1E+03	NA
STYRENE	8.7E+02	saturation limit		7.5E+03	3.8E+04	8.7E+02
TERBACIL	2.1E+03	noncarcinogenic effects		2.1E+03	1.1E+04	NA
tert-BUTYL ALCOHOL	4.5E+02	carcinogenic effects	4.5E+02			3.2E+05
TETRACHLOROETHANE, 1,1,1,2-	9.6E+00	carcinogenic effects	9.6E+00	6.0E+02	3.0E+03	6.8E+02
TETRACHLOROETHANE, 1,1,2,2-	2.9E+00	carcinogenic effects	2.9E+00	4.7E+03	2.3E+04	1.9E+03
TETRACHLOROETHYLENE	5.0E+00	carcinogenic effects	5.0E+00	8.5E+01	4.2E+02	1.7E+02
TETRACHLOROPHENOL, 2,3,4,6-	4.9E+03	noncarcinogenic effects		4.9E+03	2.5E+04	NA
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	1.1E+04	noncarcinogenic effects		1.1E+04	5.7E+04	NA
THALLIUM	1.2E+01	noncarcinogenic effects		1.2E+01	1.2E+01	NA
TOLUENE	8.2E+02	saturation limit		9.8E+03	4.9E+04	8.2E+02
TOXAPHENE	2.1E+00	carcinogenic effects	2.1E+00			NA
TPH (gasolines)	2.4E+03	noncarcinogenic effects		2.4E+03	2.4E+03	5.4E+03
TPH (middle distillates)	5.0E+02	saturation limit		1.3E+03	1.3E+03	5.0E+02
TPH (residual fuels)	1.4E+05	noncarcinogenic effects		1.4E+05	1.4E+05	NA
TRICHLOROBENZENE, 1,2,4-	3.7E+01	carcinogenic effects	3.7E+01	5.5E+01	2.8E+02	NA
TRICHLOROETHANE, 1,1,1-	6.4E+02	saturation limit		7.7E+03	3.9E+04	6.4E+02

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 (Final) (mg/kg)	[2]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
TRICHLOROETHANE, 1,1,2-	1.4E+00	noncarcinogenic effects	5.4E+00	1.4E+00	6.8E+00	2.2E+03
TRICHLOROETHYLENE	4.1E+00	noncarcinogenic effects	6.5E+00	4.1E+00	2.0E+01	6.9E+02
TRICHLOROPHENOL, 2,4,5-	1.6E+04	noncarcinogenic effects		1.6E+04	8.2E+04	NA
TRICHLOROPHENOL, 2,4,6-	1.6E+02	noncarcinogenic effects	2.1E+02	1.6E+02	8.2E+02	NA
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	1.6E+03	noncarcinogenic effects		1.6E+03	8.2E+03	NA
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	1.3E+03	noncarcinogenic effects		1.3E+03	6.6E+03	NA
TRICHLOROPROPANE, 1,2,3-	2.2E-02	carcinogenic effects	2.2E-02	4.5E+00	2.2E+01	1.4E+03
TRICHLOROPROPENE, 1,2,3-	6.7E-01	noncarcinogenic effects		6.7E-01	3.3E+00	3.1E+02
TRIFLURALIN	4.2E+02	carcinogenic effects	4.2E+02	1.8E+03	8.8E+03	NA
TRINITROBENZENE, 1,3,5-	6.5E+03	noncarcinogenic effects		6.5E+03	3.2E+04	NA
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.7E+02	noncarcinogenic effects		4.7E+02	2.3E+03	NA
TRINITROTOLUENE, 2,4,6- (TNT)	9.6E+01	carcinogenic effects	9.6E+01	1.0E+02	5.1E+02	NA
VANADIUM	6.6E+02	trench/construction worker		1.2E+03	5.8E+03	NA
VINYL CHLORIDE	1.8E+00	carcinogenic effects	1.8E+00	8.0E+01	4.0E+02	3.9E+03
XYLENES	2.6E+02	saturation limit		5.4E+02	2.7E+03	2.6E+02
ZINC	7.0E+04	noncarcinogenic effects		7.0E+04	3.5E+05	NA

Primary source: USEPA Regional Screening Levels (USEPA 2016), 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 (see Section 3). Target ECR of 10^{-5} used for Technical Chlordane, PCBs and carcinogenic PAHs (see Section 3). Target risk of 10^{-4} applied to aldrin, dieldrin, TEQ dioxins and hexavalent chromium action levels to reflect on higher confidence in noncancer toxicity factors and/or background and other factors.

2. Noncarcinogens: Final action level based on default target hazard quotient = 0.2 unless noted. 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. 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 (Final) (mg/kg)	[2]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
ACENAPHTHENE	1.3E+04	noncarcinogenic effects		1.3E+04	6.5E+04	NA
ACENAPHTHYLENE	4.5E+03	noncarcinogenic effects		4.5E+03	2.3E+04	NA
ACETONE	1.1E+05	saturation limit		2.6E+05	1.3E+06	1.1E+05
ALDRIN	1.2E+02	noncarcinogenic effects	7.0E+02	1.2E+02	2.4E+02	NA
AMETRYN	3.0E+03	noncarcinogenic effects		3.0E+03	1.5E+04	NA
AMINO,2- DINITROTOLUENE,4,6-	9.8E+02	noncarcinogenic effects		9.8E+02	4.9E+03	NA
AMINO,4- DINITROTOLUENE,2,6-	9.7E+02	noncarcinogenic effects		9.7E+02	4.8E+03	NA
ANTHRACENE	8.1E+04	noncarcinogenic effects		8.1E+04	4.1E+05	NA
ANTIMONY	2.0E+02	noncarcinogenic effects		2.0E+02	1.0E+03	NA
ARSENIC	1.3E+02	carcinogenic effects	1.3E+02	3.3E+02	3.3E+02	NA
ATRAZINE	7.2E+02	carcinogenic effects	7.2E+02	1.2E+04	5.8E+04	NA
BARIUM	4.3E+03	noncarcinogenic effects		4.3E+03	2.2E+04	NA
BENOMYL	1.7E+04	noncarcinogenic effects		1.7E+04	8.3E+04	NA
BENZENE	3.0E+01	carcinogenic effects	3.0E+01	1.4E+02	7.0E+02	1.9E+03
BENZO(a)ANTHRACENE	2.0E+02	carcinogenic effects	2.0E+02			NA
BENZO(a)PYRENE	2.0E+01	carcinogenic effects	2.0E+01			NA
BENZO(b)FLUORANTHENE	2.0E+02	carcinogenic effects	2.0E+02			NA
BENZO(g,h,i)PERYLENE	1.2E+04	noncarcinogenic effects		1.2E+04	6.0E+04	NA
BENZO(k)FLUORANTHENE	2.0E+03	carcinogenic effects	2.0E+03			NA
BERYLLIUM	1.5E+02	noncarcinogenic effects	1.9E+03	1.5E+02	7.6E+02	NA
BIPHENYL, 1,1-	6.2E+01	noncarcinogenic effects	1.7E+03	6.2E+01	3.1E+02	NA
BIS(2-CHLOROETHYL)ETHER	6.5E+00	carcinogenic effects	6.5E+00			5.0E+03
BIS(2-CHLORO-1-METHYLETHYL)ETHER	1.0E+02	carcinogenic effects	1.0E+02	3.3E+03	1.6E+04	7.9E+02
BIS(2-ETHYLHEXYL)PHTHALATE	6.6E+03	noncarcinogenic effects	1.2E+04	6.6E+03	3.3E+04	NA
BORON	6.5E+04	noncarcinogenic effects		6.5E+04	3.2E+05	NA
BROMODICHLOROMETHANE	7.4E+00	carcinogenic effects	7.4E+00	4.3E+02	2.1E+03	9.3E+02
BROMOFORM	5.2E+03	carcinogenic effects	5.2E+03	1.0E+04	5.1E+04	NA
BROMOMETHANE	9.8E+00	noncarcinogenic effects		9.8E+00	4.9E+01	3.6E+03
CADMIUM	7.4E+01	noncarcinogenic effects	2.5E+03	7.4E+01	3.7E+02	NA
CARBON TETRACHLORIDE	1.7E+01	carcinogenic effects	1.7E+01	1.9E+02	9.6E+02	4.5E+02
CHLORDANE (TECHNICAL)	5.6E+02	carcinogenic effects	5.6E+02	8.9E+02	8.9E+02	NA
CHLOROANILINE, p-	8.3E+02	carcinogenic effects	8.3E+02	1.3E+03	6.6E+03	NA
CHLOROBENZENE	4.3E+02	noncarcinogenic effects		4.3E+02	2.2E+03	7.6E+02
CHLOROETHANE	2.1E+03	saturation limit		1.9E+04	9.3E+04	2.1E+03
CHLOROFORM	8.0E+00	carcinogenic effects	8.0E+00	3.4E+02	1.7E+03	2.5E+03
CHLOROMETHANE	1.5E+02	noncarcinogenic effects		1.5E+02	7.6E+02	1.3E+03
CHLOROPHENOL, 2-	1.5E+03	noncarcinogenic effects		1.5E+03	7.6E+03	2.7E+04
CHROMIUM (Total)		not available				
CHROMIUM III	7.6E+05	noncarcinogenic effects		7.6E+05	3.8E+06	NA
CHROMIUM VI	4.8E+02	carcinogenic effects	4.8E+02	5.7E+02	2.8E+03	NA
CHRYSENE	2.0E+04	carcinogenic effects	2.0E+04			NA
COBALT	4.0E+01	noncarcinogenic effects	5.0E+02	4.0E+01	2.0E+02	NA
COPPER	2.0E+04	noncarcinogenic effects		2.0E+04	1.0E+05	NA
CYANIDE (Free)	5.0E+01	noncarcinogenic effects		5.0E+01	2.5E+02	NA
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	1.4E+03	noncarcinogenic effects	2.1E+03	1.4E+03	7.0E+03	NA
DALAPON	9.9E+03	noncarcinogenic effects		9.9E+03	5.0E+04	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 (Final) (mg/kg)	[2]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
DIBENZO(a,h)ANTHTRACENE	2.0E+01	carcinogenic effects	2.0E+01			NA
DIBROMO,1,2- CHLOROPROPANE,3-	3.7E-01	carcinogenic effects	3.7E-01	8.3E+00	4.1E+01	9.8E+02
DIBROMOCHLOROMETHANE	2.4E+01	carcinogenic effects	2.4E+01	8.2E+02	4.1E+03	NA
DIBROMOETHANE, 1,2-	9.3E-01	carcinogenic effects	9.3E-01	1.1E+02	5.3E+02	NA
DICHLOROBENZENE, 1,2-	3.8E+02	saturation limit		3.1E+03	1.5E+04	3.8E+02
DICHLOROBENZENE, 1,3-	6.0E+02	saturation limit		2.0E+03	9.8E+03	6.0E+02
DICHLOROBENZENE, 1,4-	6.6E+01	carcinogenic effects	6.6E+01	8.8E+03	4.4E+04	NA
DICHLOROBENZIDINE, 3,3-	3.6E+02	carcinogenic effects	3.6E+02			NA
DICHLORODIPHENYLDICHLOROETHANE (DDD)	6.8E+02	carcinogenic effects	6.8E+02			NA
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	7.0E+02	carcinogenic effects	7.0E+02			NA
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	2.2E+02	noncarcinogenic effects	6.3E+02	2.2E+02	1.1E+03	NA
DICHLOROETHANE, 1,1-	9.0E+01	carcinogenic effects	9.0E+01	2.3E+03	1.1E+04	1.7E+03
DICHLOROETHANE, 1,2-	1.2E+01	carcinogenic effects	1.2E+01	4.5E+01	2.2E+02	3.0E+03
DICHLOROETHYLENE, 1,1-	3.2E+02	noncarcinogenic effects		3.2E+02	1.6E+03	1.2E+03
DICHLOROETHYLENE, Cis 1,2-	2.7E+01	noncarcinogenic effects		2.7E+01	1.4E+02	2.4E+03
DICHLOROETHYLENE, Trans 1,2-	1.9E+02	noncarcinogenic effects		1.9E+02	9.7E+02	1.9E+03
DICHLOROPHENOL, 2,4-	9.9E+02	noncarcinogenic effects		9.9E+02	5.0E+03	NA
DICHLOROPHENOXYACETIC ACID (2,4-D)	4.0E+03	noncarcinogenic effects		4.0E+03	2.0E+04	NA
DICHLOROPROPANE, 1,2-	2.1E+01	noncarcinogenic effects	2.5E+01	2.1E+01	1.1E+02	1.4E+03
DICHLOROPROPENE, 1,3-	5.0E+01	carcinogenic effects	5.0E+01	9.8E+01	4.9E+02	1.6E+03
DIELDRIN	6.6E+01	noncarcinogenic effects	2.3E+02	6.6E+01	1.3E+02	NA
DIETHYLPHTHALATE	2.6E+05	noncarcinogenic effects		2.6E+05	1.3E+06	NA
DIMETHYLPHENOL, 2,4-	6.6E+03	noncarcinogenic effects		6.6E+03	3.3E+04	NA
DIMETHYLPHTHALATE	1.0E+06	maximum		3.3E+06	1.7E+07	NA
DINITROBENZENE, 1,3-	3.3E+01	noncarcinogenic effects		3.3E+01	1.7E+02	NA
DINITROPHENOL, 2,4-	6.6E+02	noncarcinogenic effects		6.6E+02	3.3E+03	NA
DINITROTOLUENE, 2,4- (2,4-DNT)	5.2E+02	carcinogenic effects	5.2E+02	6.6E+02	3.3E+03	NA
DINITROTOLUENE, 2,6- (2,6-DNT)	1.0E+02	noncarcinogenic effects	1.1E+02	1.0E+02	5.0E+02	NA
DIOXANE, 1,4-	1.5E+03	noncarcinogenic effects	1.7E+03	1.5E+03	7.5E+03	1.2E+05
DIOXINS (TEQ)	1.5E-03	HDOH 2010a	1.6E-02			
DIURON	6.6E+02	noncarcinogenic effects		6.6E+02	3.3E+03	NA
ENDOSULFAN	3.0E+03	noncarcinogenic effects		3.0E+03	1.5E+04	NA
ENDRIN	9.9E+01	noncarcinogenic effects		9.9E+01	5.0E+02	NA
ETHANOL	1.5E-03	commercial/industrial exposure				
ETHYLBENZENE	1.5E+02	carcinogenic effects	1.5E+02	6.9E+03	3.5E+04	4.8E+02
FLUORANTHENE	1.2E+04	noncarcinogenic effects		1.2E+04	6.0E+04	NA
FLUORENE	1.0E+04	noncarcinogenic effects		1.0E+04	5.0E+04	NA
GLYPHOSATE	3.3E+04	noncarcinogenic effects		3.3E+04	1.7E+05	NA
HEPTACHLOR	4.6E+01	carcinogenic effects	4.6E+01	2.5E+02	1.3E+03	NA
HEPTACHLOR EPOXIDE	6.6E+00	noncarcinogenic effects	2.4E+01	6.6E+00	3.3E+01	NA
HEXACHLOROBENZENE	6.2E+01	carcinogenic effects	6.2E+01	4.0E+02	2.0E+03	NA
HEXACHLOROBUTADIENE	3.1E+02	carcinogenic effects	3.1E+02	5.1E+02	2.5E+03	NA
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	1.3E+02	noncarcinogenic effects	1.9E+02	1.3E+02	6.3E+02	NA
HEXACHLOROETHANE	1.7E+02	noncarcinogenic effects	4.7E+02	1.7E+02	8.7E+02	NA
HEXAZINONE	1.1E+04	noncarcinogenic effects		1.1E+04	5.5E+04	NA
INDENO(1,2,3-cd)PYRENE	2.0E+02	carcinogenic effects	2.0E+02			NA

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

CHEMICAL	Final Action Level (mg/kg)	Basis	[1]Carcinogens (Risk = 10^{-5}) (mg/kg)	[2]Noncarcinogens (Final) (mg/kg)	[2]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
ISOPHORONE	6.6E+04	noncarcinogenic effects	1.7E+05	6.6E+04	3.3E+05	NA
LEAD	8.0E+02	commercial/industrial exposure				
MERCURY	1.4E+02	noncarcinogenic effects		1.4E+02	7.2E+02	NA
METHOXYCHLOR	1.7E+03	noncarcinogenic effects		1.7E+03	8.3E+03	NA
METHYL ETHYL KETONE	2.8E+04	saturation limit		6.7E+04	3.4E+05	2.8E+04
METHYL ISOBUTYL KETONE	3.4E+03	saturation limit		4.5E+04	2.2E+05	3.4E+03
METHYL MERCURY	5.1E+01	noncarcinogenic effects		5.1E+01	2.5E+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	1.2E+03	noncarcinogenic effects	7.0E+03	1.2E+03	5.8E+03	3.3E+03
METHYLNAPHTHALENE, 1-	2.7E+02	carcinogenic effects	2.7E+02	1.1E+04	5.5E+04	NA
METHYLNAPHTHALENE, 2-	6.3E+02	noncarcinogenic effects		6.3E+02	3.1E+03	NA
MOLYBDENUM	2.5E+03	noncarcinogenic effects		2.5E+03	1.3E+04	NA
NAPHTHALENE	9.6E+01	carcinogenic effects	9.6E+01	1.9E+02	9.5E+02	NA
NICKEL	7.5E+02	noncarcinogenic effects		7.5E+02	3.8E+03	NA
NITROBENZENE	1.3E+02	carcinogenic effects	1.3E+02	4.8E+02	2.4E+03	3.0E+03
NITROGLYCERIN	3.3E+01	noncarcinogenic effects	9.7E+03	3.3E+01	1.7E+02	NA
NITROTOLUENE, 2-	6.9E+01	carcinogenic effects	6.9E+01	2.7E+02	1.4E+03	NA
NITROTOLUENE, 3-	3.3E+01	noncarcinogenic effects		3.3E+01	1.6E+02	NA
NITROTOLUENE, 4-	1.3E+03	noncarcinogenic effects	1.0E+04	1.3E+03	6.6E+03	NA
PENTACHLOROPHENOL	2.7E+02	carcinogenic effects	2.7E+02	1.1E+03	5.5E+03	NA
PENTAERYTHRITOLTETRANITRATE (PETN)	6.6E+02	noncarcinogenic effects	4.1E+04	6.6E+02	3.3E+03	NA
PERCHLORATE	3.5E+02	noncarcinogenic effects		3.5E+02	1.8E+03	NA
PHENANTHRENE	1.1E+04	noncarcinogenic effects		1.1E+04	5.3E+04	NA
PHENOL	9.4E+04	noncarcinogenic effects		9.4E+04	4.7E+05	NA
POLYCHLORINATED BIPHENYLS (PCBs)	2.9E+01	noncarcinogenic effects	6.7E+01	2.9E+01	2.9E+01	NA
PROPICONAZOLE	4.3E+03	noncarcinogenic effects		4.3E+03	2.2E+04	NA
PYRENE	8.7E+03	noncarcinogenic effects		8.7E+03	4.4E+04	NA
SELENIUM	2.5E+03	noncarcinogenic effects		2.5E+03	1.2E+04	NA
SILVER	2.5E+03	noncarcinogenic effects		2.5E+03	1.3E+04	NA
SIMAZINE	1.4E+03	carcinogenic effects	1.4E+03	1.7E+03	8.3E+03	NA
STYRENE	8.7E+02	saturation limit		1.2E+04	5.9E+04	8.7E+02
TERBACIL	4.3E+03	noncarcinogenic effects		4.3E+03	2.2E+04	NA
tert-BUTYL ALCOHOL	2.7E+03	carcinogenic effects	2.7E+03			3.2E+05
TETRACHLOROETHANE, 1,1,1,2-	5.2E+01	carcinogenic effects	5.2E+01	9.2E+02	4.6E+03	6.8E+02
TETRACHLOROETHANE, 1,1,2,2-	1.6E+01	carcinogenic effects	1.6E+01	1.0E+04	5.1E+04	1.9E+03
TETRACHLOROETHYLENE	2.7E+01	carcinogenic effects	2.7E+01	1.3E+02	6.4E+02	1.7E+02
TETRACHLOROPHENOL, 2,3,4,6-	9.9E+03	noncarcinogenic effects		9.9E+03	5.0E+04	NA
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	2.5E+04	noncarcinogenic effects		2.5E+04	1.2E+05	NA
THALLIUM	2.5E+01	noncarcinogenic effects		2.5E+01	2.5E+01	NA
TOLUENE	8.2E+02	saturation limit		1.7E+04	8.7E+04	8.2E+02
TOXAPHENE	1.5E+02	carcinogenic effects	1.5E+02			NA
TPH (gasolines)	3.7E+03	noncarcinogenic effects		3.7E+03	3.7E+03	5.4E+03
TPH (middle distillates)	5.0E+02	saturation limit		1.9E+03	1.9E+03	5.0E+02
TPH (residual fuels)	3.0E+05	noncarcinogenic effects		3.0E+05	3.0E+05	NA
TRICHLOROBENZENE, 1,2,4-	8.2E+01	noncarcinogenic effects	2.2E+02	8.2E+01	4.1E+02	NA
TRICHLOROETHANE, 1,1,1-	6.4E+02	saturation limit		1.2E+04	5.8E+04	6.4E+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 (Final) (mg/kg)	[2]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
TRICHLOROETHANE, 1,1,2-	2.0E+00	noncarcinogenic effects	3.0E+01	2.0E+00	1.0E+01	2.2E+03
TRICHLOROETHYLENE	6.1E+00	noncarcinogenic effects	3.6E+01	6.1E+00	3.0E+01	6.9E+02
TRICHLOROPHENOL, 2,4,5-	3.3E+04	noncarcinogenic effects		3.3E+04	1.6E+05	NA
TRICHLOROPHENOL, 2,4,6-	3.3E+02	noncarcinogenic effects	1.5E+04	3.3E+02	1.7E+03	NA
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	3.3E+03	noncarcinogenic effects		3.3E+03	1.7E+04	NA
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	2.6E+03	noncarcinogenic effects		2.6E+03	1.3E+04	NA
TRICHLOROPROPANE, 1,2,3-	1.3E-01	carcinogenic effects	1.3E-01	6.7E+00	3.3E+01	1.4E+03
TRICHLOROPROPENE, 1,2,3-	9.9E-01	noncarcinogenic effects		9.9E-01	5.0E+00	3.1E+02
TRIFLURALIN	3.8E+03	noncarcinogenic effects	3.3E+04	3.8E+03	1.9E+04	NA
TRINITROBENZENE, 1,3,5-	1.4E+04	noncarcinogenic effects		1.4E+04	6.9E+04	NA
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	1.0E+03	noncarcinogenic effects		1.0E+03	5.0E+03	NA
TRINITROTOLUENE, 2,4,6- (TNT)	2.2E+02	noncarcinogenic effects	7.2E+03	2.2E+02	1.1E+03	NA
VANADIUM	6.6E+02	noncarcinogenic effects		6.6E+02	3.3E+03	NA
VINYL CHLORIDE	1.1E+01	carcinogenic effects	1.1E+01	1.2E+02	6.2E+02	3.9E+03
XYLENES	2.6E+02	saturation limit		8.0E+02	4.0E+03	2.6E+02
ZINC	1.5E+05	noncarcinogenic effects		1.5E+05	7.6E+05	NA

Primary source: USEPA Regional Screening Levels (USEPA 2016), modified as noted below and described in Appendix 1, Section 3.2.

1. Carcinogens: Default t+A6arget excess cancer risk = 10^{-5}. Target excess cancer risk of 10^{-6} used for volatile contaminants that are carcinogens. Target risk of 10^{-4} applied to aldrin, dieldrin, TEQ dioxins and hexavalent chromium action levels to reflect on higher confidence in noncancer toxicity factors and/or background and other factors.

2. Noncarcinogens: Final action level based on default target hazard quotient = 0.2 unless noted. 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. 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			
BENOMYL	C				5										
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-CHLORO-1-METHYLETHYL)ETHER	B2							5							
BIS(2-ETHYLHEXYL)PHTHALATE	?		6,7									7			No chronic toxicity factors.
BORON	D											3,5	4		
BROMODICHLOROMETHANE	B2		3							3,5					
BROMOFORM	B2		2,3,5							3	2,3				
BROMOMETHANE	D		1,2,4,5	2			1			1,2,3	2,3		2,3,4,5		
CADMIUM	B1/D									1,2,3,4,5			1,2,3		bone loss (1,3)
CARBON TETRACHLORIDE	B2		1,3,5		1					3	1				
CHLORDANE (TECHNICAL)	B2		2,3,5						2,4		3				
CHLOROANILINE, p-	?		2,5						4	2				2	
CHLOROBENZENE	D		1,2,4,5					2		1,2,3,4	2	1			
CHLOROETHANE	B		1		1,3										
CHLOROFORM	B2		1,2,3,5		1					1,2,3					
CHLOROMETHANE	C/D				3						2	2,3			
CHLOROPHENOL, 2-	D		1,3		1							1,4,5			
CHROMIUM (Total)	-														
CHROMIUM III	D							1					1	2	
CHROMIUM VI	A	M						1				1	1,5		
CHRYSENE	B2	M							3					3	No chronic toxicity factors.
COBALT	?			2									2	2	hearing (2)
COPPER	D		7										1,3	2	
CYANIDE (Free)	D			1,3		1,3,5		3			1,4,5		3		
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	C		3		3					3					
DALAPON	D									2,5,7					
DIBENZO(a,h)ANTHTRACENE	B2	M							3					2,3	
DIBROMO-3-CHLOROPROPANE, 1,2-	B2	M	1		1					2		1,2,3,4,5	1		
DIBROMOCHLOROMETHANE	C		5												
DIBROMOETHANE, 1,2-	B2				3							3	1,2		

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

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

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

CHEMICAL PARAMETER	Target Organs And Health Effects														
	[a]Carcinogen	[b]Mutagen	[c]Alimentary Tract	Cardiovascular	Developmental	Endocrine	Eye	Hematologic	Immune	Kidney	Nervous	Reproductive	Respiratory	[d]Skin	Other
METHYLENE CHLORIDE	B2	M	2,5	1						2	1				
METHYLNAPHTHALENE, 1-	C							4,5	3					3	= Fluorene
METHYLNAPHTHALENE, 2-	D							4,5	3					3	= Fluorene
MOLYBDENUM	D							5							
NAPHTHALENE	C						2	2	3				1,5	3	
NICKEL	A/D		1,5					1		5			1,2	2	
NITROBENZENE	D		1,2,3,4,5,6		2	4,5,6		2,3,4,5,6		4,5,6	1,6		2	6	
NITROGLYCERIN	?														Information not available
NITROTOLUENE, 2-	?		2					2				2			
NITROTOLUENE, 3-	D							2							
NITROTOLUENE, 4-	?		2					2				2			
PENTACHLOROPHENOL	B2		1,2,3,5		1,3			3	3	2,5	2,3	1	2,3		
PENTAERYTHRITOLTETRANITRATE (PETN)	?														Information not available
PERCHLORATE	D					7		2							
PHENANTHRENE	D							4,5	3					3	= Fluorene
PHENOL	D		1,2		3,5			1		1,2	1	4	1		
POLYCHLORINATED BIPHENYLS (PCBs)	B2		1,2,3		1,3	3	5	3	1,3,5			1,2,3		3	
PROPICONAZOLE	D		5												
PYRENE	D								3	4,5					
SELENIUM	D		1,2,5	1				5			1		1,2	2,3,5	Selenosis (3,5)
SILVER	D													2,3,5	
SIMAZINE	?				4,5			5,7						2	
STYRENE	C		3,4,5					4,5			1,2,4,5		2	2	
TERBACIL	D		5			5									
tert-BUTYL ALCOHOL	?														No chronic toxicity factors.
TETRACHLOROETHANE, 1,1,1,2-	C		5							5					
TETRACHLOROETHANE, 1,1,2,2-	C		2,3								2,3				
TETRACHLOROETHYLENE	C		1,2,5							1,2					
TETRACHLOROPHENOL, 2,3,4,6-	D		1		1							1			
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	D														
THALLIUM	D		2	2			2	5			2,3	2,3		2	
TOLUENE	D		4,5		1,3					4,5	1,2,5	2	1,5		
TOXAPHENE	B2		3			3			3	3					
TPH (gasolines)	D		8					8		8	8				Decreased body weight
TPH (middle distillates)	D		8					8		8	8				Decreased body weight
TPH (residual fuels)	D		8					8		8	8				Decreased body weight
TRICHLOROBENZENE, 1,2,4-	D					4,5									
TRICHLOROETHANE, 1,1,1-	D		2,6	7							1				
TRICHLOROETHANE, 1,1,2-	C		5					6	7					2	
TRICHLOROETHYLENE	B2	M	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
(For general reference only. May not be adequately comprehensive for some chemicals. Some noted effects may be insignificant. Refer to original documents for additional information.)

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

Notes:

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

Carcinogen Classification

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

References:

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2. CDC, 2007, International Chemical Safety Cards: International Programme on Chemical Safety: United Nations Environment Program, International Labour Office and World Health Organization (accessed December 2007); published through US Department of Health and Human Services, Centers for Disease Control and Prevention, http://www.cdc.gov/niosh/ipcs/icstart.html
3. ATSDR, 2007, ToxFAQs™: Agency for Toxic Substances and Disease Registry (accessed December 2007), http://www.atsdr.cdc.gov/toxfaq.html
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5. USEPA, 2007, IRIS: U.S. Environmental Protection Agency, IRIS Database (accessed December 2007); (Critical effect used for derivation of USEPA RfD as presented in IRIS database; may not be inclusive of all potentially significant health effects), http://www.epa.gov/iris/subst/index.html
6. ORNL, 2007, Risk Assessment Information System (RAIS), Toxicity Profiles: Oak Ridge National Laboratory/U.S. Department of Energy (accessed December 2007), RAGs A Format, especially Critical Effect used for derivation of RfDs, http://risk.lsd.ornl.gov/tox/rap_toxp.shtml
7. USEPA National Primary Drinking Water Standards (March 2001): U.S. Environmental Protection Agency, Office of Water, EPA 816-F-01-007, http://www.epa.gov/safewater/consumer/pdf/mcl.pdf (selectively used)
8. TPH whole product toxicity based review of TPH Working Group petroleum carbon fraction guidance (TPHWG 1998, Volume 4) and Massachusetts DEP VPH/EPH guidance (MADEP 2002a).
For additional online references, see also: Hazardous Substances (On-line) Database: U.S. National Library of Medicine, Toxicology Data Network, http://toxnet.nlm.nih.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
BENOMYL				
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-CHLORO-1-METHYLETHYL)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

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)
COPPER	2.4-450	2.5E+02	4.5E+02	2.5E+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)				
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				

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)
HEXACHLOROBENZENE				
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)				

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)
THALLIUM	<0.25-15	2.5E-01	1.5E+01	2.5E-01
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
BENOMYL	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-CHLORO-1-METHYLETHYL)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

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, 1,2-	site-specific	site-specific
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

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
METHYLNAPHTHALENE, 2-	site-specific	site-specific
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.

Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater

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

Appendix 1: Detailed Lookup Tables

Hawai‘i Edition

Prepared by:

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Fall 2017
(refer to Appendix 9 and Updates worksheet in EAL Surfer for summary of most recent updates)

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DISCLAIMER

This document, *Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater* (Fall 2017), is a technical report prepared by staff of the Hawai'i Department of Health (HDOH), Environmental Management Division. The document updates and replaces the Summer 2016 edition.

The document provides guidance for identification and evaluation of environmental hazards associated with contaminated soil and groundwater. The Environmental Action Levels (EALs) presented in this document and the accompanying text are specifically *not* intended to serve as: 1) a stand-alone decision making tool, 2) guidance for the preparation of a baseline environmental risk assessment, 3) a rule to determine if a waste is hazardous under the state or federal regulations, or 4) a rule to determine when the release of hazardous substances must be reported to the HDOH.

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

This document will be periodically updated. Please send comments, edits, etc. in writing to the above contacts. It is cautioned, however, that reference to the action levels presented in this document without adequate review of the accompanying narrative could result in misinterpretation and misuse of the information.

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

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4 EXAMPLE PRINTOUTS OF VAPOR INTRUSION MODELS

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6 DEVELOPMENT OF CARBON RANGE AND TOTAL PETROLEUM HYDROCARBON RISK-BASED ACTION LEVELS

7 DETERMINATION OF GROUNDWATER UTILITY (HDOH 1995)

8 SUPPLEMENTAL HDOH TECHNICAL GUIDANCE DOCUMENTS

9 UPDATES TO 2011 EHE GUIDANCE DOCUMENT

GLOSSARY OF TERMS

AWQC: Aquatic Water Quality Criteria
CCC: Criterion for Continuous Concentration
CCM: Criterion for Maximum Concentration
EPA: Environmental Protection Agency
ESL: Environmental Screening Level
FVC: Final Chronic Value
HIDOH: Hawai'i Department of Health
HH: Human Health-consumption of aquatic organisms
LOEL: Lowest-Observed-Effects Level
MADEP: Massachusetts Department of Environmental Protection
MCL: Maximum Concentration Level
MOEE: Ontario Ministry of Environment and Energy
MTBE: Methyl tert-Butyl Ethylene
PCE: Tetrachloroethylene
PRG: Preliminary Remediation Goals
RBSL: Risk-Based Screening Level
RSL: Regional Screening Level
RWQCB: Regional Water Quality Control Board
TPH: Total Petroleum Hydrocarbons
USEPA: U.S. Environmental Protection Agency
USDOE: U.S. Department of Energy

APPENDIX 1

DEVELOPMENT OF TIER 1 LOOKUP TABLES

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

APPENDIX 1
DEVELOPMENT OF TIER 1 LOOKUP TABLES

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1 Development of Tier 1 Lookup Tables

1.1 Introduction

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

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

Indoor Air and Soil Vapor:

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

Soil:

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

Groundwater:

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

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

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

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

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

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

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

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

As discussed in Volume 1, analysis and evaluation of TPH in conjunction with targeted, individual petroleum compounds such as benzene is required at petroleum-release sites. Contrary to past beliefs, the combined TPH compounds will drive risk posed by petroleum

contamination at many sites, rather than individual chemicals like benzene or naphthalene. Risk is based on a combination of toxicity and mass. While benzene and naphthalene may be more toxic on a relative scale, the overwhelming mass of otherwise less toxic, non-specific, aliphatic and aromatic compounds can ultimately pose a greater risk to human health and the environment.

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

1.2 Example Selection of Tier 1 EALs for Tetrachloroethylene

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

The Tier 1 EAL for PCE in shallow soil is selected as the lowest of the individual action levels for Direct Exposure (1.1 mg/kg), Vapor Intrusion (0.098 mg/kg), Gross Contamination (170 mg/kg) and Groundwater Protection (leaching concerns, (0.64 mg/kg). The final soil EAL for PCE is the lowest of the individual action levels, or 0.098 mg/kg, based on potential vapor intrusion concerns for buildings overlying contaminated soil (see also Table A-1 in this appendix and Table A in Volume 1).

The process for selection of a Tier 1 PCE EAL in groundwater is similar (refer to Figure 2). Individual action levels for Drinking Water (5.0 µg/L), Vapor Intrusion (190 µg/L), Impacts to Aquatic Habitats (53 µg/L) and Gross Contamination (170 µg/L) concerns are compared and the lowest of these is selected for inclusion in the Volume 1 summary, Tier 1 lookup tables. In this example, the groundwater action level for drinking water concerns drives potential risks and is selected as the Tier 1 EAL (5.0 µg/L).

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

The process described above was carried out for each of the 100+ chemicals included in the Tier 1 lookup tables under each combination of groundwater beneficial use, soil depth and land use. The results are summarized in Tables A and B (soil) and Table D (groundwater) of this appendix. As can be seen from a review of these tables, the selection of final, Tier 1 EALs for highly mobile or highly toxic chemicals is typically driven by groundwater protection or vapor intrusion concerns (e.g., see selection process for benzene or vinyl chloride EALs in Table A-1). Final EALs for chemicals that are relatively immobile in soils but highly toxic are typically driven by direct-exposure concerns (e.g., see selection process for polychlorinated biphenyls [PCBs] in Table A-1). In contrast, selection of EALs for heavy metals that are relatively non-toxic to humans is typically driven by ecological concerns or ceiling levels for general resource degradation (e.g., see selection process for copper EAL in Table A-1). For chemicals that have particularly strong odors, selection of EALs may be driven in part by gross contamination concerns ("ceiling levels", e.g., see TPH EALs in Table B-2). The consideration of gross contamination becomes especially important in the selection of alternative action levels for relatively immobile chemicals in isolated, deep soils (e.g., refer to Tables F-3).

1.3 Toxicity Factors and Physiochemical Constants

Toxicity factors and physiochemical constants used in the soil, tapwater and vapor intrusion models for risk to human health are taken directly from the USEPA Regional Screening Levels (RSLs) guidance except as noted in footnotes to Table H (USEPA 2017a). References for constants not included in the RSL guidance include: National Library of Medicine Toxnet database (NLM 2017a), NLM ChemID Plus (NLM 2017b), ATSDR Toxprofiles (ATSDR 2006) and USDOE RAIS database (USDOE 2006), in that order or preference, unless otherwise noted. Refer to footnotes in Table H for additional details on specific chemicals.

Inhalation Reference Concentrations are not available for a number of volatile chemicals included in the USEPA RSLs. Affected chemicals are indicated in the footnotes to Table H. The RSL guidance instead calls for a case-by-case review of these chemicalsby a toxicologists. This is highly unlikely to occur given the widespread use of the RSLs by workers not trained in risk assessment, effectively eliminating consideration of the inhalation exposure pathway in most cases where the affected screening levels are applied. The original USEPA Region IX Preliminary Remediation Goals (PRGs), the precursors of the current RSLs, used route-to-route extrapolation to develop an interim, inhalation Reference Concentration from an oral Reference Dose for chemical where studies specific to this pathway were not available or inadequate to develop toxicity factors (USEPA 2004a; see also USEPA 1993, 2011a):

$$Reference\ Concenration\ \left(\frac{mg}{m^3}\right) = Reference\ Dose \times 70\ kg \times \left(\frac{1}{20\frac{m^3}{day}}\right).$$

Although confidence in the resulting Reference Concentration is low, the need to include the chemicals in the EAL summary tables and the subsequent need to consider the inhalation exposure pathway in generic action levels outweighs limitations in the use of route-to-route extrapolation methods. . Chemicals where this approach was used are noted in the footnotes of Table H. Alternative inhalation toxicity factors can be considered on a site-specific basis.

Note that estimation of Unit Inhalation Risk factors from oral cancer slope factors for volatile chemicals where the latter had been published was discontinued in the 2017 update to this guidance. This was based on discussions with toxicologists and the lack of evidence that the subject chemicals were carcinogenic via the inhalation exposure route. Inhalation toxicity factors based on noncancer risk were available or estimated for the subject chemicals (see Table H).

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

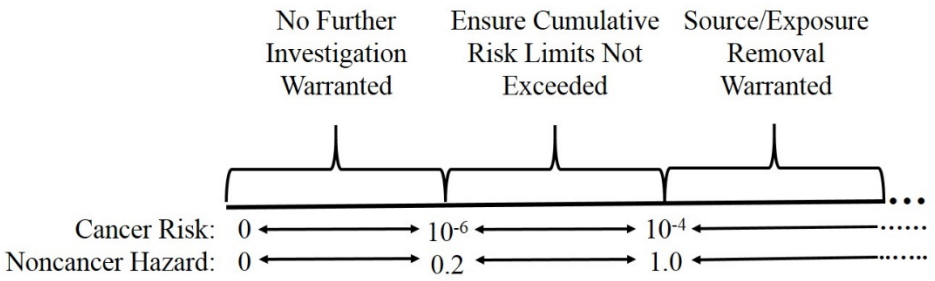
Chemicals are subdivided in terms of volatility into the following categories for use in this guidance (see Table H):

- Volatile: Henry's Constant >0.00001 (atm-m^3/mole]) OR Vapor Pressure (VP) >1 mm Hg AND molecular weight <200;
- Semi-volatile: Henry's Constant >0.00001 (atm-m^3/mole) OR VP >1 mm Hg and molecular weight $\geq$200;
- Nonvolatile: Henry's Constant $\leq$0.00001 (atm-m^3/mole) AND VP $\leq$1 mm Hg.

Soil and groundwater screening levels for vapor intrusion are only developed for "volatile" chemicals as defined above (Tables E-1a and E-1b), although indoor air and subslab soil vapor screening levels are also included for semi-volatile chemicals (Tables E-2 and E-3). Tapwater and soil direct exposure screening levels are calculated using the "volatile" chemical model incorporated into the USEPA RSLs for both "volatile" and "semi-volatile" chemicals (Tables F-3b and K-1 through K-3). Soil and water screening levels for nonvolatile chemicals are generated using alternative models, as discussed below.

1.4 Cumulative Risk vs Target Action Level

Calculation of a risk-based, action level for a chemical in soil, water, air or other media requires incorporation of a target cancer risk and/or noncancer Hazard Quotient into the exposure models (see Appendix 2). Three ranges of risk are used to determine the need for additional actions at a site under investigation, as summarized in the following figure:



"Cancer risk" represents a theoretical increase in cancer occurrences based on comparison of exposure to a toxicity factor intended to reflect a one-in-a-million risk (10^{-6}). A cancer risk of less than one-in-ten thousand (10^{-4}) is considered to be insignificant and not detectable in a population. A Hazard Quotient represents the ratio of the potential exposure to the substance and the level at which no adverse, systemic or "noncancer" health effects are expected. A Hazard Quotient less than or equal to "1" indicates that adverse noncancer effects are not likely to occur, and exposure can thus be considered to have negligible hazard.

The USEPA recommends that removal of the source of contamination or exposure to the contamination be carried out if a cumulative, excess cancer risk of 10^{-4} (one-in-ten-thousand) or a noncancer Hazard Index of 1.0, calculated as the sum of Hazard Quotients for individual chemicals, is exceeded (USEPA 1989a,b, 1991, 1994, 2017b). Use of these target risk levels to develop action levels is in general not appropriate, however, since the cumulative health risk posed by the presence of multiple contaminants in soil with similar health effects could be exceeded, even though the risk posed by individual chemicals is deemed acceptable.

More conservative risk targets are instead used to develop action levels for individual chemicals. This allows the action levels to be used without the need to evaluate cumulative risk in the majority of cases. For example, an excess cancer risk of 10^{-6} (one-in-a-million) is used as the default, departure point for calculation of the majority of cancer-based action levels presented in this guidance. This allows up to 100 chemicals with similar, carcinogenic effects to be present in the soil at the corresponding action levels before a cumulative, target cancer risk of 10^{-4} is exceeded. This is highly, if not excessively,

conservative, since it is rare to identify more than five potential carcinogens associated with a single source of contamination at typical release sites.

A default, noncancer target Hazard Quotient of 0.2 is utilized to develop soil, air and soil vapor action levels (see above figure). This allows up five chemicals with similar, systemic health effects to be present in the soil at the corresponding action levels before exceedance of a cumulative, Hazard Index of 1.0 is possible. A similar target Hazard Quotient was used by the Massachusetts Department of Environmental Protection (MADEP) (MADEP 1994) and Ontario Ministry of Environment and Energy (MOEE) (MOEE 1996) to develop action levels for direct-exposure concerns. Additional evaluation may be required for sites where more than five chemicals with similar noncarcinogenic health effects are present. For reference, a compilation of chronic health effects for the chemicals listed in the EALs is provided in Table J of this appendix. Note that a noncancer Hazard Quotient of 3.0 is sometimes used to develop screening levels for emergency removal actions (e.g., USEPA 2017b). This is intended to only address short-term exposure risks, however, and requires followup consideration of cumulative risk as part of a longer-term remedy.

A default Hazard Quotient of 1.0 is utilized for calculation of toxicity-based, drinking water action levels unless otherwise noted in the lookup tables (refer to Section 4.2). Consideration of potential cumulative risk is thus not directly incorporated into the resulting action levels. This is consistent with development of promulgated drinking water standards, however, and takes into consideration the likely assessment of cumulative risk in the event of actual impacts to an actively used, drinking water supply.

Less conservative, target risks that exceed the default 10^{-6} excess cancer risk or 0.2 Hazard Quotient but fall within the range for consideration of potential cumulative risk noted in the above figure are applied to some chemicals, particularly for develop of direct-exposure action levels for soil. Refer to Section 4.2.2 for discussion of specific chemicals. This was implemented to expedite the identification of impacts that could require remedial actions by upfront consideration circumstances where a single chemical typically drives cancer risk (e.g., arsenic), where there is greater confidence in toxicity factors based on noncancer studies (e.g., organochlorine pesticides), and/or widespread, natural or anthropogenic, background levels of a chemical in excess a target risk of 10^{-6} (e.g., PAHs). Additional assessment of cumulative risk could be required in rare cases where the action levels are applied to sites where complex mixtures of contaminants could cause cumulative risk targets to be exceeded.

Exposure assumptions used to develop direct-exposure and indoor-air action levels primarily reflect parameter values presented in USEPA risk assessment guidance for Superfund sites (refer to USEPA 2017a). Alternative, and in some cases less conservative, exposure assumptions are presented in the USEPA technical document *Exposure Factors Handbook* (USEPA 2011c), among other examples. For example, recommended inhalation

rates for residents are 11.3 m^3/day for women and 15.2 m^3/day for men, in comparison to the value of 20 m^3/day used to develop the direct-exposure action levels presented in this appendix (Section 4). The average time (50th percentile) spent at one residence is also stated to be 9 years, in contrast to the more conservative exposure duration used of 30 years (revised to 26 years in the 2015 USEPA RSL guidance; USEPA 2017a). The average occupational tenure is similarly stated to be 6.6 years, in contrast to the occupational exposure duration used of 25 years. While the more conservative exposure assumptions are still generally recommended for use in site-specific risk assessments, the variance in the assumptions helps to demonstrate the overall conservative nature of the models referenced in this document.

As discussed in Volume 1, the action levels presented in this guidance are not intended to represent mandatory, cleanup levels. Exceedance of an action level does not necessarily indicate that an adverse health risk is present, but rather that additional action is warranted. Use of the action levels for final decision making will in many, if not most, instances be both time and cost beneficial, however. Consideration of alternative exposure assumptions, target risks and related factors in a more "site-specific" risk assessment could result in an increase of direct-exposure action levels while still allowing for cumulative risk targets to be met..

A Hazard Quotient of 1.0 was used for calculation of risk-based action levels for Total Petroleum Hydrocarbons (TPH, see Section 6 and Appendix 6). Nonspecific compounds collectively measured as TPH dominate soil, water and air impacted by releases of common, petroleum fuels and overwhelmingly drive noncancer health risks. A less stringent target Hazard Quotient is therefore considered justified. The need to calculate cumulative risks in more detail should be evaluated on a site-by-site basis.

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

2 Background and Use of Vapor Intrusion Models

2.1 Background

This section describes the general approach used to develop vapor intrusion action levels for indoor air, subslab soil vapor, soil and groundwater, presented in Sections 3, 4 and 5 of this document. Indoor air action levels are based on a model used by USEPA to generate Regional Screening Levels (RSLs) for ambient air (USEPA 2017a). Subslab soil vapor action levels were developed based on estimations of indoor air exchange rates (IAERs) and building slab vapor entry rates for tropical settings published by Brewer et al. (2014). A copy of the paper is included in Appendix 3. Corresponding vapor intrusion action levels for soil and groundwater were generated using a computer spreadsheet model published by the U.S Environmental Protection Agency (USEPA 2004b and updates).

The USEPA vapor intrusion model incorporates a model presented in the document *Heuristic Model for Predicting the Intrusion Rate of Contaminant Vapors into Buildings* (Johnson and Ettinger, 1991). These models were developed to study radon intrusion into homes but were subsequently modified for use with any volatile chemical. Development of the models included calibration with field data. They are thus based on empirical data and not purely theoretical. Excerpts of key text from the USEPA guidance document is provided in Appendix 3, as is a sensitivity evaluation of the Johnson and Ettinger model.

Refer to Section 4.5 in Volume 1 of this guidance for a basic overview of vapor intrusion. The model considers both diffusive and convective flow of subsurface vapors into buildings. Diffusive flow occurs as soil vapor migrates from areas of higher concentration to areas of lower concentration. Wind effects and indoor heating can cause a decrease in air pressure inside a building and lead to upward, advective flow of subslab vapors through cracks and gaps in the floor. Potential adverse impacts to indoor air are driven by the concentration of volatile organic chemicals (VOCs) in the intruding vapors, the vapor entry rate into the structure and the exchange rate of the building with fresh, outdoor air.

2.2 Vapor Intrusion Model Parameters

Example printouts of the model as used to calculate action levels for this document are included in Appendix 4. Input parameter values used in the models are noted in the

examples (front pages). Default parameters values presented in the spreadsheet technical document were generally selected for use.

2.2.1 Target Risks

Human exposure assumptions were set equal to assumptions used in the USEPA RSLs. Unless otherwise noted in Table E-3. Action levels were calculated using a target risk of 10^{-6} for chemicals with carcinogenic health effects and a target Hazard Quotient of 0.2 for chemicals with noncarcinogenic health effects (1.0 for TPH, see Section 6). For consistency purposes, default physio-chemical constants included in the original, USEPA vapor intrusion models were replaced with constants used in the USEPA RSL models if different (refer to Table H and Appendix 4).

2.2.2 Assumed Building Parameters

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

Default indoor-air exchange rates of one-time per hour for residences and two-times per hour for commercial/industrial buildings were used (see Brewer et al. 2014; directly input into the model). Based on the input building design and volume, this generates an indoor air exchange rate of 225 m^3/hour or 3,750 L/min for a residential home model and 7,500 L/min for a commercial building of the same size (see Appendix 4). The IAERs are assumed to be conservative for the tropical climate of Hawai‘i, where buildings are not heated and windows at homes are often left open year round. Air exchange rates could be lower for homes and buildings that rely on heating, air conditioning and ventilation (HVAC) systems for ventilation. This would result in lower vapor entry rates, however, especially in cases where air conditioning is being used due to over pressurization of lower floors (see Brewer et al. 2014). Assumptions regarding persistent vapor entry due to wind effects and open windows are therefore considered to be conservative.

2.2.3 Assumed Vapor Entry Rate

An annual average, subslab vapor entry rate (Qsoil) of 2 L/min (per 100 m^2 floor area) was incorporated into the vapor intrusion models, based on estimations tropical climates

presented in Brewer et al. (2014). This was generated in the models by inputting "Sand" as the soil type for Layer A soil type and a default value of 20 g/cm-s^2 for the "Soil-Building Pressure Differential" parameter (see Appendix 4). The latter reflects the assumed, annual-average difference between indoor and outdoor air pressures and an under pressurization of the structure. This generates a default vapor flux rate through the building slab of approximately 38 cm^3/second or two liters per minute. **A vapor entry rate of 2 L/min per 100m^2 floor space should be maintained for site-specific models where a larger building size is used unless otherwise approved by HDOH.**

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

The default, annual average vapor entry rates incorporated into the models are intended to reflect an overall lower vapor intrusion risk for buildings in tropical climates in comparison to colder climates, where buildings are heated for much of the year and thus more susceptible to vapor intrusion (see Brewer et al. 2014). Higher, assumed indoor-outdoor pressure differentials and correspondingly higher average vapor entry rates are typically recommended for buildings in colder climates (Brewer et al. 2014; see also USEPA 2004b, 2015a). This would be reflected by a corresponding reduction in soil vapor, soil and groundwater action levels for vapor intrusion. Example modification of HDOH action levels for use in other climate zone is included in Section 13 of the HEER Office *Technical Guidance Manual* (HDOH 2016 and updates).

2.2.4 Assumed Indoor Air:Subslab Soil Vapor Attenuation Factors

A key part of the action levels is the assumed attenuation of subsurface vapors as they intrude a building and mix with indoor air. Shallow soil vapor action levels for vapor intrusion are calculated by dividing the indoor air goal by an Indoor Air:Subslab Soil Vapor attenuation factor that reflects dilution of subsurface vapors upon mixing with indoor air:

$$Soil\ Vapor\ Action\ Level = \frac{Indoor\ Air\ Action\ Level}{Subslab\ Attenuation\ Factor}$$

The subslab soil attenuation factor (SSAF) reflects the ratio of the estimated, mean annual vapor entry rate and the mean annual IAER for tropical climates (see Brewer et al. 2014).

$$SSAF = \frac{Vapor\ Entry\ Rate\ (L/min)}{Indoor\ Air\ Exchange\ Rate\ (L/min)}$$

This generates a default, SSAF of approximately 0.0005 (1/2,000) for residential homes and 0.00025 (1/4,000) for commercial and industrial buildings. These attenuation factors are used in Section 3 to calculate subslab vapor intrusion action levels for subslab soil vapor. The default building pressure differential and IAERs are incorporated into the soil and groundwater vapor intrusion models to generate correlative action levels for those media.

Note that the vapor intrusion models used to develop soil and groundwater action levels are not sensitive to the "Soil-Building Pressure Differential" parameter. A reduction or increase in the input pressure differential and the calculated SSAF will not result in a significant change in the action levels. This is because the mass of a VOC entering an overlying structure during a given time period is governed by rate of upward diffusion from the source into the advective zone under the slab, not by the vapor entry rate, and remains unchanged. The mass of VOCs that diffuses into the advective zone and is ultimately drawn into the overlying building over a given time period is unaffected by the vapor entry rate. Reducing the flow rate of vapors under the slab and into the structure by half, for example from 4 L/min to 2 L/min, will result in a doubling of VOC concentrations in vapors under the slab. The volume of vapors entering the building is concurrently reduced by half during the same time period, however, effectively cancelling out the doubling of VOC concentrations in the vapor. This can be observed in the vapor intrusion models by reducing the "Soil-Building Pressure Differential" parameter from 40 to 20 g/cm-s^2. This results in a reduction of the calculated vapor entry rate from approximately 4 L/min to 2 L/min without causing a noticeable change in calculated screening level for a given VOC.

3 Indoor Air and Soil Vapor Action levels

3.1 Introduction

This section describes the development of risk-based action levels for indoor air and subslab soil vapors. Indoor air action levels were developed based on models and exposure assumptions incorporated into the USEPA Regional Screening Levels (RSLs) for ambient air (USEPA 2017a). Corresponding action levels for VOCs in subslab soil vapors were estimated based on attenuation factors published by Brewer et al. (2014). These action levels are intended to correlate with and be used in conjunction with vapor intrusion action levels for subsurface soil and groundwater presented in Chapters 4 and 5 respectively.

3.2 Indoor Air Action levels

Indoor air action levels were calculated using the following equation incorporated in the model (see USEPA RSL equations in Appendix 2):

Carcinogens:

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

Noncarcinogens:

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

where:

Cia = Target indoor air concentration;

TR = Target risk (carcinogens);

THQ = Target hazard quotient (noncarcinogens);

ATc = Averaging time for carcinogens;

ATnc = Averaging time for noncarcinogens;

URF = Unit risk factor for carcinogens (carcinogens);

RfC = Reference concentration (noncarcinogens);

EF = Exposure frequency;

ED = Exposure duration;

ET = Exposure time.

Exposure time is expressed in terms of a 24 hour day. An ET of 24hr/24hrs is assumed for residents. An ET of 8hrs/24hrs is assumed for commercial/industrial workers (see Appendix 2). A summary of the indoor-air action levels calculated is provided in Table C-3. Cancer-based action levels reflect a default, target excess cancer risk of 10^{-6} unless otherwise noted (refer to Section 2.2.1 and footnotes to Table C-3).. Exceptions, including ethylbenzene and naphthalene. Noncancer-based action levels reflect a target Hazard Quotient of 0.2 unless otherwise noted. Exceptions include TPHg and TPHmd, in which case a Hazard Quotient of 1.0 was used (refer also to Section 6). Inhalation toxicity factors for volatile chemicals are summarized in Table H.

3.3 Soil Vapor Action levels

Section 2.2.4 describes the development of default, subslab attenuation factors (SSAFs) for subsurface vapors that intrude homes and impact indoor air. A default SSAF of 0.0005 was estimated for residential homes. A default SSAF of 0.00025 was estimated for commercial/industrial structures. The latter assumes better and more consistent ventilation of businesses during normal operating hours.

Soil vapor action levels (C_{sv}) were subsequently calculated as:

$$Csv = \frac{Indoor\ Air\ Action\ Level\ (\mu g/m^3)}{SSAF}$$

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

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

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

4 Soil Action levels

4.1 Introduction – Selection of Tier 1 Soil EALs

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

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

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

4.2 Soil Action levels for Direct-Exposure Concerns

4.2.1 Direct Exposure Models and Assumptions

Direct exposure soil action ("screening") levels for unrestricted land use (e.g., "residential"), commercial/industrial land use and construction/trench worker exposure are

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

The direct-exposure action levels closely follow the approach used to develop the USEPA RSLs, with the exceptions noted below (RSLs; USEPA 2017a). Direct-exposure soil action levels generated for the Unrestricted Land Use category are consistently more stringent (lower) than action levels developed for the commercial/industrial and construction/trench worker exposure scenarios. This is due to the longer, assumed exposure duration (years) and frequency (days per year) as well as the presence of young children in comparison to the latter two scenarios (see Appendix 2). Action levels for construction and trench workers take precedence over action levels based on residential and/or commercial/industrial exposure scenarios if lower. This is the case for several chemicals that pose an increased risk via inhalation of dust particles, including a number of trace metals as well as some volatile compounds (see Table I-2).

As a default, direct-exposure models and associated physiochemical constants, toxicity factors, exposure assumptions and target risks used to develop the USEPA Regional Screening Levels (USEPA 2017a) were referred to for development of the direct exposure action levels presented in this document (refer to Section 1.2). Use of the USEPA RSLs by state agencies is not mandatory, but the guidance serves as a very useful starting point for state-specific guidance. Staff in HDOH are in routine contact with the developers of the RSLs and exchange information and suggestions for specific chemicals to help ensure that the underlying fundamentals of the respective guidance documents are consistent.

Exposure assumptions incorporated into the USEPA RSLs were adhered to in most cases. Exceptions include an increase in the assumed, adult body weight from 70 kg to 80kg in recent updates of the RSLs. The original, default body weight of 70 kg was retained for use in the EALs, due to a lower, average body weight for women in Hawaii of 66 kg (City-Data.com 2017). This does not significantly affect the resulting action levels.

Preliminary Remediation Goals (PRGs) previously published USEPA Region IX included a hybrid, direct-exposure action level for total chromium in soil based on an assumed 1:6 ratio of Cr VI (highly toxic) to Cr III (minimally toxic) (USEPA 2004a). This is not included in more recently published, USEPA RSLs (USEPA 2017a) and likewise omitted from the HDOH EALs. The soil action level for total chromium is instead based on an assumed natural background concentration of 1,100 mg/kg, based primarily on data for

soils developed over basaltic bedrock (refer to Table K). If the reported concentration of total chromium in soil exceeds 1,100 mg/kg then an additional evaluation of background concentrations in the area should be carried out and/or chromium in the soil should be speciated into Cr III and Cr VI and data compared to action levels for these compounds. Note that background concentrations of total chromium in soils developed over caprock can be lower than 100 mg/kg. If a release of Cr VI is suspected at a site then chromium should be speciated and evaluated, even if total chromium concentrations do not exceed the default action level of 1,100 mg/kg.

4.2.2 Target Risks

Refer to Section 1.4 for a detailed discussion of default target risk levels used to generate soil action levels. Deviations from the default, target cancer risk of 10^{-6} and a target, noncancer Hazard Quotient of 0.2 noted in Section 1.4 for calculation of direct-exposure soil action levels are summarized in the following table:

Chemical	**HDOH-Specific Models**
Aldrin	Target Excess Cancer Risk (ECR) of 10^{-4} applied to reflect higher confidence in noncancer toxicity factors (see also Dieldrin).
Arsenic	Bioaccessibility data required if natural background exceeded, with target noncancer. Target ECR of $5x10^{-5}$ used to calculate bioaccessible arsenic action levels in order to reflect higher confidence in noncancer toxicity studies and background, dietary exposure; HQ of 1 applied to reflect typical dominance as risk driver when present in soil.
Chlordane (Technical)	Target ECR of 10^{-5} applied to reflect higher confidence in noncancer toxicity studies and primary risk driver when present.
Dieldrin	Target ECR of 10^{-4} applied to reflect higher confidence in noncancer toxicity factors (see also Aldrin).
Dioxins (TEQ)	Refer to 2010 HDOH action levels for TEQ dioxins. Final action level based on noncancer Hazard Quotient of 1.0.
Chromium (hexavalent)	Target ECR of 10^{-4} applied to reflect higher confidence in noncancer toxicity factors and natural background.
Ethylbenzene	Target ECR of 10^{-5} applied to reflect higher confidence in noncancer toxicity factors.

Chemical	HDOH-Specific Models
Heptachlor, Heptachlor Epoxide	Target ECR of 10^{-5} applied to reflect higher confidence in noncancer toxicity studies and primary risk driver when present.
Lead	Residential direct-exposure soil action level of 200 mg/kg based on consideration of both health risk and anthropogenic background in urban areas.
PAHs (carcinogenic)	Target ECR of $5x10^{-5}$ applied to benzo(a)pyrene to reflect higher confidence in noncancer toxicity factors and address anthropogenic background. Target ECR of 10^{-5} applied to other, carcinogenic PAHs to address widespread, anthropogenic background.
PCBs (total)	Target ECR of 10^{-5} applied to reflect increased confidence in noncancer toxicity studies and address anthropogenic background.
Thallium	Target HQ of 1.0 applied to consider natural background and assumed low bioavailability in soil.
TPH	Target HQ of 1.0 applied to reflect TPH-related compounds as dominant mass and risk driver for noncancer hazard in common petroleum mixtures.

In most cases, use of an alternative, target cancer risk of 10^{-4} to 10^{-5} resulted in a cancer-based action level that was higher than the action level for noncancer hazard and the protection of young children. If so then the latter was selected as the final, direct-exposure action level (refer to Tables I-1 and I-2). Confidence in noncancer toxicity studies is also often higher than for cancer-based studies. When present, the chemicals noted above also tend to dominate or "drive" potential health risk with little additional risk posed by other chemicals present in the soil. The target, cumulative, excess cancer risk of 10^{-4} and noncancer Hazard Index of 1.0 is therefore unlikely to be exceeded. Additional evaluation of cumulative risk might be required on a site-specific basis, however, in rare cases where multiple chemicals in the above list are present in soil at concentrations that approach the Tier 1 action levels.

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

Low levels of **PAHs** in soil are ubiquitous in urban environments due to auto exhaust and the use of asphalt. Anthropogenic, background concentrations of PAHs in urban area soils due to auto exhaust and other sources can easily exceed risk-based screening levels based on a conservative, excess cancer risk of 10^{-6}. Massachusetts, for example, uses a background soil screening level of 2.0 mg/kg for benzo(a)pyrene (MADEP 2002a). A target excess cancer risk of $5x10^{-5}$ was used to develop the unrestricted/residential soil action level for benzo(a)pyrene in order to help identify site-specific releases anticipated to exceed anthropogenic background and express a higher confidence in newly developed toxicity factors for noncancer health risks posed by exposure to benzo(a)pyrene (refer to USEPA 2017a). A target risk of $5x10^{-5}$ likewise incorporates a reasonable safety margin for risk associated with the presence of multiple, potential carcinogens in the same soil to help ensure that a cumulative excess risk of 10^{-4} is not exceeded. This generates a soil action level of 5.7 mg/kg, which is greater than the noncancer-based action level of 3.6 mg/kg. The latter was therefore selected by HDOH as the final, direct-exposure soil action level for benzo(a)pyrene under an unrestricted, landuse exposure scenario (refer to Table I-1). A more conservative, target risk of 10^{-5} was applied to carcinogenic PAHs that lack noncancer-based toxicity factors, A target risk of 10^{-5} was utilized for all carcinogenic PAHs under commercial/industrial and construction worker exposure scenarios, since the resulting screening levels are above anticipated background (refer to Tables I-2 and I-3).

Note that concentrations of PAHs in coal tar and older formulations of asphalt can be orders of magnitude higher that direct-exposure action levels set at a target risk of 10^{-4} Since asphalt is likewise ubiquitous in urban environments, cleanup of soil contaminated with small particles of asphalt that was used in its intended manner is generally not warranted. This exception would not apply to sites where asphalt, coal tar or similar materials were manufactured and disposed of as waste associated with those operations.

A similar approach was taken for **PCBs**. Use of PCBs in transformers, capacitors and other electrical equipment was widespread in the 1960s and 1970s. Although less widespread than PAHs, ambient levels in soil often fall within a target risk range of 10^{-5} and 10^{-6}. In order to again help focus attention on sites where significant releases of PCBs occurred, a target excess cancer risk of 10^{-5} was used to develop direct-exposure action levels for soil. A target Hazard Quotient of 0.2 for noncarcinogenic effects was retained. Note that noncarcinogenic effects drives human health concerns for PCBs in soils under a residential exposure scenario and is used to generate the Tier 1EAL (refer to Table I-1).

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

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

A target excess cancer risk of 10^{-5} was used for heptachlor and heptachlor epoxide. Heptachlor is typically the primary risk driver when present in soil. A target risk of 10^{-5} is considered to be adequate to ensure that a target, cumulate cancer risk of 10^{-4} posed by multiple carcinogenic contaminants in the soil is not exceeded.

A target excess cancer risk of 10^{-4} was used for **aldrin** and **dieldrin** to reflect low confidence in cancer slope factors and the potency of these chemicals (see update notes in Appendix 9). An updated review of cancer- and noncancer-based toxicity studies published by Hooker et al. (2013) were used to develop screening levels. A target noncancer Hazard Quotient of 0.5 was used to reflect the common co-occurrence of these two chemicals in the absence of other contaminants (aldrin used as a termiticide around and beneath older buildings, with dieldrin as a breakdown product).

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

Separate guidance has been prepared for **arsenic** (HDOH 2011b) and **dioxins** (HDOH 2010) in soil. Soil action levels presented in the respective technical memorandums are incorporated into the I-series tables of Appendix 1. Bioaccessibility tests are recommended for site-specific evaluation of arsenic-contaminated soil when the upper background concentration in soil is exceeded (e.g., 24 mg/kg). The World Health Organization Reference Dose used to develop the dioxin action levels incorporates an assumed bioavailability of 50%.

A target noncancer Hazard Quotient of 1.0 was used to generate soil action levels for **thallium** due to the potential for natural, background levels of thallium to exceed the unadjusted, direct-exposure action level (Tier 1 action level 0.78 mg/kg). Naturally occurring thallium in iron-rich, volcanic soils is expected to be tightly bound to the soil and not significantly bioavailable. This is not considered in the direct-exposure models. The potential for a release of highly bioavailable, thallium salts at a site should be evaluated

in cases where the Tier 1 action level is exceeded. Based on limited data, natural background levels of thallium in soil could approach 15 mg/kg (HDOH 2011a).

The direct exposure soil action level of 200 mg/kg for **lead** in residential (unrestricted) soil is based on consideration of both health risk and anthropogenic background in urban areas. The current, USEPA residential RSL of 400 mg/kg is intended to reflect a target blood-lead level in children of 10 µg/dl (USEPA 2017a). The HDOH action level in part reflects recommendations to reduce the target blood level to 5 µg/dl (USEPA 2011b; USCDC 2012a,b). The model used to calculate soil screening levels for lead is not linear, however (USEPA 2007). Any future, revised USEPA RSL based on the lower blood level is likely to be somewhat lower than the HDOH action level.

A reduction in the soil action level for lead below 200 mg/kg is not practical for heavily developed, urban areas, however. Background, anthropogenic levels of lead in urban soils from past auto exhaust and other sources is estimated to average 75-200 mg/kg and in places far exceed these values (USEPA 1994, 1998). In HDOH's experience, the use of an action level below 200 mg/kg can complicate the identification and characterization of localized contamination that could conceivable be remediated. The HEER office does, however, recommend the inclusion of soil that exceeds the natural background action level for lead of 73 mg/kg (HDOH 2011) in remediation plans when practicable and when the contamination can be attributed to a specific release. In contrast, if sample data indicate a concentration of lead above 200 mg/kg but below the USEPA RSL of 400 mg/kg a specific source cannot be identified then no further action is generally warranted. Capping or other efforts to minimization of exposure of young children should be considered where area-wide impacts above 400 mg/kg lead are identified, regardless of the suspected source.

4.2.3 Exposed or Potentially Exposed Soils

Direct-exposure soil action levels for unrestricted ("residential") land use (Table I-1) and commercial/industrial land use (Table I-2) are based on an assumption that the soil is, or at some time in the future could be, exposed at the ground surface where regular exposure of residents or workers could occur (refer to Section 2.4 and Section 4.26 in Volume 1). Equations and exposure assumptions used in each scenario are summarized in Appendix 2. For residential properties, it is assumed that soil within 3 meters (approximately 10 feet) of the ground surface could be exposed at the ground surface at some time in the future (e.g., installation of a swimming pool). For commercial/industrial properties, it is assumed that soil within one meter of the ground surface could be exposed during routine landscaping or shallow, utility work. This should be reviewed on a site-by-site basis and provisions for long-term management of deeper or otherwise isolated soil made as necessary. As discussed in the next section, risk-based soil action levels for construction/trench workers take precedence over action levels for unrestricted or commercial/industrial land use if lower (refer to next section).

4.2.4 Isolated Soils

By default, soils are assumed to be "isolated" if they are greater than three meters below ground surface in a residential setting and one meter in a commercial/industrial setting (refer to previous section and Section 2.4 of Volume 1). Direct-exposure action levels for deep or otherwise isolated soils are based on the potential exposure of construction and utility workers to contaminants in soil (Table I-3). A summary of exposure assumptions used to generate the action levels is provided in Appendix 2. The exposure assumptions are based on guidance presented in the USEPA Exposure Factor Handbook (USEPA 2011c), trench-worker risk assessment guidance developed by the Massachusetts Department of Environmental Protection (MADEP 1994), general direct-exposure assumptions included in the USEPA RSL document, and professional judgment (see Appendix 2, Table 1). As discussed above, action levels were calculated using a default, target risk of $1x10^{-5}$ for non-volatile, carcinogenic chemicals and $1x10^{-6}$ for volatile chemicals. A default, target Hazard Quotient of 0.2 was applied for chemicals with noncarcinogenic health effects except as noted in the above table. A more detailed summary of exposure assumptions and selected parameter values is included in Appendix 2.

As can been seen in Table I-2, soil action levels for construction/trench workers are lower than action levels generated for commercial/industrial exposure for Cr VI and cobalt under the construction/ trench worker scenario. Action levels for these chemicals are more stringent under the construction/trench worker exposure scenario than under the commercial/industrial exposure scenario (see Table I-2). This is due to the combined high oral and/or inhalation toxicity of these chemicals and the assumed higher soil ingestion rate and higher level of airborne dust under the construction/trench worker exposure scenario. As noted in Table I-2, commercial/industrial land use direct-exposure action levels for these chemicals are replaced with construction/trench worker action levels for use in the lookup tables if less stringent.

4.2.5 Soil Saturation Levels

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

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

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

When Csat is exceeded, the assumed presence of free product violates the use of only the Henry's Law constant to estimate the concentration of the chemical in soil vapor and subsequently the vapor emission rate at the ground surface. As noted in USEPA risk assessment guidance, the direct-exposure model is no longer valid above this concentration (USEPA 1996a, 2002, 2004b, 2011). Csat is used to set maximum direct-exposure action levels for volatile contaminants in the USEPA RSLs (USEPA 2017a) and in past publications of the USEPA Region IX Preliminary Remediation Goals (USEPA 2004a).

Soil vapor data can be used to estimate vapor emission from soil where Csat concentrations of a volatile chemical are exceeded, although direct-exposure models that allow input of soil vapor data have not been published (in preparation by HEER office). Vapor flux at the surface in the presence of free product can also be modeled mathematically. A model to do this is presented in Appendix A of the USEPA vapor intrusion guidance (USEPA 2004b, see Appendix 4). This is incorporated into the USEPA vapor intrusion model but has yet to be included in USEPA direct exposure models for soil (e.g., USEPA 2017a; see below). As discussed above for direct-exposure models, the USEPA vapor intrusion model incorporates a chemicals Henry's Law constant to estimate the concentration of the chemical in soil vapor up to Csat. When a residual phase is present, the vapor concentration is independent of the soil concentration but proportional to the mole fraction of the individual component of the residual phase mixture. At this point, the vapor intrusion model numerically estimates the equilibrium vapor concentration of the chemical in soil vapor for a series of time-steps. For each time-step, the mass of each constituent that is

volatilized is calculated using Raoult's Law and the appropriate mole fraction. At the end of each time-step, the total mass lost is subtracted from the initial mass and the mole fractions are recomputed for the next time-step to take into account mass balanced over time. Refer to the USEPA vapor intrusion guidance for additional information.

The 1996 and 2002 editions of USEPA's *Soil Screening Levels* guidance make an apparent error in the conclusion that the emission flux from soil to air for a chemical reaches a plateau when a chemicals Csat concentration in soil has been reached (USEPA 1996a, 2002, "Soil Saturation Limit"). This error is repeated in the recently published USEPA RSLs guidance (USEPA 2017a). Each document mistakenly states that Csat represents the concentration *at which soil pore air is saturated with the target contaminant*. This is not the case. As noted above, Csat represents the concentration of the chemical in soil in which the *sorbed- and dissolved-phases* are saturated. Saturation of these phases in the soil does *not* necessarily indicate that the vapor phase of the chemical has reached its maximum, nor that the vapor flux rate at the surface has reached a maximum. The concentration of a chemical in soil vapor at a soil concentration of Csat merely reflects equilibrium conditions with the chemical in soil moisture at the chemicals solubility limit. Saturation of the vapor phase will only occur in the presence of free product in the soil, when the gas phase reaches equilibrium with the *Nonaqueous Phase Liquid* or "NAPL." The concentration of the chemical in the vapor phase at this point is likely to be significantly higher than at the point that the soil moisture has reached the solubility limit of the chemical. This is why the Henry's Law Constant-dependent, vapor flux model incorporated into most soil action level models (including the one used in this guidance) is only valid in the absence of free product in the soil (i.e., concentration of chemical in soil <Csat). This is also the case frequently observed in soil vapor studies, where the concentration of a volatile chemical in soil vapor increases significantly in the presence of free product.

4.3 Soil Action levels for Potential Vapor Intrusion Concerns

Soil action levels for the evaluation of potential vapor intrusion concerns are presented in Table C-1b. As discussed in Section 3.3, the use of soil vapor data and action levels to evaluate this concern is preferred (refer also to Section 7 of the HEER *Technical Guidance Manual*). Vapor intrusion action levels were calculated for both unrestricted ("residential") and commercial/industrial land-use exposure scenarios. Only the action levels for unrestricted land use were carried forward for consideration in compilation of final, Tier 1 EALs (refer to Table A and B series).

A spreadsheet included with guidance published by the U.S. Environmental Protection Agency (USEPA 2004) was used to generate soil action levels for potential vapor intrusion concerns. A summary of these action levels is provided in Table C-1b. Correlative soil vapor action levels are provided in Table C-2. Target indoor air goals are provided in Table

C-3. Target groundwater action levels for vapor intrusion hazards are presented in Table C-1a.

As discussed in Section 2, the spreadsheet is based on a model presented in the paper *Heuristic Model for Predicting the Intrusion Rate of Contaminant Vapors into Buildings* (Johnson and Ettinger 1991). The model considers both diffusive and convective flow of subsurface vapors into buildings. Summary text from the guidance document accompanying the spreadsheet is provided in Appendix 3, as is a sensitivity evaluation of the Johnson and Ettinger model. Example printouts of the model as used to calculate action levels for this document are included in Appendix 4. A more detailed discussion of models is provided in Section 5.4 for correlative groundwater action levels.

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

A default Soil-Building Pressure Differential of 20g/cm-s^2 was used. This generates a target vapor entry rate through the building slab of approximately 38 cm^3/second or two liters per minute (refer to Section 2.2.3).

For nonchlorinated VOCs, field experience suggests that the vapor intrusion model typically overestimates the vapor-phase concentrations of these chemicals by an order of magnitude or more, due in part to high rates of natural biodegradation. Evaluation of this issue is ongoing. To address this in the lookup tables, soil action levels generated with the model were adjusted upwards by a factor of 10 (see Table C-1b). Collection of soil vapor data and concurrent use of soil vapor action levels for vapor intrusion concerns is strongly recommended for sites where this pathway may be of significant concern.

The USEPA spreadsheet calculates the theoretical emission rate of a chemical into an overlying building based on the properties of the chemical and the soil type. For highly volatile chemicals (e.g., vinyl chloride), however, an unrealistic mass of the chemical per unit area would have to be present at depth to maintain the theoretical emission rates over the assumed exposure duration. To compensate, the model spreadsheet calculates a second, mass-balanced emission rate by dividing the total mass of the chemical in the soil per unit

area by the input exposure duration. This conservatively assumes that the entire mass of the chemical directly beneath the building will ultimately be emitted into the building over the assumed exposure duration. For chemicals where the mass-balanced vapor emission rate is lower than the theoretical emission rate, the mass-balanced emission rate is used to generate an action level (or calculate risk).

The same action levels developed for shallow soils should be applied to deep soils for initial, screening surfaces. While conservative, the parameter for depth to impacted soil does not significantly control calculated action levels for soils within 5 to 10 meters of the ground surface. As discussed in Volume 1, the collection of soil vapor data is preferred over the use of models for more detailed evaluations of vapor intrusion hazards.

4.4 Soil Action Levels for Leaching Hazards

4.4.1 Default Soil Leaching Model

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

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

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

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

where: DAF = SESOIL-based dilution/attenuation factor;
H = Henry's Law Constant (atm-m^3/mol);
Koc = Organic carbon partition coefficient (cm^3/g);
C_{soil} = Leaching based soil concentration (mg/kg);
C_{gw} = Target groundwater action level (µg/L).

The term DAF is defined for the purposes of the model as the concentration of the contaminant in soil (in mg/kg) divided by the concentration of the contaminant in groundwater (in mg/L). The algorithm was originally developed by the state of Oregon (Anderson 1992), slightly modified for use by the Massachusetts DEP (MADEP 1994) and then incorporated into the Ontario MOEE lookup table guidance (MOEE 1996). The

algorithm is based on a combined use of the computer applications SESOIL and AT123D. These applications model the leaching of chemicals from the vadose zone and subsequent mixing of leachate to groundwater, respectively.

SESOIL models the generation and downward migration of leachate in the vadose zone. The AT123D application models the mixing of leachate with groundwater immediately below the impacted area. A more detailed discussion of the derivation and application of the SESOIL/AT123D algorithm as modified by the Massachusetts DEP and adopted for use by the Ontario MOEE is provided in Appendix 5. The algorithm is based on a three-meter thick vadose zone characterized by one meter of impacted soil sandwiched between two one-meter thick layers of clean soil. The lower layer immediately overlies groundwater. All vadose-zone soil is conservatively assumed to be very permeable sand that freely allows the migration of leachate to groundwater. The organic carbon content of the soil is assumed to be 0.1%. (Note that this is more conservative than the 0.6% organic carbon content assumed in the direct-exposure models.) Mixing with groundwater is modeled over a 10-meter by 10-meter area. Use of a thicker assumed sequence of impacted soil would not significantly alter the results of the model given the assumed one-meter depth to groundwater.

The model assumes an annual rainfall of 1,100 mm (approximately 43 inches). A total of 720 mm (28 inches) of the total rainfall is assumed to infiltrate the ground surface and reach groundwater (assumed to be conservative for the majority of developed areas in Hawai‘i). This is assumed to also be adequate for higher rainfall areas, although a site-specific evaluation may be required for large (e.g., > one-half acre) areas of contaminated soil with persistent and highly mobile chemicals. Biodegradation during migration of leachate to groundwater is not considered. This could cause the model to be especially over conservative for non-chlorinated, petroleum compounds. The model does, however, allow for resorption and volatilization of chemicals from the leachate during migration based on the physio-chemical properties of the chemical and the assumed soil properties. Groundwater is assumed to flow at a moderate rate of approximately 73m (240 feet) per year. The concentration of a chemical in leachate is assumed to be further reduced upon mixing of the leachate with groundwater (dilution factor approximately 3).

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

- Leaching of highly volatile chemicals (e.g., vinyl chloride);

- Leaching of highly sorptive chemicals (e.g., PAHs);
- Leaching of highly biodegradable chemicals (e.g., common petroleum compounds);
- Sites where the depth to groundwater is greater than 10 meters below the base of the impacted soil.

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

SESOIL modeling carried out by the Hawai'i Department of Health (HIDOH 1995) and site-specific, SPLP soil batch test carried out by consultants and HDOH between 2005 and 2011 (see Fall 2011 update memo in Appendix 9) suggested that chemicals with sorption coefficients greater than 30,000 cm^3/g will be essentially immobile in the surface under normal soil conditions and not likely to impact groundwater. The SESOIL models were run conservatively assuming an annual rainfall of 400 cm/year (158 inches/year), an infiltration rate of 144 cm/year (57 inches/year) and very permeable soil overlying fractured bedrock.

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

The majority of PCBs releases are related to 1242 to 1260 range Aroclors or similar mixtures. The default koc of 33,000 cm^3/g presented in Table H was considered to be adequately conservative for this range and used in the leaching model. For less chlorinated PCB mixtures, a site-specific evaluation of potential leaching concerns and even possible vapor emission concerns is required.

Leaching based action levels were generated only for chemicals considered to be significantly soluble and mobile in groundwater under normal, ambient conditions (e.g., pH 5.0 to 9.0 and normal redox conditions). Leaching-based soil action levels were not

developed for metals. Leaching of metals from soil is highly dependent on the species of the metal present and the geochemical nature of the soil. At sites where physio-chemical conditions may promote enhanced leaching of metals and other chemicals from soils or waste piles (e.g., mining related wastes), the use of laboratory-based leaching tests is recommended (refer to Section 4.2.3 in Volume 1).

Leaching based soil action levels were developed for perchlorate (ClO4). Perchlorate, a salt, is not significantly sorptive, volatile or biodegradable under normal conditions. Use of the SESOIL/AT123D algorithm was therefore not considered appropriate. As an alternative, a simple, chemical partitioning model presented in the USEPA *Soil Screening Level Guidance* document was referred to (USEPA 2002):

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

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

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

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

The default water-filled porosity in the models is 0.15 and the default soil bulk density is 1.5. Based on groundwater action levels for perchlorate of 3.6 µg/L for drinking water resources and 600 µg/L for non-drinking water resources (refer to Tables D-1a and D-1b), leaching based soil action levels of 0.00036 mg/kg and 0.06 mg/kg are generated, respectively. A dilution/attenuation factor of 20 was incorporated to account for mixing of leachate with groundwater (USEPA 2002). This yielded final soil action levels for leaching concerns for perchlorate of 0.007 mg/kg and 1.2 mg/kg (refer to Table E). Laboratory-

based tests are recommended for more site-specific analysis of potential leaching of perchlorate from soil (refer to Chapter 4 in Volume 1).

4.4.2 Soil Vapor Screening Levels for Groundwater Protection

Soil vapor screening levels that can be used to indirectly evaluate leachate conditions in the vadose zone and potential threats to groundwater are presented in Table E-2 (see also Section 4.3.4 of Volume 1). The screening levels focus on volatile hydrocarbons, solvents, explosives and fumigants. The evaluation of leachate associated with petroleum fuels focuses on TPHgasoline, TPHmiddle distillates, benzene, toluene, ethylbenzene and xylenes (BTEX) and naphthalene. Testing for additional, semi-volatile, PAHs in soil vapors is not necessary to evaluate potential leachate conditions (e.g., acenaphthene or methylnaphthalenes; see Section 2.6 of Volume 1 and Section 9 of the HDOH *Technical Guidance Manual*; HDOH 2009).

The ultimate focus of soil leaching models is the concentration of a targeted chemical in the soil moisture or "leachate." The leaching threat to groundwater posed by the presence of a chemical in vadose-zone soil would ideally be evaluated by the direct measurement of the dissolved-phase concentration of the chemical in pore water. This could be compared to a target groundwater screening level times an assumed, dilution-attenuation factor. The collection of adequate volumes of pore water to evaluate potential leaching hazards using currently available investigation tools is impractical, however. As an alternative, soil screening levels are developed that represent the total concentration of a chemical in soil at equilibrium with target concentrations of the chemical in soil moisture or leachate (see the previous section; see also USEPA 2002). This allows soil data to be used to evaluate potential leaching hazards as an alternative to the direct collection and testing of soil pore water. Soil batch tests can also be used to more accurately evaluate the mobility of chemicals in soil and the potential threat to groundwater (see Section 4.3.3 in Volume 1).

Although relatively simple in concept and easy to implement in the field, this approach is highly prone to error due to assumptions that must be made regarding how a chemical partitions between sorption to organic carbon (and clay) and dissolution into soil moisture. The collection of representative soil samples from the subsurface is also very prone to error, give the small number of samples typically collected and the small mass of soil ultimately analyzed (e.g., 5 grams or less than one teaspoon or volatile chemicals). The use of multi-increment sampling (MIS) approaches and preservation of samples in methanol in the field can help, but limited coverage can still hamper the representativeness of the data (HDOH 2009). As discussed in Section 4.3.3 of Volume 1, batch tests suggest that soil leaching overestimate the concentration of a chemical in leachate based on the total concentration of the chemical in soil by orders of magnitude (i.e., greater proportion of chemical sorbed to soil particles than predicted by standard, equilibrium model).

For volatile chemicals (VOCs), direct measurement of the vapor-phase concentration of a chemical in vadose-zone soil or bedrock offers a more accurate method for estimation of the concentration of a chemical in leachate than a soil sample. The equilibrium concentration of a chemical in soil vapor to that in leachate is described by the Henry's Constant for that chemical (ratio of concentration in soil vapor over concentration dissolved in water at an assumed temperature; see Table H). Soil vapor screening levels for potential leaching (or leachate) hazards can be developed by designating a target concentration of the chemical in soil leachate, for example the target groundwater concentration (+/- attenuation factor), and then multiplying this by the chemicals Henry's Constant. (Note that a chemical's Henry's Constant varies as a function of temperature. The Henry's Constants presented in Table H are conservatively based on an assumed temperature of 25ºC, as presented in the USEPA RSL guidance; USEPA 2017a.)

This approach was used to generate the soil vapor screening levels for leaching concerns presented in Table E of Volume 1 and Table E-2 of this appendix. The screening levels are based on the following, simple equation:

$$Csoil\,gas = Cgw \times H' \times DAF$$

where: $C_{soil\ vapor}$ = soil vapor screening level for leaching concerns;
C_{gw} = Target dissolved-phase concentration of chemical in groundwater;
H' = Dimensionless Henry's Number constant; and
DAF = Dilution-Attenuation Factor

Soil vapor screening levels focus on protection of drinking water, with the target groundwater action level set to the lowest of the toxicity-based screening level and the taste and odor threshold for the chemical (see Table D-1a). Henry's Constants for VOCs are noted in Table E-2 and Table H. A default DAF of 20 was included in the model to take into account mixing of leachate with groundwater (after USEPA 2002). For example, a concentration of 5 µg/L benzene in vadose zone leachate would in theory yield an equilibrium concentration in soil vapor of 24,000 µg/m^3, taking into account the dilution-attenuation factor.

The presence of a VOC in soil vapor above its respective screening level suggests that the concentration of the VOC in soil moisture or leachate could adversely impact an unconfined, underlying drinking water aquifer. The screening levels do not consider the actual mobility of the soil moisture. Vapor concentrations would be relatively high in dry soils with little soil moisture in comparison to saturated soils with migrating leachate. Whether or not the leachate (or even the vapors) is actually mobile and poses a true threat to groundwater depends on site-specific factors, including the size of the source area and the mass of contaminant present, the rainfall infiltration rate, the rate and amount of

downward moving leachate, the distance to the water table, the rate of groundwater flow and the thickness of the leachate-groundwater mixing zone. These factors need to be evaluated in more detail on a site-specific basis if the soil vapor screening levels are exceeded.

4.5 Soil Ceiling Levels for Gross Contamination Concerns

Ceiling levels for gross contamination concerns are presented in each of the EAL summary tables for soil. These action levels are intended to be protective against odor and other nuisance and aesthetic concerns, as well as restrict the presence of potentially mobile, free product and limit the overall degradation of soil quality (i.e., "gross contamination"). The selection of soil ceiling levels was based on methods originally published by the Massachusetts DEP (MADEP 1994) and also used by the Ontario MOEE (MOEE 1996), as described in the Table F series of this appendix. Only the gross contamination action levels for shallow, exposed soils are carried forward for consideration in the Tier 1 EALs (refer to Table A and B series). Alternative action levels for isolated or deeper soils are provided for reference in site-specific Environmental Hazard Evaluations as needed.

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

4.6 Soil Action levels for Terrestrial Ecotoxicity

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

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

5 Groundwater and Surface Water Action Levels

5.1 Introduction

Action levels for groundwater are summarized in the "D" series of tables at the end of this appendix. A discuss of individual concerns considered in the action levels is provided in this Chapter and summarized below. For the purpose of developing Tier 1 action levels, it is assumed that all groundwater could at some point in time potentially discharge to a body of surface water. Discharge could occur through natural processes (e.g., natural discharge of groundwater to a stream, river, lake, wetland, bay, etc. via springs) or through human activities (e.g., pumping and discharge of groundwater at remediation or construction dewatering projects).

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

As discussed below, groundwater action levels for potential discharges to aquatic habitats consider chronic surface water quality goals for sites within 150m of a surface water body and acute goals for sites >150m from a surface water body. Although not used for groundwater action levels, HDOH standards for the potential bioaccumulation of contaminants in aquatic organisms and subsequent consumption of the organisms by humans must be used to evaluate actual impacts to a body of surface water. A summary of these standards is provided in Table D-3f for reference.

Groundwater action levels should be compared to dissolved-phase chemical concentrations unless instructed by the overseeing regulatory agency. This may require filtering of turbid samples (refer to Section 6 of the HEER Office *Technical Guidance Manual*). Filtering should not be carried out on samples to be tested for volatile chemicals.

5.2 Action levels for Drinking Water (Toxicity)

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

- HDOH Maximum Contaminant Level;
- USPEPA Primary Maximum Contaminant Level;
- Risk-based goal based on USEPA Region IX Tapwater model.

HDOH and/or USEPA Primary Maximum Contaminant Level (MCLs) are available for approximately half of the chemicals listed in the lookup tables (HDOH 2002; USEPA 2006). Although numerous factors are taken into account in development of primary MCLs (toxicity, detection limits, attainability, etc.), these standards are primarily intended to address toxicity to humans in drinking water supplies and are used for this purpose in this document.

For chemicals where Primary MCLs have not been promulgated, a tapwater model presented in the USEPA RSLs (RSL) document (USEPA 2017a) was used to calculate alternative drinking water goals (Table D-4). Toxicity factors and physiochemical constants published in the 2011 USEPA RSLs were used to develop the action levels with the exceptions noted in Table H (refer to Section 1.3). The action levels are based on a target excess cancer risk of 10^{-6} and a target Hazard Quotient for noncancer concerns of 1.0. Note that the noncancer action levels in particular may not be adequate to address potential cumulative risks concerns. The need to evaluate cumulative risks should be determined on a site-by-site basis (refer to Chapter 4 of Volume 1).

For volatile chemicals, the tapwater goals take into account uptake via inhalation of vapors during showering and other activities in addition to toxicity via normal ingestion of drinking water. Goals for nonvolatile chemicals are based on ingestion only. Equations for the USEPA RSLs for tapwater are included in Appendix 2. Risk-based goals for noncarcinogenic effects take precedence over goals for carcinogenic effects if lower. Note that the more recent RSL tapwater model includes an additional and complicated component for dermal absorption of VOCs during water use. Risk posed by exposure to VOCs in drinking water is largely driven by ingestion, however, and to a lesser extent inhalation. The inclusion of a dermal absorption pathway in the model does not significantly alter the resulting screening level and was not incorporated into the EAL model.

Drinking water goals intended to address taste and odor concerns (e.g., Secondary MCLs) take precedence if lower than toxicity-based goals. For example, the USEPA Primary MCL for xylenes is 10,000 µg/L. The USEPA Secondary MCL for xylenes is only 20 µg/L, however. The latter value should be (and is) used as the groundwater action level for drinking water concerns. This is discussed under ceiling levels for groundwater (see Section 5.5).

5.3 Action Levels for Aquatic Habitat Protection

5.3.1 Basis of Action Levels

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

5.3.2 Surface Water Aquatic Habitat Goals

A summary of aquatic habitat goals considered for use in this document is provided in Tables D-3a and D-3b. Separate goals were compiled for freshwater and saltwater habitats.

The goals reflect a compilation of standards formally promulgated in state law by HDOH and goals published by USEPA and other sources. Formal standards have not been promulgated for the majority of chemicals listed. Final goals were selected based on the following order of preference and availability, unless otherwise noted in Table D-4f:

- HDOH Surface Water Standard (HDOH 2012b);
- USEPA Region 4 (USEPA 2015c);
- USEPA Office of Pesticides (USEPA 2016);
- USGS National Water Quality Program (USGS 2012);
- U.S. Department of Energy (USDOE 1996);
- Ontario MOEE (MOEE 1996);
- USEPA AQUIRE database (USEPA 2008b);
- Toxicity-based drinking water goal.

An exception to this approach is the use of a general, acute aquatic toxicity action level of 300 µg/L published by the Canadian Council of Ministers of the Environment (CCME) for semivolatile PAHs, excluding naphthalenes (CCME 2002; refer to Table D-4e). Goals provided in each reference are generally based on dissolved-phase concentrations of the chemicals in water. Goals for arsenic, chromium III, chromium VI, lead, mercury, nickel, selenium, silver and zinc are, however, based on total concentrations (see USEPA 2015c).

The USEPA AQUIRE ECOTOX database of ecotoxicity studies was referred to for chemicals with no published aquatic habitat goals, primarily a small number of pesticides (USEPA 2008b). Emphasis was placed 96 hour-duration aquatic animal studies (48 hours for daphnia studies). Modification factors in general followed recommendations and methods provided in the USEPA Great Lakes water quality initiative guidance (USEPA 1995). Goals provided in each reference are generally based on dissolved-phase concentrations of the chemicals in water.

Note that many if not most of the referenced aquatic ecotoxicity action levels focus on toxicity to fish and benthic organisms. Action levels based on toxicity to aquatic plants could be lower. A more site-specific evaluation of this issue should be considered where discharges of impacted groundwater might adversely affect aquatic plants.

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

Chronic and acute surface water standards specific to Hawaii are presented in the Hawaii Administrative Rules, Title 11, Chapter 54, Section 11-54-04: Basic Water Quality Criteria (HDOH 2012b). Surface water standards for potential bioaccumulation of chemicals in aquatic organisms and subsequent human consumption of these organisms are presented in Table D-4f. Both Hawaii and Federal standards are given. Aquatic toxicity action levels presented in Table D-4e that include a component of bioaccumulation and potential impacts to predators are noted in red (see USEPA 2015c).

5.3.3 Groundwater Action levels for Aquatic Habitat Impacts

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

basis under a Tier 2 or Tier 3 assessment. The goals should be compared to dissolved-phase chemical concentrations unless otherwise instructed by HDOH.

Dilution of groundwater upon discharge to surface water was not considered in the selection of groundwater action levels for aquatic habitat protection. Benthic organisms were assumed to be exposed to the full concentration of chemicals in impacted groundwater prior to mixing of the groundwater with surface water. Potential dilution of groundwater upon discharge to surface water or in groundwater "mixing zones" adjacent to shorelines areas was therefore not appropriate for development of conservative action levels. Adjustment of the final groundwater action levels with respect to potential dilution may, however, be appropriate on a site-specific basis (e.g., no significant benthic habitat present, see Volume 1, Section 4.3).

Note that natural background concentrations of boron, copper, lead, mercury, selenium, thallium and zinc among other metals could exceed groundwater action levels presented in the lookup tables. This issue should be evaluated on a site-by-site basis and discussed with HDOH where necessary. This potential issue has been noted for shallow groundwater in caprock sediments around the islands, although data are too sparse to prepare a strong summary.

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

5.4 Groundwater Action Levels for Potential Vapor Intrusion Concerns

5.4.1 Vapor Intrusion Model Parameters

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

All groundwater was assumed to potentially flow offsite and pass under residential areas. Final action levels are therefore based on a unrestricted (“residential”) land use exposure

scenario. Groundwater action levels for commercial/industrial areas are included in Table C-1a for reference but were not carried on for use in subsequent lookup tables.

Default building parameters including anticipated IAERs and vapor entry rates are discussed in Section 2. The same building characteristic assumptions are used to develop action levels for subslab soil vapor, soil and groundwater. In particular, a default Soil-Building Pressure Differential of 20g/cm-s^2 was incorporated into the model. This generates a targeted vapor entry rate through the building slab of approximately 38 cm^3/second or 2 L/min (refer to Section 2.2.3). This, combined with the default, input IAERs for residential versus commercial/industrial settings, is used to generate a targeted SSAF for the intrusion and mixing of vapors into the overlying building. The SSAF subsequently plays an important role in generation of corresponding vapor intrusion action levels for VOCs in underlying groundwater.

For the purposes of this document, the vadose-zone soil profile overlying groundwater is modeled as one meter of coarse-grained, dry, sandy soil (S) overlying two meters of somewhat more moist clayey loam (CL, 1/3 sand, 1/3 silt, 1/3 clay). This is considered to be representative of fill material commonly placed beneath the slabs of new buildings. "Sand" is defined as material that is equal to or greater than 0.075 mm in diameter (i.e., will not pass through a U.S. Standard 200 mesh sieve). Silt and clay are defined as material that is less than 0.075 mm in diameter (i.e., will pass through a U.S. Standard 200 mesh sieve). These definitions are consistent with default parameter values for soil types presented in the USEPA model (USEPA 2004). The depth from the ground surface to the top of impacted groundwater in both sets of models was assumed to be 3.0m. This is just above the minimum thickness allowed for modeling of vapor transport through a low to moderate permeability vadose-zone soil profile, due to capillary fringe height constraints.

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

Input soil parameter values for total porosity, water-filled porosity and fraction organic carbon for the upper portion of the soil profiles were set equal to values used by USEPA in development of the RSLs (USEPA 2017a). Soil moisture was assumed to be somewhat higher for the lower soil units than the upper units, at 0.30 (vs 0.15), consistent with the default recommended in the USEPA vapor intrusion guidance document. Default values presented in the USEPA spreadsheets were used for remaining soil properties.

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

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

5.4.2 Adjustment of Action levels

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

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

5.5 Water Ceiling Levels for Gross Contamination Concerns

Ceiling levels based on gross contamination concerns for surface water and groundwater are summarized in the Table G series. Ceiling levels for surface water and groundwater that is considered to be a current or potential source of drinking water are based on the lowest of the chemicals taste and odor threshold (e.g., Secondary MCLs), one-half the solubility and a maximum of 50,000 µg/L for any chemical based on general resource degradation concerns (Tables G-1 and G-4, after MADEP 1994). Taste and odor thresholds for drinking water were selected in the following order of preference and availability:

- HDOH Secondary MCLs (HDOH 2002);
- USEPA Secondary MCLs;
- California Department of Health Services Taste and Odor Action Levels;
- Taste and odor levels developed by Amoore and Hautala (as presented in Central Valley Regional Water Quality Control [RWQCBCV] 2007);
- Odor thresholds presented in Massachusetts DEP (MADEP 1994) and Ontario MOEE (MOEE 1996) guidance documents and other published reports (e.g., Young et al 1996).

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

Ceiling levels for surface water and groundwater that is NOT considered to be a current or potential source of drinking water were selected in a similar manner with the exception that the drinking water taste and odor thresholds were replaced with general nuisance thresholds and gross contamination concerns (Tables G-2 and G-4). Nuisance thresholds are intended to reflect the concentration at which a chemical in water poses unacceptable odor problems or sheens.

Thresholds presented in the Massachusetts DEP and Ontario MOEE guidance documents were used as the primary sources of data. Taste and odor levels developed by Amoore and Hautala (in RWQCBCV 2007) were referred to for chemicals that lack odor thresholds in the Ontario guidance, although conservative considerations for drinking water concerns could cause these criteria to be overly stringent. It is apparent, however, that similar sources were used to develop both the Ontario MOEE and the Amoore and Hautala databases (compare Tables G-1 and G-2). In keeping with the Ontario and Massachusetts guidance documents, a ten-fold dilution/attenuation of chemical concentrations in groundwater upon discharge to surface water was assumed (non-drinking water resources, gross contamination action levels only). The potential for an adverse buildup of contaminants in

sediment over time through long-term discharges of contaminated groundwater should be evaluated on a case-by-case basis (e.g., sorption and buildup of dissolved-phase petroleum onto organic material in sediment over time).

The nuisance threshold for methyl tertiary butyl ether (MTBE) is based on average, upper range at which most subjects in a USEPA study could smell MTBE in water (180 µg/L), as summarized in the public health goals document for MTBE prepared by Cal EPA (CalEPA 1999a). This was selected as a nuisance action level for MTBE in surface water. Assuming a dilution factor of ten yields the odor threshold of 1,800 µg/L for groundwater.

Drinking water taste and odor thresholds for TPH are discussed separately in Section 6.6. Note that consideration of the aqueous solubility for individual compounds to assess the potential presence of free product in groundwater is not appropriate for petroleum mixtures. Solubility should instead be assessed on a molar composition basis using Raoult's Law. Free product is likely to be present when the sample data equals or exceeds the estimated mixture solubility of an individual compound or the sum of the individual component solubilities. One-half of the total petroleum product solubility measured as TPH can also be considered, although data might be biased high to the presence of more soluble, degradation compounds (refer to Section 6).

5.6 Other Groundwater Action Levels

Additional action levels for groundwater provided in the California EPA technical document *A Compilation of Water Quality Goals* include USEPA and National Academy of Sciences "Suggested No-Adverse-Response (SNARL)" goals for toxicity other than cancer risk and "Agricultural Water Quality" goals developed by the United Nations (RWQCBCV 2007). The SNARL goals largely duplicate risk-based action levels for drinking water presented in Table D-3. Agricultural Water Quality goals for 12 metals are provided in Table D-5. These goals were not considered in the final lookup tables but may need to be considered on a site-specific basis. The agricultural goals are higher than action levels for both drinking water and surface water protection for 7 of the 12 metals listed. Agricultural goals for copper, cobalt, selenium and zinc are higher than goals for aquatic habitat protection but are lower than goals for drinking water (i.e., drinking water goals may not be adequately protective for irrigation use). The agricultural goal for molybdenum is lower than both the drinking water goal and the surface water goal for this metal. The development of these goals was not reviewed for preparation of the EAL document.

Table 5-1. Environmental concerns considered in groundwater action levels.

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

6 Soil, Soil vapor and Groundwater Action Levels for TPH

6.1 Introduction

Petroleum is a complex mixture of hundreds of different compounds composed of hydrogen and carbon (i.e., "hydrocarbon" compounds). The carbon range makeup of common petroleum fuels is noted in Figure 3. Non-specific, aliphatic and aromatic compounds and related degradation compounds make up the overwhelming majority of the mass in fuels and in vapors emitted from fuels (see Appendix 6). These compound and related, degradation compounds are collectively measured and assessed as “Total Petroleum Hydrocarbons” or “TPH” (refer to Volume 1, Section 2.6.1). Risk to human health and the environmental posed by petroleum releases is evaluated in terms of both TPH and individual, “indicator” compounds such as benzene, toluene, ethylbenzene and xylenes (BTEX) as well as naphthalene and other targeted polyaromatic hydrocarbons (PAHs). The latter only make up a small percentage of the total mass in fuels and in vapors but can pose a significant risk due to their higher toxicity.

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

Petroleum-related, polar compounds are considered to have similar toxicities as the parent compounds and TPH action levels are applicable to both the nonpolar and polar fractions for initial screening. The use of alternative toxicity factors and physiochemical constants for metabolites can be proposed in a site-specific Environmental Hazard Evaluation. Refer to Volume 1, Section 2.6.1 and Section 9 of the HEER *Technical Guidance Manual* (HDOH 2016). This issue will be reviewed in an ITRC document entitled *TPH Risk Evaluation at Petroleum Contaminated Sites*, currently under preparation (ITRC 2017). Several HEER staff are participating in the preparation of the document, particularly in the Chemistry and Case Studies sections of the document, both of which discuss methods to address petroleum-related degradation compounds.

The development of risk-based action levels for TPH in soil, soil vapor and groundwater is described below. For the purposes of this document, petroleum mixtures are subdivided into "gasolines", "middles distillates" and "residual fuels", following the methodology used by the American Petroleum Institute (API 1994). Middle distillates include common diesel fuel, kerosene and jet fuels such as JP-8. The action levels are based on the assumed carbon range makeup of fuel types and associated vapors in conjunction with carbon range-specific toxicity factors published by USEPA and Massachusetts, among other agencies.

Several published documents were available to select a default, carbon range makeup of different fuel types (e.g., TPHCWG 1998, MADEP 1997, 2003). Published data on the carbon range makeup and toxicity of vapors associated with petroleum fuels are limited. In 2011, the HEER office carried out a soil vapor study of key, petroleum-contaminated sites in Hawai‘i to help fill this data gap and updated the environmental hazard evaluation (EHE) guidance and associated TPH EALs (HDOH 2012a). The results of that study are summarized below. A paper published on the study (Brewer et al. 2013) and an overview of common questions regarding TPH are included in Appendix 6.

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

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

As discussed in the Volume 1, the use of EALs as final “cleanup levels” for petroleum-related compounds that are known to be highly biodegradable may be unnecessarily conservative. This is especially true for TPH and petroleum-related compounds. Final cleanup levels should be evaluated on a site-specific basis and in conjunction with guidance from the overseeing regulatory agency (e.g., refer to HDOH 2007).

6.2 TPH Carbon Range Makeup of Fuels and Fuel Vapors

A summary of the selected, default carbon range TPH makeup of fuels and fuel vapors is provided in Table 6-2. This was used in combination with carbon range toxicity factors published by USEPA and other agencies to developed risk-based action levels for TPH in indoor air, soil vapor, soil and groundwater. A copy of the paper published on the 2011 HDOH soil vapor study is provided in Appendix 6 (Brewer et al. 1013).

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

6.2.1 Gasolines

Gasolines are defined as petroleum mixtures characterized by a predominance of branched alkanes and aromatic hydrocarbons with carbon ranges of C6 to C12 and lesser amounts of straight-chain alkanes, alkenes and cycloalkanes of the same carbon range (TPHCWG 1998). Based on information published by the State of Indiana, a relative TPH carbon range makeup of gasoline fuels (not including BTEX, naphthalene and other individual, targeted compounds) of 45% C5-C8 aliphatics, 12% C9-C12 aliphatics and 43% C9-C12 aromatics was selected for development of TPHgasoline action levels for soil and groundwater (see Table 6-2a). Separately targeted, individual compounds such as BTEX and naphthalene generally do not make up more than 5% of gasoline fuels in Hawai‘i. Other compounds such as MTBE are not added in significant quantities.

An assumed TPH carbon range makeup of vapors associated with gasolines of 77.3% C5-C8 aliphatics, 7.3% C9-C12 aliphatics and 15.4% C9-C10 aromatics was selected for development of TPHgasoline soil vapor screening levels. This is based on the median carbon range composition of gasoline vapors published in the USEPA Petroleum Vapor Intrusion database (see Table 6-2b; Brewer et al. 2013; see also USEPA 2012). A much great dominance of gasoline vapors by C5-C8 aliphatics has been reported by other entities (e.g., BioVapor 2010). The higher, relative proportions of longer chain aliphatics and heavier aromatics in the USEPA database could be due to weathering, inadvertent inclusion of vapor data from middle distillate release sites and/or the incorporation of volatile metabolites in the data. The latter issue has not been studied in detail.

Vapors associated with fresh gasoline are dominated by C2-C4 aliphatics and C5-C8 aliphatics, with only a minor component (<5%) of BTEX and non-specific aromatic

compounds (see Appendix 6). Vapors associated with weathered fuel, as is the case at most gasoline-release sites, are dominated by C5-C8 aliphatics with little to no C2-C4 aliphatics remaining and again a relatively minor component of BTEX and non-specific aromatic compounds (see Appendix 6; may differ on the mainland due to local gasoline formulations). The C2-C4 aliphatics primarily pose explosion hazards. Chronic toxicity factors have not been developed for these compounds.

The ratio of TPH to benzene in soil vapor at sites contaminated with releases of older, high-benzene gasoline sites is typically less than 500:1, with the ratio lower (i.e., increased proportion of benzene) at fresh release sites and higher ratio at more weathered sites (i.e., preferential loss of benzene). The ratio of TPH to benzene can be much higher at more recent releases (post 2005) of gasoline due to an initially much lower proportion of benzene in the formulation in comparison to earlier formulations (see Brewer et al 2013).

6.2.2 Middle Distillates

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

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

Selection of a default, carbon range makeup of vapors associated with middle distillates is less straight forward than for gasolines. Published data regarding the specific, carbon range makeup of vapors associated with diesel fuel and other middle distillates is lacking. Vapor headspace chromatograms have been published by a few private entities, however (e.g. Hayes 2007, NCFS 2011). Not surprising given the chemical makeup of middle distillate fuels, the chromatograms suggest a dominance of C12 and greater aliphatic compounds in vapors associated with these fuels, with an accompanying significant amount of C5-C8 aliphatics. The increased presence of the latter in vapor in part reflects the preferential release of lighter-end and more volatile aliphatic compounds from the fuels. Elevated C5-C8 aliphatics in the vapor could also reflect degradation of longer-chain compounds. The

U.S. Geologic Survey (USGS) has documented the latter in groundwater for a diesel release site they have been monitoring since the 1980s (Chaplain et al, 2002). Aromatic compounds, including BTEX and naphthalene make up only a small amount of the total mass of vapor-phase compounds.

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

In order to address this potential concern HDOH collected TO-17 sorbent tube soil vapor samples at five key petroleum sites as part of its TPH vapor study (see HDOH 2012a). The TO-17 samples allowed full capture and extraction of the full range of petroleum compounds present in the soil vapor. The samples were collected by drawing a fixed volume of soil vapor (e.g., 50ml) through a narrow tube filled with a carbon-based sorbent material (see Appendix 6). Summa canister samples were also collected at the sites for comparison. The laboratory extracts and measures the mass of targeted VOCs captured by the sorbent material. Dividing this by the volume of soil vapor (or air) drawn through the tube yields the original concentration of the individual VOC in the soil vapor..

Soil vapor data collected by HDOH at several middle distillate release sites in Hawai‘i revealed wide variations in the ratio of C5-C8 and C9-C12+ aliphatic compounds between and even within sites (HDOH 2012a; Brewer et al. 2013; see Appendix 6). In some cases C9-C12+ aliphatics dominated, in agreement with published chromatograms for headspace samples over diesel fuel (e.g. Hayes 2007, NCFS 2011). In other cases C5-C8 aliphatics dominated. This may have been in part due to mixing of vapors with nearby gasoline releases and/or the breakdown of longer-chain aliphatics into shorter chain aliphatics at more weather sites. Vapor samples collected over fresh fuels were likewise mixed (see Appendix 6), although it is suspected that the fuel associated with the sample that reported a higher proportion of C5-C8 aliphatics may have been excessively warmed in the sun prior to collection of the vapor sample. The distinct presence of C9-C12+ aliphatics in the soil vapor samples, however, clearly distinguishes sites with middle distillate contamination from gasoline-release sites.

Based on the results of the HEER Office study, an assumed TPH carbon range makeup of vapors associated with middle distillate fuels of 25% C5-C8 aliphatics, 75% C9-C12+ aliphatics and 0% C9-C10 aromatics was selected for development of TPH soil vapor action levels (see Table 6-2b and Appendix 6). This reflects the worst-case sample

collected at diesel-release site and is considered to be conservative, given that the toxicity of longer-chain aliphatics is assumed to be six times greater than shorter-chain aliphatics (see Table 6-3). An assumed dominance of C9-C12+ aliphatic compounds in middle distillate vapors is consistent with published chromatograms for headspace samples over diesel fuel noted above (e.g. Hayes 2007, NCFS 2011). A high percentage of C12+ aliphatics and C10+ aromatics was not, however, identified in the middle distillate sites investigated, even this was predicted by the published chromatograms (maximum 13%, see Appendix 6). This may reflect the fact that the chromatograms reflect vapors collected over fresh fuels.

Small amounts of BTEX and naphthalene were reported in vapor samples collected over fresh fuel. Benzene, naphthalene and other aromatic compounds were present in only trace amounts in soil vapor samples collected at targeted middle distillate release sites, however (generally <0.1%). The ratio of TPH to benzene was typically greater than 1,000:1 and in some cases over 10,000:1. Non-specific aliphatics clearly drove vapor intrusion risks at these sites over individual compounds such as benzene and naphthalene. Testing for only the latter in the soil vapor samples would have significantly underestimated the vapor intrusion risk.

6.2.3 Residual Fuels Distillates

Residual fuels (e.g., Fuel Oil Nos. 4, 5, and 6, lubricating oils, “waste oils”, “oil and grease,” asphalts, etc.) are characterized by complex, polar PAHs, naphthenoaromatics, asphaltenes and other high-molecular-weight, saturated hydrocarbon compounds with carbon ranges that in general fall between C24 and C40. Published data on the specific, aliphatic and aromatic makeup of the TPH fraction of residual fuels after subtracting individual, targeted PAH compounds was not identified for use in this guidance but is expected to vary widely between different products and wastes.

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

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

Mineral oils used in electrical transformers are highly refined, fractions of crude oil with little to no chemical additives (EPRI 1998). The oils are dominated by C9-C30 aliphatics (approximately 85%) with a lesser amount of non-specific, aromatic compounds (approximately 15%) and overlap the carbon ranges discussed for middle distillates and residual fuels (see Figure 3). The volatile component of mineral oils is significantly lower than that found in middle distillates. The viscosity of the oils is also significantly greater. Carcinogenic PAHs such as benzo(a)pyrene are not present in detectable amounts. Additives including PCBs were included in older formulations of mineral oil but have been banned from new formulations in the 1970s. Releases of mineral oils from electrical transformers are relatively small in comparison to releases of diesel fuels and contamination is generally limited.

6.3 Carbon Range TPH Toxicity Factors and Physiochemical Constants

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

Weighted RfC ($\mu g/m^3$) =

$$\frac{1}{\left[\left(\frac{(\text{FractionC5}\cdot 8\text{aliphatics})}{\text{C5}\cdot 8\text{aliphaticsRfC}}\right)+\left(\frac{\text{FractionC9}\cdot 12+\text{aliphatics}}{\text{C9}\cdot 12+\text{aliphaticsRfC}}\right)+\left(\frac{\text{FractionC9}\cdot 10+\text{aromatics}}{\text{C9}\cdot 10\text{aromatics}+\text{RfC}}\right)\right]}$$

Weighted RfD (mg/kg-day) =

$$\frac{1}{\left[\left(\frac{(\text{FractionC5}\cdot 8\text{aliphatics})}{\text{C5}\cdot 8\text{aliphaticsRfD}}\right)+\left(\frac{\text{FractionC9}\cdot 12+\text{aliphatics}}{\text{C9}\cdot 12+\text{aliphaticsRfD}}\right)+\left(\frac{\text{FractionC19}+\text{aliphatics}}{\text{C19}+\text{aliphaticsRfD}}\right)+\left(\frac{\text{FractionC9}\cdot 10+\text{aromatics}}{\text{C9}\cdot 10\text{aromatics}+\text{RfD}}\right)\right]}$$

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

Default physiochemical constant values for TPHg and TPHd were revised to reflect default parameter values for C9-C10 aromatics published by Massachusetts DEP (see Table H, MADEP 1997, 2002). The is primarily a factor for the soil leaching models and reflects the anticipated, preferential dissolution of more soluble and less volatile aromatic compounds into infiltrating surface water. A cap of 5,000 mg/kg was applied to leaching based screening levels due to uncertainty regarding the utility of the model at high concentrations. Reference to C9-C10 parameter values is intended to reflect the increased mobility of TPH and TPH degradation products warranted deference to more mobile aromatic compounds, primarily with respect to the assumed sorption coefficient (koc). The increase in mobility with degradation is also reflected in application the default solubility for C9-C10 aromatics of 51 mg/L to TPHd. This is significantly higher than a solubility for fresh product of approximately 5 mg/L (USACE 1998).

As summarized below, these toxicity factors and physiochemical constants were used to develop soil vapor, soil and groundwater TPH action levels. Risk-based action levels for TPH are based on a target, noncancer Hazard Quotient of 1.0. This is based on an assumption that TPH represents the primary noncancer risk posed by petroleum-contaminated soil, soil vapor and groundwater due to the overwhelming mass of hydrocarbon compounds included in the analysis (see Section 1.4 and Appendix 6).

6.4 TPH Action Levels for Indoor Air and Soil Vapor

Preliminary, risk-based action levels for TPHgasolines and TPH middle distillates in indoor air and soil vapor as were calculated in the same manner as done for other volatile chemicals but with the use of a target, noncancer Hazard Quotient of 1.0 (see above and equations in Appendix 2). An indoor action level of 290 µg/m^3 was calculated for TPHgasolines. An indoor action level of 130 µg/m^3 was calculated for TPHmiddle

distillates. Soil vapor action levels were calculated using the default, Indoor Air:Soil vapor attenuation factors discussed in Section 2 (Residential: 1/2,000, Commercial/Industrial: 1/4,000). This generates residential soil vapor action levels of 590,000 µg/m^3 for TPHgasolines and 260,000 µg/m^3 for TPHmiddle distillates (Table 6-5; soil vapor action levels for carbon ranges also provided). Commercial/Industrial action levels are much higher-4,900,000 µg/m^3 for TPHgasolines and 2,200,000 µg/m^3 for TPHmiddle distillates. This is due to both an adult-only exposure scenario and an average, daily exposure time of 8 hours instead of 24 hours (see Appendix 2).

Petroleum release sites often contain a mix of fuels. Vapors in soil vapor could likewise be a mix of several fuel types. Applying soil vapor (and indoor air) action levels for gasolines versus middle distillate fuels is therefore not straightforward. The default, carbon range makeup assumed in the action levels can be re-evaluated on a site-specific basis as needed. Note also that the TPH indoor air action levels could be below ambient background levels for indoor and outdoor air, due to the use of petroleum-based cleaners, auto exhaust, etc.

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

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

6.5 TPH Action Levels for Soil

6.5.1 TPH (gasolines, middle distillates)

Risk-based, direct-exposure action levels for TPHgasolines and TPHmiddle distillates in soil can be calculated in the same manner as done for individual chemicals, using the toxicity factors noted above and physiochemical constants noted in Table H (see Chapter 4). The model calculated residential direct-exposure soil action levels of 450 mg/kg and 220 mg/kg using this approach, respectively. These action levels are highly conservative. This is especially true for soil exposed at the surface, This is especially true for especially soil exposed at the surface, where offgassing and biodegradation is likely to be be significant.

As discussed in Chapter 4, maximum, direct-exposure action levels for volatile liquids in soil are normally set equal to the contaminants theoretical soil saturation level or Csat (e.g., refer to xylene action levels in Table I series). This represents the concentration above which the contaminant can no longer be sorbed to soil particles (e.g., organic carbon or clay) or dissolved into the soil moisture (e.g., solubility limits reached). Above this concentration, free product will be present in the soil. This approach was alsoused to establish Csat and maximum direct-exposure action levels for TPHg and TPHd. (refer to Table I series). Residual fuels are not considered to pose significant vapor emission hazards other than the potential generation of methane and related explosion hazards (refer to Volume 1).

As discussed in Section 6.3, physio-chemical constants for the C9-C10 aromatics carbon range fraction developed by Massachusetts were referred to for calculation of soil screening levels for TPHg and TPHd (MADEP 2002b, refer to Section 6.3). Ceiling levels for nuisance and other gross contamination concerns developed by Massachusetts for TPH as gasoline and diesel (latter included under "middle distillates") were modified for use in this document (MADEP 1997a,b, refer to Table F series). Based on calculated “odor indexes”, a shallow soil ceiling level of 100 mg/kg was selected for unrestricted (“residential”) land-use scenarios and a ceiling level of 500 mg/kg was selected for commercial/industrial land-use (both categories of TPH). For deep soils, a ceiling level of 5,000 mg/kg was retained (primarily intended to prevent the presence of potentially mobile free product in soil).

6.5.2 TPH (residual fuels)

Risk-based, direct-exposure action levels for TPH as residual fuels were calculated in the same manner as done for individual chemicals, using the toxicity factors and physiochemical constants noted earlier. The action levels developed incorporate the Particulate Emission Factor used by USEPA to calculate RSLs for nonvolatile contaminants (USEPA 2017a, refer to Appendix 2). Risk-based action levels for TPHresidual fuels in drinking water and soil were then developed in the same manner as done for other chemicals (Table D-3 and Table I series, respectively). As discussed in Volume 1, testing for individual, target indicator compounds is also recommended for soil and groundwater contaminated by heavy fuels (e.g., PAHs, heavy metals, etc.).

Individual PAHs are likely to drive health risks posed by soils contaminated with residual fuels. The non-specific, TPH fraction of the petroleum may, however, pose gross contamination concerns even in the absence of significant PAHs. Following Massachusetts DEP guidance (MADEP 1997a,b), ceiling levels for gross contamination concerns of 500 mg/kg and 2,500 mg/kg were selected for exposed or potentially exposed soils in

unrestricted ("residential") and commercial/industrial land use scenarios, respectively (see Table F series). The MADEP ceiling level of 5,000 mg/kg was selected for isolated or otherwise deep soils.

The Massachusetts DEP did not develop specific action levels for leaching of heavy hydrocarbons from soil (refer to C19-C36 carbon range summary in Appendix 6). Residual fuels are by definition characterized by a predominance hydrocarbon compounds with carbon ranges greater than C24. These compounds are considered to be substantially less mobile in the subsurface that hydrocarbon compounds that make up the lighter-weight petroleum mixtures. For TPH that is characterized by a predominance of C23-C32 carbon range compounds, the California EPA Los Angeles Regional Water Board proposed an action level of 1,000 mg/kg for protection of drinking water resources (RWQCBLA 1996). This action level was adopted for use in this document (refer to Table E). The target TPH action level for groundwater was not specifically stated but was presumably 100 µg/L, an informal action level in use at that time. The action level is likely to be highly conservative, given the relative immobility of heavier hydrocarbons in soil..

The Los Angeles Regional Water Quality Control Board did not present a similar action level for potential leaching of TPH from soil and subsequent discharge of impacted groundwater to a body of surface water. The TPHd action level of 1,500 mg/kg was adopted for reference in this guidance (see Table E, refer also to Section 4.4).

The toxicity of mineral oils and vegetable oils is low. The oils are more viscous and less volatile than fuels. Significant vapor emissions from contaminated soil and groundwater are not anticipated, although methane buildup could be a concern for very large, subsurface releases. For the purpose of this guidance and in order to address potential gross contamination concerns, a TPH action level of 5,000 mg/kg is recommended for exposed soils or soils within three feet of the ground surface that has been contaminated with mineral or vegetable oil. For deeper soils an action level of 25,000 mg/kg is recommended. Refer also to the HEER Office 2007 guidance for the long-term management of petroleum-contaminated sites (HDOH 2007). These action levels are not specifically called out in the EAL lookup tables. Soil and other media contaminated by releases of oil from electrical equipment should also be tested for PCBs unless it can be demonstrated that PCB-based oils were never used in the equipment.

6.6 TPH Action levels For Groundwater

Regulatory drinking water standards for TPH and petroleum in general have not been developed. Toxicity-based drinking water goals of 300 µg/L for gasoline, 400 µg/L for middle distillates (e.g., diesel) and 2,400 µg/L for residual fuels were developed using on the USEPA RSL Tapwater model and the above-noted toxicity factors (refer to Table F-

3). The action level for TPHgasoline considered exposure via both ingestion and inhalation of vapors, as called for in the USEPA RSL model for volatile chemicals. The action level for TPHmiddle distillates assumes that petroleum-related compounds reported in this range will be dominated by non-volatile, degradation compounds or "metabolites" of biogenic origin (Zemo et al. 2013, 2016). The resulting action level is therefore based on ingestion only and does not incorporate an inhalation pathway. Petroleum-related, degradation compounds are assumed to have a similar toxicity as the parent hydrocarbon compounds for the purpose of this document, unless otherwise demonstrated in a site-specific risk assessment (refer to Volume 1, Section 2.5.1).

Past HDOH guidance presented a taste and odor threshold for TPH in drinking water of 100 µg/L TPHgasoline. This was based on a taste and odor threshold or "Suggested No Adverse Response Level (SNARL)" for kerosene in drinking water published by the USEPA (1980). A review of the original source documents (in Polish and Russian) by Zemo and O'Reilly (2016) identified flaws in the derivation of this threshold.

A closer review of the original references reviewed to develop the SNARL suggests that this threshold could be too low for some types of petroleum (Zemo and Reilly 2016). Most of the research was carried out in the 1940s to 1960s. The representativeness of the petroleum formulations in the studies of more recent fuels is uncertain. McFee and Wolfe (1963) reference odor thresholds for drinking water that range from 10 µg/L to 2,000 µg/L for gasoline, 82 µg/L to 667 µg/L for kerosene and heating oil, and 500 µg/L to 25,000 µg/L for heavier oils. Additional screening levels of 100 µg/L to 500 µg/L are referenced for "unrefined petroleum," with screening levels of 1,000 µg/L to 2,000 µg/L noted for "refined petroleum." Based on the studies presented, a taste and odor threshold for refined, low- to mid-range petroleum fuels of 500 µg/L is reasonable for initial screening purposes (see Table G-1). The adequacy of this threshold should be verified if impacts to actively used sources of drinking water are identified.

This is marginally above toxicity-based action levels for TPH in drinking water and suggests that exposure to potentially significant levels of TPH in drinking water will be readily noticeable by the user (see Tables D-1a and D-1b).

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

The groundwater nuisance and odor concerns action level of 5,000 µg/L for TPH (all categories) noted in the Table G series for nondrinking water was taken directly from Massachusetts DEP risk assessment guidance (MADEP 1997a,b). MADEP lists a gross contamination, "Ceiling Value" of 50,000 µg/L for all aliphatic and aromatic carbon ranges. This includes an assumed, dilution factor of "10", however. The dilution factor was omitted for used in the action levels, since as a default groundwater should meet surface water action levels at the point of discharge, both for aquatic toxicity and potential nuisance concerns. This also corresponds with the approximate solubility of diesel fuel and light motor oil in fresh water (ATSDR 2001) and is intended to address potential nuisance issues (odors, etc.) if discharged to surface water. The TPH ceiling levels for gross contamination concerns are based on 1/2 the solubility of the respective TPH categories (refer to Table G series). The solubility of gasoline in freshwater is approximately 150,000 µg/L. The solubility of diesel range and heavier fuels is assumed to be approximately 5,000 µg/L. These action levels are intended to highlight the potential presence of free product on groundwater.

6.7 Additional Target Indicator Compounds

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

Monocyclic Aromatic Compounds (primarily gasolines and middle distillates)

- benzene
- ethylbenzene
- toluene
- xylene

Fuel additives (primarily gasolines)

- MTBE
- other oxygenates as necessary

Polycyclic Aromatic Compounds (primarily middle distillates and residual fuels)

- methylnaphthalene (1- and 2-)
- acenaphthene
- acenaphthylene
- anthracene
- benzo(a)anthracene

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

The TPH EALs should be used in conjunction with EALs for these chemicals. Note that volatile chemicals such as butylbenzene, isopropyl benzene, isopropyl toluene and trimethylbenzenes are often reported in analyses of gasoline and other light-end petroleum products. These chemicals are collectively addressed under action levels for "TPH" and generally do not need to be evaluated separately.

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

6.8 Ethanol

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

Safety and Health Administration (OSHA) Permissible Exposure Limit (PEL) of 1,000 ppmv for workers.

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

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

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

*VOCs include BTEX and chlorinated solvent compounds

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

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

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

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

Carbon Range	[1]$TPH_{gasoline}$	[1]TPH_{diesel}
C5-C8 aliphatics	77.3%	25%
C9-C18 aliphatics	7.3%	75%
C9-C16 aromatics	15.4%	0%

1. Median carbon range makeup of gasoline vapors in USEPA 2013 Petroleum Vapor Intrusion database (see Brewer et al. 2013; Appendix 6).
2. HDOH soil vapors study and published information (see Brewer et al. 2013; Appendix 6).

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

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

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

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

Carbon Range	RfD_{0ral} (mg/kg-day)	RfC ($\mu g/m^3$)
$TPH_{gasolines}$	0.03	281
$TPH_{middle\ distillates}$	0.02	126
$TPH_{residual\ fuels}$	0.12	-

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

	[1]Indoor Air		[1]Subslab Soil vapor	
Carbon Range	**Residential (µg/m³)**	**Commercial/ Industrial (µg/m³)**	**Residential (µg/m³)**	**Commercial/ Industrial (µg/m³)**
C5-C8 aliphatics	630	2,600	1,300,000	11,700,000
C9-C18 aliphatics	100	440	210,000	1,800,000
C19+ aliphatics	-	-	-	-
C9+ aromatics	100	440	210,000	1,800,000

1. Assumed indoor air:subslab vapor attenuation factor: Residential = 0.0005; C/I = 0.00025 (see Section 3.3). Noncancer Hazard Quotient = 1.0. Calculate cumulative risk if used to evaluate site-specific carbon range data for soil vapor.

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

	Indoor Air		Subslab Soil vapor	
Carbon Range	**Residential (µg/m³)**	**Commercial/ Industrial (µg/m³)**	**Residential (µg/m³)**	**Commercial/ Industrial (µg/m³)**
$TPH_{gasolines}$	290	1,200	590,000	4,900,000
$TPH_{middle\ distillates}$	130	330	260,000	2,200,000
[1]$TPH_{residual\ fuels}$	-	-	-	-

1. Use TPHmiddle distillate indoor air and soil vapor action levels at sites contaminated with residual fuels if vapors present.

7 Other Issues

7.1 Background Concentrations

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

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

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

Available background soil data for thallium suggest that this metal is generally not detectable in the volcanic soils of Hawaii (<0.25 mg/kg). Data are lacking, however, with only ten samples referenced in the 2011 HEER Office study (HDOH 2011a). Thallium was reported at 12 to 15 mg/kg in two samples, however. No anthropogenic source is known at these two sample sites. Nonetheless, a default background concentration of 0.25 mg/kg was selected for consideration in the Tier 1 EALs due to the high toxicity of thallium salts and the associated low action level for potential direct exposure hazards (e.g., 0.78 mg/kg for residential exposure scenarios). The potential release of thallium salts should be evaluated at sites where the reported level of thallium in soil exceeds this concentration. It is reasonable to assume that the thallium is naturally occurring and non-toxic for reported concentrations in soil between 0.25 and 15 mg/kg when there is no reason to suspect a release of thallium salts.

7.2 Laboratory Reporting Levels

Laboratory method reporting limits and background concentrations of chemicals were not directly considered in development of the lookup tables. As discussed in Volume 1 of this document, however, reporting limits approved by the overseeing regulatory agency should be used in place of the EALs presented in this document when higher.

7.3 Reporting of Soil Data

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

From a site-investigation and risk assessment-standpoint, a difference in the reported concentration of a chemical of 10-20% is not necessarily significant. **For consistency and for comparison to soil EALs presented in this document, however, soil data should be reported on dry-weight basis.** This is in part because soil ingestion rates assumed in direct-exposure models (see Appendices 1 and 2) are based on dry-weight studies (USEPA 2011c). Comparison of wet-weight data to direct-exposure action level would technically require adjustment of the direct-exposure action levels to reflect wet weight-based soil ingestion rates. A site-specific consideration of wet-weight soil data will be dependent on assumptions in the model(s) being used to evaluate risk or generate environmental action levels. Existing wet-weight soil data may not necessarily need to be adjusted prior to comparison to the EALs unless the introduced bias is considered to be a potentially

significant factor at the site. (Note that sediment data should also be reported on a dry-weight basis.)

7.4 Additional Soil Parameters

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

7.5 Degradation to Daughter Products

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

Tier 1 lookup tables generated by the Massachusetts Department of Environmental Protection (MADEP) and other regulatory agencies incorporate a very conservative assumption that the entire mass of a parent chemical will be eventually be transformed to the daughter product at the same initial concentration (e.g., MADEP 1994, MOEE 1996). MADEP reduces the initially derived action levels for parent compounds to reflect the action levels for the more toxic daughter product, without taking into account issues such as the lower molecular weights (and lower ultimate masses) of the daughter products.

Degradation to potentially more toxic daughter products is not directly considered in the Tier 1 EALs presented in this guidance document. While the need to monitor for degradation byproducts is well founded, HDOH feels that the MADEP approach is

excessively conservative and not reflective of the wide range of conditions at different sites. As an alternative, HDOH recommends that soil and groundwater samples be tested for both parent and daughter products. HDOH also strongly recommends the collection of soil vapor data at sites where initial soil or groundwater data suggests that volatile contaminants could pose potential vapor intrusion hazards (refer to Section 2.0 and Volume 1, Section 4.4, as well as the HEER *Technical Guidance Manual*).

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FIGURES

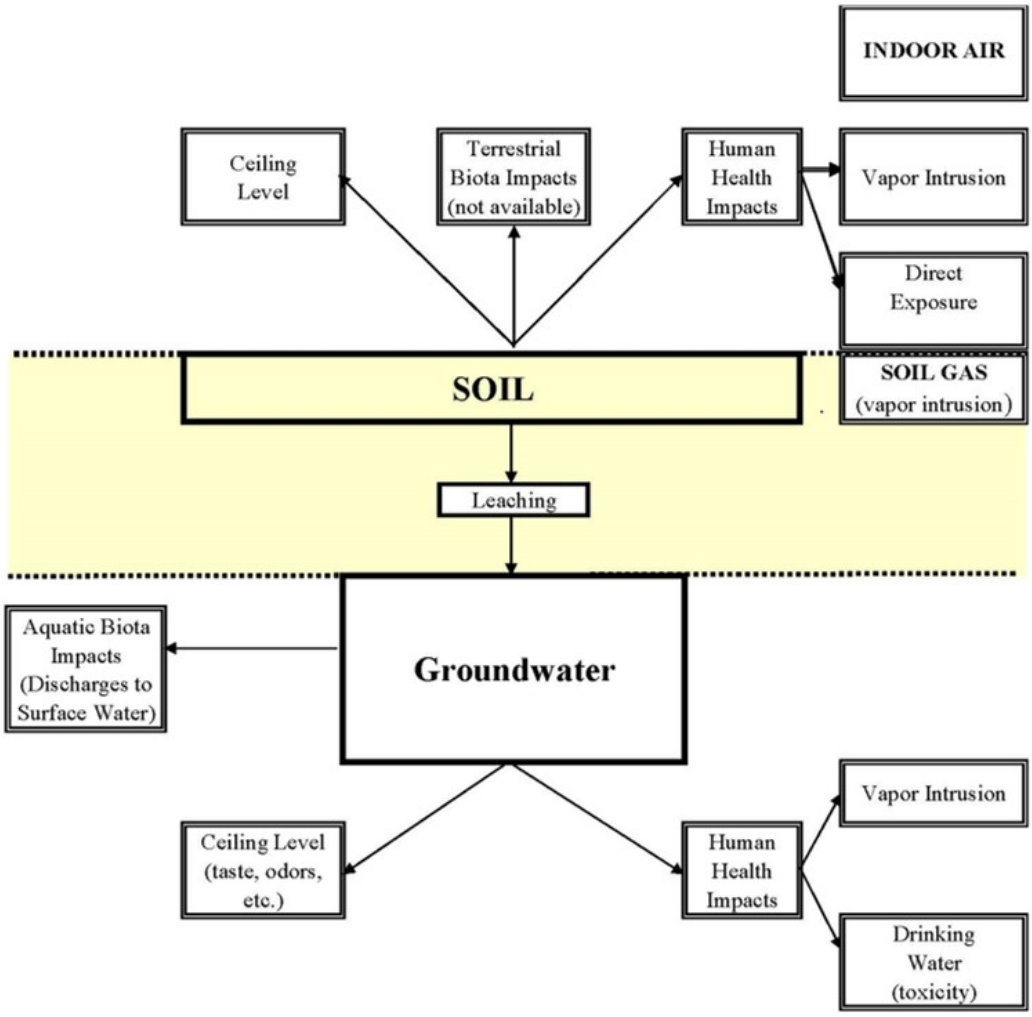

Figure 1. Summary of environmental hazards considered in action levels. Additional site-specific considerations include groundwater beneficial use, depth to impacted soil, soil type and land use. Evaluation of environmental hazards in additional to those shown should be carried out in a site-specific EHE.

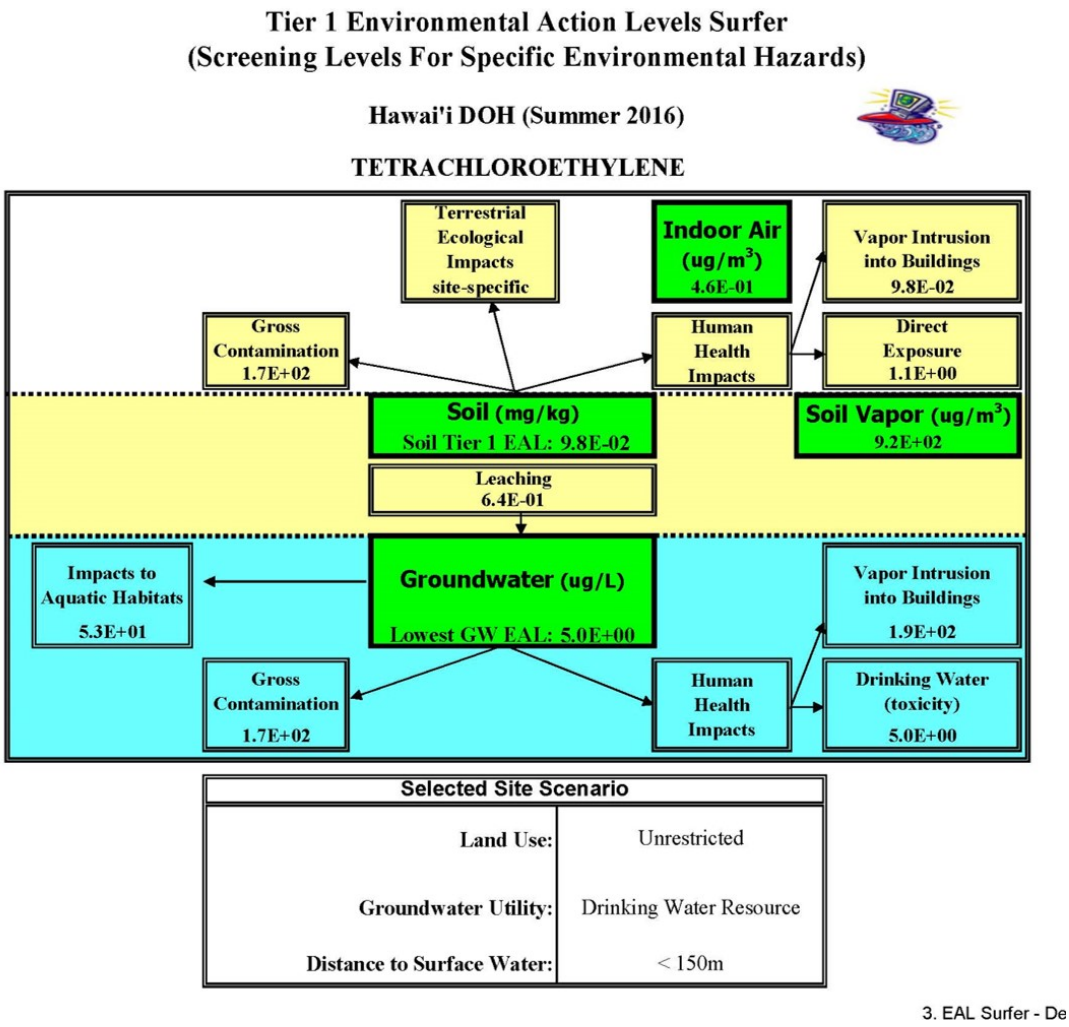

Figure 2. Summary of individual action levels used to select final, Tier 1 EALs for tetrachloroethylene (PCE) in soils situated within 10 feet of the ground surface and in groundwater that is a current or potential source of drinking water; based on a residential land-use scenario. Final EALs presented in Volume 1 summary tables are the lowest of the individual action levels. Vapor intrusion concerns drive selection of the final soil Tier 1 EAL (0.098 mg/kg). For groundwater, drinking water toxicity concerns drive selection of final Tier 1 EAL (5.0 ug/L).

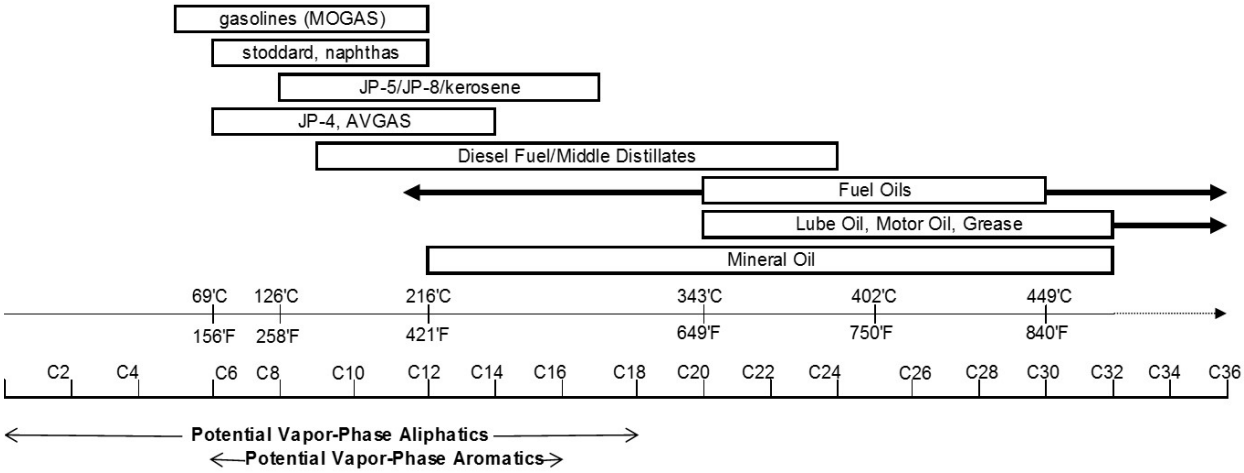

Figure 3. Fuel types versus carbon range composition.

DETAILED ACTION LEVEL TABLES

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

	(mg/kg)							
						[1]Human Health		Leaching & Groundwater Protection
CHEMICAL PARAMETER	Final EAL	Basis	[1]Gross Contamination (Odors, etc.) Table F-2	Terrestrial Ecotoxicity Table L	Background Table K	Direct Exposure Table I-1	Vapor Intrusion Into Buildings Table C-1b	Drinking Water Resource Table E
ACENAPHTHENE	1.2E+02	Vapor Intrusion	1.0E+03	site-specific		6.6E+02	1.2E+02	1.2E+02
ACENAPHTHYLENE	1.0E+02	Groundwater Protection	5.0E+02	site-specific		3.4E+02	(Use soil gas)	1.0E+02
ACETONE	9.5E+00	Groundwater Protection	5.0E+02	site-specific		1.2E+04	1.4E+04	9.5E+00
ALDRIN	3.9E+00	Direct Exposure	1.0E+03	site-specific		3.9E+00		8.4E+00
AMETRYN	1.3E+01	Groundwater Protection	5.0E+02	site-specific		1.1E+02		1.3E+01
AMINO,2- DINITROTOLUENE,4,6-	1.9E+00	Groundwater Protection	5.0E+02	site-specific		3.1E+01		1.9E+00
AMINO,4- DINITROTOLUENE,2,6-	1.9E+00	Groundwater Protection	5.0E+02	site-specific		3.1E+01		1.9E+00
ANTHRACENE	4.2E+00	Vapor Intrusion	5.0E+02	site-specific		3.5E+03	4.2E+00	4.2E+00
ANTIMONY	6.3E+00	Direct Exposure	1.0E+03	site-specific	2.4E+00	6.3E+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		2.3E+00		1.1E-01
BARIUM	1.0E+03	Ceiling Value	1.0E+03	site-specific	6.9E+02	3.1E+03		(Use batch test)
BENOMYL	1.6E-01	Groundwater Protection	1.0E+03	site-specific		6.3E+02		1.6E-01
BENZENE	3.0E-01	Groundwater Protection	5.0E+02	site-specific		1.2E+00	7.7E-01	3.0E-01
BENZO(a)ANTHRACENE	1.0E+01	Groundwater Protection	5.0E+02	site-specific		1.1E+01		1.0E+01
BENZO(a)PYRENE	3.6E+00	Direct Exposure	5.0E+02	site-specific		3.6E+00		2.0E+01
BENZO(b)FLUORANTHENE	1.1E+01	Direct Exposure	5.0E+02	site-specific		1.1E+01		2.1E+01
BENZO(g,h,i)PERYLENE	3.5E+01	Groundwater Protection	5.0E+02	site-specific		4.8E+02		3.5E+01
BENZO(k)FLUORANTHENE	3.9E+01	Groundwater Protection	5.0E+02	site-specific		1.1E+02		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)	2.3E+02
BIS(2-CHLOROETHYL)ETHER	7.5E-05	Groundwater Protection	5.0E+02	site-specific		2.4E-01	7.9E-03	7.5E-05
BIS(2-CHLORO-1-METHYLETHYL)ETHER	4.0E-03	Groundwater Protection	5.0E+02	site-specific		3.7E+00	(Use soil gas)	4.0E-03
BIS(2-ETHYLHEXYL)PHTHALATE	3.7E+01	Direct Exposure	5.0E+02	site-specific		3.7E+01		1.9E+02
BORON	1.0E+03	Ceiling Value	1.0E+03	site-specific		3.1E+03		(Use batch test)
BROMODICHLOROMETHANE	2.5E-03	Groundwater Protection	9.3E+02	site-specific		3.2E-01	1.6E-02	2.5E-03
BROMOFORM	6.9E-01	Groundwater Protection	5.0E+02	site-specific		2.0E+01		6.9E-01
BROMOMETHANE	2.2E-01	Vapor Intrusion	5.0E+02	site-specific		1.5E+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	1.0E-01	Vapor Intrusion	4.5E+02	site-specific		7.1E-01	1.0E-01	9.1E-01
CHLORDANE (TECHNICAL)	1.7E+01	Direct Exposure	1.0E+03	site-specific		1.7E+01		2.3E+01
CHLOROANILINE, p-	7.3E-03	Groundwater Protection	1.0E+03	site-specific		2.6E+00		7.3E-03
CHLOROBENZENE	2.2E+00	Vapor Intrusion	5.0E+02	site-specific		5.9E+01	2.2E+00	2.9E+00
CHLOROETHANE	1.2E+00	Groundwater Protection	5.0E+02	site-specific		2.1E+03	4.5E+02	1.2E+00
CHLOROFORM	2.6E-02	Vapor Intrusion	5.0E+02	site-specific		3.4E-01	2.6E-02	2.0E+00
CHLOROMETHANE	4.0E+00	Vapor Intrusion	1.0E+02	site-specific		2.4E+01	4.0E+00	1.1E+01
CHLOROPHENOL, 2-	1.2E-02	Groundwater Protection	1.0E+02	site-specific		7.0E+01	4.2E+01	1.2E-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	3.0E+01	Direct Exposure	1.0E+03	site-specific		3.0E+01		(Use batch test)
CHRYSENE	3.0E+01	Groundwater Protection	1.0E+03	site-specific		1.1E+03		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)	4.8E+00	Direct Exposure	1.0E+02	site-specific		4.8E+00	(Use soil gas)	(Use batch test)
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	1.0E-02	Groundwater Protection	5.0E+02	site-specific		5.9E+00		1.0E-02

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

	(mg/kg)							
						[1]Human Health		Leaching & Groundwater Protection
CHEMICAL PARAMETER	Final EAL	Basis	[1]Gross Contamination (Odors, etc.) Table F-2	Terrestrial Ecotoxicity Table L	Background Table K	Direct Exposure Table I-1	Vapor Intrusion Into Buildings Table C-1b	Drinking Water Resource Table E
DALAPON	1.1E-01	Groundwater Protection	5.0E+02	site-specific		3.8E+02		1.1E-01
DIBENZO(a,h)ANTHTRACENE	1.1E+00	Direct Exposure	5.0E+02	site-specific		1.1E+00		2.9E+01
DIBROMO,1,2- CHLOROPROPANE,3-	8.1E-04	Groundwater Protection	5.0E+02	site-specific		5.7E-03	(Use soil gas)	8.1E-04
DIBROMOCHLOROMETHANE	9.4E-03	Groundwater Protection	1.0E+02	site-specific		8.0E+00	3.6E+00	9.4E-03
DIBROMOETHANE, 1,2-	4.2E-04	Groundwater Protection	5.0E+02	site-specific		3.9E-02	1.0E-03	4.2E-04
DICHLOROBENZENE, 1,2-	7.5E-01	Groundwater Protection	3.8E+02	site-specific		3.8E+02	8.9E+00	7.5E-01
DICHLOROBENZENE, 1,3-	5.7E-01	Groundwater Protection	1.0E+02	site-specific		2.0E+02	(Use soil gas)	5.7E-01
DICHLOROBENZENE, 1,4-	5.5E-02	Vapor Intrusion	5.0E+02	site-specific		2.8E+00	5.5E-02	3.9E-01
DICHLOROBENZIDINE, 3,3-	9.2E-02	Groundwater Protection	5.0E+02	site-specific		1.2E+00		9.2E-02
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.2E+00	Direct Exposure	5.0E+02	site-specific		2.2E+00		6.3E+01
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.9E+00	Direct Exposure	5.0E+02	site-specific		1.9E+00		2.8E+01
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.8E+00	Direct Exposure	1.0E+03	site-specific		1.8E+00		5.6E+00
DICHLOROETHANE, 1,1-	1.1E-01	Groundwater Protection	5.0E+02	site-specific		3.8E+00	3.8E-01	1.1E-01
DICHLOROETHANE, 1,2-	2.3E-02	Vapor Intrusion	5.0E+02	site-specific		5.0E-01	2.3E-02	7.0E-02
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-	3.6E-01	Vapor Intrusion	1.0E+02	site-specific		3.9E+00	3.6E-01	2.2E+00
DICHLOROETHYLENE, Trans 1,2-	3.6E+00	Vapor Intrusion	5.0E+02	site-specific		2.9E+01	3.6E+00	6.5E+00
DICHLOROPHENOL, 2,4-	7.3E-03	Groundwater Protection	5.0E+02	site-specific		3.8E+01		7.3E-03
DICHLOROPHENOXYACETIC ACID (2,4-D)	3.4E-01	Groundwater Protection	5.0E+02	site-specific		1.4E+02		3.4E-01
DICHLOROPROPANE, 1,2-	1.4E-01	Groundwater Protection	1.0E+02	site-specific		2.6E+00	1.6E-01	1.4E-01
DICHLOROPROPENE, 1,3-	1.7E-02	Groundwater Protection	5.0E+02	site-specific		1.9E+00	1.5E-01	1.7E-02
DIELDRIN	2.5E+00	Direct Exposure	1.0E+03	site-specific		2.5E+00		2.4E+01
DIETHYLPHTHALATE	1.7E+01	Groundwater Protection	5.0E+02	site-specific		1.0E+04		1.7E+01
DIMETHYLPHENOL, 2,4-	3.3E+01	Groundwater Protection	1.0E+02	site-specific		2.5E+02		3.3E+01
DIMETHYLPHTHALATE	7.4E+01	Groundwater Protection	5.0E+02	site-specific		1.3E+05		7.4E+01
DINITROBENZENE, 1,3-	1.2E-01	Groundwater Protection	5.0E+02	site-specific		1.3E+00		1.2E-01
DINITROPHENOL, 2,4-	3.1E+00	Groundwater Protection	5.0E+02	site-specific		2.5E+01		3.1E+00
DINITROTOLUENE, 2,4- (2,4-DNT)	2.4E-02	Groundwater Protection	5.0E+02	site-specific		1.7E+00		2.4E-02
DINITROTOLUENE, 2,6- (2,6-DNT)	5.1E-03	Groundwater Protection	5.0E+02	site-specific		3.5E-01		5.1E-03
DIOXANE, 1,4-	2.1E-04	Groundwater Protection	5.0E+02	site-specific		5.3E+00	(Use soil gas)	2.1E-04
DIOXINS (TEQ)	2.4E-04	Direct Exposure	1.0E+03	site-specific	2.0E-05	2.4E-04		3.0E-01
DIURON	7.3E-01	Groundwater Protection	5.0E+02	site-specific		2.5E+01		7.3E-01
ENDOSULFAN	1.3E+01	Groundwater Protection	5.0E+02	site-specific		9.4E+01		1.3E+01
ENDRIN	3.8E+00	Direct Exposure	5.0E+02	site-specific		3.8E+00		3.0E+01
ETHANOL	4.5E+00	Groundwater Protection	5.0E+02	site-specific			(Use soil gas)	4.5E+00
ETHYLBENZENE	3.7E+00	Groundwater Protection	4.8E+02	site-specific		6.2E+01	2.4E+01	3.7E+00
FLUORANTHENE	1.2E+02	Groundwater Protection	5.0E+02	site-specific		4.8E+02		1.2E+02
FLUORENE	9.3E+01	Vapor Intrusion	5.0E+02	site-specific		4.6E+02	9.3E+01	3.6E+02
GLYPHOSATE	2.4E+02	Groundwater Protection	5.0E+02	site-specific		1.3E+03		2.4E+02
HEPTACHLOR	1.3E+00	Direct Exposure	1.0E+03	site-specific		1.3E+00		4.5E+01
HEPTACHLOR EPOXIDE	2.0E-01	Direct Exposure	1.0E+03	site-specific		2.0E-01		1.2E+01
HEXACHLOROBENZENE	2.2E-01	Direct Exposure	5.0E+02	site-specific		2.2E-01		2.3E-01
HEXACHLOROBUTADIENE	4.1E-02	Groundwater Protection	5.0E+02	site-specific		1.3E+00		4.1E-02
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	7.5E-02	Groundwater Protection	5.0E+02	site-specific		5.5E-01		7.5E-02
HEXACHLOROETHANE	2.3E-02	Groundwater Protection	5.0E+02	site-specific		2.0E+00		2.3E-02

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	(mg/kg)							
						[1]Human Health		Leaching & Groundwater Protection
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HEXAZINONE	1.4E+01	Groundwater Protection	5.0E+02	site-specific		4.2E+02		1.4E+01
INDENO(1,2,3-cd)PYRENE	1.1E+01	Direct Exposure	5.0E+02	site-specific		1.1E+01		3.1E+01
ISOPHORONE	8.9E-01	Groundwater Protection	5.0E+02	site-specific		5.5E+02		8.9E-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 batch test)
METHOXYCHLOR	1.6E+01	Groundwater Protection	5.0E+02	site-specific		6.3E+01		1.6E+01
METHYL ETHYL KETONE	6.2E+00	Groundwater Protection	5.0E+02	site-specific		5.6E+03	2.2E+03	6.2E+00
METHYL ISOBUTYL KETONE	3.8E+00	Groundwater Protection	1.0E+02	site-specific		3.4E+03	1.3E+03	3.8E+00
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		5.0E+01	2.3E+00	2.8E-02
METHYLENE CHLORIDE	1.2E-01	Groundwater Protection	5.0E+02	site-specific		5.8E+01	2.2E+01	1.2E-01
METHYLNAPHTHALENE, 1-	4.2E+00	Groundwater Protection	5.0E+02	site-specific		1.7E+02	3.9E+02	4.2E+00
METHYLNAPHTHALENE, 2-	4.1E+00	Groundwater Protection	5.0E+02	site-specific		3.9E+01	5.0E+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	7.0E+00	4.4E+00
NICKEL	4.1E+02	Background	1.0E+03	site-specific	4.1E+02	3.1E+02		(Use batch test)
NITROBENZENE	5.3E-03	Groundwater Protection	5.0E+02	site-specific		5.6E+00	(Use soil gas)	5.3E-03
NITROGLYCERIN	3.9E-02	Groundwater Protection	5.0E+02	site-specific		1.3E+00		3.9E-02
NITROTOLUENE, 2-	2.2E-02	Groundwater Protection	5.0E+02	site-specific		3.1E+00	(Use soil gas)	2.2E-02
NITROTOLUENE, 3-	1.2E-01	Groundwater Protection	5.0E+02	site-specific		1.3E+00		1.2E-01
NITROTOLUENE, 4-	2.9E-01	Groundwater Protection	5.0E+02	site-specific		3.3E+01		2.9E-01
PENTACHLOROPHENOL	9.8E-02	Groundwater Protection	5.0E+02	site-specific		9.8E-01		9.8E-02
PENTAERYTHRITOLTETRANITRATE (PETN)	2.1E+00	Groundwater Protection	5.0E+02	site-specific		2.5E+01		2.1E+00
PERCHLORATE	7.0E-03	Groundwater Protection	1.0E+03	site-specific		1.1E+01		7.0E-03
PHENANTHRENE	4.6E+02	Direct Exposure	5.0E+02	site-specific		4.6E+02	(Use soil gas)	5.0E+02
PHENOL	9.3E+00	Groundwater Protection	5.0E+02	site-specific		3.8E+03		9.3E+00
POLYCHLORINATED BIPHENYLS (PCBs)	1.2E+00	Direct Exposure	5.0E+02	site-specific		1.2E+00		3.4E+01
PROPICONAZOLE	1.1E+02	Groundwater Protection	5.0E+02	site-specific		1.3E+03		1.1E+02
PYRENE	4.4E+01	Vapor Intrusion	5.0E+02	site-specific		3.6E+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	9.7E-02	Groundwater Protection	5.0E+02	site-specific		4.4E+00		9.7E-02
STYRENE	9.1E-01	Groundwater Protection	5.0E+02	site-specific		8.7E+02	4.5E+02	9.1E-01
TERBACIL	2.2E+00	Groundwater Protection	5.0E+02	site-specific		1.6E+02		2.2E+00
tert-BUTYL ALCOHOL	3.2E-02	Groundwater Protection	1.0E+02	site-specific		9.0E+01	(Use soil gas)	3.2E-02
TETRACHLOROETHANE, 1,1,1,2-	1.8E-02	Groundwater Protection	1.0E+02	site-specific		2.2E+00	(Use soil gas)	1.8E-02
TETRACHLOROETHANE, 1,1,2,2-	1.4E-03	Groundwater Protection	5.0E+02	site-specific		6.4E-01	1.0E-02	1.4E-03
TETRACHLOROETHYLENE	9.8E-02	Vapor Intrusion	1.7E+02	site-specific		1.1E+00	9.8E-02	6.4E-01
TETRACHLOROPHENOL, 2,3,4,6-	5.1E-01	Groundwater Protection	5.0E+02	site-specific		3.8E+02		5.1E-01
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	8.8E+01	Groundwater Protection	5.0E+02	site-specific		7.7E+02		8.8E+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	4.8E-01	Direct Exposure	5.0E+02	site-specific		4.8E-01		2.5E+02
TPH (gasolines)	1.0E+02	Ceiling Value	1.0E+02	site-specific		4.5E+02	(Use soil gas)	7.0E+02
TPH (middle distillates)	2.2E+02	Direct Exposure	5.0E+02	site-specific		2.2E+02	(Use soil gas)	9.4E+02

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

	(mg/kg)							
						[1]Human Health		Leaching & Groundwater Protection
CHEMICAL PARAMETER	Final EAL	Basis	[1]Gross Contamination (Odors, etc.) Table F-2	Terrestrial Ecotoxicity Table L	Background Table K	Direct Exposure Table I-1	Vapor Intrusion Into Buildings Table C-1b	Drinking Water Resource Table E
TPH (residual fuels)	5.0E+02	Ceiling Value	5.0E+02	site-specific		9.4E+03		1.0E+03
TRICHLOROBENZENE, 1,2,4-	1.8E-01	Vapor Intrusion	5.0E+02	site-specific		1.2E+01	1.8E-01	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	8.9E-02	Vapor Intrusion	5.0E+02	site-specific		8.9E-01	8.9E-02	3.6E-01
TRICHLOROPHENOL, 2,4,5-	4.5E+00	Groundwater Protection	1.0E+02	site-specific		1.3E+03		4.5E+00
TRICHLOROPHENOL, 2,4,6-	4.5E-01	Groundwater Protection	5.0E+02	site-specific		1.3E+01		4.5E-01
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	3.6E+00	Groundwater Protection	1.0E+03	site-specific		1.3E+02		3.6E+00
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	1.5E+00	Groundwater Protection	5.0E+02	site-specific		1.0E+02		1.5E+00
TRICHLOROPROPANE, 1,2,3-	5.0E-03	Direct Exposure	1.0E+02	site-specific		5.0E-03	(Use soil gas)	1.3E-02
TRICHLOROPROPENE, 1,2,3-	8.1E-02	Groundwater Protection	1.0E+02	site-specific		1.6E-01	(Use soil gas)	8.1E-02
TRIFLURALIN	2.8E+01	Groundwater Protection	1.0E+02	site-specific		8.7E+01		2.8E+01
TRINITROBENZENE, 1,3,5-	7.5E+00	Groundwater Protection	5.0E+02	site-specific		4.5E+02		7.5E+00
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	3.1E+01	Groundwater Protection	5.0E+02	site-specific		3.1E+01		3.1E+01
TRINITROTOLUENE, 2,4,6- (TNT)	1.2E+00	Groundwater Protection	5.0E+02	site-specific		7.3E+00		1.2E+00
VANADIUM	7.7E+02	Background	1.0E+03	site-specific	7.7E+02	7.8E+01		(Use batch test)
VINYL CHLORIDE	3.6E-02	Vapor Intrusion	5.0E+02	site-specific		5.9E-02	3.6E-02	3.5E-01
XYLENES	2.1E+00	Groundwater Protection	2.6E+02	site-specific		1.3E+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		6.6E+02	1.2E+02	1.2E+02
ACENAPHTHYLENE	5.5E+00	Groundwater Protection	5.0E+02	site-specific		3.4E+02	(Use soil gas)	5.5E+00
ACETONE	1.0E+00	Groundwater Protection	5.0E+02	site-specific		1.2E+04	1.4E+04	1.0E+00
ALDRIN	3.9E+00	Direct Exposure	1.0E+03	site-specific		3.9E+00		8.4E+00
AMETRYN	1.3E+01	Groundwater Protection	5.0E+02	site-specific		1.1E+02		1.3E+01
AMINO,2- DINITROTOLUENE,4,6-	8.5E-01	Groundwater Protection	5.0E+02	site-specific		3.1E+01		8.5E-01
AMINO,4- DINITROTOLUENE,2,6-	5.2E-01	Groundwater Protection	5.0E+02	site-specific		3.1E+01		5.2E-01
ANTHRACENE	4.2E+00	Vapor Intrusion	5.0E+02	site-specific		3.5E+03	4.2E+00	4.2E+00
ANTIMONY	6.3E+00	Direct Exposure	1.0E+03	site-specific	2.4E+00	6.3E+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		2.3E+00		1.1E-01
BARIUM	1.0E+03	Ceiling Value	1.0E+03	site-specific	6.9E+02	3.1E+03		(Use batch test)
BENOMYL	7.8E-03	Groundwater Protection	1.0E+03	site-specific		6.3E+02		7.8E-03
BENZENE	3.0E-01	Groundwater Protection	5.0E+02	site-specific		1.2E+00	7.7E-01	3.0E-01
BENZO(a)ANTHRACENE	1.0E+01	Groundwater Protection	5.0E+02	site-specific		1.1E+01		1.0E+01
BENZO(a)PYRENE	3.6E+00	Direct Exposure	5.0E+02	site-specific		3.6E+00		5.9E+00
BENZO(b)FLUORANTHENE	1.1E+01	Direct Exposure	5.0E+02	site-specific		1.1E+01		2.1E+01
BENZO(g,h,i)PERYLENE	3.5E+01	Groundwater Protection	5.0E+02	site-specific		4.8E+02		3.5E+01
BENZO(k)FLUORANTHENE	3.9E+01	Groundwater Protection	5.0E+02	site-specific		1.1E+02		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)	2.3E+02
BIS(2-CHLOROETHYL)ETHER	7.5E-05	Groundwater Protection	5.0E+02	site-specific		2.4E-01	7.9E-03	7.5E-05
BIS(2-CHLORO-1-METHYLETHYL)ETHER	4.0E-03	Groundwater Protection	5.0E+02	site-specific		3.7E+00	(Use soil gas)	4.0E-03
BIS(2-ETHYLHEXYL)PHTHALATE	3.7E+01	Direct Exposure	5.0E+02	site-specific		3.7E+01		1.9E+02
BORON	1.0E+03	Ceiling Value	1.0E+03	site-specific		3.1E+03		(Use batch test)
BROMODICHLOROMETHANE	2.5E-03	Groundwater Protection	9.3E+02	site-specific		3.2E-01	1.6E-02	2.5E-03
BROMOFORM	6.9E-01	Groundwater Protection	5.0E+02	site-specific		2.0E+01		6.9E-01
BROMOMETHANE	2.2E-01	Vapor Intrusion	5.0E+02	site-specific		1.5E+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	1.0E-01	Vapor Intrusion	4.5E+02	site-specific		7.1E-01	1.0E-01	9.1E-01
CHLORDANE (TECHNICAL)	1.7E+01	Direct Exposure	1.0E+03	site-specific		1.7E+01		2.3E+01
CHLOROANILINE, p-	7.3E-03	Groundwater Protection	1.0E+03	site-specific		2.6E+00		7.3E-03
CHLOROBENZENE	1.5E+00	Groundwater Protection	5.0E+02	site-specific		5.9E+01	2.2E+00	1.5E+00
CHLOROETHANE	1.2E+00	Groundwater Protection	5.0E+02	site-specific		2.1E+03	4.5E+02	1.2E+00
CHLOROFORM	2.6E-02	Vapor Intrusion	5.0E+02	site-specific		3.4E-01	2.6E-02	7.9E-01
CHLOROMETHANE	4.0E+00	Vapor Intrusion	1.0E+02	site-specific		2.4E+01	4.0E+00	1.1E+01
CHLOROPHENOL, 2-	1.2E-02	Groundwater Protection	1.0E+02	site-specific		7.0E+01	4.2E+01	1.2E-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	3.0E+01	Direct Exposure	1.0E+03	site-specific		3.0E+01		(Use batch test)
CHRYSENE	3.0E+01	Groundwater Protection	1.0E+03	site-specific		1.1E+03		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)	4.8E+00	Direct Exposure	1.0E+02	site-specific		4.8E+00	(Use soil gas)	(Use batch test)
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	1.0E-02	Groundwater Protection	5.0E+02	site-specific		5.9E+00		1.0E-02
DALAPON	1.1E-01	Groundwater Protection	5.0E+02	site-specific		3.8E+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	1.1E+00	Direct Exposure	5.0E+02	site-specific		1.1E+00		2.9E+01
DIBROMO,1,2- CHLOROPROPANE,3-	8.1E-04	Groundwater Protection	5.0E+02	site-specific		5.7E-03	(Use soil gas)	8.1E-04
DIBROMOCHLOROMETHANE	9.4E-03	Groundwater Protection	1.0E+02	site-specific		8.0E+00	3.6E+00	9.4E-03
DIBROMOETHANE, 1,2-	4.2E-04	Groundwater Protection	5.0E+02	site-specific		3.9E-02	1.0E-03	4.2E-04
DICHLOROBENZENE, 1,2-	7.5E-01	Groundwater Protection	3.8E+02	site-specific		3.8E+02	8.9E+00	7.5E-01
DICHLOROBENZENE, 1,3-	5.7E-01	Groundwater Protection	1.0E+02	site-specific		2.0E+02	(Use soil gas)	5.7E-01
DICHLOROBENZENE, 1,4-	5.5E-02	Vapor Intrusion	5.0E+02	site-specific		2.8E+00	5.5E-02	3.9E-01
DICHLOROBENZIDINE, 3,3-	9.2E-02	Groundwater Protection	5.0E+02	site-specific		1.2E+00		9.2E-02
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.2E+00	Direct Exposure	5.0E+02	site-specific		2.2E+00		6.3E+01
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.9E+00	Direct Exposure	5.0E+02	site-specific		1.9E+00		2.8E+01
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.8E+00	Direct Exposure	1.0E+03	site-specific		1.8E+00		5.6E+00
DICHLOROETHANE, 1,1-	1.1E-01	Groundwater Protection	5.0E+02	site-specific		3.8E+00	3.8E-01	1.1E-01
DICHLOROETHANE, 1,2-	2.3E-02	Vapor Intrusion	5.0E+02	site-specific		5.0E-01	2.3E-02	7.0E-02
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-	3.6E-01	Vapor Intrusion	1.0E+02	site-specific		3.9E+00	3.6E-01	2.2E+00
DICHLOROETHYLENE, Trans 1,2-	3.6E+00	Vapor Intrusion	5.0E+02	site-specific		2.9E+01	3.6E+00	6.5E+00
DICHLOROPHENOL, 2,4-	7.3E-03	Groundwater Protection	5.0E+02	site-specific		3.8E+01		7.3E-03
DICHLOROPHENOXYACETIC ACID (2,4-D)	3.4E-01	Groundwater Protection	5.0E+02	site-specific		1.4E+02		3.4E-01
DICHLOROPROPANE, 1,2-	1.4E-01	Groundwater Protection	1.0E+02	site-specific		2.6E+00	1.6E-01	1.4E-01
DICHLOROPROPENE, 1,3-	2.1E-03	Groundwater Protection	5.0E+02	site-specific		1.9E+00	1.5E-01	2.1E-03
DIELDRIN	2.5E+00	Direct Exposure	1.0E+03	site-specific		2.5E+00		2.4E+01
DIETHYLPHTHALATE	3.7E+00	Groundwater Protection	5.0E+02	site-specific		1.0E+04		3.7E+00
DIMETHYLPHENOL, 2,4-	9.8E+00	Groundwater Protection	1.0E+02	site-specific		2.5E+02		9.8E+00
DIMETHYLPHTHALATE	2.6E+01	Groundwater Protection	5.0E+02	site-specific		1.3E+05		2.6E+01
DINITROBENZENE, 1,3-	1.2E-01	Groundwater Protection	5.0E+02	site-specific		1.3E+00		1.2E-01
DINITROPHENOL, 2,4-	1.1E+00	Groundwater Protection	5.0E+02	site-specific		2.5E+01		1.1E+00
DINITROTOLUENE, 2,4- (2,4-DNT)	2.4E-02	Groundwater Protection	5.0E+02	site-specific		1.7E+00		2.4E-02
DINITROTOLUENE, 2,6- (2,6-DNT)	5.1E-03	Groundwater Protection	5.0E+02	site-specific		3.5E-01		5.1E-03
DIOXANE, 1,4-	2.1E-04	Groundwater Protection	5.0E+02	site-specific		5.3E+00	(Use soil gas)	2.1E-04
DIOXINS (TEQ)	2.4E-04	Direct Exposure	1.0E+03	site-specific	2.0E-05	2.4E-04		3.0E-01
DIURON	7.3E-01	Groundwater Protection	5.0E+02	site-specific		2.5E+01		7.3E-01
ENDOSULFAN	1.3E+01	Groundwater Protection	5.0E+02	site-specific		9.4E+01		1.3E+01
ENDRIN	3.8E+00	Direct Exposure	5.0E+02	site-specific		3.8E+00		3.0E+01
ETHANOL	4.5E+00	Groundwater Protection	5.0E+02	site-specific			(Use soil gas)	4.5E+00
ETHYLBENZENE	9.0E-01	Groundwater Protection	4.8E+02	site-specific		6.2E+01	2.4E+01	9.0E-01
FLUORANTHENE	8.7E+01	Groundwater Protection	5.0E+02	site-specific		4.8E+02		8.7E+01
FLUORENE	9.3E+01	Vapor Intrusion	5.0E+02	site-specific		4.6E+02	9.3E+01	9.3E+01
GLYPHOSATE	2.4E+02	Groundwater Protection	5.0E+02	site-specific		1.3E+03		2.4E+02
HEPTACHLOR	1.3E+00	Direct Exposure	1.0E+03	site-specific		1.3E+00		4.5E+01
HEPTACHLOR EPOXIDE	2.0E-01	Direct Exposure	1.0E+03	site-specific		2.0E-01		1.2E+01
HEXACHLOROBENZENE	2.2E-01	Direct Exposure	5.0E+02	site-specific		2.2E-01		2.3E-01
HEXACHLOROBUTADIENE	4.1E-02	Groundwater Protection	5.0E+02	site-specific		1.3E+00		4.1E-02
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	2.9E-02	Groundwater Protection	5.0E+02	site-specific		5.5E-01		2.9E-02
HEXACHLOROETHANE	2.3E-02	Groundwater Protection	5.0E+02	site-specific		2.0E+00		2.3E-02
HEXAZINONE	1.4E+01	Groundwater Protection	5.0E+02	site-specific		4.2E+02		1.4E+01
INDENO(1,2,3-cd)PYRENE	1.1E+01	Direct Exposure	5.0E+02	site-specific		1.1E+01		3.1E+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
ISOPHORONE	8.9E-01	Groundwater Protection	5.0E+02	site-specific		5.5E+02		8.9E-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 batch test)
METHOXYCHLOR	1.6E+01	Groundwater Protection	5.0E+02	site-specific		6.3E+01		1.6E+01
METHYL ETHYL KETONE	6.2E+00	Groundwater Protection	5.0E+02	site-specific		5.6E+03	2.2E+03	6.2E+00
METHYL ISOBUTYL KETONE	5.0E-01	Groundwater Protection	1.0E+02	site-specific		3.4E+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		5.0E+01	2.3E+00	2.8E-02
METHYLENE CHLORIDE	1.2E-01	Groundwater Protection	5.0E+02	site-specific		5.8E+01	2.2E+01	1.2E-01
METHYLNAPHTHALENE, 1-	8.9E-01	Groundwater Protection	5.0E+02	site-specific		1.7E+02	3.9E+02	8.9E-01
METHYLNAPHTHALENE, 2-	1.9E+00	Groundwater Protection	5.0E+02	site-specific		3.9E+01	5.0E+01	1.9E+00
MOLYBDENUM	7.8E+01	Direct Exposure	1.0E+03	site-specific	4.0E+00	7.8E+01		(Use batch test)
NAPHTHALENE	3.1E+00	Groundwater Protection	5.0E+02	site-specific		2.8E+01	7.0E+00	3.1E+00
NICKEL	4.1E+02	Background	1.0E+03	site-specific	4.1E+02	3.1E+02		(Use batch test)
NITROBENZENE	5.3E-03	Groundwater Protection	5.0E+02	site-specific		5.6E+00	(Use soil gas)	5.3E-03
NITROGLYCERIN	3.9E-02	Groundwater Protection	5.0E+02	site-specific		1.3E+00		3.9E-02
NITROTOLUENE, 2-	2.2E-02	Groundwater Protection	5.0E+02	site-specific		3.1E+00	(Use soil gas)	2.2E-02
NITROTOLUENE, 3-	1.2E-01	Groundwater Protection	5.0E+02	site-specific		1.3E+00		1.2E-01
NITROTOLUENE, 4-	2.9E-01	Groundwater Protection	5.0E+02	site-specific		3.3E+01		2.9E-01
PENTACHLOROPHENOL	9.8E-02	Groundwater Protection	5.0E+02	site-specific		9.8E-01		9.8E-02
PENTAERYTHRITOLTETRANITRATE (PETN)	2.1E+00	Groundwater Protection	5.0E+02	site-specific		2.5E+01		2.1E+00
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		4.6E+02	(Use soil gas)	6.9E+01
PHENOL	1.8E+00	Groundwater Protection	5.0E+02	site-specific		3.8E+03		1.8E+00
POLYCHLORINATED BIPHENYLS (PCBs)	1.2E+00	Direct Exposure	5.0E+02	site-specific		1.2E+00		3.4E+01
PROPICONAZOLE	2.5E+01	Groundwater Protection	5.0E+02	site-specific		1.3E+03		2.5E+01
PYRENE	4.4E+01	Vapor Intrusion	5.0E+02	site-specific		3.6E+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	9.7E-02	Groundwater Protection	5.0E+02	site-specific		4.4E+00		9.7E-02
STYRENE	9.1E-01	Groundwater Protection	5.0E+02	site-specific		8.7E+02	4.5E+02	9.1E-01
TERBACIL	2.2E+00	Groundwater Protection	5.0E+02	site-specific		1.6E+02		2.2E+00
tert-BUTYL ALCOHOL	3.2E-02	Groundwater Protection	1.0E+02	site-specific		9.0E+01	(Use soil gas)	3.2E-02
TETRACHLOROETHANE, 1,1,1,2-	1.8E-02	Groundwater Protection	1.0E+02	site-specific		2.2E+00	(Use soil gas)	1.8E-02
TETRACHLOROETHANE, 1,1,2,2-	1.4E-03	Groundwater Protection	5.0E+02	site-specific		6.4E-01	1.0E-02	1.4E-03
TETRACHLOROETHYLENE	9.8E-02	Vapor Intrusion	1.7E+02	site-specific		1.1E+00	9.8E-02	6.4E-01
TETRACHLOROPHENOL, 2,3,4,6-	5.6E-02	Groundwater Protection	5.0E+02	site-specific		3.8E+02		5.6E-02
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	1.9E+01	Groundwater Protection	5.0E+02	site-specific		7.7E+02		1.9E+01
THALLIUM	7.8E-01	Direct Exposure	1.0E+03	site-specific	2.5E-01	7.8E-01		(Use batch test)
TOLUENE	7.8E-01	Groundwater Protection	5.0E+02	site-specific		8.2E+02	8.2E+02	7.8E-01
TOXAPHENE	4.8E-01	Direct Exposure	5.0E+02	site-specific		4.8E-01		2.5E+02
TPH (gasolines)	1.0E+02	Ceiling Value	1.0E+02	site-specific		4.5E+02	(Use soil gas)	7.0E+02
TPH (middle distillates)	2.2E+02	Direct Exposure	5.0E+02	site-specific		2.2E+02	(Use soil gas)	9.4E+02
TPH (residual fuels)	5.0E+02	Ceiling Value	5.0E+02	site-specific		9.4E+03		1.0E+03
TRICHLOROBENZENE, 1,2,4-	1.8E-01	Vapor Intrusion	5.0E+02	site-specific		1.2E+01	1.8E-01	1.6E+01
TRICHLOROETHANE, 1,1,1-	1.2E+00	Groundwater Protection	5.0E+02	site-specific		6.4E+02	2.2E+02	1.2E+00

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

	(mg/kg)							
						[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
TRICHLOROETHANE, 1,1,2-	8.9E-03	Vapor Intrusion	1.0E+02	site-specific		3.2E-01	8.9E-03	7.6E-02
TRICHLOROETHYLENE	8.9E-02	Vapor Intrusion	5.0E+02	site-specific		8.9E-01	8.9E-02	3.6E-01
TRICHLOROPHENOL, 2,4,5-	5.0E-01	Groundwater Protection	1.0E+02	site-specific		1.3E+03		5.0E-01
TRICHLOROPHENOL, 2,4,6-	3.1E-01	Groundwater Protection	5.0E+02	site-specific		1.3E+01		3.1E-01
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	3.6E+00	Groundwater Protection	1.0E+03	site-specific		1.3E+02		3.6E+00
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	8.7E-01	Groundwater Protection	5.0E+02	site-specific		1.0E+02		8.7E-01
TRICHLOROPROPANE, 1,2,3-	5.0E-03	Direct Exposure	1.0E+02	site-specific		5.0E-03	(Use soil gas)	1.3E-02
TRICHLOROPROPENE, 1,2,3-	8.1E-02	Groundwater Protection	1.0E+02	site-specific		1.6E-01	(Use soil gas)	8.1E-02
TRIFLURALIN	1.8E+01	Groundwater Protection	1.0E+02	site-specific		8.7E+01		1.8E+01
TRINITROBENZENE, 1,3,5-	2.8E+00	Groundwater Protection	5.0E+02	site-specific		4.5E+02		2.8E+00
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	3.1E+01	Groundwater Protection	5.0E+02	site-specific		3.1E+01		3.1E+01
TRINITROTOLUENE, 2,4,6- (TNT)	1.2E+00	Groundwater Protection	5.0E+02	site-specific		7.3E+00		1.2E+00
VANADIUM	7.7E+02	Background	1.0E+03	site-specific	7.7E+02	7.8E+01		(Use batch test)
VINYL CHLORIDE	3.6E-02	Vapor Intrusion	5.0E+02	site-specific		5.9E-02	3.6E-02	3.5E-01
XYLENES	1.4E+00	Groundwater Protection	2.6E+02	site-specific		1.3E+02	4.5E+01	1.4E+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 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		6.6E+02	1.2E+02	1.7E+02
ACENAPHTHYLENE	1.3E+02	Groundwater Protection	5.0E+02	site-specific		3.4E+02	(Use soil gas)	1.3E+02
ACETONE	1.0E+01	Groundwater Protection	5.0E+02	site-specific		1.2E+04	1.4E+04	1.0E+01
ALDRIN	3.9E+00	Direct Exposure	1.0E+03	site-specific		3.9E+00		1.8E+01
AMETRYN	1.1E+02	Direct Exposure	5.0E+02	site-specific		1.1E+02		1.3E+02
AMINO,2- DINITROTOLUENE,4,6-	7.5E+00	Groundwater Protection	5.0E+02	site-specific		3.1E+01		7.5E+00
AMINO,4- DINITROTOLUENE,2,6-	4.6E+00	Groundwater Protection	5.0E+02	site-specific		3.1E+01		4.6E+00
ANTHRACENE	4.2E+00	Vapor Intrusion	5.0E+02	site-specific		3.5E+03	4.2E+00	4.2E+00
ANTIMONY	6.3E+00	Direct Exposure	1.0E+03	site-specific	2.4E+00	6.3E+00		(Use batch test)
ARSENIC	2.4E+01	Background	1.0E+03	site-specific	2.4E+01	2.3E+01		(Use batch test)
ATRAZINE	2.3E+00	Direct Exposure	5.0E+02	site-specific		2.3E+00		1.2E+01
BARIUM	1.0E+03	Ceiling Value	1.0E+03	site-specific	6.9E+02	3.1E+03		(Use batch test)
BENOMYL	1.6E-01	Groundwater Protection	1.0E+03	site-specific		6.3E+02		1.6E-01
BENZENE	7.7E-01	Vapor Intrusion	5.0E+02	site-specific		1.2E+00	7.7E-01	1.0E+02
BENZO(a)ANTHRACENE	1.1E+01	Direct Exposure	5.0E+02	site-specific		1.1E+01		1.4E+02
BENZO(a)PYRENE	3.6E+00	Direct Exposure	5.0E+02	site-specific		3.6E+00		7.8E+01
BENZO(b)FLUORANTHENE	1.1E+01	Direct Exposure	5.0E+02	site-specific		1.1E+01		7.5E+01
BENZO(g,h,i)PERYLENE	3.5E+01	Groundwater Protection	5.0E+02	site-specific		4.8E+02		3.5E+01
BENZO(k)FLUORANTHENE	3.9E+01	Groundwater Protection	5.0E+02	site-specific		1.1E+02		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)	2.3E+02
BIS(2-CHLOROETHYL)ETHER	7.9E-03	Vapor Intrusion	5.0E+02	site-specific		2.4E-01	7.9E-03	9.6E-01
BIS(2-CHLORO-1-METHYLETHYL)ETHER	4.0E-03	Groundwater Protection	5.0E+02	site-specific		3.7E+00	(Use soil gas)	4.0E-03
BIS(2-ETHYLHEXYL)PHTHALATE	3.7E+01	Direct Exposure	5.0E+02	site-specific		3.7E+01		5.4E+02
BORON	1.0E+03	Ceiling Value	1.0E+03	site-specific		3.1E+03		(Use batch test)
BROMODICHLOROMETHANE	1.6E-02	Vapor Intrusion	9.3E+02	site-specific		3.2E-01	1.6E-02	2.1E+00
BROMOFORM	9.5E+00	Groundwater Protection	5.0E+02	site-specific		2.0E+01		9.5E+00
BROMOMETHANE	2.2E-01	Vapor Intrusion	5.0E+02	site-specific		1.5E+00	2.2E-01	1.8E+00
CADMIUM	1.4E+01	Direct Exposure	1.0E+03	site-specific	2.3E+00	1.4E+01		(Use batch test)
CARBON TETRACHLORIDE	1.0E-01	Vapor Intrusion	4.5E+02	site-specific		7.1E-01	1.0E-01	2.0E+01
CHLORDANE (TECHNICAL)	1.7E+01	Direct Exposure	1.0E+03	site-specific		1.7E+01		2.3E+01
CHLOROANILINE, p-	2.6E+00	Direct Exposure	1.0E+03	site-specific		2.6E+00		8.6E+00
CHLOROBENZENE	2.2E+00	Vapor Intrusion	5.0E+02	site-specific		5.9E+01	2.2E+00	1.3E+01
CHLOROETHANE	1.2E+01	Groundwater Protection	5.0E+02	site-specific		2.1E+03	4.5E+02	1.2E+01
CHLOROFORM	2.6E-02	Vapor Intrusion	5.0E+02	site-specific		3.4E-01	2.6E-02	3.1E+00
CHLOROMETHANE	4.0E+00	Vapor Intrusion	1.0E+02	site-specific		2.4E+01	4.0E+00	1.1E+01
CHLOROPHENOL, 2-	1.2E-01	Groundwater Protection	1.0E+02	site-specific		7.0E+01	4.2E+01	1.2E-01
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	3.0E+01	Direct Exposure	1.0E+03	site-specific		3.0E+01		(Use batch test)
CHRYSENE	3.0E+01	Groundwater Protection	1.0E+03	site-specific		1.1E+03		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)	4.8E+00	Direct Exposure	1.0E+02	site-specific		4.8E+00	(Use soil gas)	(Use batch test)
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	5.9E+00	Direct Exposure	5.0E+02	site-specific		5.9E+00		7.7E+00
DALAPON	1.6E+00	Groundwater Protection	5.0E+02	site-specific		3.8E+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	1.1E+00	Direct Exposure	5.0E+02	site-specific		1.1E+00		4.0E+02
DIBROMO,1,2- CHLOROPROPANE,3-	8.1E-04	Groundwater Protection	5.0E+02	site-specific		5.7E-03	(Use soil gas)	8.1E-04
DIBROMOCHLOROMETHANE	3.6E+00	Vapor Intrusion	1.0E+02	site-specific		8.0E+00	3.6E+00	2.9E+01
DIBROMOETHANE, 1,2-	1.0E-03	Vapor Intrusion	5.0E+02	site-specific		3.9E-02	1.0E-03	2.0E-01
DICHLOROBENZENE, 1,2-	7.5E+00	Groundwater Protection	3.8E+02	site-specific		3.8E+02	8.9E+00	7.5E+00
DICHLOROBENZENE, 1,3-	4.2E+01	Groundwater Protection	1.0E+02	site-specific		2.0E+02	(Use soil gas)	4.2E+01
DICHLOROBENZENE, 1,4-	5.5E-02	Vapor Intrusion	5.0E+02	site-specific		2.8E+00	5.5E-02	8.5E+00
DICHLOROBENZIDINE, 3,3-	1.2E+00	Direct Exposure	5.0E+02	site-specific		1.2E+00		2.2E+01
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.2E+00	Direct Exposure	5.0E+02	site-specific		2.2E+00		6.3E+01
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.9E+00	Direct Exposure	5.0E+02	site-specific		1.9E+00		1.4E+02
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.8E+00	Direct Exposure	1.0E+03	site-specific		1.8E+00		5.6E+00
DICHLOROETHANE, 1,1-	3.8E-01	Vapor Intrusion	5.0E+02	site-specific		3.8E+00	3.8E-01	3.3E+01
DICHLOROETHANE, 1,2-	2.3E-02	Vapor Intrusion	5.0E+02	site-specific		5.0E-01	2.3E-02	2.6E+00
DICHLOROETHYLENE, 1,1-	8.9E+00	Vapor Intrusion	5.0E+02	site-specific		4.9E+01	8.9E+00	6.5E+02
DICHLOROETHYLENE, Cis 1,2-	3.6E-01	Vapor Intrusion	1.0E+02	site-specific		3.9E+00	3.6E-01	4.1E+01
DICHLOROETHYLENE, Trans 1,2-	3.6E+00	Vapor Intrusion	5.0E+02	site-specific		2.9E+01	3.6E+00	1.7E+02
DICHLOROPHENOL, 2,4-	7.3E-02	Groundwater Protection	5.0E+02	site-specific		3.8E+01		7.3E-02
DICHLOROPHENOXYACETIC ACID (2,4-D)	6.4E-01	Groundwater Protection	5.0E+02	site-specific		1.4E+02		6.4E-01
DICHLOROPROPANE, 1,2-	1.6E-01	Vapor Intrusion	1.0E+02	site-specific		2.6E+00	1.6E-01	2.7E+00
DICHLOROPROPENE, 1,3-	1.5E-01	Vapor Intrusion	5.0E+02	site-specific		1.9E+00	1.5E-01	8.9E+00
DIELDRIN	2.5E+00	Direct Exposure	1.0E+03	site-specific		2.5E+00		2.4E+01
DIETHYLPHTHALATE	1.7E+01	Groundwater Protection	5.0E+02	site-specific		1.0E+04		1.7E+01
DIMETHYLPHENOL, 2,4-	5.7E+01	Groundwater Protection	1.0E+02	site-specific		2.5E+02		5.7E+01
DIMETHYLPHTHALATE	7.4E+01	Groundwater Protection	5.0E+02	site-specific		1.3E+05		7.4E+01
DINITROBENZENE, 1,3-	1.3E+00	Direct Exposure	5.0E+02	site-specific		1.3E+00		5.8E+00
DINITROPHENOL, 2,4-	2.5E+01	Direct Exposure	5.0E+02	site-specific		2.5E+01		2.9E+01
DINITROTOLUENE, 2,4- (2,4-DNT)	1.7E+00	Direct Exposure	5.0E+02	site-specific		1.7E+00		1.1E+01
DINITROTOLUENE, 2,6- (2,6-DNT)	3.5E-01	Direct Exposure	5.0E+02	site-specific		3.5E-01		1.1E+01
DIOXANE, 1,4-	5.3E+00	Direct Exposure	5.0E+02	site-specific		5.3E+00	(Use soil gas)	2.3E+01
DIOXINS (TEQ)	2.4E-04	Direct Exposure	1.0E+03	site-specific	2.0E-05	2.4E-04		3.0E-01
DIURON	3.6E+00	Groundwater Protection	5.0E+02	site-specific		2.5E+01		3.6E+00
ENDOSULFAN	1.3E+01	Groundwater Protection	5.0E+02	site-specific		9.4E+01		1.3E+01
ENDRIN	3.8E+00	Direct Exposure	5.0E+02	site-specific		3.8E+00		3.0E+01
ETHANOL	4.5E+00	Groundwater Protection	5.0E+02	site-specific			(Use soil gas)	4.5E+00
ETHYLBENZENE	1.7E+01	Groundwater Protection	4.8E+02	site-specific		6.2E+01	2.4E+01	1.7E+01
FLUORANTHENE	1.2E+02	Groundwater Protection	5.0E+02	site-specific		4.8E+02		1.2E+02
FLUORENE	9.3E+01	Vapor Intrusion	5.0E+02	site-specific		4.6E+02	9.3E+01	4.6E+02
GLYPHOSATE	5.0E+02	Ceiling Value	5.0E+02	site-specific		1.3E+03		7.5E+03
HEPTACHLOR	1.3E+00	Direct Exposure	1.0E+03	site-specific		1.3E+00		4.5E+01
HEPTACHLOR EPOXIDE	2.0E-01	Direct Exposure	1.0E+03	site-specific		2.0E-01		1.2E+01
HEXACHLOROBENZENE	2.2E-01	Direct Exposure	5.0E+02	site-specific		2.2E-01		2.3E-01
HEXACHLOROBUTADIENE	1.3E+00	Direct Exposure	5.0E+02	site-specific		1.3E+00		2.2E+00
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	7.5E-02	Groundwater Protection	5.0E+02	site-specific		5.5E-01		7.5E-02
HEXACHLOROETHANE	2.0E+00	Direct Exposure	5.0E+02	site-specific		2.0E+00		5.7E+00
HEXAZINONE	4.2E+02	Direct Exposure	5.0E+02	site-specific		4.2E+02		1.1E+03

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

	(mg/kg)							
						[1]Human Health		Leaching & Groundwater Protection
CHEMICAL PARAMETER	Final EAL	Basis	[1]Gross Contamination (Odors, etc.) Table F-2	Terrestrial Ecotoxicity Table L	Background Table K	Direct Exposure Table I-1	Vapor Intrusion Into Buildings Table C-1b	NON-Drinking Water Resource Table E
INDENO(1,2,3-cd)PYRENE	1.1E+01	Direct Exposure	5.0E+02	site-specific		1.1E+01		3.1E+01
ISOPHORONE	4.7E+01	Groundwater Protection	5.0E+02	site-specific		5.5E+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 batch test)
METHOXYCHLOR	1.6E+01	Groundwater Protection	5.0E+02	site-specific		6.3E+01		1.6E+01
METHYL ETHYL KETONE	5.5E+01	Groundwater Protection	5.0E+02	site-specific		5.6E+03	2.2E+03	5.5E+01
METHYL ISOBUTYL KETONE	6.5E+00	Groundwater Protection	1.0E+02	site-specific		3.4E+03	1.3E+03	6.5E+00
METHYL MERCURY	1.6E+00	Direct Exposure	1.0E+02	site-specific		1.6E+00		(Use batch test)
METHYL TERT BUTYL ETHER	2.3E+00	Vapor Intrusion	1.0E+02	site-specific		5.0E+01	2.3E+00	1.0E+01
METHYLENE CHLORIDE	2.2E+01	Vapor Intrusion	5.0E+02	site-specific		5.8E+01	2.2E+01	2.0E+02
METHYLNAPHTHALENE, 1-	1.6E+01	Groundwater Protection	5.0E+02	site-specific		1.7E+02	3.9E+02	1.6E+01
METHYLNAPHTHALENE, 2-	1.7E+01	Groundwater Protection	5.0E+02	site-specific		3.9E+01	5.0E+01	1.7E+01
MOLYBDENUM	7.8E+01	Direct Exposure	1.0E+03	site-specific	4.0E+00	7.8E+01		(Use batch test)
NAPHTHALENE	7.0E+00	Vapor Intrusion	5.0E+02	site-specific		2.8E+01	7.0E+00	5.4E+01
NICKEL	4.1E+02	Background	1.0E+03	site-specific	4.1E+02	3.1E+02		(Use batch test)
NITROBENZENE	5.6E+00	Direct Exposure	5.0E+02	site-specific		5.6E+00	(Use soil gas)	7.5E+01
NITROGLYCERIN	1.3E+00	Direct Exposure	5.0E+02	site-specific		1.3E+00		3.1E+00
NITROTOLUENE, 2-	3.1E+00	Direct Exposure	5.0E+02	site-specific		3.1E+00	(Use soil gas)	3.9E+01
NITROTOLUENE, 3-	1.3E+00	Direct Exposure	5.0E+02	site-specific		1.3E+00		2.3E+01
NITROTOLUENE, 4-	2.5E+01	Groundwater Protection	5.0E+02	site-specific		3.3E+01		2.5E+01
PENTACHLOROPHENOL	9.8E-01	Direct Exposure	5.0E+02	site-specific		9.8E-01		1.3E+00
PENTAERYTHRITOLTETRANITRATE (PETN)	2.5E+01	Direct Exposure	5.0E+02	site-specific		2.5E+01		2.3E+03
PERCHLORATE	1.2E+00	Groundwater Protection	1.0E+03	site-specific		1.1E+01		1.2E+00
PHENANTHRENE	4.6E+02	Direct Exposure	5.0E+02	site-specific		4.6E+02	(Use soil gas)	7.0E+02
PHENOL	9.3E+00	Groundwater Protection	5.0E+02	site-specific		3.8E+03		9.3E+00
POLYCHLORINATED BIPHENYLS (PCBs)	1.2E+00	Direct Exposure	5.0E+02	site-specific		1.2E+00		4.3E+01
PROPICONAZOLE	1.1E+02	Groundwater Protection	5.0E+02	site-specific		1.3E+03		1.1E+02
PYRENE	4.4E+01	Vapor Intrusion	5.0E+02	site-specific		3.6E+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	1.9E+00	Groundwater Protection	5.0E+02	site-specific		4.4E+00		1.9E+00
STYRENE	1.0E+01	Groundwater Protection	5.0E+02	site-specific		8.7E+02	4.5E+02	1.0E+01
TERBACIL	2.2E+00	Groundwater Protection	5.0E+02	site-specific		1.6E+02		2.2E+00
tert-BUTYL ALCOHOL	9.0E+01	Direct Exposure	1.0E+02	site-specific		9.0E+01	(Use soil gas)	3.1E+02
TETRACHLOROETHANE, 1,1,1,2-	2.2E+00	Direct Exposure	1.0E+02	site-specific		2.2E+00	(Use soil gas)	2.3E+01
TETRACHLOROETHANE, 1,1,2,2-	1.0E-02	Vapor Intrusion	5.0E+02	site-specific		6.4E-01	1.0E-02	4.3E+00
TETRACHLOROETHYLENE	9.8E-02	Vapor Intrusion	1.7E+02	site-specific		1.1E+00	9.8E-02	2.5E+01
TETRACHLOROPHENOL, 2,3,4,6-	5.1E-01	Groundwater Protection	5.0E+02	site-specific		3.8E+02		5.1E-01
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	1.1E+02	Groundwater Protection	5.0E+02	site-specific		7.7E+02		1.1E+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	4.8E-01	Direct Exposure	5.0E+02	site-specific		4.8E-01		2.5E+02
TPH (gasolines)	1.0E+02	Ceiling Value	1.0E+02	site-specific		4.5E+02	(Use soil gas)	5.0E+03
TPH (middle distillates)	2.2E+02	Direct Exposure	5.0E+02	site-specific		2.2E+02	(Use soil gas)	5.0E+03
TPH (residual fuels)	5.0E+02	Ceiling Value	5.0E+02	site-specific		9.4E+03		5.0E+03

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

	(mg/kg)							
						[1]Human Health		Leaching & Groundwater Protection
CHEMICAL PARAMETER	Final EAL	Basis	[1]Gross Contamination (Odors, etc.) Table F-2	Terrestrial Ecotoxicity Table L	Background Table K	Direct Exposure Table I-1	Vapor Intrusion Into Buildings Table C-1b	NON-Drinking Water Resource Table E
TRICHLOROBENZENE, 1,2,4-	1.8E-01	Vapor Intrusion	5.0E+02	site-specific		1.2E+01	1.8E-01	9.8E+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	8.9E-02	Vapor Intrusion	5.0E+02	site-specific		8.9E-01	8.9E-02	1.5E+01
TRICHLOROPHENOL, 2,4,5-	4.5E+00	Groundwater Protection	1.0E+02	site-specific		1.3E+03		4.5E+00
TRICHLOROPHENOL, 2,4,6-	2.5E+00	Groundwater Protection	5.0E+02	site-specific		1.3E+01		2.5E+00
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	1.2E+01	Groundwater Protection	1.0E+03	site-specific		1.3E+02		1.2E+01
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	7.9E+00	Groundwater Protection	5.0E+02	site-specific		1.0E+02		7.9E+00
TRICHLOROPROPANE, 1,2,3-	5.0E-03	Direct Exposure	1.0E+02	site-specific		5.0E-03	(Use soil gas)	3.0E+00
TRICHLOROPROPENE, 1,2,3-	8.1E-02	Groundwater Protection	1.0E+02	site-specific		1.6E-01	(Use soil gas)	8.1E-02
TRIFLURALIN	5.6E+01	Groundwater Protection	1.0E+02	site-specific		8.7E+01		5.6E+01
TRINITROBENZENE, 1,3,5-	7.5E+00	Groundwater Protection	5.0E+02	site-specific		4.5E+02		7.5E+00
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	3.1E+01	Groundwater Protection	5.0E+02	site-specific		3.1E+01		3.1E+01
TRINITROTOLUENE, 2,4,6- (TNT)	7.3E+00	Direct Exposure	5.0E+02	site-specific		7.3E+00		9.8E+01
VANADIUM	7.7E+02	Background	1.0E+03	site-specific	7.7E+02	7.8E+01		(Use batch test)
VINYL CHLORIDE	3.6E-02	Vapor Intrusion	5.0E+02	site-specific		5.9E-02	3.6E-02	3.3E+00
XYLENES	2.4E+01	Groundwater Protection	2.6E+02	site-specific		1.3E+02	4.5E+01	2.4E+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)	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		6.6E+02	1.2E+02	1.2E+02
ACENAPHTHYLENE	5.5E+00	Groundwater Protection	5.0E+02	site-specific		3.4E+02	(Use soil gas)	5.5E+00
ACETONE	1.0E+00	Groundwater Protection	5.0E+02	site-specific		1.2E+04	1.4E+04	1.0E+00
ALDRIN	3.9E+00	Direct Exposure	1.0E+03	site-specific		3.9E+00		8.4E+00
AMETRYN	5.0E+01	Groundwater Protection	5.0E+02	site-specific		1.1E+02		5.0E+01
AMINO,2- DINITROTOLUENE,4,6-	8.5E-01	Groundwater Protection	5.0E+02	site-specific		3.1E+01		8.5E-01
AMINO,4- DINITROTOLUENE,2,6-	5.2E-01	Groundwater Protection	5.0E+02	site-specific		3.1E+01		5.2E-01
ANTHRACENE	4.2E+00	Vapor Intrusion	5.0E+02	site-specific		3.5E+03	4.2E+00	4.2E+00
ANTIMONY	6.3E+00	Direct Exposure	1.0E+03	site-specific	2.4E+00	6.3E+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		2.3E+00		4.5E-01
BARIUM	1.0E+03	Ceiling Value	1.0E+03	site-specific	6.9E+02	3.1E+03		(Use batch test)
BENOMYL	7.8E-03	Groundwater Protection	1.0E+03	site-specific		6.3E+02		7.8E-03
BENZENE	7.7E-01	Vapor Intrusion	5.0E+02	site-specific		1.2E+00	7.7E-01	4.3E+00
BENZO(a)ANTHRACENE	1.0E+01	Groundwater Protection	5.0E+02	site-specific		1.1E+01		1.0E+01
BENZO(a)PYRENE	3.6E+00	Direct Exposure	5.0E+02	site-specific		3.6E+00		5.9E+00
BENZO(b)FLUORANTHENE	1.1E+01	Direct Exposure	5.0E+02	site-specific		1.1E+01		6.8E+01
BENZO(g,h,i)PERYLENE	3.5E+01	Groundwater Protection	5.0E+02	site-specific		4.8E+02		3.5E+01
BENZO(k)FLUORANTHENE	3.9E+01	Groundwater Protection	5.0E+02	site-specific		1.1E+02		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)	2.3E+02
BIS(2-CHLOROETHYL)ETHER	7.9E-03	Vapor Intrusion	5.0E+02	site-specific		2.4E-01	7.9E-03	9.6E-01
BIS(2-CHLORO-1-METHYLETHYL)ETHER	4.0E-03	Groundwater Protection	5.0E+02	site-specific		3.7E+00	(Use soil gas)	4.0E-03
BIS(2-ETHYLHEXYL)PHTHALATE	3.7E+01	Direct Exposure	5.0E+02	site-specific		3.7E+01		1.9E+02
BORON	1.0E+03	Ceiling Value	1.0E+03	site-specific		3.1E+03		(Use batch test)
BROMODICHLOROMETHANE	1.6E-02	Vapor Intrusion	9.3E+02	site-specific		3.2E-01	1.6E-02	2.1E+00
BROMOFORM	2.0E+00	Groundwater Protection	5.0E+02	site-specific		2.0E+01		2.0E+00
BROMOMETHANE	2.2E-01	Vapor Intrusion	5.0E+02	site-specific		1.5E+00	2.2E-01	7.6E-01
CADMIUM	1.4E+01	Direct Exposure	1.0E+03	site-specific	2.3E+00	1.4E+01		(Use batch test)
CARBON TETRACHLORIDE	1.0E-01	Vapor Intrusion	4.5E+02	site-specific		7.1E-01	1.0E-01	1.8E+00
CHLORDANE (TECHNICAL)	1.7E+01	Direct Exposure	1.0E+03	site-specific		1.7E+01		2.3E+01
CHLOROANILINE, p-	3.6E-01	Groundwater Protection	1.0E+03	site-specific		2.6E+00		3.6E-01
CHLOROBENZENE	1.5E+00	Groundwater Protection	5.0E+02	site-specific		5.9E+01	2.2E+00	1.5E+00
CHLOROETHANE	1.2E+01	Groundwater Protection	5.0E+02	site-specific		2.1E+03	4.5E+02	1.2E+01
CHLOROFORM	2.6E-02	Vapor Intrusion	5.0E+02	site-specific		3.4E-01	2.6E-02	7.9E-01
CHLOROMETHANE	4.0E+00	Vapor Intrusion	1.0E+02	site-specific		2.4E+01	4.0E+00	1.1E+01
CHLOROPHENOL, 2-	1.2E-01	Groundwater Protection	1.0E+02	site-specific		7.0E+01	4.2E+01	1.2E-01
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	3.0E+01	Direct Exposure	1.0E+03	site-specific		3.0E+01		(Use batch test)
CHRYSENE	3.0E+01	Groundwater Protection	1.0E+03	site-specific		1.1E+03		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)	4.8E+00	Direct Exposure	1.0E+02	site-specific		4.8E+00	(Use soil gas)	(Use batch test)
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	1.2E+00	Groundwater Protection	5.0E+02	site-specific		5.9E+00		1.2E+00

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
DALAPON	1.6E-01	Groundwater Protection	5.0E+02	site-specific		3.8E+02		1.6E-01
DIBENZO(a,h)ANTHTRACENE	1.1E+00	Direct Exposure	5.0E+02	site-specific		1.1E+00		2.5E+02
DIBROMO,1,2- CHLOROPROPANE,3-	8.1E-04	Groundwater Protection	5.0E+02	site-specific		5.7E-03	(Use soil gas)	8.1E-04
DIBROMOCHLOROMETHANE	3.4E-01	Groundwater Protection	1.0E+02	site-specific		8.0E+00	3.6E+00	3.4E-01
DIBROMOETHANE, 1,2-	1.0E-03	Vapor Intrusion	5.0E+02	site-specific		3.9E-02	1.0E-03	2.0E-01
DICHLOROBENZENE, 1,2-	1.1E+00	Groundwater Protection	3.8E+02	site-specific		3.8E+02	8.9E+00	1.1E+00
DICHLOROBENZENE, 1,3-	2.5E+00	Groundwater Protection	1.0E+02	site-specific		2.0E+02	(Use soil gas)	2.5E+00
DICHLOROBENZENE, 1,4-	5.5E-02	Vapor Intrusion	5.0E+02	site-specific		2.8E+00	5.5E-02	7.3E-01
DICHLOROBENZIDINE, 3,3-	1.2E+00	Direct Exposure	5.0E+02	site-specific		1.2E+00		2.4E+00
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.2E+00	Direct Exposure	5.0E+02	site-specific		2.2E+00		6.3E+01
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.9E+00	Direct Exposure	5.0E+02	site-specific		1.9E+00		2.8E+01
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.8E+00	Direct Exposure	1.0E+03	site-specific		1.8E+00		5.6E+00
DICHLOROETHANE, 1,1-	3.8E-01	Vapor Intrusion	5.0E+02	site-specific		3.8E+00	3.8E-01	1.9E+00
DICHLOROETHANE, 1,2-	2.3E-02	Vapor Intrusion	5.0E+02	site-specific		5.0E-01	2.3E-02	2.6E+00
DICHLOROETHYLENE, 1,1-	4.2E+00	Groundwater Protection	5.0E+02	site-specific		4.9E+01	8.9E+00	4.2E+00
DICHLOROETHYLENE, Cis 1,2-	3.6E-01	Vapor Intrusion	1.0E+02	site-specific		3.9E+00	3.6E-01	2.0E+01
DICHLOROETHYLENE, Trans 1,2-	3.6E+00	Vapor Intrusion	5.0E+02	site-specific		2.9E+01	3.6E+00	3.6E+01
DICHLOROPHENOL, 2,4-	7.3E-02	Groundwater Protection	5.0E+02	site-specific		3.8E+01		7.3E-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-	1.6E-01	Vapor Intrusion	1.0E+02	site-specific		2.6E+00	1.6E-01	2.7E+00
DICHLOROPROPENE, 1,3-	2.1E-03	Groundwater Protection	5.0E+02	site-specific		1.9E+00	1.5E-01	2.1E-03
DIELDRIN	2.5E+00	Direct Exposure	1.0E+03	site-specific		2.5E+00		2.4E+01
DIETHYLPHTHALATE	3.7E+00	Groundwater Protection	5.0E+02	site-specific		1.0E+04		3.7E+00
DIMETHYLPHENOL, 2,4-	9.8E+00	Groundwater Protection	1.0E+02	site-specific		2.5E+02		9.8E+00
DIMETHYLPHTHALATE	2.6E+01	Groundwater Protection	5.0E+02	site-specific		1.3E+05		2.6E+01
DINITROBENZENE, 1,3-	5.8E-01	Groundwater Protection	5.0E+02	site-specific		1.3E+00		5.8E-01
DINITROPHENOL, 2,4-	1.1E+00	Groundwater Protection	5.0E+02	site-specific		2.5E+01		1.1E+00
DINITROTOLUENE, 2,4- (2,4-DNT)	8.7E-01	Groundwater Protection	5.0E+02	site-specific		1.7E+00		8.7E-01
DINITROTOLUENE, 2,6- (2,6-DNT)	3.5E-01	Direct Exposure	5.0E+02	site-specific		3.5E-01		7.9E+00
DIOXANE, 1,4-	5.3E+00	Direct Exposure	5.0E+02	site-specific		5.3E+00	(Use soil gas)	2.3E+01
DIOXINS (TEQ)	2.4E-04	Direct Exposure	1.0E+03	site-specific	2.0E-05	2.4E-04		3.0E-01
DIURON	1.1E+00	Groundwater Protection	5.0E+02	site-specific		2.5E+01		1.1E+00
ENDOSULFAN	1.3E+01	Groundwater Protection	5.0E+02	site-specific		9.4E+01		1.3E+01
ENDRIN	3.8E+00	Direct Exposure	5.0E+02	site-specific		3.8E+00		3.0E+01
ETHANOL	4.5E+00	Groundwater Protection	5.0E+02	site-specific			(Use soil gas)	4.5E+00
ETHYLBENZENE	9.0E-01	Groundwater Protection	4.8E+02	site-specific		6.2E+01	2.4E+01	9.0E-01
FLUORANTHENE	8.7E+01	Groundwater Protection	5.0E+02	site-specific		4.8E+02		8.7E+01
FLUORENE	9.3E+01	Vapor Intrusion	5.0E+02	site-specific		4.6E+02	9.3E+01	9.3E+01
GLYPHOSATE	5.0E+02	Ceiling Value	5.0E+02	site-specific		1.3E+03		6.3E+02
HEPTACHLOR	1.3E+00	Direct Exposure	1.0E+03	site-specific		1.3E+00		4.5E+01
HEPTACHLOR EPOXIDE	2.0E-01	Direct Exposure	1.0E+03	site-specific		2.0E-01		1.2E+01
HEXACHLOROBENZENE	2.2E-01	Direct Exposure	5.0E+02	site-specific		2.2E-01		2.3E-01
HEXACHLOROBUTADIENE	6.1E-02	Groundwater Protection	5.0E+02	site-specific		1.3E+00		6.1E-02
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	2.9E-02	Groundwater Protection	5.0E+02	site-specific		5.5E-01		2.9E-02
HEXACHLOROETHANE	6.8E-01	Groundwater Protection	5.0E+02	site-specific		2.0E+00		6.8E-01

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

	(mg/kg)							
						[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	3.7E+02	Groundwater Protection	5.0E+02	site-specific		4.2E+02		3.7E+02
INDENO(1,2,3-cd)PYRENE	1.1E+01	Direct Exposure	5.0E+02	site-specific		1.1E+01		3.1E+01
ISOPHORONE	1.0E+01	Groundwater Protection	5.0E+02	site-specific		5.5E+02		1.0E+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 batch test)
METHOXYCHLOR	1.6E+01	Groundwater Protection	5.0E+02	site-specific		6.3E+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		3.4E+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	2.3E+00	Vapor Intrusion	1.0E+02	site-specific		5.0E+01	2.3E+00	4.1E+00
METHYLENE CHLORIDE	2.2E+01	Vapor Intrusion	5.0E+02	site-specific		5.8E+01	2.2E+01	3.6E+01
METHYLNAPHTHALENE, 1-	8.9E-01	Groundwater Protection	5.0E+02	site-specific		1.7E+02	3.9E+02	8.9E-01
METHYLNAPHTHALENE, 2-	1.9E+00	Groundwater Protection	5.0E+02	site-specific		3.9E+01	5.0E+01	1.9E+00
MOLYBDENUM	7.8E+01	Direct Exposure	1.0E+03	site-specific	4.0E+00	7.8E+01		(Use batch test)
NAPHTHALENE	3.1E+00	Groundwater Protection	5.0E+02	site-specific		2.8E+01	7.0E+00	3.1E+00
NICKEL	4.1E+02	Background	1.0E+03	site-specific	4.1E+02	3.1E+02		(Use batch test)
NITROBENZENE	5.6E+00	Direct Exposure	5.0E+02	site-specific		5.6E+00	(Use soil gas)	1.4E+01
NITROGLYCERIN	3.5E-01	Groundwater Protection	5.0E+02	site-specific		1.3E+00		3.5E-01
NITROTOLUENE, 2-	3.1E+00	Direct Exposure	5.0E+02	site-specific		3.1E+00	(Use soil gas)	4.4E+00
NITROTOLUENE, 3-	1.3E+00	Direct Exposure	5.0E+02	site-specific		1.3E+00		2.5E+00
NITROTOLUENE, 4-	2.8E+00	Groundwater Protection	5.0E+02	site-specific		3.3E+01		2.8E+00
PENTACHLOROPHENOL	7.8E-01	Groundwater Protection	5.0E+02	site-specific		9.8E-01		7.8E-01
PENTAERYTHRITOLTETRANITRATE (PETN)	2.5E+01	Direct Exposure	5.0E+02	site-specific		2.5E+01		2.3E+03
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		4.6E+02	(Use soil gas)	6.9E+01
PHENOL	1.8E+00	Groundwater Protection	5.0E+02	site-specific		3.8E+03		1.8E+00
POLYCHLORINATED BIPHENYLS (PCBs)	1.2E+00	Direct Exposure	5.0E+02	site-specific		1.2E+00		3.4E+01
PROPICONAZOLE	2.5E+01	Groundwater Protection	5.0E+02	site-specific		1.3E+03		2.5E+01
PYRENE	4.4E+01	Vapor Intrusion	5.0E+02	site-specific		3.6E+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	2.2E-01	Groundwater Protection	5.0E+02	site-specific		4.4E+00		2.2E-01
STYRENE	2.9E+00	Groundwater Protection	5.0E+02	site-specific		8.7E+02	4.5E+02	2.9E+00
TERBACIL	2.2E+00	Groundwater Protection	5.0E+02	site-specific		1.6E+02		2.2E+00
tert-BUTYL ALCOHOL	9.0E+01	Direct Exposure	1.0E+02	site-specific		9.0E+01	(Use soil gas)	1.1E+02
TETRACHLOROETHANE, 1,1,1,2-	3.2E-01	Groundwater Protection	1.0E+02	site-specific		2.2E+00	(Use soil gas)	3.2E-01
TETRACHLOROETHANE, 1,1,2,2-	1.0E-02	Vapor Intrusion	5.0E+02	site-specific		6.4E-01	1.0E-02	3.6E+00
TETRACHLOROETHYLENE	9.8E-02	Vapor Intrusion	1.7E+02	site-specific		1.1E+00	9.8E-02	6.8E+00
TETRACHLOROPHENOL, 2,3,4,6-	5.6E-02	Groundwater Protection	5.0E+02	site-specific		3.8E+02		5.6E-02
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	1.9E+01	Groundwater Protection	5.0E+02	site-specific		7.7E+02		1.9E+01
THALLIUM	7.8E-01	Direct Exposure	1.0E+03	site-specific	2.5E-01	7.8E-01		(Use batch test)
TOLUENE	7.8E-01	Groundwater Protection	5.0E+02	site-specific		8.2E+02	8.2E+02	7.8E-01
TOXAPHENE	4.8E-01	Direct Exposure	5.0E+02	site-specific		4.8E-01		2.5E+02
TPH (gasolines)	1.0E+02	Ceiling Value	1.0E+02	site-specific		4.5E+02	(Use soil gas)	1.2E+03
TPH (middle distillates)	2.2E+02	Direct Exposure	5.0E+02	site-specific		2.2E+02	(Use soil gas)	1.5E+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
TPH (residual fuels)	5.0E+02	Ceiling Value	5.0E+02	site-specific		9.4E+03		1.5E+03
TRICHLOROBENZENE, 1,2,4-	1.8E-01	Vapor Intrusion	5.0E+02	site-specific		1.2E+01	1.8E-01	2.6E+01
TRICHLOROETHANE, 1,1,1-	1.2E+00	Groundwater Protection	5.0E+02	site-specific		6.4E+02	2.2E+02	1.2E+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	8.9E-02	Vapor Intrusion	5.0E+02	site-specific		8.9E-01	8.9E-02	3.4E+00
TRICHLOROPHENOL, 2,4,5-	5.0E-01	Groundwater Protection	1.0E+02	site-specific		1.3E+03		5.0E-01
TRICHLOROPHENOL, 2,4,6-	3.1E-01	Groundwater Protection	5.0E+02	site-specific		1.3E+01		3.1E-01
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	1.2E+01	Groundwater Protection	1.0E+03	site-specific		1.3E+02		1.2E+01
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	8.7E-01	Groundwater Protection	5.0E+02	site-specific		1.0E+02		8.7E-01
TRICHLOROPROPANE, 1,2,3-	5.0E-03	Direct Exposure	1.0E+02	site-specific		5.0E-03	(Use soil gas)	3.0E-01
TRICHLOROPROPENE, 1,2,3-	8.1E-02	Groundwater Protection	1.0E+02	site-specific		1.6E-01	(Use soil gas)	8.1E-02
TRIFLURALIN	1.8E+01	Groundwater Protection	1.0E+02	site-specific		8.7E+01		1.8E+01
TRINITROBENZENE, 1,3,5-	2.8E+00	Groundwater Protection	5.0E+02	site-specific		4.5E+02		2.8E+00
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	3.1E+01	Groundwater Protection	5.0E+02	site-specific		3.1E+01		3.1E+01
TRINITROTOLUENE, 2,4,6- (TNT)	6.1E+00	Groundwater Protection	5.0E+02	site-specific		7.3E+00		6.1E+00
VANADIUM	7.7E+02	Background	1.0E+03	site-specific	7.7E+02	7.8E+01		(Use batch test)
VINYL CHLORIDE	3.6E-02	Vapor Intrusion	5.0E+02	site-specific		5.9E-02	3.6E-02	3.3E+00
XYLENES	1.4E+00	Groundwater Protection	2.6E+02	site-specific		1.3E+02	4.5E+01	1.4E+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 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	6.2E+08	1.0E+09
ALDRIN	SV	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		
BENOMYL	NV	S		
#BENZENE	V	L	2.3E+03	2.0E+04
BENZO(a)ANTHRACENE	SV	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	1.8E+02	1.5E+03
BIS(2-CHLORO-1-METHYLETHYL)ETHER	V	L	(Use soil gas)	(Use soil gas)
BIS(2-ETHYLHEXYL)PHTHALATE	NV	S		
BORON	NV	S		
BROMODICHLOROMETHANE	V	L	1.1E+02	1.0E+03
BROMOFORM	SV	S		
BROMOMETHANE	V	G	4.1E+02	3.4E+03
CADMIUM	NV	S		
CARBON TETRACHLORIDE	V	L	1.1E+02	9.6E+02
CHLORDANE (TECHNICAL)	SV	S		
CHLOROANILINE, p-	NV	S		
CHLOROBENZENE	V	L	1.2E+04	1.0E+05
CHLOROETHANE	V	G	6.0E+05	5.1E+06
CHLOROFORM	V	L	1.1E+02	9.5E+02
CHLOROMETHANE	V	G	5.2E+03	4.4E+04
CHLOROPHENOL, 2-	V	L	1.0E+05	8.4E+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	5.6E+04	4.7E+05
DIBROMOETHANE, 1,2-	V	S	1.9E+01	1.6E+02
DICHLOROBENZENE, 1,2-	V	L	8.3E+04	1.6E+05
DICHLOROBENZENE, 1,3-	V	L	(Use soil gas)	(Use soil gas)
DICHLOROBENZENE, 1,4-	V	S	4.5E+02	3.9E+03
DICHLOROBENZIDINE, 3,3-	NV	S		
DICHLORODIPHENYLDICHLOROETHANE (DDD)	NV	S		
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	SV	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)
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	NV	S		
DICHLOROETHANE, 1,1-	V	L	1.1E+03	9.6E+03
DICHLOROETHANE, 1,2-	V	L	1.8E+02	1.6E+03
DICHLOROETHYLENE, 1,1-	V	L	6.6E+03	5.6E+04
DICHLOROETHYLENE, Cis 1,2-	V	L	1.3E+03	1.1E+04
DICHLOROETHYLENE, Trans 1,2-	V	L	6.6E+03	5.5E+04
DICHLOROPHENOL, 2,4-	NV	S		
DICHLOROPHENOXYACETIC ACID (2,4-D)	NV	S		
DICHLOROPROPANE, 1,2-	V	L	9.1E+02	7.9E+03
DICHLOROPROPENE, 1,3-	V	L	6.7E+02	5.9E+03
DIELDRIN	NV	S		
DIETHYLPHTHALATE	NV	S		
#DIMETHYLPHENOL, 2,4-	NV	S		
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-	V	L	(Use soil gas)	(Use soil gas)
DIOXINS (TEQ)	SV	S		
DIURON	NV	S		
ENDOSULFAN	SV	S		
ENDRIN	NV	S		
ETHANOL	V	L	(Use soil gas)	(Use soil gas)
#ETHYLBENZENE	V	L	7.6E+04	1.7E+05
FLUORANTHENE	NV	S		
#FLUORENE	V	S	1.7E+03	1.7E+03
GLYPHOSATE	NV	S		
HEPTACHLOR	SV	S		
HEPTACHLOR EPOXIDE	SV	S		
HEXACHLOROBENZENE	SV	S		
HEXACHLOROBUTADIENE	SV	S		
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	NV	S		
HEXACHLOROETHANE	SV	S		
HEXAZINONE	NV	S		
INDENO(1,2,3-cd)PYRENE	NV	S		
ISOPHORONE	NV	L		
LEAD	NV	S		
MERCURY	NV	S		
METHOXYCHLOR	NV	S		
#METHYL ETHYL KETONE	V	L	2.2E+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	3.1E+04	2.7E+05
METHYLENE CHLORIDE	V	L	7.6E+04	7.9E+05
#METHYLNAPHTHALENE, 1-	V	S	2.6E+04	2.6E+04
#METHYLNAPHTHALENE, 2-	V	S	2.5E+04	2.5E+04
MOLYBDENUM	NV	S		
#NAPHTHALENE	V	S	2.9E+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-	NV	S		
NITROTOLUENE, 4-	NV	S		
PENTACHLOROPHENOL	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)
PENTAERYTHRITOLTETRANITRATE (PETN)	NV	S		
PERCHLORATE	NV	S		
PHENANTHRENE	V	S	(Use soil gas)	(Use soil gas)
PHENOL	NV	S		
POLYCHLORINATED BIPHENYLS (PCBs)	SV	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	2.4E+02	2.1E+03
TETRACHLOROETHYLENE	V	L	1.9E+02	1.7E+03
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	1.3E+03	1.1E+04
TRICHLOROETHANE, 1,1,1-	V	L	3.4E+05	1.3E+06
TRICHLOROETHANE, 1,1,2-	V	L	1.1E+02	9.0E+02
TRICHLOROETHYLENE	V	L	2.1E+02	1.8E+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	(Use soil gas)	(Use soil gas)
TRICHLOROPROPENE, 1,2,3-	V	L	(Use soil gas)	(Use soil gas)
TRIFLURALIN	SV	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	1.8E+01	6.1E+02
#XYLENES	V	L	1.1E+05	1.1E+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	1.0E+05
ALDRIN	SV	S		
AMETRYN	NV	S		
AMINO,2- DINITROTOLUENE,4,6-	NV	S		
AMINO,4- DINITROTOLUENE,2,6-	NV	S		
#ANTHRACENE	V	S	4.2E+00	4.2E+00
ANTIMONY	NV	S		
ARSENIC	NV	S		
ATRAZINE	NV	S		
BARIUM	NV	S		
BENOMYL	NV	S		
#BENZENE	V	L	7.7E-01	5.6E+00
BENZO(a)ANTHRACENE	SV	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	7.9E-03	6.7E-02
BIS(2-CHLORO-1-METHYLETHYL)ETHER	V	L	(Use soil gas)	(Use soil gas)
BIS(2-ETHYLHEXYL)PHTHALATE	NV	S		
BORON	NV	S		
BROMODICHLOROMETHANE	V	L	1.6E-02	1.2E-01
BROMOFORM	SV	S		
BROMOMETHANE	V	G	2.2E-01	1.6E+00
CADMIUM	NV	S		
CARBON TETRACHLORIDE	V	L	1.0E-01	7.3E-01
CHLORDANE (TECHNICAL)	SV	S		
CHLOROANILINE, p-	NV	S		
CHLOROBENZENE	V	L	2.2E+00	1.6E+01
CHLOROETHANE	V	G	4.5E+02	2.1E+03
CHLOROFORM	V	L	2.6E-02	1.9E-01
CHLOROMETHANE	V	G	4.0E+00	2.8E+01
CHLOROPHENOL, 2-	V	L	4.2E+01	3.5E+02
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	3.6E+00	2.5E+01
DIBROMOETHANE, 1,2-	V	S	1.0E-03	7.3E-03
DICHLOROBENZENE, 1,2-	V	L	8.9E+00	6.2E+01
DICHLOROBENZENE, 1,3-	V	L	(Use soil gas)	(Use soil gas)
DICHLOROBENZENE, 1,4-	V	S	5.5E-02	4.0E-01
DICHLOROBENZIDINE, 3,3-	NV	S		
DICHLORODIPHENYLDICHLOROETHANE (DDD)	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)
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	SV	S		
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	NV	S		
DICHLOROETHANE, 1,1-	V	L	3.8E-01	2.7E+00
DICHLOROETHANE, 1,2-	V	L	2.3E-02	1.7E-01
DICHLOROETHYLENE, 1,1-	V	L	8.9E+00	6.2E+01
DICHLOROETHYLENE, Cis 1,2-	V	L	3.6E-01	2.5E+00
DICHLOROETHYLENE, Trans 1,2-	V	L	3.6E+00	2.5E+01
DICHLOROPHENOL, 2,4-	NV	S		
DICHLOROPHENOXYACETIC ACID (2,4-D)	NV	S		
DICHLOROPROPANE, 1,2-	V	L	1.6E-01	1.2E+00
DICHLOROPROPENE, 1,3-	V	L	1.5E-01	1.1E+00
DIELDRIN	NV	S		
DIETHYLPHTHALATE	NV	S		
#DIMETHYLPHENOL, 2,4-	NV	S		
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-	V	L	(Use soil gas)	(Use soil gas)
DIOXINS (TEQ)	SV	S		
DIURON	NV	S		
ENDOSULFAN	SV	S		
ENDRIN	NV	S		
ETHANOL	V	L	(Use soil gas)	(Use soil gas)
#ETHYLBENZENE	V	L	2.4E+01	1.7E+02
FLUORANTHENE	NV	S		
#FLUORENE	V	S	9.3E+01	9.3E+01
GLYPHOSATE	NV	S		
HEPTACHLOR	SV	S		
HEPTACHLOR EPOXIDE	SV	S		
HEXACHLOROBENZENE	SV	S		
HEXACHLOROBUTADIENE	SV	S		
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	NV	S		
HEXACHLOROETHANE	SV	S		
HEXAZINONE	NV	S		
INDENO(1,2,3-cd)PYRENE	NV	S		
ISOPHORONE	NV	L		
LEAD	NV	S		
MERCURY	NV	S		
METHOXYCHLOR	NV	S		
#METHYL ETHYL KETONE	V	L	2.2E+03	1.6E+04
#METHYL ISOBUTYL KETONE	V	L	1.3E+03	3.4E+03
METHYL MERCURY	NV	S		
METHYL TERT BUTYL ETHER	V	L	2.3E+00	1.7E+01
METHYLENE CHLORIDE	V	L	2.2E+01	1.9E+02
#METHYLNAPHTHALENE, 1-	V	S	3.9E+02	3.9E+02
#METHYLNAPHTHALENE, 2-	V	S	5.0E+01	3.7E+02
MOLYBDENUM	NV	S		
#NAPHTHALENE	V	S	7.0E+00	5.8E+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-	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)
NITROTOLUENE, 4-	NV	S		
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)	SV	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	1.0E-02	7.5E-02
TETRACHLOROETHYLENE	V	L	9.8E-02	7.2E-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	1.8E-01	1.4E+00
TRICHLOROETHANE, 1,1,1-	V	L	2.2E+02	6.4E+02
TRICHLOROETHANE, 1,1,2-	V	L	8.9E-03	6.2E-02
TRICHLOROETHYLENE	V	L	8.9E-02	6.2E-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	SV	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	3.6E-02	9.9E-01
#XYLENES	V	L	4.5E+01	2.6E+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 VAPOR 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	1.0E+05		1.0E+05	8.4E+05		8.4E+05
ACENAPHTHYLENE	V	S	6.7E+04		6.7E+04	5.6E+05		5.6E+05
ACETONE	V	L	1.3E+07		1.3E+07	1.1E+08		1.1E+08
ALDRIN	SV	S	1.1E+02	1.1E+02		1.0E+03	1.0E+03	
AMETRYN	NV	S						
AMINO,2- DINITROTOLUENE,4,6-	NV	S						
AMINO,4- DINITROTOLUENE,2,6-	NV	S						
ANTHRACENE	V	S	5.0E+05		5.0E+05	4.2E+06		4.2E+06
ANTIMONY	NV	S						
ARSENIC	NV	S						
ATRAZINE	NV	S						
BARIUM	NV	S						
BENOMYL	NV	S						
BENZENE	V	L	7.2E+02	7.2E+02	1.3E+04	6.3E+03	6.3E+03	1.1E+05
BENZO(a)ANTHRACENE	SV	S	3.4E+02	3.4E+02		8.2E+03	8.2E+03	
BENZO(a)PYRENE	NV	S						
BENZO(b)FLUORANTHENE	NV	S						
BENZO(g,h,i)PERYLENE	NV	S						
BENZO(k)FLUORANTHENE	NV	S						
BERYLLIUM	NV	S						
BIPHENYL, 1,1-	V	S	1.7E+02		1.7E+02	1.4E+03		1.4E+03
BIS(2-CHLOROETHYL)ETHER	V	L	1.7E+01	1.7E+01		1.5E+02	1.5E+02	
BIS(2-CHLORO-1-METHYLETHYL)ETHER	V	L	5.6E+02	5.6E+02	5.8E+04	4.9E+03	4.9E+03	4.9E+05
BIS(2-ETHYLHEXYL)PHTHALATE	NV	S						
BORON	NV	S						
BROMODICHLOROMETHANE	V	L	1.5E+02	1.5E+02	3.3E+04	1.3E+03	1.3E+03	2.8E+05
BROMOFORM	SV	S	5.1E+03	5.1E+03		4.5E+04	4.5E+04	
BROMOMETHANE	V	G	2.1E+03		2.1E+03	1.8E+04		1.8E+04
CADMIUM	NV	S						
CARBON TETRACHLORIDE	V	L	9.4E+02	9.4E+02	4.2E+04	8.2E+03	8.2E+03	3.5E+05
CHLORDANE (TECHNICAL)	SV	S	5.6E+02	5.6E+02	1.5E+03	4.9E+03	4.9E+03	1.2E+04
CHLOROANILINE, p-	NV	S						
CHLOROBENZENE	V	L	2.1E+04		2.1E+04	1.8E+05		1.8E+05
CHLOROETHANE	V	G	4.2E+06		4.2E+06	3.5E+07		3.5E+07
CHLOROFORM	V	L	2.4E+02	2.4E+02	4.1E+04	2.1E+03	2.1E+03	3.4E+05
CHLOROMETHANE	V	G	3.8E+04		3.8E+04	3.2E+05		3.2E+05
CHLOROPHENOL, 2-	V	L	8.3E+03		8.3E+03	7.0E+04		7.0E+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	3.3E+02		3.3E+02	2.8E+03		2.8E+03
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	NV	S						
DALAPON	NV	L						

TABLE C-2. [1]SHALLOW SOIL VAPOR 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)
DIBENZO(a,h)ANTHTRACENE	NV	S						
DIBROMO,1,2- CHLOROPROPANE,3-	V	L	3.4E-01	3.4E-01	8.3E+01	8.2E+00	8.2E+00	7.0E+02
DIBROMOCHLOROMETHANE	V	S	3.3E+04		3.3E+04	2.8E+05		2.8E+05
DIBROMOETHANE, 1,2-	V	S	9.4E+00	9.4E+00	3.8E+03	8.2E+01	8.2E+01	3.2E+04
DICHLOROBENZENE, 1,2-	V	L	8.3E+04		8.3E+04	7.0E+05		7.0E+05
DICHLOROBENZENE, 1,3-	V	L	5.0E+04		5.0E+04	4.2E+05		4.2E+05
DICHLOROBENZENE, 1,4-	V	S	5.1E+02	5.1E+02	3.3E+05	4.5E+03	4.5E+03	2.8E+06
DICHLOROBENZIDINE, 3,3-	NV	S						
DICHLORODIPHENYLDICHLOROETHANE (DDD)	NV	S						
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	SV	S	5.8E+01	5.8E+01		5.1E+02	5.1E+02	
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	NV	S						
DICHLOROETHANE, 1,1-	V	L	3.5E+03	3.5E+03	3.3E+05	3.1E+04	3.1E+04	2.8E+06
DICHLOROETHANE, 1,2-	V	L	2.2E+02	2.2E+02	2.9E+03	1.9E+03	1.9E+03	2.5E+04
DICHLOROETHYLENE, 1,1-	V	L	8.3E+04		8.3E+04	7.0E+05		7.0E+05
DICHLOROETHYLENE, Cis 1,2-	V	L	3.3E+03		3.3E+03	2.8E+04		2.8E+04
DICHLOROETHYLENE, Trans 1,2-	V	L	3.3E+04		3.3E+04	2.8E+05		2.8E+05
DICHLOROPHENOL, 2,4-	NV	S						
DICHLOROPHENOXYACETIC ACID (2,4-D)	NV	S						
DICHLOROPROPANE, 1,2-	V	L	1.5E+03	1.5E+03	1.7E+03	1.3E+04	1.3E+04	1.4E+04
DICHLOROPROPENE, 1,3-	V	L	1.4E+03	1.4E+03	8.3E+03	1.2E+04	1.2E+04	7.0E+04
DIELDRIN	NV	S						
DIETHYLPHTHALATE	NV	S						
DIMETHYLPHENOL, 2,4-	NV	S						
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-	V	L	1.1E+03	1.1E+03	1.3E+04	9.8E+03	9.8E+03	1.1E+05
DIOXINS (TEQ)	SV	S	1.5E-02	1.5E-02	8.3E-02	1.3E-01	1.3E-01	7.0E-01
DIURON	NV	S						
ENDOSULFAN	SV	S						
ENDRIN	NV	S						
ETHANOL	V	L						
ETHYLBENZENE	V	L	2.2E+04	2.2E+04	4.2E+05	2.0E+05	2.0E+05	3.5E+06
FLUORANTHENE	NV	S						
FLUORENE	V	S	6.7E+04		6.7E+04	5.6E+05		5.6E+05
GLYPHOSATE	NV	S						
HEPTACHLOR	SV	S	4.3E+01	4.3E+01		3.8E+02	3.8E+02	
HEPTACHLOR EPOXIDE	SV	S	2.2E+01	2.2E+01		1.9E+02	1.9E+02	
HEXACHLOROBENZENE	SV	S	1.2E+01	1.2E+01		1.1E+02	1.1E+02	
HEXACHLOROBUTADIENE	SV	S	2.6E+02	2.6E+02		2.2E+03	2.2E+03	
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	NV	S						
HEXACHLOROETHANE	SV	S	5.1E+02	5.1E+02	1.3E+04	4.5E+03	4.5E+03	1.1E+05
HEXAZINONE	NV	S						
INDENO(1,2,3-cd)PYRENE	NV	S						

TABLE C-2. [1]SHALLOW SOIL VAPOR 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)
ISOPHORONE	NV	L						
LEAD	NV	S						
MERCURY	NV	S						
METHOXYCHLOR	NV	S						
METHYL ETHYL KETONE	V	L	2.1E+06		2.1E+06	1.8E+07		1.8E+07
METHYL ISOBUTYL KETONE	V	L	1.3E+06		1.3E+06	1.1E+07		1.1E+07
METHYL MERCURY	NV	S						
METHYL TERT BUTYL ETHER	V	L	2.2E+04	2.2E+04	1.3E+06	1.9E+05	1.9E+05	1.1E+07
METHYLENE CHLORIDE	V	L	2.0E+05	2.0E+05	2.5E+05	2.1E+06	4.9E+06	2.1E+06
METHYLNAPHTHALENE, 1-	V	S	1.2E+05		1.2E+05	9.8E+05		9.8E+05
METHYLNAPHTHALENE, 2-	V	S	6.7E+03		6.7E+03	5.6E+04		5.6E+04
MOLYBDENUM	NV	S						
NAPHTHALENE	V	S	1.3E+03	1.7E+03	1.3E+03	1.1E+04	1.4E+04	1.1E+04
NICKEL	NV	S						
NITROBENZENE	V	L	1.4E+02	1.4E+02	3.8E+03	1.2E+03	1.2E+03	3.2E+04
NITROGLYCERIN	NV	L						
NITROTOLUENE, 2-	V	S	1.5E+03		1.5E+03	1.3E+04		1.3E+04
NITROTOLUENE, 3-	NV	S						
NITROTOLUENE, 4-	NV	S						
PENTACHLOROPHENOL	NV	S						
PENTAERYTHRITOLTETRANITRATE (PETN)	NV	S						
PERCHLORATE	NV	S						
PHENANTHRENE	V	S	5.8E+04		5.8E+04	4.9E+05		4.9E+05
PHENOL	NV	S						
POLYCHLORINATED BIPHENYLS (PCBs)	SV	S	9.9E+01	9.9E+01		8.6E+02	8.6E+02	
PROPICONAZOLE	NV	L						
PYRENE	V	S	5.0E+04		5.0E+04	4.2E+05		4.2E+05
SELENIUM	NV	S						
SILVER	NV	S						
SIMAZINE	NV	S						
STYRENE	V	L	4.2E+05		4.2E+05	3.5E+06		3.5E+06
TERBACIL	NV	S						
tert-BUTYL ALCOHOL	V	L	6.5E+03	6.5E+03		5.7E+04	5.7E+04	
TETRACHLOROETHANE, 1,1,1,2-	V	L	7.6E+02	7.6E+02	5.0E+04	6.6E+03	6.6E+03	4.2E+05
TETRACHLOROETHANE, 1,1,2,2-	V	L	9.7E+01	9.7E+01		8.5E+02	8.5E+02	
TETRACHLOROETHYLENE	V	L	9.2E+02	9.2E+02	1.7E+04	8.0E+03	8.0E+03	1.4E+05
TETRACHLOROPHENOL, 2,3,4,6-	NV	S						
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	NV	S						
THALLIUM	NV	S						
TOLUENE	V	L	2.1E+06		2.1E+06	1.8E+07		1.8E+07
TOXAPHENE	NV	S						
TPH (gasolines)	V	L	5.9E+05		5.9E+05	4.9E+06		4.9E+06
TPH (middle distillates)	V	L	2.6E+05		2.6E+05	2.2E+06		2.2E+06
TPH (residual fuels)	NV	L						
TRICHLOROBENZENE, 1,2,4-	V	S	8.3E+02		8.3E+02	7.0E+03		7.0E+03
TRICHLOROETHANE, 1,1,1-	V	L	2.1E+06		2.1E+06	1.8E+07		1.8E+07

TABLE C-2. [1]SHALLOW SOIL VAPOR 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)
TRICHLOROETHANE, 1,1,2-	V	L	8.3E+01	3.5E+02	8.3E+01	7.0E+02	3.1E+03	7.0E+02
TRICHLOROETHYLENE	V	L	8.3E+02	9.6E+02	8.3E+02	7.0E+03	1.2E+04	7.0E+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	1.3E+02		1.3E+02	1.1E+03		1.1E+03
TRICHLOROPROPENE, 1,2,3-	V	L	1.3E+02		1.3E+02	1.1E+03		1.1E+03
TRIFLURALIN	SV	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	3.4E+02	3.4E+02	4.2E+04	1.1E+04	1.1E+04	3.5E+05
XYLENES	V	L	4.2E+04		4.2E+04	3.5E+05		3.5E+05
ZINC	NV	S						

Notes:

1. Shallow soil gas defined as soil gas sample data collected within 1.5 meters (five feet) from a building foundation or the ground surface. Assumes very permeable (e.g., sandy) fill material 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 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/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)	
ACENAPHTHENE	V	S		2.4E+02	5.0E+01		5.0E+01	2.1E+02		2.1E+02	5.13E+02
ACENAPHTHYLENE	V	S		1.6E+02	3.3E+01		3.3E+01	1.4E+02		1.4E+02	-
ACETONE	V	L		3.1E+04	6.5E+03		6.5E+03	2.7E+04		2.7E+04	3.09E+04
ALDRIN	SV	S	4.9E-03		5.7E-02	5.7E-02		2.5E-01	2.5E-01		2.63E+02
AMETRYN	NV	S									-
AMINO,2- DINITROTOLUENE,4,6-	NV	S									-
AMINO,4- DINITROTOLUENE,2,6-	NV	S									-
ANTHRACENE	V	S		1.2E+03	2.5E+02		2.5E+02	1.1E+03		1.1E+03	-
ANTIMONY	NV	S									-
ARSENIC	NV	S									-
ATRAZINE	NV	S									-
BARIUM	NV	S									-
BENOMYL	NV	S									-
BENZENE	V	L	7.8E-06	3.0E+01	3.6E-01	3.6E-01	6.3E+00	1.6E+00	1.6E+00	2.6E+01	4.89E+03
BENZO(a)ANTHRACENE	SV	S	6.0E-05		1.7E-01	1.7E-01		2.0E+00	2.0E+00		-
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		4.0E-01	8.3E-02		8.3E-02	3.5E-01		3.5E-01	6.00E+01
BIS(2-CHLOROETHYL)ETHER	V	L	3.3E-04		8.5E-03	8.5E-03		3.7E-02	3.7E-02		2.87E+02
BIS(2-CHLORO-1-METHYLETHYL)ETHER	V	L	1.0E-05	1.4E+02	2.8E-01	2.8E-01	2.9E+01	1.2E+00	1.2E+00	1.2E+02	2.24E+03
BIS(2-ETHYLHEXYL)PHTHALATE	NV	S									-
BORON	NV	S									-
BROMODICHLOROMETHANE	V	L	3.7E-05	8.0E+01	7.6E-02	7.6E-02	1.7E+01	3.3E-01	3.3E-01	7.0E+01	1.10E+07
BROMOFORM	SV	S	1.1E-06		2.6E+00	2.6E+00		1.1E+01	1.1E+01		1.35E+04
BROMOMETHANE	V	G		5.0E+00	1.0E+00		1.0E+00	4.4E+00		4.4E+00	8.00E+04
CADMIUM	NV	S									-
CARBON TETRACHLORIDE	V	L	6.0E-06	1.0E+02	4.7E-01	4.7E-01	2.1E+01	2.0E+00	2.0E+00	8.8E+01	6.30E+04
CHLORDANE (TECHNICAL)	SV	S	1.0E-04	7.0E-01	2.8E-01	2.8E-01	7.3E-01	1.2E+00	1.2E+00	3.1E+00	8.40E+00
CHLOROANILINE, p-	NV	S									-
CHLOROBENZENE	V	L		5.0E+01	1.0E+01		1.0E+01	4.4E+01		4.4E+01	1.00E+03
CHLOROETHANE	V	G		1.0E+04	2.1E+03		2.1E+03	8.8E+03		8.8E+03	3.80E+05
CHLOROFORM	V	L	2.3E-05	9.8E+01	1.2E-01	1.2E-01	2.0E+01	5.3E-01	5.3E-01	8.6E+01	4.22E+05
CHLOROMETHANE	V	G		9.0E+01	1.9E+01		1.9E+01	7.9E+01		7.9E+01	-
CHLOROPHENOL, 2-	V	L		2.0E+01	4.2E+00		4.2E+00	1.8E+01		1.8E+01	1.90E+01
CHROMIUM (Total)	NV	S									-
CHROMIUM III	NV	S									-
CHROMIUM VI	NV	S									-
CHRYSENE	NV	S									-
COBALT	NV	S									-
COPPER	NV	S									-
CYANIDE (Free)	V	S		8.0E-01	1.7E-01		1.7E-01	7.0E-01		7.0E-01	6.52E+02
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	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/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)	
DALAPON	NV	L									-
DIBENZO(a,h)ANTHTRACENE	NV	S									-
DIBROMO,1,2- CHLOROPROPANE,3-	V	L	6.0E-03	2.0E-01	1.7E-04	1.7E-04	4.2E-02	2.0E-03	2.0E-03	1.8E-01	-
DIBROMOCHLOROMETHANE	V	S		8.0E+01	1.7E+01		1.7E+01	7.0E+01		7.0E+01	-
DIBROMOETHANE, 1,2-	V	S	6.0E-04	9.0E+00	4.7E-03	4.7E-03	1.9E+00	2.0E-02	2.0E-02	7.9E+00	2.00E+05
DICHLOROBENZENE, 1,2-	V	L		2.0E+02	4.2E+01		4.2E+01	1.8E+02		1.8E+02	3.05E+05
DICHLOROBENZENE, 1,3-	V	L		1.2E+02	2.5E+01		2.5E+01	1.1E+02		1.1E+02	-
DICHLOROBENZENE, 1,4-	V	S	1.1E-05	8.0E+02	2.6E-01	2.6E-01	1.7E+02	1.1E+00	1.1E+00	7.0E+02	1.10E+03
DICHLOROBENZIDINE, 3,3-	NV	S									-
DICHLORODIPHENYLDICHLOROETHANE (DDD)	NV	S									-
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	SV	S	9.7E-05		2.9E-02	2.9E-02		1.3E-01	1.3E-01		-
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	NV	S									-
DICHLOROETHANE, 1,1-	V	L	1.6E-06	8.0E+02	1.8E+00	1.8E+00	1.7E+02	7.7E+00	7.7E+00	7.0E+02	1.25E+05
DICHLOROETHANE, 1,2-	V	L	2.6E-05	7.0E+00	1.1E-01	1.1E-01	1.5E+00	4.7E-01	4.7E-01	6.1E+00	2.42E+03
DICHLOROETHYLENE, 1,1-	V	L		2.0E+02	4.2E+01		4.2E+01	1.8E+02		1.8E+02	2.00E+06
DICHLOROETHYLENE, Cis 1,2-	V	L		8.0E+00	1.7E+00		1.7E+00	7.0E+00		7.0E+00	-
DICHLOROETHYLENE, Trans 1,2-	V	L		8.0E+01	1.7E+01		1.7E+01	7.0E+01		7.0E+01	6.73E+04
DICHLOROPHENOL, 2,4-	NV	S									1.40E+03
DICHLOROPHENOXYACETIC ACID (2,4-D)	NV	S									-
DICHLOROPROPANE, 1,2-	V	L	3.7E-06	4.0E+00	7.6E-01	7.6E-01	8.3E-01	3.3E+00	3.3E+00	3.5E+00	1.19E+03
DICHLOROPROPENE, 1,3-	V	L	4.0E-06	2.0E+01	7.0E-01	7.0E-01	4.2E+00	3.1E+00	3.1E+00	1.8E+01	4.16E+03
DIELDRIN	NV	S									-
DIETHYLPHTHALATE	NV	S									-
DIMETHYLPHENOL, 2,4-	NV	S									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-	V	L	5.0E-06	3.0E+01	5.6E-01	5.6E-01	6.3E+00	2.5E+00	2.5E+00	2.6E+01	6.12E+05
DIOXINS (TEQ)	SV	S	3.8E+01	4.0E-05	7.4E-06	7.4E-06	4.2E-05	3.2E-05	3.2E-05	1.8E-04	-
DIURON	NV	S									-
ENDOSULFAN	SV	S									-
ENDRIN	NV	S									-
ETHANOL	V	L									1.92E+04
ETHYLBENZENE	V	L	2.5E-06	1.0E+03	1.1E+01	1.1E+01	2.1E+02	4.9E+01	4.9E+01	8.8E+02	2.00E+03
FLUORANTHENE	NV	S									-
FLUORENE	V	S		1.6E+02	3.3E+01		3.3E+01	1.4E+02		1.4E+02	-
GLYPHOSATE	NV	S									-
HEPTACHLOR	SV	S	1.3E-03		2.2E-02	2.2E-02		9.4E-02	9.4E-02		3.00E+02
HEPTACHLOR EPOXIDE	SV	S	2.6E-03		1.1E-02	1.1E-02		4.7E-02	4.7E-02		3.00E+02
HEXACHLOROBENZENE	SV	S	4.6E-04		6.1E-03	6.1E-03		2.7E-02	2.7E-02		-
HEXACHLOROBUTADIENE	SV	S	2.2E-05		1.3E-01	1.3E-01		5.6E-01	5.6E-01		1.20E+04
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	NV	S									-
HEXACHLOROETHANE	SV	S	1.1E-05	3.0E+01	2.6E-01	2.6E-01	6.3E+00	1.1E+00	1.1E+00	2.6E+01	-

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)	
HEXAZINONE	NV	S									-
INDENO(1,2,3-cd)PYRENE	NV	S									-
ISOPHORONE	NV	L									-
LEAD	NV	S									-
MERCURY	NV	S									-
METHOXYCHLOR	NV	S									-
METHYL ETHYL KETONE	V	L		5.0E+03	1.0E+03		1.0E+03	4.4E+03		4.4E+03	3.20E+04
METHYL ISOBUTYL KETONE	V	L		3.0E+03	6.3E+02		6.3E+02	2.6E+03		2.6E+03	4.20E+02
METHYL MERCURY	NV	S									-
METHYL TERT BUTYL ETHER	V	L	2.6E-07	3.0E+03	1.1E+01	1.1E+01	6.3E+02	4.7E+01	4.7E+01	2.6E+03	5.30E+02
METHYLENE CHLORIDE	V	L	1.0E-08	6.0E+02	1.0E+02	1.0E+02	1.3E+02	5.3E+02	1.2E+03	5.3E+02	5.60E+05
METHYLNAPHTHALENE, 1-	V	S		2.8E+02	5.8E+01		5.8E+01	2.5E+02		2.5E+02	6.80E+01
METHYLNAPHTHALENE, 2-	V	S		1.6E+01	3.3E+00		3.3E+00	1.4E+01		1.4E+01	6.80E+01
MOLYBDENUM	NV	S									-
NAPHTHALENE	V	S	3.4E-05	3.0E+00	6.3E-01	8.3E-01	6.3E-01	2.6E+00	3.6E+00	2.6E+00	4.40E+02
NICKEL	NV	S									-
NITROBENZENE	V	L	4.0E-05	9.0E+00	7.0E-02	7.0E-02	1.9E+00	3.1E-01	3.1E-01	7.9E+00	-
NITROGLYCERIN	NV	L									-
NITROTOLUENE, 2-	V	S		3.6E+00	7.5E-01		7.5E-01	3.2E+00		3.2E+00	-
NITROTOLUENE, 3-	NV	S									-
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	1.2E+02		1.2E+02	5.50E+01
PHENOL	NV	S									1.56E+02
POLYCHLORINATED BIPHENYLS (PCBs)	SV	S	5.7E-04		4.9E-02	4.9E-02		2.2E-01	2.2E-01		-
PROPICONAZOLE	NV	L									-
PYRENE	V	S		1.2E+02	2.5E+01		2.5E+01	1.1E+02		1.1E+02	-
SELENIUM	NV	S									-
SILVER	NV	S									-
SIMAZINE	NV	S									-
STYRENE	V	L		1.0E+03	2.1E+02		2.1E+02	8.8E+02		8.8E+02	1.36E+03
TERBACIL	NV	S									-
tert-BUTYL ALCOHOL	V	L	8.6E-07		3.3E+00	3.3E+00		1.4E+01	1.4E+01		-
TETRACHLOROETHANE, 1,1,1,2-	V	L	7.4E-06	1.2E+02	3.8E-01	3.8E-01	2.5E+01	1.7E+00	1.7E+00	1.1E+02	-
TETRACHLOROETHANE, 1,1,2,2-	V	L	5.8E-05		4.8E-02	4.8E-02		2.1E-01	2.1E-01		1.05E+04
TETRACHLOROETHYLENE	V	L	6.1E-06	4.0E+01	4.6E-01	4.6E-01	8.3E+00	2.0E+00	2.0E+00	3.5E+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	4.4E+03		4.4E+03	3.00E+04
TOXAPHENE	NV	S									-
TPH (gasolines)	V	L		2.8E+02	2.9E+02		2.9E+02	1.2E+03		1.2E+03	1.10E+03
TPH (middle distillates)	V	L		1.3E+02	1.3E+02		1.3E+02	5.5E+02		5.5E+02	5.00E+03

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)	
TPH (residual fuels)	NV	L									-
TRICHLOROBENZENE, 1,2,4-	V	S		2.0E+00	4.2E-01		4.2E-01	1.8E+00		1.8E+00	2.20E+04
TRICHLOROETHANE, 1,1,1-	V	L		5.0E+03	1.0E+03		1.0E+03	4.4E+03		4.4E+03	6.51E+04
TRICHLOROETHANE, 1,1,2-	V	L	1.6E-05	2.0E-01	4.2E-02	1.8E-01	4.2E-02	1.8E-01	7.7E-01	1.8E-01	-
TRICHLOROETHYLENE	V	L	4.1E-06	2.0E+00	4.2E-01	4.8E-01	4.2E-01	1.8E+00	3.0E+00	1.8E+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		3.0E-01	6.3E-02		6.3E-02	2.6E-01		2.6E-01	-
TRICHLOROPROPENE, 1,2,3-	V	L		3.0E-01	6.3E-02		6.3E-02	2.6E-01		2.6E-01	-
TRIFLURALIN	SV	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	1.7E-01	1.7E-01	2.1E+01	2.8E+00	2.8E+00	8.8E+01	7.71E+05
XYLENES	V	L		1.0E+02	2.1E+01		2.1E+01	8.8E+01		8.8E+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 = 10^{-6}, Target Hazard Quotient = 0.2 for all chemicals except as noted. Target 10^{-5} risk applied to ethylbenzene, 1-methylnaphthalene and naphthalene. Target HQ of 1.0 applied to TPHg and TPHmd.
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).
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	1.5E+01	Aquatic Habitat Goal	2.0E+01	3.5E+02	3.9E+03	1.5E+01
ACENAPHTHYLENE	1.3E+01	Aquatic Habitat Goal	2.0E+03	2.4E+02	(Use soil gas)	1.3E+01
ACETONE	1.5E+03	Aquatic Habitat Goal	2.0E+04	1.4E+04	6.2E+08	1.5E+03
ALDRIN	1.4E-04	Aquatic Habitat Goal	8.5E+00	1.1E-03		1.4E-04
AMETRYN	1.8E+02	Drinking Water Toxicity	5.0E+04	1.8E+02		7.0E+02
AMINO,2- DINITROTOLUENE,4,6-	1.8E+01	Aquatic Habitat Goal	5.0E+04	4.0E+01		1.8E+01
AMINO,4- DINITROTOLUENE,2,6-	1.1E+01	Aquatic Habitat Goal	5.0E+04	4.0E+01		1.1E+01
ANTHRACENE	2.0E-02	Aquatic Habitat Goal	2.2E+01	1.8E+03	4.3E+01	2.0E-02
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	2.2E+02	Aquatic Habitat Goal	5.0E+04	2.0E+03		2.2E+02
BENOMYL	1.4E-01	Aquatic Habitat Goal	1.9E+03	1.0E+03		1.4E-01
BENZENE	5.0E+00	Drinking Water Toxicity	1.7E+02	5.0E+00	2.3E+03	7.1E+01
BENZO(a)ANTHRACENE	2.7E-02	Aquatic Habitat Goal	4.7E+00	2.9E-02		2.7E-02
BENZO(a)PYRENE	6.0E-02	Aquatic Habitat Goal	8.0E-01	2.0E-01		6.0E-02
BENZO(b)FLUORANTHENE	2.2E-01	Drinking Water Toxicity	7.5E-01	2.2E-01		6.8E-01
BENZO(g,h,i)PERYLENE	1.3E-01	Gross Contamination	1.3E-01	8.0E+02		4.4E-01
BENZO(k)FLUORANTHENE	4.0E-01	Gross Contamination	4.0E-01	2.2E+00		6.4E-01
BERYLLIUM	6.6E-01	Aquatic Habitat Goal	5.0E+04	4.0E+00		6.6E-01
BIPHENYL, 1,1-	5.0E-01	Gross Contamination	5.0E-01	8.3E-01	(Use soil gas)	6.5E+00
BIS(2-CHLOROETHYL)ETHER	1.4E-02	Drinking Water Toxicity	3.6E+02	1.4E-02	1.8E+02	2.4E+03
BIS(2-CHLORO-1-METHYLETHYL)ETHER	3.7E-01	Aquatic Habitat Goal	3.2E+02	3.7E-01	(Use soil gas)	3.7E-01
BIS(2-ETHYLHEXYL)PHTHALATE	3.0E+00	Aquatic Habitat Goal	1.4E+02	6.0E+00		3.0E+00
BORON	1.0E+03	Aquatic Habitat Goal	5.0E+04	4.0E+03		1.0E+03
BROMODICHLOROMETHANE	1.4E-01	Drinking Water Toxicity	5.0E+04	1.4E-01	1.1E+02	3.4E+02
BROMOFORM	8.0E+01	Drinking Water Toxicity	5.1E+02	8.0E+01		2.3E+02
BROMOMETHANE	7.6E+00	Drinking Water Toxicity	5.0E+04	7.6E+00	4.1E+02	1.6E+01
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	1.1E+02	9.8E+00
CHLORDANE (TECHNICAL)	4.0E-03	Aquatic Habitat Goal	2.5E+00	2.0E+00		4.0E-03
CHLOROANILINE, p-	3.9E-01	Drinking Water Toxicity	5.0E+04	3.9E-01		1.9E+01
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	6.0E+05	2.1E+04
CHLOROFORM	2.8E+01	Aquatic Habitat Goal	2.4E+03	7.0E+01	1.1E+02	2.8E+01
CHLOROMETHANE	1.9E+02	Aquatic Habitat Goal	5.0E+04	1.9E+02	5.2E+03	1.9E+02
CHLOROPHENOL, 2-	1.8E-01	Gross Contamination	1.8E-01	2.9E+01	1.0E+05	3.2E+01
CHROMIUM (Total)	1.1E+01	Aquatic Habitat Goal	5.0E+04	1.0E+02		1.1E+01
CHROMIUM III	2.0E+01	Aquatic Habitat Goal	5.0E+04	3.0E+04		2.0E+01
CHROMIUM VI	4.3E+00	Drinking Water Toxicity	5.0E+04	4.3E+00		1.1E+01
CHRYSENE	1.0E+00	Gross Contamination	1.0E+00	2.2E+01		2.0E+00
COBALT	6.0E+00	Drinking Water Toxicity	5.0E+04	6.0E+00		1.9E+01
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)	7.1E-01	Drinking Water Toxicity	3.0E+04	7.1E-01		7.9E+01
DALAPON	2.0E+02	Drinking Water Toxicity	5.0E+04	2.0E+02		3.0E+02

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

CONTAMINANT	[1]Final Groundwater Action Level	Basis	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
DIBENZO(a,h)ANTHTRACENE	2.2E-02	Drinking Water Toxicity	1.3E+00	2.2E-02		8.0E-01
DIBROMO,1,2- CHLOROPROPANE,3-	4.0E-02	Aquatic Habitat Goal	1.0E+01	4.0E-02	(Use soil gas)	4.0E-02
DIBROMOCHLOROMETHANE	9.3E-01	Drinking Water Toxicity	5.0E+04	9.3E-01	5.6E+04	3.4E+01
DIBROMOETHANE, 1,2-	4.0E-02	Drinking Water Toxicity	5.0E+04	4.0E-02	1.9E+01	1.4E+03
DICHLOROBENZENE, 1,2-	1.0E+01	Gross Contamination	1.0E+01	6.0E+02	8.3E+04	1.4E+01
DICHLOROBENZENE, 1,3-	5.0E+00	Gross Contamination	5.0E+00	1.8E+02	(Use soil gas)	2.2E+01
DICHLOROBENZENE, 1,4-	5.0E+00	Gross Contamination	5.0E+00	7.5E+01	4.5E+02	9.4E+00
DICHLOROBENZIDINE, 3,3-	1.7E-01	Drinking Water Toxicity	1.6E+03	1.7E-01		4.5E+00
DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.1E-02	Aquatic Habitat Goal	4.5E+01	3.2E-01		1.1E-02
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	4.6E-02	Drinking Water Toxicity	2.0E+01	4.6E-02		4.1E-01
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.0E-03	Aquatic Habitat Goal	2.8E+00	2.3E-01		1.0E-03
DICHLOROETHANE, 1,1-	2.8E+00	Drinking Water Toxicity	5.0E+04	2.8E+00	1.1E+03	4.7E+01
DICHLOROETHANE, 1,2-	5.0E+00	Drinking Water Toxicity	7.0E+03	5.0E+00	1.8E+02	9.1E+02
DICHLOROETHYLENE, 1,1-	7.0E+00	Drinking Water Toxicity	1.5E+03	7.0E+00	6.6E+03	2.5E+01
DICHLOROETHYLENE, Cis 1,2-	7.0E+01	Drinking Water Toxicity	5.0E+04	7.0E+01	1.3E+03	6.2E+02
DICHLOROETHYLENE, Trans 1,2-	1.0E+02	Drinking Water Toxicity	2.6E+02	1.0E+02	6.6E+03	5.6E+02
DICHLOROPHENOL, 2,4-	3.0E-01	Gross Contamination	3.0E-01	6.0E+01		1.1E+01
DICHLOROPHENOXYACETIC ACID (2,4-D)	7.0E+01	Aquatic Habitat Goal	5.0E+04	7.0E+01		7.0E+01
DICHLOROPROPANE, 1,2-	5.0E+00	Drinking Water Toxicity	1.0E+01	5.0E+00	9.1E+02	5.2E+02
DICHLOROPROPENE, 1,3-	6.0E-02	Aquatic Habitat Goal	5.0E+04	5.0E-01	6.7E+02	6.0E-02
DIELDRIN	1.9E-03	Aquatic Habitat Goal	4.1E+01	1.1E-02		1.9E-03
DIETHYLPHTHALATE	2.1E+02	Aquatic Habitat Goal	5.0E+04	1.6E+04		2.1E+02
DIMETHYLPHENOL, 2,4-	1.2E+02	Aquatic Habitat Goal	4.0E+02	4.0E+02		1.2E+02
DIMETHYLPHTHALATE	1.1E+03	Aquatic Habitat Goal	5.0E+04	2.0E+05		1.1E+03
DINITROBENZENE, 1,3-	2.0E+00	Drinking Water Toxicity	5.0E+04	2.0E+00		1.0E+01
DINITROPHENOL, 2,4-	1.4E+01	Aquatic Habitat Goal	5.0E+04	4.0E+01		1.4E+01
DINITROTOLUENE, 2,4- (2,4-DNT)	2.5E-01	Drinking Water Toxicity	5.0E+04	2.5E-01		9.1E+00
DINITROTOLUENE, 2,6- (2,6-DNT)	5.2E-02	Drinking Water Toxicity	5.0E+04	5.2E-02		8.1E+01
DIOXANE, 1,4-	4.6E-01	Drinking Water Toxicity	5.0E+04	4.6E-01	(Use soil gas)	3.4E+05
DIOXINS (TEQ)	3.1E-09	Aquatic Habitat Goal	1.0E-01	3.0E-05		3.1E-09
DIURON	4.0E+01	Drinking Water Toxicity	2.1E+04	4.0E+01		6.0E+01
ENDOSULFAN	8.7E-03	Aquatic Habitat Goal	1.6E+02	1.2E+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		(Use soil gas)	
ETHYLBENZENE	7.3E+00	Aquatic Habitat Goal	3.0E+01	7.0E+02	7.6E+04	7.3E+00
FLUORANTHENE	8.0E-01	Aquatic Habitat Goal	1.3E+02	8.0E+02		8.0E-01
FLUORENE	3.9E+00	Aquatic Habitat Goal	8.5E+02	2.4E+02	1.7E+03	3.9E+00
GLYPHOSATE	7.0E+02	Drinking Water Toxicity	5.0E+04	7.0E+02		1.8E+03
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	3.0E-04	Aquatic Habitat Goal	3.1E+00	1.0E+00		3.0E-04
HEXACHLOROBUTADIENE	2.0E-01	Drinking Water Toxicity	6.0E+00	2.0E-01		3.0E-01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	6.3E-02	Aquatic Habitat Goal	3.7E+03	2.0E-01		6.3E-02
HEXACHLOROETHANE	4.0E-01	Drinking Water Toxicity	1.0E+01	4.0E-01		1.2E+01
HEXAZINONE	6.6E+02	Drinking Water Toxicity	5.0E+04	6.6E+02		1.7E+04

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
INDENO(1,2,3-cd)PYRENE	9.5E-02	Gross Contamination	9.5E-02	2.2E-01		2.8E-01
ISOPHORONE	8.2E+01	Drinking Water Toxicity	5.0E+04	8.2E+01		9.2E+02
LEAD	5.6E+00	Aquatic Habitat Goal	5.0E+04	1.5E+01		5.6E+00
MERCURY	2.5E-02	Aquatic Habitat Goal	5.0E+04	2.0E+00		2.5E-02
METHOXYCHLOR	3.0E-02	Aquatic Habitat Goal	5.0E+01	4.0E+01		3.0E-02
METHYL ETHYL KETONE	5.6E+03	Drinking Water Toxicity	8.4E+03	5.6E+03	2.2E+08	1.4E+04
METHYL ISOBUTYL KETONE	1.7E+02	Aquatic Habitat Goal	1.3E+03	6.3E+03	1.9E+07	1.7E+02
METHYL MERCURY	2.8E-03	Aquatic Habitat Goal	5.0E+04	2.0E+00		2.8E-03
METHYL TERT BUTYL ETHER	5.0E+00	Gross Contamination	5.0E+00	1.4E+01	3.1E+04	7.3E+02
METHYLENE CHLORIDE	5.0E+00	Drinking Water Toxicity	9.1E+03	5.0E+00	7.6E+04	1.5E+03
METHYLNAPHTHALENE, 1-	2.1E+00	Aquatic Habitat Goal	1.0E+01	2.7E+01	2.6E+04	2.1E+00
METHYLNAPHTHALENE, 2-	4.7E+00	Aquatic Habitat Goal	1.0E+01	2.4E+01	2.5E+04	4.7E+00
MOLYBDENUM	1.0E+02	Drinking Water Toxicity	5.0E+04	1.0E+02		3.7E+02
NAPHTHALENE	1.2E+01	Aquatic Habitat Goal	2.1E+01	1.7E+01	2.9E+04	1.2E+01
NICKEL	5.0E+00	Aquatic Habitat Goal	5.0E+04	4.0E+02		5.0E+00
NITROBENZENE	1.4E-01	Drinking Water Toxicity	5.0E+04	1.4E-01	(Use soil gas)	3.8E+02
NITROGLYCERIN	2.0E+00	Drinking Water Toxicity	5.0E+04	2.0E+00		1.8E+01
NITROTOLUENE, 2-	3.5E-01	Drinking Water Toxicity	5.0E+04	3.5E-01	(Use soil gas)	7.1E+01
NITROTOLUENE, 3-	2.0E+00	Drinking Water Toxicity	5.0E+04	2.0E+00		4.2E+01
NITROTOLUENE, 4-	4.9E+00	Drinking Water Toxicity	5.0E+04	4.9E+00		4.6E+01
PENTACHLOROPHENOL	1.0E+00	Drinking Water Toxicity	3.0E+01	1.0E+00		7.9E+00
PENTAERYTHRITOLTETRANITRATE (PETN)	1.9E+01	Drinking Water Toxicity	2.2E+04	1.9E+01		8.5E+05
PERCHLORATE	1.5E+01	Drinking Water Toxicity	5.0E+04	1.5E+01		6.0E+02
PHENANTHRENE	2.3E+00	Aquatic Habitat Goal	4.1E+02	2.1E+02	(Use soil gas)	2.3E+00
PHENOL	5.8E+01	Aquatic Habitat Goal	7.9E+03	6.0E+03		5.8E+01
POLYCHLORINATED BIPHENYLS (PCBs)	1.4E-02	Aquatic Habitat Goal	2.2E+01	5.0E-01		1.4E-02
PROPICONAZOLE	9.5E+01	Aquatic Habitat Goal	5.0E+04	2.0E+03		9.5E+01
PYRENE	4.6E+00	Aquatic Habitat Goal	6.8E+01	1.8E+02	1.4E+02	4.6E+00
SELENIUM	5.0E+00	Aquatic Habitat Goal	5.0E+04	5.0E+01		5.0E+00
SILVER	1.0E-01	Aquatic Habitat Goal	1.0E+02	1.0E+02		1.0E-01
SIMAZINE	4.0E+00	Drinking Water Toxicity	3.1E+03	4.0E+00		9.0E+00
STYRENE	1.0E+01	Gross Contamination	1.0E+01	1.0E+02	3.1E+05	3.2E+01
TERBACIL	2.6E+02	Aquatic Habitat Goal	5.0E+04	2.6E+02		2.6E+02
tert-BUTYL ALCOHOL	5.2E+00	Drinking Water Toxicity	5.0E+04	5.2E+00	(Use soil gas)	1.8E+04
TETRACHLOROETHANE, 1,1,1,2-	6.1E-01	Drinking Water Toxicity	5.0E+04	6.1E-01	(Use soil gas)	1.1E+01
TETRACHLOROETHANE, 1,1,2,2-	7.8E-02	Drinking Water Toxicity	5.0E+02	7.8E-02	2.4E+02	2.0E+02
TETRACHLOROETHYLENE	5.0E+00	Drinking Water Toxicity	1.7E+02	5.0E+00	1.9E+02	5.3E+01
TETRACHLOROPHENOL, 2,3,4,6-	1.2E+00	Aquatic Habitat Goal	1.2E+04	6.0E+02		1.2E+00
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	2.2E+02	Aquatic Habitat Goal	2.5E+03	1.0E+03		2.2E+02
THALLIUM	2.0E+00	Drinking Water Toxicity	5.0E+04	2.0E+00		6.0E+00
TOLUENE	9.8E+00	Aquatic Habitat Goal	4.0E+01	1.0E+03	5.3E+05	9.8E+00
TOXAPHENE	2.0E-04	Aquatic Habitat Goal	1.4E+02	3.0E+00		2.0E-04
TPH (gasolines)	3.0E+02	Drinking Water Toxicity	5.0E+02	3.0E+02	(Use soil gas)	5.0E+02
TPH (middle distillates)	4.0E+02	Drinking Water Toxicity	5.0E+02	4.0E+02	(Use soil gas)	6.4E+02
TPH (residual fuels)	5.0E+02	Gross Contamination	5.0E+02	2.4E+03		6.4E+02

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

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Taste & Odors, etc.) Table G-1	Drinking Water Toxicity Table D-3a	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (chronic) Table D-4a
TRICHLOROBENZENE, 1,2,4-	7.0E+01	Drinking Water Toxicity	3.0E+03	7.0E+01	1.3E+03	1.1E+02
TRICHLOROETHANE, 1,1,1-	1.1E+01	Aquatic Habitat Goal	9.7E+02	2.0E+02	3.4E+05	1.1E+01
TRICHLOROETHANE, 1,1,2-	5.0E+00	Drinking Water Toxicity	5.0E+04	5.0E+00	1.1E+02	7.3E+02
TRICHLOROETHYLENE	5.0E+00	Drinking Water Toxicity	3.1E+02	5.0E+00	2.1E+02	4.7E+01
TRICHLOROPHENOL, 2,4,5-	1.9E+00	Aquatic Habitat Goal	2.0E+02	2.0E+03		1.9E+00
TRICHLOROPHENOL, 2,4,6-	4.9E+00	Aquatic Habitat Goal	1.0E+02	7.1E+00		4.9E+00
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	2.0E+02	Drinking Water Toxicity	5.0E+04	2.0E+02		6.9E+02
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	3.0E+01	Aquatic Habitat Goal	3.6E+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	1.1E+00	Aquatic Habitat Goal	9.0E+01	1.0E+01		1.1E+00
TRINITROBENZENE, 1,3,5-	1.0E+01	Aquatic Habitat Goal	5.0E+04	6.0E+02		1.0E+01
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.0E+01	Aquatic Habitat Goal	3.7E+04	4.0E+01		4.0E+01
TRINITROTOLUENE, 2,4,6- (TNT)	2.6E+00	Drinking Water Toxicity	5.0E+04	2.6E+00		1.3E+01
VANADIUM	2.7E+01	Aquatic Habitat Goal	5.0E+04	1.0E+02		2.7E+01
VINYL CHLORIDE	2.0E+00	Drinking Water Toxicity	3.4E+03	2.0E+00	1.8E+01	9.3E+02
XYLENES	1.3E+01	Aquatic Habitat Goal	2.0E+01	1.0E+04	1.1E+05	1.3E+01
ZINC	2.2E+01	Aquatic Habitat Goal	5.0E+03	6.0E+03		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 ecotoxicity data for ethanol underway. Based on preliminary review of available data, chronic toxicity screening levels likely to be significantly greater than ceiling level of 50,000 ug/L (refer to USEPA 2003b, ECOTOX database).

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

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

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Taste & Odors, etc.) Table G-1	Drinking Water Toxicity Table D-3a	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (acute) Table D-4a
ACENAPHTHENE	2.0E+01	Gross Contamination	2.0E+01	3.5E+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	1.4E+04	Drinking Water Toxicity	2.0E+04	1.4E+04	6.2E+08	1.5E+04
ALDRIN	1.1E-03	Drinking Water Toxicity	8.5E+00	1.1E-03		1.3E+00
AMETRYN	1.8E+02	Drinking Water Toxicity	5.0E+04	1.8E+02		1.8E+03
AMINO,2- DINITROTOLUENE,4,6-	4.0E+01	Drinking Water Toxicity	5.0E+04	4.0E+01		1.6E+02
AMINO,4- DINITROTOLUENE,2,6-	4.0E+01	Drinking Water Toxicity	5.0E+04	4.0E+01		9.8E+01
ANTHRACENE	1.8E-01	Aquatic Habitat Goal	2.2E+01	1.8E+03	4.3E+01	1.8E-01
ANTIMONY	6.0E+00	Drinking Water Toxicity	5.0E+04	6.0E+00		1.8E+02
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		3.3E+02
BARIUM	2.0E+03	Aquatic Habitat Goal	5.0E+04	2.0E+03		2.0E+03
BENOMYL	2.8E+00	Aquatic Habitat Goal	1.9E+03	1.0E+03		2.8E+00
BENZENE	5.0E+00	Drinking Water Toxicity	1.7E+02	5.0E+00	2.3E+03	1.7E+03
BENZO(a)ANTHRACENE	2.9E-02	Drinking Water Toxicity	4.7E+00	2.9E-02		3.0E+02
BENZO(a)PYRENE	2.0E-01	Drinking Water Toxicity	8.0E-01	2.0E-01		3.0E+02
BENZO(b)FLUORANTHENE	2.2E-01	Drinking Water Toxicity	7.5E-01	2.2E-01		3.0E+02
BENZO(g,h,i)PERYLENE	1.3E-01	Gross Contamination	1.3E-01	8.0E+02		3.0E+02
BENZO(k)FLUORANTHENE	4.0E-01	Gross Contamination	4.0E-01	2.2E+00		3.0E+02
BERYLLIUM	4.0E+00	Drinking Water Toxicity	5.0E+04	4.0E+00		3.5E+01
BIPHENYL, 1,1-	5.0E-01	Gross Contamination	5.0E-01	8.3E-01	(Use soil gas)	2.6E+01
BIS(2-CHLOROETHYL)ETHER	1.4E-02	Drinking Water Toxicity	3.6E+02	1.4E-02	1.8E+02	2.4E+04
BIS(2-CHLORO-1-METHYLETHYL)ETHER	3.7E-01	Aquatic Habitat Goal	3.2E+02	3.7E-01	(Use soil gas)	3.7E-01
BIS(2-ETHYLHEXYL)PHTHALATE	6.0E+00	Drinking Water Toxicity	1.4E+02	6.0E+00		2.7E+01
BORON	4.0E+03	Drinking Water Toxicity	5.0E+04	4.0E+03		3.4E+04
BROMODICHLOROMETHANE	1.4E-01	Drinking Water Toxicity	5.0E+04	1.4E-01	1.1E+02	3.1E+03
BROMOFORM	8.0E+01	Drinking Water Toxicity	5.1E+02	8.0E+01		1.1E+03
BROMOMETHANE	7.6E+00	Drinking Water Toxicity	5.0E+04	7.6E+00	4.1E+02	3.8E+01
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	1.1E+02	1.2E+04
CHLORDANE (TECHNICAL)	9.0E-02	Aquatic Habitat Goal	2.5E+00	2.0E+00		9.0E-02
CHLOROANILINE, p-	3.9E-01	Drinking Water Toxicity	5.0E+04	3.9E-01		4.6E+02
CHLOROBENZENE	5.0E+01	Gross Contamination	5.0E+01	1.0E+02	1.2E+04	2.2E+02
CHLOROETHANE	1.6E+01	Gross Contamination	1.6E+01	2.1E+04	6.0E+05	2.1E+04
CHLOROFORM	7.0E+01	Drinking Water Toxicity	2.4E+03	7.0E+01	1.1E+02	4.9E+02
CHLOROMETHANE	1.9E+02	Aquatic Habitat Goal	5.0E+04	1.9E+02	5.2E+03	1.9E+02
CHLOROPHENOL, 2-	1.8E-01	Gross Contamination	1.8E-01	2.9E+01	1.0E+05	4.0E+02
CHROMIUM (Total)	1.6E+01	Aquatic Habitat Goal	5.0E+04	1.0E+02		1.6E+01
CHROMIUM III	5.7E+02	Aquatic Habitat Goal	5.0E+04	3.0E+04		5.7E+02
CHROMIUM VI	4.3E+00	Drinking Water Toxicity	5.0E+04	4.3E+00		1.6E+01
CHRYSENE	1.0E+00	Gross Contamination	1.0E+00	2.2E+01		3.0E+02
COBALT	6.0E+00	Drinking Water Toxicity	5.0E+04	6.0E+00		1.2E+02
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)	7.1E-01	Drinking Water Toxicity	3.0E+04	7.1E-01		5.2E+02
DALAPON	2.0E+02	Drinking Water Toxicity	5.0E+04	2.0E+02		3.0E+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
DIBENZO(a,h)ANTHTRACENE	2.2E-02	Drinking Water Toxicity	1.3E+00	2.2E-02		3.0E+02
DIBROMO,1,2- CHLOROPROPANE,3-	4.0E-02	Aquatic Habitat Goal	1.0E+01	4.0E-02	(Use soil gas)	4.0E-02
DIBROMOCHLOROMETHANE	9.3E-01	Drinking Water Toxicity	5.0E+04	9.3E-01	5.6E+04	2.9E+03
DIBROMOETHANE, 1,2-	4.0E-02	Drinking Water Toxicity	5.0E+04	4.0E-02	1.9E+01	1.4E+03
DICHLOROBENZENE, 1,2-	1.0E+01	Gross Contamination	1.0E+01	6.0E+02	8.3E+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	4.5E+02	3.7E+02
DICHLOROBENZIDINE, 3,3-	1.7E-01	Drinking Water Toxicity	1.6E+03	1.7E-01		4.1E+01
DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.9E-01	Aquatic Habitat Goal	4.5E+01	3.2E-01		1.9E-01
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	4.6E-02	Drinking Water Toxicity	2.0E+01	4.6E-02		7.0E+00
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.3E-02	Aquatic Habitat Goal	2.8E+00	2.3E-01		1.3E-02
DICHLOROETHANE, 1,1-	2.8E+00	Drinking Water Toxicity	5.0E+04	2.8E+00	1.1E+03	8.3E+02
DICHLOROETHANE, 1,2-	5.0E+00	Drinking Water Toxicity	7.0E+03	5.0E+00	1.8E+02	3.8E+04
DICHLOROETHYLENE, 1,1-	7.0E+00	Drinking Water Toxicity	1.5E+03	7.0E+00	6.6E+03	3.9E+03
DICHLOROETHYLENE, Cis 1,2-	7.0E+01	Drinking Water Toxicity	5.0E+04	7.0E+01	1.3E+03	5.5E+03
DICHLOROETHYLENE, Trans 1,2-	1.0E+02	Drinking Water Toxicity	2.6E+02	1.0E+02	6.6E+03	1.0E+04
DICHLOROPHENOL, 2,4-	3.0E-01	Gross Contamination	3.0E-01	6.0E+01		6.7E+02
DICHLOROPHENOXYACETIC ACID (2,4-D)	7.0E+01	Drinking Water Toxicity	5.0E+04	7.0E+01		1.3E+02
DICHLOROPROPANE, 1,2-	5.0E+00	Drinking Water Toxicity	1.0E+01	5.0E+00	9.1E+02	3.4E+03
DICHLOROPROPENE, 1,3-	5.0E-01	Drinking Water Toxicity	5.0E+04	5.0E-01	6.7E+02	2.6E+02
DIELDRIN	1.1E-02	Drinking Water Toxicity	4.1E+01	1.1E-02		7.1E-01
DIETHYLPHTHALATE	9.8E+02	Aquatic Habitat Goal	5.0E+04	1.6E+04		9.8E+02
DIMETHYLPHENOL, 2,4-	4.0E+02	Gross Contamination	4.0E+02	4.0E+02		7.0E+02
DIMETHYLPHTHALATE	3.2E+03	Aquatic Habitat Goal	5.0E+04	2.0E+05		3.2E+03
DINITROBENZENE, 1,3-	2.0E+00	Drinking Water Toxicity	5.0E+04	2.0E+00		1.0E+02
DINITROPHENOL, 2,4-	4.0E+01	Drinking Water Toxicity	5.0E+04	4.0E+01		3.8E+02
DINITROTOLUENE, 2,4- (2,4-DNT)	2.5E-01	Drinking Water Toxicity	5.0E+04	2.5E-01		1.1E+02
DINITROTOLUENE, 2,6- (2,6-DNT)	5.2E-02	Drinking Water Toxicity	5.0E+04	5.2E-02		1.1E+02
DIOXANE, 1,4-	4.6E-01	Drinking Water Toxicity	5.0E+04	4.6E-01	(Use soil gas)	3.4E+06
DIOXINS (TEQ)	3.0E-05	Drinking Water Toxicity	1.0E-01	3.0E-05		3.0E-03
DIURON	4.0E+01	Drinking Water Toxicity	2.1E+04	4.0E+01		2.0E+02
ENDOSULFAN	3.4E-02	Aquatic Habitat Goal	1.6E+02	1.2E+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		(Use soil gas)	
ETHYLBENZENE	3.0E+01	Gross Contamination	3.0E+01	7.0E+02	7.6E+04	1.4E+02
FLUORANTHENE	1.3E+01	Aquatic Habitat Goal	1.3E+02	8.0E+02		1.3E+01
FLUORENE	2.4E+02	Drinking Water Toxicity	8.5E+02	2.4E+02	1.7E+03	3.0E+02
GLYPHOSATE	7.0E+02	Drinking Water Toxicity	5.0E+04	7.0E+02		2.2E+04
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	3.0E-04	Aquatic Habitat Goal	3.1E+00	1.0E+00		3.0E-04
HEXACHLOROBUTADIENE	2.0E-01	Drinking Water Toxicity	6.0E+00	2.0E-01		1.1E+01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	1.6E-01	Aquatic Habitat Goal	3.7E+03	2.0E-01		1.6E-01
HEXACHLOROETHANE	4.0E-01	Drinking Water Toxicity	1.0E+01	4.0E-01		3.1E+02
HEXAZINONE	6.6E+02	Drinking Water Toxicity	5.0E+04	6.6E+02		1.4E+05
INDENO(1,2,3-cd)PYRENE	9.5E-02	Gross Contamination	9.5E-02	2.2E-01		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
ISOPHORONE	8.2E+01	Drinking Water Toxicity	5.0E+04	8.2E+01		4.3E+03
LEAD	1.5E+01	Drinking Water Toxicity	5.0E+04	1.5E+01		2.9E+01
MERCURY	2.0E+00	Drinking Water Toxicity	5.0E+04	2.0E+00		2.1E+00
METHOXYCHLOR	7.0E-01	Aquatic Habitat Goal	5.0E+01	4.0E+01		7.0E-01
METHYL ETHYL KETONE	5.6E+03	Drinking Water Toxicity	8.4E+03	5.6E+03	2.2E+08	2.0E+05
METHYL ISOBUTYL KETONE	1.3E+03	Gross Contamination	1.3E+03	6.3E+03	1.9E+07	2.2E+03
METHYL MERCURY	9.9E-02	Aquatic Habitat Goal	5.0E+04	2.0E+00		9.9E-02
METHYL TERT BUTYL ETHER	5.0E+00	Gross Contamination	5.0E+00	1.4E+01	3.1E+04	6.5E+03
METHYLENE CHLORIDE	5.0E+00	Drinking Water Toxicity	9.1E+03	5.0E+00	7.6E+04	8.5E+03
METHYLNAPHTHALENE, 1-	1.0E+01	Gross Contamination	1.0E+01	2.7E+01	2.6E+04	3.7E+01
METHYLNAPHTHALENE, 2-	1.0E+01	Gross Contamination	1.0E+01	2.4E+01	2.5E+04	4.2E+01
MOLYBDENUM	1.0E+02	Drinking Water Toxicity	5.0E+04	1.0E+02		7.2E+03
NAPHTHALENE	1.7E+01	Drinking Water Toxicity	2.1E+01	1.7E+01	2.9E+04	7.7E+02
NICKEL	5.0E+00	Aquatic Habitat Goal	5.0E+04	4.0E+02		5.0E+00
NITROBENZENE	1.4E-01	Drinking Water Toxicity	5.0E+04	1.4E-01	(Use soil gas)	2.0E+03
NITROGLYCERIN	2.0E+00	Drinking Water Toxicity	5.0E+04	2.0E+00		1.6E+02
NITROTOLUENE, 2-	3.5E-01	Drinking Water Toxicity	5.0E+04	3.5E-01	(Use soil gas)	6.4E+02
NITROTOLUENE, 3-	2.0E+00	Drinking Water Toxicity	5.0E+04	2.0E+00		3.8E+02
NITROTOLUENE, 4-	4.9E+00	Drinking Water Toxicity	5.0E+04	4.9E+00		4.1E+02
PENTACHLOROPHENOL	1.0E+00	Drinking Water Toxicity	3.0E+01	1.0E+00		1.3E+01
PENTAERYTHRITOLTETRANITRATE (PETN)	1.9E+01	Drinking Water Toxicity	2.2E+04	1.9E+01		8.5E+05
PERCHLORATE	1.5E+01	Drinking Water Toxicity	5.0E+04	1.5E+01		5.0E+03
PHENANTHRENE	2.1E+02	Drinking Water Toxicity	4.1E+02	2.1E+02	(Use soil gas)	3.0E+02
PHENOL	3.0E+02	Aquatic Habitat Goal	7.9E+03	6.0E+03		3.0E+02
POLYCHLORINATED BIPHENYLS (PCBs)	5.0E-01	Drinking Water Toxicity	2.2E+01	5.0E-01		2.0E+00
PROPICONAZOLE	4.3E+02	Aquatic Habitat Goal	5.0E+04	2.0E+03		4.3E+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	1.0E+02		1.0E+00
SIMAZINE	4.0E+00	Drinking Water Toxicity	3.1E+03	4.0E+00		8.0E+01
STYRENE	1.0E+01	Gross Contamination	1.0E+01	1.0E+02	3.1E+05	2.9E+02
TERBACIL	2.6E+02	Aquatic Habitat Goal	5.0E+04	2.6E+02		2.6E+02
tert-BUTYL ALCOHOL	5.2E+00	Drinking Water Toxicity	5.0E+04	5.2E+00	(Use soil gas)	1.8E+05
TETRACHLOROETHANE, 1,1,1,2-	6.1E-01	Drinking Water Toxicity	5.0E+04	6.1E-01	(Use soil gas)	7.7E+02
TETRACHLOROETHANE, 1,1,2,2-	7.8E-02	Drinking Water Toxicity	5.0E+02	7.8E-02	2.4E+02	9.1E+02
TETRACHLOROETHYLENE	5.0E+00	Drinking Water Toxicity	1.7E+02	5.0E+00	1.9E+02	1.8E+03
TETRACHLOROPHENOL, 2,3,4,6-	1.1E+01	Aquatic Habitat Goal	1.2E+04	6.0E+02		1.1E+01
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	1.0E+03	Drinking Water Toxicity	2.5E+03	1.0E+03		1.2E+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	2.1E+03
TOXAPHENE	2.1E-01	Aquatic Habitat Goal	1.4E+02	3.0E+00		2.1E-01
TPH (gasolines)	3.0E+02	Drinking Water Toxicity	5.0E+02	3.0E+02	(Use soil gas)	5.0E+03
TPH (middle distillates)	4.0E+02	Drinking Water Toxicity	5.0E+02	4.0E+02	(Use soil gas)	2.5E+03
TPH (residual fuels)	5.0E+02	Gross Contamination	5.0E+02	2.4E+03		2.5E+03
TRICHLOROBENZENE, 1,2,4-	7.0E+01	Drinking Water Toxicity	3.0E+03	7.0E+01	1.3E+03	4.2E+02
TRICHLOROETHANE, 1,1,1-	2.0E+02	Drinking Water Toxicity	9.7E+02	2.0E+02	3.4E+05	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
TRICHLOROETHANE, 1,1,2-	5.0E+00	Drinking Water Toxicity	5.0E+04	5.0E+00	1.1E+02	5.2E+03
TRICHLOROETHYLENE	5.0E+00	Drinking Water Toxicity	3.1E+02	5.0E+00	2.1E+02	7.0E+02
TRICHLOROPHENOL, 2,4,5-	1.7E+01	Aquatic Habitat Goal	2.0E+02	2.0E+03		1.7E+01
TRICHLOROPHENOL, 2,4,6-	7.1E+00	Drinking Water Toxicity	1.0E+02	7.1E+00		3.9E+01
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	2.0E+02	Drinking Water Toxicity	5.0E+04	2.0E+02		6.9E+02
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	5.0E+01	Drinking Water Toxicity	3.6E+04	5.0E+01		2.7E+02
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	1.0E+01	Drinking Water Toxicity	9.0E+01	1.0E+01		2.1E+01
TRINITROBENZENE, 1,3,5-	2.7E+01	Aquatic Habitat Goal	5.0E+04	6.0E+02		2.7E+01
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.0E+01	Aquatic Habitat Goal	3.7E+04	4.0E+01		4.0E+01
TRINITROTOLUENE, 2,4,6- (TNT)	2.6E+00	Drinking Water Toxicity	5.0E+04	2.6E+00		2.1E+02
VANADIUM	9.0E+01	Aquatic Habitat Goal	5.0E+04	1.0E+02		9.0E+01
VINYL CHLORIDE	2.0E+00	Drinking Water Toxicity	3.4E+03	2.0E+00	1.8E+01	8.4E+03
XYLENES	2.0E+01	Gross Contamination	2.0E+01	1.0E+04	1.1E+05	2.3E+02
ZINC	2.2E+01	Aquatic Habitat Goal	5.0E+03	6.0E+03		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 ecotoxicity 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	1.5E+01	Aquatic Habitat Goal	2.0E+02	3.9E+03	1.5E+01
ACENAPHTHYLENE	1.3E+01	Aquatic Habitat Goal	2.0E+03	(Use soil gas)	1.3E+01
ACETONE	1.5E+03	Aquatic Habitat Goal	5.0E+04	6.2E+08	1.5E+03
ALDRIN	1.4E-04	Aquatic Habitat Goal	8.5E+00		1.4E-04
AMETRYN	7.0E+02	Aquatic Habitat Goal	5.0E+04		7.0E+02
AMINO,2- DINITROTOLUENE,4,6-	1.8E+01	Aquatic Habitat Goal	5.0E+04		1.8E+01
AMINO,4- DINITROTOLUENE,2,6-	1.1E+01	Aquatic Habitat Goal	5.0E+04		1.1E+01
ANTHRACENE	2.0E-02	Aquatic Habitat Goal	2.2E+01	4.3E+01	2.0E-02
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	1.8E+04		1.2E+01
BARIUM	2.2E+02	Aquatic Habitat Goal	5.0E+04		2.2E+02
BENOMYL	1.4E-01	Aquatic Habitat Goal	1.9E+03		1.4E-01
BENZENE	7.1E+01	Aquatic Habitat Goal	2.0E+04	2.3E+03	7.1E+01
BENZO(a)ANTHRACENE	2.7E-02	Aquatic Habitat Goal	4.7E+00		2.7E-02
BENZO(a)PYRENE	6.0E-02	Aquatic Habitat Goal	8.0E-01		6.0E-02
BENZO(b)FLUORANTHENE	6.8E-01	Aquatic Habitat Goal	7.5E-01		6.8E-01
BENZO(g,h,i)PERYLENE	1.3E-01	Gross Contamination	1.3E-01		4.4E-01
BENZO(k)FLUORANTHENE	4.0E-01	Gross Contamination	4.0E-01		6.4E-01
BERYLLIUM	6.6E-01	Aquatic Habitat Goal	5.0E+04		6.6E-01
BIPHENYL, 1,1-	5.0E+00	Gross Contamination	5.0E+00	(Use soil gas)	6.5E+00
BIS(2-CHLOROETHYL)ETHER	1.8E+02	Vapor Intrusion	3.6E+03	1.8E+02	2.4E+03
BIS(2-CHLORO-1-METHYLETHYL)ETHER	3.7E-01	Aquatic Habitat Goal	3.2E+03	(Use soil gas)	3.7E-01
BIS(2-ETHYLHEXYL)PHTHALATE	3.0E+00	Aquatic Habitat Goal	1.4E+02		3.0E+00
BORON	1.0E+03	Aquatic Habitat Goal	5.0E+04		1.0E+03
BROMODICHLOROMETHANE	1.1E+02	Vapor Intrusion	5.0E+04	1.1E+02	3.4E+02
BROMOFORM	2.3E+02	Aquatic Habitat Goal	5.1E+03		2.3E+02
BROMOMETHANE	1.6E+01	Aquatic Habitat Goal	5.0E+04	4.1E+02	1.6E+01
CADMIUM	3.0E+00	Aquatic Habitat Goal	5.0E+04		3.0E+00
CARBON TETRACHLORIDE	9.8E+00	Aquatic Habitat Goal	5.2E+03	1.1E+02	9.8E+00
CHLORDANE (TECHNICAL)	4.0E-03	Aquatic Habitat Goal	2.5E+01		4.0E-03
CHLOROANILINE, p-	1.9E+01	Aquatic Habitat Goal	5.0E+04		1.9E+01
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	6.0E+05	2.1E+04
CHLOROFORM	2.8E+01	Aquatic Habitat Goal	2.4E+04	1.1E+02	2.8E+01
CHLOROMETHANE	1.9E+02	Aquatic Habitat Goal	5.0E+04	5.2E+03	1.9E+02
CHLOROPHENOL, 2-	1.8E+00	Gross Contamination	1.8E+00	1.0E+05	3.2E+01
CHROMIUM (Total)	1.1E+01	Aquatic Habitat Goal	5.0E+04		1.1E+01
CHROMIUM III	2.0E+01	Aquatic Habitat Goal	5.0E+04		2.0E+01
CHROMIUM VI	1.1E+01	Aquatic Habitat Goal	5.0E+04		1.1E+01
CHRYSENE	1.0E+00	Gross Contamination	1.0E+00		2.0E+00
COBALT	1.9E+01	Aquatic Habitat Goal	5.0E+04		1.9E+01
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)	7.9E+01	Aquatic Habitat Goal	3.0E+04		7.9E+01
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	8.0E-01	Aquatic Habitat Goal	1.3E+00		8.0E-01
DIBROMO,1,2- CHLOROPROPANE,3-	4.0E-02	Aquatic Habitat Goal	1.0E+02	(Use soil gas)	4.0E-02
DIBROMOCHLOROMETHANE	3.4E+01	Aquatic Habitat Goal	5.0E+04	5.6E+04	3.4E+01
DIBROMOETHANE, 1,2-	1.9E+01	Vapor Intrusion	5.0E+04	1.9E+01	1.4E+03
DICHLOROBENZENE, 1,2-	1.4E+01	Aquatic Habitat Goal	1.0E+02	8.3E+04	1.4E+01
DICHLOROBENZENE, 1,3-	2.2E+01	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	2.2E+01
DICHLOROBENZENE, 1,4-	9.4E+00	Aquatic Habitat Goal	1.1E+02	4.5E+02	9.4E+00
DICHLOROBENZIDINE, 3,3-	4.5E+00	Aquatic Habitat Goal	1.6E+03		4.5E+00
DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.1E-02	Aquatic Habitat Goal	4.5E+01		1.1E-02
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	4.1E-01	Aquatic Habitat Goal	2.0E+01		4.1E-01
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	1.1E+03	4.7E+01
DICHLOROETHANE, 1,2-	1.8E+02	Vapor Intrusion	5.0E+04	1.8E+02	9.1E+02
DICHLOROETHYLENE, 1,1-	2.5E+01	Aquatic Habitat Goal	1.5E+04	6.6E+03	2.5E+01
DICHLOROETHYLENE, Cis 1,2-	6.2E+02	Aquatic Habitat Goal	5.0E+04	1.3E+03	6.2E+02
DICHLOROETHYLENE, Trans 1,2-	5.6E+02	Aquatic Habitat Goal	2.6E+03	6.6E+03	5.6E+02
DICHLOROPHENOL, 2,4-	3.0E+00	Gross Contamination	3.0E+00		1.1E+01
DICHLOROPHENOXYACETIC ACID (2,4-D)	7.0E+01	Aquatic Habitat Goal	5.0E+04		7.0E+01
DICHLOROPROPANE, 1,2-	1.0E+02	Gross Contamination	1.0E+02	9.1E+02	5.2E+02
DICHLOROPROPENE, 1,3-	6.0E-02	Aquatic Habitat Goal	5.0E+04	6.7E+02	6.0E-02
DIELDRIN	1.9E-03	Aquatic Habitat Goal	9.8E+01		1.9E-03
DIETHYLPHTHALATE	2.1E+02	Aquatic Habitat Goal	5.0E+04		2.1E+02
DIMETHYLPHENOL, 2,4-	1.2E+02	Aquatic Habitat Goal	4.0E+03		1.2E+02
DIMETHYLPHTHALATE	1.1E+03	Aquatic Habitat Goal	5.0E+04		1.1E+03
DINITROBENZENE, 1,3-	1.0E+01	Aquatic Habitat Goal	5.0E+04		1.0E+01
DINITROPHENOL, 2,4-	1.4E+01	Aquatic Habitat Goal	5.0E+04		1.4E+01
DINITROTOLUENE, 2,4- (2,4-DNT)	9.1E+00	Aquatic Habitat Goal	5.0E+04		9.1E+00
DINITROTOLUENE, 2,6- (2,6-DNT)	8.1E+01	Aquatic Habitat Goal	5.0E+04		8.1E+01
DIOXANE, 1,4-	5.0E+04	Gross Contamination	5.0E+04	(Use soil gas)	3.4E+05
DIOXINS (TEQ)	3.1E-09	Aquatic Habitat Goal	1.0E-01		3.1E-09
DIURON	6.0E+01	Aquatic Habitat Goal	2.1E+04		6.0E+01
ENDOSULFAN	8.7E-03	Aquatic Habitat Goal	1.6E+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	(Use soil gas)	
ETHYLBENZENE	7.3E+00	Aquatic Habitat Goal	3.0E+02	7.6E+04	7.3E+00
FLUORANTHENE	8.0E-01	Aquatic Habitat Goal	1.3E+02		8.0E-01
FLUORENE	3.9E+00	Aquatic Habitat Goal	8.5E+02	1.7E+03	3.9E+00
GLYPHOSATE	1.8E+03	Aquatic Habitat Goal	5.0E+04		1.8E+03
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	3.0E-04	Aquatic Habitat Goal	3.1E+00		3.0E-04
HEXACHLOROBUTADIENE	3.0E-01	Aquatic Habitat Goal	6.0E+01		3.0E-01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	6.3E-02	Aquatic Habitat Goal	3.7E+03		6.3E-02
HEXACHLOROETHANE	1.2E+01	Aquatic Habitat Goal	1.0E+02		1.2E+01
HEXAZINONE	1.7E+04	Aquatic Habitat Goal	5.0E+04		1.7E+04
INDENO(1,2,3-cd)PYRENE	9.5E-02	Gross Contamination	9.5E-02		2.8E-01

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

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Odors, etc.) Table G-2	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (chronic) Table D-4a
ISOPHORONE	9.2E+02	Aquatic Habitat Goal	5.0E+04		9.2E+02
LEAD	5.6E+00	Aquatic Habitat Goal	5.0E+04		5.6E+00
MERCURY	2.5E-02	Aquatic Habitat Goal	5.0E+04		2.5E-02
METHOXYCHLOR	3.0E-02	Aquatic Habitat Goal	5.0E+01		3.0E-02
METHYL ETHYL KETONE	1.4E+04	Aquatic Habitat Goal	5.0E+04	2.2E+08	1.4E+04
METHYL ISOBUTYL KETONE	1.7E+02	Aquatic Habitat Goal	1.3E+04	1.9E+07	1.7E+02
METHYL MERCURY	2.8E-03	Aquatic Habitat Goal	5.0E+04		2.8E-03
METHYL TERT BUTYL ETHER	7.3E+02	Aquatic Habitat Goal	1.8E+03	3.1E+04	7.3E+02
METHYLENE CHLORIDE	1.5E+03	Aquatic Habitat Goal	5.0E+04	7.6E+04	1.5E+03
METHYLNAPHTHALENE, 1-	2.1E+00	Aquatic Habitat Goal	1.0E+02	2.6E+04	2.1E+00
METHYLNAPHTHALENE, 2-	4.7E+00	Aquatic Habitat Goal	1.0E+02	2.5E+04	4.7E+00
MOLYBDENUM	3.7E+02	Aquatic Habitat Goal	5.0E+04		3.7E+02
NAPHTHALENE	1.2E+01	Aquatic Habitat Goal	2.1E+02	2.9E+04	1.2E+01
NICKEL	5.0E+00	Aquatic Habitat Goal	5.0E+04		5.0E+00
NITROBENZENE	3.8E+02	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	3.8E+02
NITROGLYCERIN	1.8E+01	Aquatic Habitat Goal	5.0E+04		1.8E+01
NITROTOLUENE, 2-	7.1E+01	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	7.1E+01
NITROTOLUENE, 3-	4.2E+01	Aquatic Habitat Goal	5.0E+04		4.2E+01
NITROTOLUENE, 4-	4.6E+01	Aquatic Habitat Goal	5.0E+04		4.6E+01
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+05
PERCHLORATE	6.0E+02	Aquatic Habitat Goal	5.0E+04		6.0E+02
PHENANTHRENE	2.3E+00	Aquatic Habitat Goal	4.1E+02	(Use soil gas)	2.3E+00
PHENOL	5.8E+01	Aquatic Habitat Goal	5.0E+04		5.8E+01
POLYCHLORINATED BIPHENYLS (PCBs)	1.4E-02	Aquatic Habitat Goal	2.2E+01		1.4E-02
PROPICONAZOLE	9.5E+01	Aquatic Habitat Goal	5.0E+04		9.5E+01
PYRENE	4.6E+00	Aquatic Habitat Goal	6.8E+01	1.4E+02	4.6E+00
SELENIUM	5.0E+00	Aquatic Habitat Goal	5.0E+04		5.0E+00
SILVER	1.0E-01	Aquatic Habitat Goal	5.0E+04		1.0E-01
SIMAZINE	9.0E+00	Aquatic Habitat Goal	3.1E+03		9.0E+00
STYRENE	3.2E+01	Aquatic Habitat Goal	1.1E+02	3.1E+05	3.2E+01
TERBACIL	2.6E+02	Aquatic Habitat Goal	5.0E+04		2.6E+02
tert-BUTYL ALCOHOL	1.8E+04	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	1.8E+04
TETRACHLOROETHANE, 1,1,1,2-	1.1E+01	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	1.1E+01
TETRACHLOROETHANE, 1,1,2,2-	2.0E+02	Aquatic Habitat Goal	5.0E+03	2.4E+02	2.0E+02
TETRACHLOROETHYLENE	5.3E+01	Aquatic Habitat Goal	3.0E+03	1.9E+02	5.3E+01
TETRACHLOROPHENOL, 2,3,4,6-	1.2E+00	Aquatic Habitat Goal	1.2E+04		1.2E+00
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	2.2E+02	Aquatic Habitat Goal	2.5E+03		2.2E+02
THALLIUM	6.0E+00	Aquatic Habitat Goal	5.0E+04		6.0E+00
TOLUENE	9.8E+00	Aquatic Habitat Goal	4.0E+02	5.3E+05	9.8E+00
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	5.0E+03	(Use soil gas)	6.4E+02
TPH (residual fuels)	6.4E+02	Aquatic Habitat Goal	5.0E+03		6.4E+02
TRICHLOROBENZENE, 1,2,4-	1.1E+02	Aquatic Habitat Goal	2.5E+04	1.3E+03	1.1E+02
TRICHLOROETHANE, 1,1,1-	1.1E+01	Aquatic Habitat Goal	5.0E+04	3.4E+05	1.1E+01

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

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Odors, etc.) Table G-2	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (chronic) Table D-4a
TRICHLOROETHANE, 1,1,2-	1.1E+02	Vapor Intrusion	5.0E+04	1.1E+02	7.3E+02
TRICHLOROETHYLENE	4.7E+01	Aquatic Habitat Goal	5.0E+04	2.1E+02	4.7E+01
TRICHLOROPHENOL, 2,4,5-	1.9E+00	Aquatic Habitat Goal	2.0E+03		1.9E+00
TRICHLOROPHENOL, 2,4,6-	4.9E+00	Aquatic Habitat Goal	1.0E+03		4.9E+00
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	3.6E+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	1.1E+00	Aquatic Habitat Goal	9.0E+01		1.1E+00
TRINITROBENZENE, 1,3,5-	1.0E+01	Aquatic Habitat Goal	5.0E+04		1.0E+01
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.0E+01	Aquatic Habitat Goal	3.7E+04		4.0E+01
TRINITROTOLUENE, 2,4,6- (TNT)	1.3E+01	Aquatic Habitat Goal	5.0E+04		1.3E+01
VANADIUM	2.7E+01	Aquatic Habitat Goal	5.0E+04		2.7E+01
VINYL CHLORIDE	1.8E+01	Vapor Intrusion	3.4E+04	1.8E+01	9.3E+02
XYLENES	1.3E+01	Aquatic Habitat Goal	5.3E+03	1.1E+05	1.3E+01
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 ecotoxicity 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+04	Aquatic Habitat Goal	5.0E+04	6.2E+08	1.5E+04
ALDRIN	1.3E+00	Aquatic Habitat Goal	8.5E+00		1.3E+00
AMETRYN	1.8E+03	Aquatic Habitat Goal	5.0E+04		1.8E+03
AMINO,2- DINITROTOLUENE,4,6-	1.6E+02	Aquatic Habitat Goal	5.0E+04		1.6E+02
AMINO,4- DINITROTOLUENE,2,6-	9.8E+01	Aquatic Habitat Goal	5.0E+04		9.8E+01
ANTHRACENE	1.8E-01	Aquatic Habitat Goal	2.2E+01	4.3E+01	1.8E-01
ANTIMONY	1.8E+02	Aquatic Habitat Goal	5.0E+04		1.8E+02
ARSENIC	6.9E+01	Aquatic Habitat Goal	5.0E+04		6.9E+01
ATRAZINE	3.3E+02	Aquatic Habitat Goal	1.8E+04		3.3E+02
BARIUM	2.0E+03	Aquatic Habitat Goal	5.0E+04		2.0E+03
BENOMYL	2.8E+00	Aquatic Habitat Goal	1.9E+03		2.8E+00
BENZENE	1.7E+03	Aquatic Habitat Goal	2.0E+04	2.3E+03	1.7E+03
BENZO(a)ANTHRACENE	4.7E+00	Gross Contamination	4.7E+00		3.0E+02
BENZO(a)PYRENE	8.0E-01	Gross Contamination	8.0E-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	3.5E+01	Aquatic Habitat Goal	5.0E+04		3.5E+01
BIPHENYL, 1,1-	5.0E+00	Gross Contamination	5.0E+00	(Use soil gas)	2.6E+01
BIS(2-CHLOROETHYL)ETHER	1.8E+02	Vapor Intrusion	3.6E+03	1.8E+02	2.4E+04
BIS(2-CHLORO-1-METHYLETHYL)ETHER	3.7E-01	Aquatic Habitat Goal	3.2E+03	(Use soil gas)	3.7E-01
BIS(2-ETHYLHEXYL)PHTHALATE	2.7E+01	Aquatic Habitat Goal	1.4E+02		2.7E+01
BORON	3.4E+04	Aquatic Habitat Goal	5.0E+04		3.4E+04
BROMODICHLOROMETHANE	1.1E+02	Vapor Intrusion	5.0E+04	1.1E+02	3.1E+03
BROMOFORM	1.1E+03	Aquatic Habitat Goal	5.1E+03		1.1E+03
BROMOMETHANE	3.8E+01	Aquatic Habitat Goal	5.0E+04	4.1E+02	3.8E+01
CADMIUM	3.0E+00	Aquatic Habitat Goal	5.0E+04		3.0E+00
CARBON TETRACHLORIDE	1.1E+02	Vapor Intrusion	5.2E+03	1.1E+02	1.2E+04
CHLORDANE (TECHNICAL)	9.0E-02	Aquatic Habitat Goal	2.5E+01		9.0E-02
CHLOROANILINE, p-	4.6E+02	Aquatic Habitat Goal	5.0E+04		4.6E+02
CHLOROBENZENE	2.2E+02	Aquatic Habitat Goal	5.0E+02	1.2E+04	2.2E+02
CHLOROETHANE	1.6E+02	Gross Contamination	1.6E+02	6.0E+05	2.1E+04
CHLOROFORM	1.1E+02	Vapor Intrusion	2.4E+04	1.1E+02	4.9E+02
CHLOROMETHANE	1.9E+02	Aquatic Habitat Goal	5.0E+04	5.2E+03	1.9E+02
CHLOROPHENOL, 2-	1.8E+00	Gross Contamination	1.8E+00	1.0E+05	4.0E+02
CHROMIUM (Total)	1.6E+01	Aquatic Habitat Goal	5.0E+04		1.6E+01
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	1.2E+02	Aquatic Habitat Goal	5.0E+04		1.2E+02
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)	5.2E+02	Aquatic Habitat Goal	3.0E+04		5.2E+02

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

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Odors, etc.) Table G-2	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (acute) Table D-4a
DALAPON	3.0E+03	Aquatic Habitat Goal	5.0E+04		3.0E+03
DIBENZO(a,h)ANTHTRACENE	1.3E+00	Gross Contamination	1.3E+00		3.0E+02
DIBROMO,1,2- CHLOROPROPANE,3-	4.0E-02	Aquatic Habitat Goal	1.0E+02	(Use soil gas)	4.0E-02
DIBROMOCHLOROMETHANE	2.9E+03	Aquatic Habitat Goal	5.0E+04	5.6E+04	2.9E+03
DIBROMOETHANE, 1,2-	1.9E+01	Vapor Intrusion	5.0E+04	1.9E+01	1.4E+03
DICHLOROBENZENE, 1,2-	1.0E+02	Gross Contamination	1.0E+02	8.3E+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	4.5E+02	3.7E+02
DICHLOROBENZIDINE, 3,3-	4.1E+01	Aquatic Habitat Goal	1.6E+03		4.1E+01
DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.9E-01	Aquatic Habitat Goal	4.5E+01		1.9E-01
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	7.0E+00	Aquatic Habitat Goal	2.0E+01		7.0E+00
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.3E-02	Aquatic Habitat Goal	2.8E+00		1.3E-02
DICHLOROETHANE, 1,1-	8.3E+02	Aquatic Habitat Goal	5.0E+04	1.1E+03	8.3E+02
DICHLOROETHANE, 1,2-	1.8E+02	Vapor Intrusion	5.0E+04	1.8E+02	3.8E+04
DICHLOROETHYLENE, 1,1-	3.9E+03	Aquatic Habitat Goal	1.5E+04	6.6E+03	3.9E+03
DICHLOROETHYLENE, Cis 1,2-	1.3E+03	Vapor Intrusion	5.0E+04	1.3E+03	5.5E+03
DICHLOROETHYLENE, Trans 1,2-	2.6E+03	Gross Contamination	2.6E+03	6.6E+03	1.0E+04
DICHLOROPHENOL, 2,4-	3.0E+00	Gross Contamination	3.0E+00		6.7E+02
DICHLOROPHENOXYACETIC ACID (2,4-D)	1.3E+02	Aquatic Habitat Goal	5.0E+04		1.3E+02
DICHLOROPROPANE, 1,2-	1.0E+02	Gross Contamination	1.0E+02	9.1E+02	3.4E+03
DICHLOROPROPENE, 1,3-	2.6E+02	Aquatic Habitat Goal	5.0E+04	6.7E+02	2.6E+02
DIELDRIN	7.1E-01	Aquatic Habitat Goal	9.8E+01		7.1E-01
DIETHYLPHTHALATE	9.8E+02	Aquatic Habitat Goal	5.0E+04		9.8E+02
DIMETHYLPHENOL, 2,4-	7.0E+02	Aquatic Habitat Goal	4.0E+03		7.0E+02
DIMETHYLPHTHALATE	3.2E+03	Aquatic Habitat Goal	5.0E+04		3.2E+03
DINITROBENZENE, 1,3-	1.0E+02	Aquatic Habitat Goal	5.0E+04		1.0E+02
DINITROPHENOL, 2,4-	3.8E+02	Aquatic Habitat Goal	5.0E+04		3.8E+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	(Use soil gas)	3.4E+06
DIOXINS (TEQ)	3.0E-03	Aquatic Habitat Goal	1.0E-01		3.0E-03
DIURON	2.0E+02	Aquatic Habitat Goal	2.1E+04		2.0E+02
ENDOSULFAN	3.4E-02	Aquatic Habitat Goal	1.6E+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	(Use soil gas)	
ETHYLBENZENE	1.4E+02	Aquatic Habitat Goal	3.0E+02	7.6E+04	1.4E+02
FLUORANTHENE	1.3E+01	Aquatic Habitat Goal	1.3E+02		1.3E+01
FLUORENE	3.0E+02	Aquatic Habitat Goal	8.5E+02	1.7E+03	3.0E+02
GLYPHOSATE	2.2E+04	Aquatic Habitat Goal	5.0E+04		2.2E+04
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	3.0E-04	Aquatic Habitat Goal	3.1E+00		3.0E-04
HEXACHLOROBUTADIENE	1.1E+01	Aquatic Habitat Goal	6.0E+01		1.1E+01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	1.6E-01	Aquatic Habitat Goal	3.7E+03		1.6E-01
HEXACHLOROETHANE	1.0E+02	Gross Contamination	1.0E+02		3.1E+02

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

CONTAMINANT	[1]Final Groundwater Action Level	Basis	Gross Contamination (Odors, etc.) Table G-2	Vapor Intrusion Into Buildings Table C-1a	Aquatic Habitat Impacts (acute) Table D-4a
HEXAZINONE	5.0E+04	Gross Contamination	5.0E+04		1.4E+05
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	5.0E+04		2.1E+00
METHOXYCHLOR	7.0E-01	Aquatic Habitat Goal	5.0E+01		7.0E-01
METHYL ETHYL KETONE	5.0E+04	Gross Contamination	5.0E+04	2.2E+08	2.0E+05
METHYL ISOBUTYL KETONE	2.2E+03	Aquatic Habitat Goal	1.3E+04	1.9E+07	2.2E+03
METHYL MERCURY	9.9E-02	Aquatic Habitat Goal	5.0E+04		9.9E-02
METHYL TERT BUTYL ETHER	1.8E+03	Gross Contamination	1.8E+03	3.1E+04	6.5E+03
METHYLENE CHLORIDE	8.5E+03	Aquatic Habitat Goal	5.0E+04	7.6E+04	8.5E+03
METHYLNAPHTHALENE, 1-	3.7E+01	Aquatic Habitat Goal	1.0E+02	2.6E+04	3.7E+01
METHYLNAPHTHALENE, 2-	4.2E+01	Aquatic Habitat Goal	1.0E+02	2.5E+04	4.2E+01
MOLYBDENUM	7.2E+03	Aquatic Habitat Goal	5.0E+04		7.2E+03
NAPHTHALENE	2.1E+02	Gross Contamination	2.1E+02	2.9E+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	1.6E+02	Aquatic Habitat Goal	5.0E+04		1.6E+02
NITROTOLUENE, 2-	6.4E+02	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	6.4E+02
NITROTOLUENE, 3-	3.8E+02	Aquatic Habitat Goal	5.0E+04		3.8E+02
NITROTOLUENE, 4-	4.1E+02	Aquatic Habitat Goal	5.0E+04		4.1E+02
PENTACHLOROPHENOL	1.3E+01	Aquatic Habitat Goal	5.9E+03		1.3E+01
PENTAERYTHRITOLTETRANITRATE (PETN)	2.2E+04	Gross Contamination	2.2E+04		8.5E+05
PERCHLORATE	5.0E+03	Aquatic Habitat Goal	5.0E+04		5.0E+03
PHENANTHRENE	3.0E+02	Aquatic Habitat Goal	4.1E+02	(Use soil gas)	3.0E+02
PHENOL	3.0E+02	Aquatic Habitat Goal	5.0E+04		3.0E+02
POLYCHLORINATED BIPHENYLS (PCBs)	2.0E+00	Aquatic Habitat Goal	2.2E+01		2.0E+00
PROPICONAZOLE	4.3E+02	Aquatic Habitat Goal	5.0E+04		4.3E+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	8.0E+01	Aquatic Habitat Goal	3.1E+03		8.0E+01
STYRENE	1.1E+02	Gross Contamination	1.1E+02	3.1E+05	2.9E+02
TERBACIL	2.6E+02	Aquatic Habitat Goal	5.0E+04		2.6E+02
tert-BUTYL ALCOHOL	5.0E+04	Gross Contamination	5.0E+04	(Use soil gas)	1.8E+05
TETRACHLOROETHANE, 1,1,1,2-	7.7E+02	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	7.7E+02
TETRACHLOROETHANE, 1,1,2,2-	2.4E+02	Vapor Intrusion	5.0E+03	2.4E+02	9.1E+02
TETRACHLOROETHYLENE	1.9E+02	Vapor Intrusion	3.0E+03	1.9E+02	1.8E+03
TETRACHLOROPHENOL, 2,3,4,6-	1.1E+01	Aquatic Habitat Goal	1.2E+04		1.1E+01
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	1.2E+03	Aquatic Habitat Goal	2.5E+03		1.2E+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	2.1E+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	5.0E+03	(Use soil gas)	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
TPH (residual fuels)	2.5E+03	Aquatic Habitat Goal	5.0E+03		2.5E+03
TRICHLOROBENZENE, 1,2,4-	4.2E+02	Aquatic Habitat Goal	2.5E+04	1.3E+03	4.2E+02
TRICHLOROETHANE, 1,1,1-	6.0E+03	Aquatic Habitat Goal	5.0E+04	3.4E+05	6.0E+03
TRICHLOROETHANE, 1,1,2-	1.1E+02	Vapor Intrusion	5.0E+04	1.1E+02	5.2E+03
TRICHLOROETHYLENE	2.1E+02	Vapor Intrusion	5.0E+04	2.1E+02	7.0E+02
TRICHLOROPHENOL, 2,4,5-	1.7E+01	Aquatic Habitat Goal	2.0E+03		1.7E+01
TRICHLOROPHENOL, 2,4,6-	3.9E+01	Aquatic Habitat Goal	1.0E+03		3.9E+01
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)	2.7E+02	Aquatic Habitat Goal	3.6E+04		2.7E+02
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	2.1E+01	Aquatic Habitat Goal	9.0E+01		2.1E+01
TRINITROBENZENE, 1,3,5-	2.7E+01	Aquatic Habitat Goal	5.0E+04		2.7E+01
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.0E+01	Aquatic Habitat Goal	3.7E+04		4.0E+01
TRINITROTOLUENE, 2,4,6- (TNT)	2.1E+02	Aquatic Habitat Goal	5.0E+04		2.1E+02
VANADIUM	9.0E+01	Aquatic Habitat Goal	5.0E+04		9.0E+01
VINYL CHLORIDE	1.8E+01	Vapor Intrusion	3.4E+04	1.8E+01	8.4E+03
XYLENES	2.3E+02	Aquatic Habitat Goal	5.3E+03	1.1E+05	2.3E+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 ecotoxicity 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	1.5E+01	Aquatic Habitat Chronic Toxicity	2.0E+01	3.5E+02	1.5E+01	9.9E+02
ACENAPHTHYLENE	1.3E+01	Aquatic Habitat Chronic Toxicity	2.0E+03	2.4E+02	1.3E+01	
ACETONE	1.7E+03	Aquatic Habitat Chronic Toxicity	2.0E+04	1.4E+04	1.7E+03	
ALDRIN	2.6E-05	Bioaccumulation/Human Consumption	8.5E+00	1.1E-03	3.5E-02	2.6E-05
AMETRYN	1.8E+02	Drinking Water Toxicity	5.0E+04	1.8E+02	7.0E+02	
AMINO,2- DINITROTOLUENE,4,6-	1.8E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	4.0E+01	1.8E+01	
AMINO,4- DINITROTOLUENE,2,6-	1.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	4.0E+01	1.1E+01	
ANTHRACENE	2.0E-02	Aquatic Habitat Chronic Toxicity	2.2E+01	1.8E+03	2.0E-02	4.0E+04
ANTIMONY	6.0E+00	Drinking Water Toxicity	5.0E+04	6.0E+00	1.3E+02	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	2.2E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	2.0E+03	2.2E+02	
BENOMYL	1.4E-01	Aquatic Habitat Chronic Toxicity	1.9E+03	1.0E+03	1.4E-01	
BENZENE	5.0E+00	Drinking Water Toxicity	1.7E+02	5.0E+00	1.6E+02	1.3E+01
BENZO(a)ANTHRACENE	1.8E-02	Bioaccumulation/Human Consumption	4.7E+00	2.9E-02	4.7E+00	1.8E-02
BENZO(a)PYRENE	1.8E-02	Bioaccumulation/Human Consumption	8.0E-01	2.0E-01	6.0E-02	1.8E-02
BENZO(b)FLUORANTHENE	1.8E-02	Bioaccumulation/Human Consumption	7.5E-01	2.2E-01	2.6E+00	1.8E-02
BENZO(g,h,i)PERYLENE	1.3E-01	Ceiling Value	1.3E-01	8.0E+02	4.4E-01	
BENZO(k)FLUORANTHENE	1.8E-02	Bioaccumulation/Human Consumption	4.0E-01	2.2E+00	6.4E-01	1.8E-02
BERYLLIUM	3.8E-02	Bioaccumulation/Human Consumption	5.0E+04	4.0E+00	1.1E+01	3.8E-02
BIPHENYL, 1,1-	5.0E-01	Ceiling Value	5.0E-01	8.3E-01	6.5E+00	
BIS(2-CHLOROETHYL)ETHER	1.4E-02	Drinking Water Toxicity	3.6E+02	1.4E-02	2.4E+03	4.4E-01
BIS(2-CHLORO-1-METHYLETHYL)ETHER	3.7E-01	Drinking Water Toxicity	3.2E+02	3.7E-01	3.7E-01	1.4E+03
BIS(2-ETHYLHEXYL)PHTHALATE	2.2E+00	Bioaccumulation/Human Consumption	1.4E+02	6.0E+00	3.0E+00	2.2E+00
BORON	4.0E+03	Drinking Water Toxicity	5.0E+04	4.0E+03	7.2E+03	
BROMODICHLOROMETHANE	1.4E-01	Drinking Water Toxicity	5.0E+04	1.4E-01	3.4E+02	
BROMOFORM	8.0E+01	Drinking Water Toxicity	5.1E+02	8.0E+01	2.3E+02	1.4E+02
BROMOMETHANE	7.6E+00	Drinking Water Toxicity	5.0E+04	7.6E+00	1.6E+01	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	7.7E+01	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-	3.9E-01	Drinking Water Toxicity	5.0E+04	3.9E-01	1.9E+01	
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	1.4E+02	5.1E+00
CHLOROMETHANE	1.9E+02	Drinking Water Toxicity	5.0E+04	1.9E+02	1.9E+02	
CHLOROPHENOL, 2-	1.8E-01	Ceiling Value	1.8E-01	2.9E+01	3.2E+01	1.5E+02
CHROMIUM (Total)	1.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.0E+02	1.1E+01	
CHROMIUM III	7.4E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	3.0E+04	7.4E+01	
CHROMIUM VI	4.3E+00	Drinking Water Toxicity	5.0E+04	4.3E+00	1.1E+01	
CHRYSENE	1.8E-02	Bioaccumulation/Human Consumption	1.0E+00	2.2E+01	4.7E+00	1.8E-02
COBALT	6.0E+00	Drinking Water Toxicity	5.0E+04	6.0E+00	1.9E+01	
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)	7.1E-01	Drinking Water Toxicity	3.0E+04	7.1E-01	7.9E+01	
DALAPON	2.0E+02	Drinking Water Toxicity	5.0E+04	2.0E+02	3.0E+02	
DIBENZO(a,h)ANTHTRACENE	1.8E-02	Bioaccumulation/Human Consumption	1.3E+00	2.2E-02	8.0E-01	1.8E-02
DIBROMO,1,2- CHLOROPROPANE,3-	4.0E-02	Drinking Water Toxicity	1.0E+01	4.0E-02	4.0E-02	
DIBROMOCHLOROMETHANE	9.3E-01	Drinking Water Toxicity	5.0E+04	9.3E-01	3.2E+02	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	2.3E+01	8.5E+02
DICHLOROBENZENE, 1,3-	2.2E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.8E+02	2.2E+01	8.5E+02
DICHLOROBENZENE, 1,4-	5.0E+00	Ceiling Value	5.0E+00	7.5E+01	9.4E+00	8.5E+02
DICHLOROBENZIDINE, 3,3-	7.0E-03	Bioaccumulation/Human Consumption	1.6E+03	1.7E-01	4.5E+00	7.0E-03
DICHLORODIPHENYLDICHLOROETHANE (DDD)	3.1E-04	Bioaccumulation/Human Consumption	4.5E+01	3.2E-01	1.1E-02	3.1E-04
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.2E-04	Bioaccumulation/Human Consumption	2.0E+01	4.6E-02	4.1E-01	2.2E-04
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	8.0E-06	Bioaccumulation/Human Consumption	2.8E+00	2.3E-01	1.0E-03	8.0E-06
DICHLOROETHANE, 1,1-	2.8E+00	Drinking Water Toxicity	5.0E+04	2.8E+00	4.1E+02	
DICHLOROETHANE, 1,2-	5.0E+00	Drinking Water Toxicity	7.0E+03	5.0E+00	2.0E+03	7.9E+01
DICHLOROETHYLENE, 1,1-	6.0E-01	Bioaccumulation/Human Consumption	1.5E+03	7.0E+00	1.3E+02	6.0E-01
DICHLOROETHYLENE, Cis 1,2-	7.0E+01	Drinking Water Toxicity	5.0E+04	7.0E+01	6.2E+02	
DICHLOROETHYLENE, Trans 1,2-	1.0E+02	Drinking Water Toxicity	2.6E+02	1.0E+02	5.6E+02	140000
DICHLOROPHENOL, 2,4-	3.0E-01	Ceiling Value	3.0E-01	6.0E+01	1.1E+01	2.9E+02
DICHLOROPHENOXYACETIC ACID (2,4-D)	7.0E+01	Drinking Water Toxicity	5.0E+04	7.0E+01	7.9E+01	
DICHLOROPROPANE, 1,2-	5.0E+00	Drinking Water Toxicity	1.0E+01	5.0E+00	5.2E+02	1.5E+01
DICHLOROPROPENE, 1,3-	5.0E-01	Drinking Water Toxicity	5.0E+04	5.0E-01	1.7E+00	4.6E+00
DIELDRIN	2.5E-05	Bioaccumulation/Human Consumption	4.1E+01	1.1E-02	1.9E-03	2.5E-05
DIETHYLPHTHALATE	2.2E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	1.6E+04	2.2E+02	4.4E+04
DIMETHYLPHENOL, 2,4-	1.2E+02	Aquatic Habitat Chronic Toxicity	4.0E+02	4.0E+02	1.2E+02	8.5E+02
DIMETHYLPHTHALATE	1.1E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	2.0E+05	1.1E+03	1.1E+06
DINITROBENZENE, 1,3-	2.0E+00	Drinking Water Toxicity	5.0E+04	2.0E+00	2.2E+01	
DINITROPHENOL, 2,4-	4.0E+01	Drinking Water Toxicity	5.0E+04	4.0E+01	7.1E+01	5.3E+03
DINITROTOLUENE, 2,4- (2,4-DNT)	2.5E-01	Drinking Water Toxicity	5.0E+04	2.5E-01	4.4E+01	3.0E+00
DINITROTOLUENE, 2,6- (2,6-DNT)	5.2E-02	Drinking Water Toxicity	5.0E+04	5.2E-02	8.1E+01	
DIOXANE, 1,4-	4.6E-01	Drinking Water Toxicity	5.0E+04	4.6E-01	3.4E+05	
DIOXINS (TEQ)	3.1E-09	Aquatic Habitat Chronic Toxicity	1.0E-01	3.0E-05	3.1E-09	5.0E-09
DIURON	4.0E+01	Drinking Water Toxicity	2.1E+04	4.0E+01	6.0E+01	
ENDOSULFAN	5.6E-02	Aquatic Habitat Chronic Toxicity	1.6E+02	1.2E+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	6.1E+01	1.1E+03
FLUORANTHENE	8.0E-01	Aquatic Habitat Chronic Toxicity	1.3E+02	8.0E+02	8.0E-01	1.8E+01
FLUORENE	1.9E+01	Aquatic Habitat Chronic Toxicity	8.5E+02	2.4E+02	1.9E+01	5.3E+03
GLYPHOSATE	7.0E+02	Drinking Water Toxicity	5.0E+04	7.0E+02	1.8E+03	
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	3.0E-04	2.4E-04
HEXACHLOROBUTADIENE	2.0E-01	Drinking Water Toxicity	6.0E+00	2.0E-01	1.0E+00	1.6E+01

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
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	2.0E-02	Bioaccumulation/Human Consumption	3.7E+03	2.0E-01	8.0E-02	2.0E-02
HEXACHLOROETHANE	4.0E-01	Drinking Water Toxicity	1.0E+01	4.0E-01	1.2E+01	2.9E+00
HEXAZINONE	6.6E+02	Drinking Water Toxicity	5.0E+04	6.6E+02	1.7E+04	
INDENO(1,2,3-cd)PYRENE	1.8E-02	Bioaccumulation/Human Consumption	9.5E-02	2.2E-01	2.8E-01	1.8E-02
ISOPHORONE	8.2E+01	Drinking Water Toxicity	5.0E+04	8.2E+01	9.2E+02	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	5.0E+04	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	5.6E+03	Drinking Water Toxicity	8.4E+03	5.6E+03	2.2E+04	
METHYL ISOBUTYL KETONE	1.7E+02	Aquatic Habitat Chronic Toxicity	1.3E+03	6.3E+03	1.7E+02	
METHYL MERCURY	2.8E-03	Aquatic Habitat Chronic Toxicity	5.0E+04	2.0E+00	2.8E-03	
METHYL TERT BUTYL ETHER	5.0E+00	Ceiling Value	5.0E+00	1.4E+01	7.3E+02	
METHYLENE CHLORIDE	5.0E+00	Drinking Water Toxicity	9.1E+03	5.0E+00	1.5E+03	5.9E+02
METHYLNAPHTHALENE, 1-	2.1E+00	Aquatic Habitat Chronic Toxicity	1.0E+01	2.7E+01	2.1E+00	
METHYLNAPHTHALENE, 2-	4.7E+00	Aquatic Habitat Chronic Toxicity	1.0E+01	2.4E+01	4.7E+00	
MOLYBDENUM	1.0E+02	Drinking Water Toxicity	5.0E+04	1.0E+02	8.0E+02	
NAPHTHALENE	1.7E+01	Drinking Water Toxicity	2.1E+01	1.7E+01	2.1E+01	
NICKEL	5.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	4.0E+02	5.0E+00	3.3E+01
NITROBENZENE	1.4E-01	Drinking Water Toxicity	5.0E+04	1.4E-01	3.8E+02	
NITROGLYCERIN	2.0E+00	Drinking Water Toxicity	5.0E+04	2.0E+00	1.8E+01	
NITROTOLUENE, 2-	3.5E-01	Drinking Water Toxicity	5.0E+04	3.5E-01	7.1E+01	
NITROTOLUENE, 3-	2.0E+00	Drinking Water Toxicity	5.0E+04	2.0E+00	4.2E+01	
NITROTOLUENE, 4-	4.9E+00	Drinking Water Toxicity	5.0E+04	4.9E+00	4.6E+01	
PENTACHLOROPHENOL	1.0E+00	Drinking Water Toxicity	3.0E+01	1.0E+00	1.3E+01	3.0E+00
PENTAERYTHRITOLTETRANITRATE (PETN)	1.9E+01	Drinking Water Toxicity	2.2E+04	1.9E+01	8.5E+05	
PERCHLORATE	1.5E+01	Drinking Water Toxicity	5.0E+04	1.5E+01	6.0E+02	
PHENANTHRENE	2.3E+00	Aquatic Habitat Chronic Toxicity	4.1E+02	2.1E+02	2.3E+00	
PHENOL	1.6E+02	Aquatic Habitat Chronic Toxicity	7.9E+03	6.0E+03	1.6E+02	1.7E+06
POLYCHLORINATED BIPHENYLS (PCBs)	7.9E-05	Bioaccumulation/Human Consumption	2.2E+01	5.0E-01	1.4E-02	7.9E-05
PROPICONAZOLE	9.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	2.0E+03	9.5E+01	
PYRENE	4.6E+00	Aquatic Habitat Chronic Toxicity	6.8E+01	1.8E+02	4.6E+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	1.0E+02	1.0E+00	
SIMAZINE	4.0E+00	Drinking Water Toxicity	3.1E+03	4.0E+00	9.0E+00	
STYRENE	1.0E+01	Ceiling Value	1.0E+01	1.0E+02	3.2E+01	
TERBACIL	2.6E+02	Drinking Water Toxicity	5.0E+04	2.6E+02	1.2E+03	
tert-BUTYL ALCOHOL	5.2E+00	Drinking Water Toxicity	5.0E+04	5.2E+00	1.8E+04	
TETRACHLOROETHANE, 1,1,1,2-	6.1E-01	Drinking Water Toxicity	5.0E+04	6.1E-01	8.5E+01	
TETRACHLOROETHANE, 1,1,2,2-	7.8E-02	Drinking Water Toxicity	5.0E+02	7.8E-02	2.0E+02	3.5E+00
TETRACHLOROETHYLENE	2.9E+00	Bioaccumulation/Human Consumption	1.7E+02	5.0E+00	5.3E+01	2.9E+00
TETRACHLOROPHENOL, 2,3,4,6-	1.2E+00	Aquatic Habitat Chronic Toxicity	1.2E+04	6.0E+02	1.2E+00	
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	2.2E+02	Aquatic Habitat Chronic Toxicity	2.5E+03	1.0E+03	2.2E+02	
THALLIUM	2.0E+00	Drinking Water Toxicity	5.0E+04	2.0E+00	6.0E+00	1.6E+01
TOLUENE	4.0E+01	Ceiling Value	4.0E+01	1.0E+03	6.2E+01	1.4E+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
TOXAPHENE	2.0E-04	Aquatic Habitat Chronic Toxicity	1.4E+02	3.0E+00	2.0E-04	2.4E-04
TPH (gasolines)	3.0E+02	Drinking Water Toxicity	5.0E+02	3.0E+02	5.0E+02	
TPH (middle distillates)	4.0E+02	Drinking Water Toxicity	5.0E+02	4.0E+02	6.4E+02	
TPH (residual fuels)	5.0E+02	Ceiling Value	5.0E+02	2.4E+03	6.4E+02	
TRICHLOROBENZENE, 1,2,4-	7.0E+01	Drinking Water Toxicity	3.0E+03	7.0E+01	1.3E+02	
TRICHLOROETHANE, 1,1,1-	7.6E+01	Aquatic Habitat Chronic Toxicity	9.7E+02	2.0E+02	7.6E+01	3.4E+05
TRICHLOROETHANE, 1,1,2-	5.0E+00	Drinking Water Toxicity	5.0E+04	5.0E+00	7.3E+02	1.4E+01
TRICHLOROETHYLENE	5.0E+00	Drinking Water Toxicity	3.1E+02	5.0E+00	2.0E+02	2.6E+01
TRICHLOROPHENOL, 2,4,5-	1.9E+00	Aquatic Habitat Chronic Toxicity	2.0E+02	2.0E+03	1.9E+00	3.6E+03
TRICHLOROPHENOL, 2,4,6-	1.2E+00	Bioaccumulation/Human Consumption	1.0E+02	7.1E+00	4.9E+00	1.2E+00
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	2.0E+02	Drinking Water Toxicity	5.0E+04	2.0E+02	6.9E+02	-
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	3.0E+01	Aquatic Habitat Chronic Toxicity	3.6E+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	1.1E+00	Aquatic Habitat Chronic Toxicity	9.0E+01	1.0E+01	1.1E+00	
TRINITROBENZENE, 1,3,5-	1.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	6.0E+02	1.1E+01	
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.0E+01	Drinking Water Toxicity	3.7E+04	4.0E+01	4.0E+01	
TRINITROTOLUENE, 2,4,6- (TNT)	2.6E+00	Drinking Water Toxicity	5.0E+04	2.6E+00	1.3E+01	
VANADIUM	2.7E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.0E+02	2.7E+01	
VINYL CHLORIDE	2.0E+00	Drinking Water Toxicity	3.4E+03	2.0E+00	9.3E+02	1.7E+02
XYLENES	2.0E+01	Ceiling Value	2.0E+01	1.0E+04	2.7E+01	
ZINC	2.2E+01	Aquatic Habitat Chronic Toxicity	5.0E+03	6.0E+03	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 ecotoxicity 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	2.0E+01	9.9E+02
ACENAPHTHYLENE	3.1E+02	Aquatic Habitat Chronic Toxicity	2.0E+03	3.1E+02	
ACETONE	1.5E+03	Aquatic Habitat Chronic Toxicity	2.0E+04	1.5E+03	
ALDRIN	2.6E-05	Bioaccumulation/Human Consumption	8.5E+00	1.4E-04	2.6E-05
AMETRYN	7.0E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	7.0E+02	
AMINO,2- DINITROTOLUENE,4,6-	2.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	2.0E+01	
AMINO,4- DINITROTOLUENE,2,6-	1.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.1E+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	1.8E+04	1.2E+01	
BARIUM	2.2E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	2.2E+02	
BENOMYL	1.4E-01	Aquatic Habitat Chronic Toxicity	1.9E+03	1.4E-01	
BENZENE	1.3E+01	Bioaccumulation/Human Consumption	2.0E+03	7.1E+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	1.8E-02	Bioaccumulation/Human Consumption	8.0E-01	3.0E-01	1.8E-02
BENZO(b)FLUORANTHENE	1.8E-02	Bioaccumulation/Human Consumption	7.5E-01	6.8E-01	1.8E-02
BENZO(g,h,i)PERYLENE	1.3E-01	Ceiling Level	1.3E-01	4.4E-01	
BENZO(k)FLUORANTHENE	1.8E-02	Bioaccumulation/Human Consumption	4.0E-01	6.4E-01	1.8E-02
BERYLLIUM	3.8E-02	Bioaccumulation/Human Consumption	5.0E+04	6.6E-01	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	2.4E+03	4.4E-01
BIS(2-CHLORO-1-METHYLETHYL)ETHER	3.7E-01	Aquatic Habitat Chronic Toxicity	3.2E+02	3.7E-01	1.4E+03
BIS(2-ETHYLHEXYL)PHTHALATE	2.2E+00	Bioaccumulation/Human Consumption	1.4E+02	3.0E+00	2.2E+00
BORON	1.0E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	1.0E+03	
BROMODICHLOROMETHANE	3.4E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	3.4E+02	
BROMOFORM	1.4E+02	Bioaccumulation/Human Consumption	5.1E+02	3.2E+02	1.4E+02
BROMOMETHANE	1.6E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.6E+01	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	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-	1.9E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.9E+01	
CHLOROBENZENE	5.0E+01	Ceiling Level	5.0E+01	6.4E+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	2.8E+01	5.1E+00
CHLOROMETHANE	1.9E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	1.9E+02	
CHLOROPHENOL, 2-	1.8E-01	Ceiling Level	1.8E-01	4.0E+02	1.5E+02
CHROMIUM (Total)	5.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	5.0E+01	
CHROMIUM III	2.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	2.0E+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	2.0E+00	1.8E-02
COBALT	2.3E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	2.3E+01	
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

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
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	1.9E+02	Aquatic Habitat Chronic Toxicity	3.0E+04	1.9E+02	
DALAPON	3.0E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	3.0E+02	
DIBENZO(a,h)ANTHTRACENE	1.8E-02	Bioaccumulation/Human Consumption	1.3E+00	7.1E+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	3.4E+01	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-	7.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	7.1E+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	4.5E+00	7.0E-03
DICHLORODIPHENYLDICHLOROETHANE (DDD)	3.1E-04	Bioaccumulation/Human Consumption	4.5E+01	1.1E-02	3.1E-04
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.2E-04	Bioaccumulation/Human Consumption	2.0E+01	4.1E-01	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	9.1E+02	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-	6.2E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	6.2E+02	
DICHLOROETHYLENE, Trans 1,2-	2.6E+02	Ceiling Level	2.6E+02	5.6E+02	140000
DICHLOROPHENOL, 2,4-	3.0E-01	Ceiling Level	3.0E-01	7.9E+02	2.9E+02
DICHLOROPHENOXYACETIC ACID (2,4-D)	7.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	7.0E+01	
DICHLOROPROPANE, 1,2-	1.0E+01	Ceiling Level	1.0E+01	5.2E+02	1.5E+01
DICHLOROPROPENE, 1,3-	6.0E-02	Aquatic Habitat Chronic Toxicity	5.0E+04	6.0E-02	4.6E+00
DIELDRIN	2.5E-05	Bioaccumulation/Human Consumption	4.1E+01	1.9E-03	2.5E-05
DIETHYLPHTHALATE	2.1E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	2.1E+02	4.4E+04
DIMETHYLPHENOL, 2,4-	1.2E+02	Aquatic Habitat Chronic Toxicity	4.0E+02	1.2E+02	8.5E+02
DIMETHYLPHTHALATE	2.9E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	2.9E+03	1.1E+06
DINITROBENZENE, 1,3-	1.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.0E+01	
DINITROPHENOL, 2,4-	1.4E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.4E+01	5.3E+03
DINITROTOLUENE, 2,4- (2,4-DNT)	3.0E+00	Bioaccumulation/Human Consumption	5.0E+04	9.1E+00	3.0E+00
DINITROTOLUENE, 2,6- (2,6-DNT)	8.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	8.1E+01	
DIOXANE, 1,4-	5.0E+04	Ceiling Level	5.0E+04	5.0E+05	
DIOXINS (TEQ)	3.1E-09	Aquatic Habitat Chronic Toxicity	1.0E-01	3.1E-09	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	1.6E+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	7.3E+00	Aquatic Habitat Chronic Toxicity	3.0E+01	7.3E+00	1.1E+03
FLUORANTHENE	7.1E+00	Aquatic Habitat Chronic Toxicity	1.3E+02	7.1E+00	1.8E+01
FLUORENE	3.9E+00	Aquatic Habitat Chronic Toxicity	8.5E+02	3.9E+00	5.3E+03
GLYPHOSATE	1.8E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	1.8E+03	
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	3.0E-04	2.4E-04
HEXACHLOROBUTADIENE	3.0E-01	Aquatic Habitat Chronic Toxicity	6.0E+00	3.0E-01	1.6E+01

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
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	2.0E-02	Bioaccumulation/Human Consumption	3.7E+03	6.3E-02	2.0E-02
HEXACHLOROETHANE	2.9E+00	Bioaccumulation/Human Consumption	1.0E+01	1.2E+01	2.9E+00
HEXAZINONE	1.7E+04	Aquatic Habitat Chronic Toxicity	5.0E+04	1.7E+04	
INDENO(1,2,3-cd)PYRENE	1.8E-02	Bioaccumulation/Human Consumption	9.5E-02	2.8E-01	1.8E-02
ISOPHORONE	9.2E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	9.2E+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	5.0E+04	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	2.8E-03	Aquatic Habitat Chronic Toxicity	5.0E+04	2.8E-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-	1.0E+01	Ceiling Level	1.0E+01	7.2E+01	
MOLYBDENUM	3.7E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	3.7E+02	
NAPHTHALENE	1.2E+01	Aquatic Habitat Chronic Toxicity	2.1E+01	1.2E+01	
NICKEL	8.3E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	8.3E+00	3.3E+01
NITROBENZENE	3.8E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	3.8E+02	
NITROGLYCERIN	1.8E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.8E+01	
NITROTOLUENE, 2-	7.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	7.1E+01	
NITROTOLUENE, 3-	4.2E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	4.2E+01	
NITROTOLUENE, 4-	4.6E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	4.6E+01	
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+05	
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	5.8E+01	Aquatic Habitat Chronic Toxicity	7.9E+03	5.8E+01	1.7E+06
POLYCHLORINATED BIPHENYLS (PCBs)	7.9E-05	Bioaccumulation/Human Consumption	2.2E+01	3.0E-02	7.9E-05
PROPICONAZOLE	9.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	9.5E+01	
PYRENE	1.0E+01	Aquatic Habitat Chronic Toxicity	6.8E+01	1.0E+01	4.0E+03
SELENIUM	7.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	7.1E+01	
SILVER	1.0E-01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.0E-01	
SIMAZINE	9.0E+00	Aquatic Habitat Chronic Toxicity	3.1E+03	9.0E+00	
STYRENE	1.1E+01	Ceiling Level	1.1E+01	3.2E+01	
TERBACIL	2.6E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	2.6E+02	
tert-BUTYL ALCOHOL	1.8E+04	Aquatic Habitat Chronic Toxicity	5.0E+04	1.8E+04	
TETRACHLOROETHANE, 1,1,1,2-	1.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.1E+01	
TETRACHLOROETHANE, 1,1,2,2-	3.5E+00	Bioaccumulation/Human Consumption	5.0E+02	6.1E+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-	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	2.5E+03	3.3E+02	
THALLIUM	1.2E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.2E+01	1.6E+01
TOLUENE	9.8E+00	Aquatic Habitat Chronic Toxicity	4.0E+01	9.8E+00	1.4E+05

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
TOXAPHENE	2.0E-04	Aquatic Habitat Chronic Toxicity	1.4E+02	2.0E-04	2.4E-04
TPH (gasolines)	3.7E+03	Aquatic Habitat Chronic Toxicity	5.0E+03	3.7E+03	
TPH (middle distillates)	6.4E+02	Aquatic Habitat Chronic Toxicity	5.0E+03	6.4E+02	
TPH (residual fuels)	6.4E+02	Aquatic Habitat Chronic Toxicity	5.0E+03	6.4E+02	
TRICHLOROBENZENE, 1,2,4-	1.1E+02	Aquatic Habitat Chronic Toxicity	3.0E+03	1.1E+02	
TRICHLOROETHANE, 1,1,1-	1.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.1E+01	3.4E+05
TRICHLOROETHANE, 1,1,2-	1.4E+01	Bioaccumulation/Human Consumption	5.0E+04	1.2E+03	1.4E+01
TRICHLOROETHYLENE	2.6E+01	Bioaccumulation/Human Consumption	1.0E+04	4.7E+01	2.6E+01
TRICHLOROPHENOL, 2,4,5-	1.2E+01	Aquatic Habitat Chronic Toxicity	2.0E+02	1.2E+01	3.6E+03
TRICHLOROPHENOL, 2,4,6-	1.2E+00	Bioaccumulation/Human Consumption	1.0E+02	6.5E+00	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)	5.0E+01	Aquatic Habitat Chronic Toxicity	3.6E+04	5.0E+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	1.1E+00	Aquatic Habitat Chronic Toxicity	9.0E+01	1.1E+00	
TRINITROBENZENE, 1,3,5-	1.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.0E+01	
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.0E+01	Aquatic Habitat Chronic Toxicity	3.7E+04	4.0E+01	
TRINITROTOLUENE, 2,4,6- (TNT)	2.0E+01	Ceiling Level	2.0E+01	9.0E+01	
VANADIUM	8.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	8.1E+01	
VINYL CHLORIDE	1.7E+02	Bioaccumulation/Human Consumption	3.4E+03	9.3E+02	1.7E+02
XYLENES	1.3E+01	Aquatic Habitat Chronic Toxicity	5.3E+02	1.3E+01	
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 ecotoxicity 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	1.5E+01	Aquatic Habitat Chronic Toxicity	2.0E+01	1.5E+01	9.9E+02
ACENAPHTHYLENE	1.3E+01	Aquatic Habitat Chronic Toxicity	2.0E+03	1.3E+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	1.4E-04	2.6E-05
AMETRYN	7.0E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	7.0E+02	
AMINO,2- DINITROTOLUENE,4,6-	1.8E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.8E+01	
AMINO,4- DINITROTOLUENE,2,6-	1.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.1E+01	
ANTHRACENE	2.0E-02	Aquatic Habitat Chronic Toxicity	2.2E+01	2.0E-02	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	1.8E+04	1.2E+01	
BARIUM	2.2E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	2.2E+02	
BENOMYL	1.4E-01	Aquatic Habitat Chronic Toxicity	1.9E+03	1.4E-01	
BENZENE	1.3E+01	Bioaccumulation/Human Consumption	2.0E+03	7.1E+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	1.8E-02	Bioaccumulation/Human Consumption	8.0E-01	6.0E-02	1.8E-02
BENZO(b)FLUORANTHENE	1.8E-02	Bioaccumulation/Human Consumption	7.5E-01	6.8E-01	1.8E-02
BENZO(g,h,i)PERYLENE	1.3E-01	Ceiling Level	1.3E-01	4.4E-01	
BENZO(k)FLUORANTHENE	1.8E-02	Bioaccumulation/Human Consumption	4.0E-01	6.4E-01	1.8E-02
BERYLLIUM	3.8E-02	Bioaccumulation/Human Consumption	5.0E+04	6.6E-01	3.8E-02
BIPHENYL, 1,1-	5.0E-01	Ceiling Level	5.0E-01	6.5E+00	
BIS(2-CHLOROETHYL)ETHER	4.4E-01	Bioaccumulation/Human Consumption	3.6E+02	2.4E+03	4.4E-01
BIS(2-CHLORO-1-METHYLETHYL)ETHER	3.7E-01	Aquatic Habitat Chronic Toxicity	3.2E+02	3.7E-01	1.4E+03
BIS(2-ETHYLHEXYL)PHTHALATE	2.2E+00	Bioaccumulation/Human Consumption	1.4E+02	3.0E+00	2.2E+00
BORON	1.0E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	1.0E+03	
BROMODICHLOROMETHANE	3.4E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	3.4E+02	
BROMOFORM	1.4E+02	Bioaccumulation/Human Consumption	5.1E+02	2.3E+02	1.4E+02
BROMOMETHANE	1.6E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.6E+01	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-	1.9E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.9E+01	
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	2.8E+01	5.1E+00
CHLOROMETHANE	1.9E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	1.9E+02	
CHLOROPHENOL, 2-	1.8E-01	Ceiling Level	1.8E-01	3.2E+01	1.5E+02
CHROMIUM (Total)	1.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.1E+01	
CHROMIUM III	2.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	2.0E+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	2.0E+00	1.8E-02
COBALT	1.9E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.9E+01	
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

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
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	7.9E+01	Aquatic Habitat Chronic Toxicity	3.0E+04	7.9E+01	
DALAPON	3.0E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	3.0E+02	
DIBENZO(a,h)ANTHTRACENE	1.8E-02	Bioaccumulation/Human Consumption	1.3E+00	8.0E-01	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	3.4E+01	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-	2.2E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	2.2E+01	8.5E+02
DICHLOROBENZENE, 1,4-	9.4E+00	Aquatic Habitat Chronic Toxicity	1.1E+01	9.4E+00	8.5E+02
DICHLOROBENZIDINE, 3,3-	7.0E-03	Bioaccumulation/Human Consumption	1.6E+03	4.5E+00	7.0E-03
DICHLORODIPHENYLDICHLOROETHANE (DDD)	3.1E-04	Bioaccumulation/Human Consumption	4.5E+01	1.1E-02	3.1E-04
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.2E-04	Bioaccumulation/Human Consumption	2.0E+01	4.1E-01	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	9.1E+02	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-	6.2E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	6.2E+02	
DICHLOROETHYLENE, Trans 1,2-	2.6E+02	Ceiling Level	2.6E+02	5.6E+02	140000
DICHLOROPHENOL, 2,4-	3.0E-01	Ceiling Level	3.0E-01	1.1E+01	2.9E+02
DICHLOROPHENOXYACETIC ACID (2,4-D)	7.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	7.0E+01	
DICHLOROPROPANE, 1,2-	1.0E+01	Ceiling Level	1.0E+01	5.2E+02	1.5E+01
DICHLOROPROPENE, 1,3-	6.0E-02	Aquatic Habitat Chronic Toxicity	5.0E+04	6.0E-02	4.6E+00
DIELDRIN	2.5E-05	Bioaccumulation/Human Consumption	4.1E+01	1.9E-03	2.5E-05
DIETHYLPHTHALATE	2.1E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	2.1E+02	4.4E+04
DIMETHYLPHENOL, 2,4-	1.2E+02	Aquatic Habitat Chronic Toxicity	4.0E+02	1.2E+02	8.5E+02
DIMETHYLPHTHALATE	1.1E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	1.1E+03	1.1E+06
DINITROBENZENE, 1,3-	1.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.0E+01	
DINITROPHENOL, 2,4-	1.4E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.4E+01	5.3E+03
DINITROTOLUENE, 2,4- (2,4-DNT)	3.0E+00	Bioaccumulation/Human Consumption	5.0E+04	9.1E+00	3.0E+00
DINITROTOLUENE, 2,6- (2,6-DNT)	8.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	8.1E+01	
DIOXANE, 1,4-	5.0E+04	Ceiling Level	5.0E+04	3.4E+05	
DIOXINS (TEQ)	3.1E-09	Aquatic Habitat Chronic Toxicity	1.0E-01	3.1E-09	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	1.6E+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	7.3E+00	Aquatic Habitat Chronic Toxicity	3.0E+01	7.3E+00	1.1E+03
FLUORANTHENE	8.0E-01	Aquatic Habitat Chronic Toxicity	1.3E+02	8.0E-01	1.8E+01
FLUORENE	3.9E+00	Aquatic Habitat Chronic Toxicity	8.5E+02	3.9E+00	5.3E+03
GLYPHOSATE	1.8E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	1.8E+03	
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	3.0E-04	2.4E-04
HEXACHLOROBUTADIENE	3.0E-01	Aquatic Habitat Chronic Toxicity	6.0E+00	3.0E-01	1.6E+01

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
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	2.0E-02	Bioaccumulation/Human Consumption	3.7E+03	6.3E-02	2.0E-02
HEXACHLOROETHANE	2.9E+00	Bioaccumulation/Human Consumption	1.0E+01	1.2E+01	2.9E+00
HEXAZINONE	1.7E+04	Aquatic Habitat Chronic Toxicity	5.0E+04	1.7E+04	
INDENO(1,2,3-cd)PYRENE	1.8E-02	Bioaccumulation/Human Consumption	9.5E-02	2.8E-01	1.8E-02
ISOPHORONE	9.2E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	9.2E+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	5.0E+04	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	2.8E-03	Aquatic Habitat Chronic Toxicity	5.0E+04	2.8E-03	
METHYL TERT BUTYL ETHER	1.8E+02	Ceiling Level	1.8E+02	7.3E+02	
METHYLENE CHLORIDE	5.9E+02	Bioaccumulation/Human Consumption	9.1E+03	1.5E+03	5.9E+02
METHYLNAPHTHALENE, 1-	2.1E+00	Aquatic Habitat Chronic Toxicity	1.0E+01	2.1E+00	
METHYLNAPHTHALENE, 2-	4.7E+00	Aquatic Habitat Chronic Toxicity	1.0E+01	4.7E+00	
MOLYBDENUM	3.7E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	3.7E+02	
NAPHTHALENE	1.2E+01	Aquatic Habitat Chronic Toxicity	2.1E+01	1.2E+01	
NICKEL	5.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	5.0E+00	3.3E+01
NITROBENZENE	3.8E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	3.8E+02	
NITROGLYCERIN	1.8E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.8E+01	
NITROTOLUENE, 2-	7.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	7.1E+01	
NITROTOLUENE, 3-	4.2E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	4.2E+01	
NITROTOLUENE, 4-	4.6E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	4.6E+01	
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+05	
PERCHLORATE	6.0E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	6.0E+02	
PHENANTHRENE	2.3E+00	Aquatic Habitat Chronic Toxicity	4.1E+02	2.3E+00	
PHENOL	5.8E+01	Aquatic Habitat Chronic Toxicity	7.9E+03	5.8E+01	1.7E+06
POLYCHLORINATED BIPHENYLS (PCBs)	7.9E-05	Bioaccumulation/Human Consumption	2.2E+01	1.4E-02	7.9E-05
PROPICONAZOLE	9.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	9.5E+01	
PYRENE	4.6E+00	Aquatic Habitat Chronic Toxicity	6.8E+01	4.6E+00	4.0E+03
SELENIUM	5.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	5.0E+00	
SILVER	1.0E-01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.0E-01	
SIMAZINE	9.0E+00	Aquatic Habitat Chronic Toxicity	3.1E+03	9.0E+00	
STYRENE	1.1E+01	Ceiling Level	1.1E+01	3.2E+01	
TERBACIL	2.6E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	2.6E+02	
tert-BUTYL ALCOHOL	1.8E+04	Aquatic Habitat Chronic Toxicity	5.0E+04	1.8E+04	
TETRACHLOROETHANE, 1,1,1,2-	1.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.1E+01	
TETRACHLOROETHANE, 1,1,2,2-	3.5E+00	Bioaccumulation/Human Consumption	5.0E+02	2.0E+02	3.5E+00
TETRACHLOROETHYLENE	2.9E+00	Bioaccumulation/Human Consumption	3.0E+02	5.3E+01	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)	2.2E+02	Aquatic Habitat Chronic Toxicity	2.5E+03	2.2E+02	
THALLIUM	6.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	6.0E+00	1.6E+01
TOLUENE	9.8E+00	Aquatic Habitat Chronic Toxicity	4.0E+01	9.8E+00	1.4E+05

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
TOXAPHENE	2.0E-04	Aquatic Habitat Chronic Toxicity	1.4E+02	2.0E-04	2.4E-04
TPH (gasolines)	5.0E+02	Aquatic Habitat Chronic Toxicity	5.0E+03	5.0E+02	
TPH (middle distillates)	6.4E+02	Aquatic Habitat Chronic Toxicity	5.0E+03	6.4E+02	
TPH (residual fuels)	6.4E+02	Aquatic Habitat Chronic Toxicity	5.0E+03	6.4E+02	
TRICHLOROBENZENE, 1,2,4-	1.1E+02	Aquatic Habitat Chronic Toxicity	3.0E+03	1.1E+02	
TRICHLOROETHANE, 1,1,1-	1.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.1E+01	3.4E+05
TRICHLOROETHANE, 1,1,2-	1.4E+01	Bioaccumulation/Human Consumption	5.0E+04	7.3E+02	1.4E+01
TRICHLOROETHYLENE	2.6E+01	Bioaccumulation/Human Consumption	1.0E+04	4.7E+01	2.6E+01
TRICHLOROPHENOL, 2,4,5-	1.9E+00	Aquatic Habitat Chronic Toxicity	2.0E+02	1.9E+00	3.6E+03
TRICHLOROPHENOL, 2,4,6-	1.2E+00	Bioaccumulation/Human Consumption	1.0E+02	4.9E+00	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	3.6E+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	1.1E+00	Aquatic Habitat Chronic Toxicity	9.0E+01	1.1E+00	
TRINITROBENZENE, 1,3,5-	1.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.0E+01	
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.0E+01	Aquatic Habitat Chronic Toxicity	3.7E+04	4.0E+01	
TRINITROTOLUENE, 2,4,6- (TNT)	1.3E+01	Aquatic Habitat Chronic Toxicity	2.0E+01	1.3E+01	
VANADIUM	2.7E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	2.7E+01	
VINYL CHLORIDE	1.7E+02	Bioaccumulation/Human Consumption	3.4E+03	9.3E+02	1.7E+02
XYLENES	1.3E+01	Aquatic Habitat Chronic Toxicity	5.3E+02	1.3E+01	
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 ecotoxicity 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	3.5E+02	noncarcinogenic effects				3.5E+02	noncarcinogenic effects
ACENAPHTHYLENE	2.4E+02	noncarcinogenic effects				2.4E+02	noncarcinogenic effects
ACETONE	1.4E+04	noncarcinogenic effects				1.4E+04	noncarcinogenic effects
ALDRIN	1.1E-03	carcinogenic effects				1.1E-03	carcinogenic effects
AMETRYN	1.8E+02	noncarcinogenic effects				1.8E+02	noncarcinogenic effects
AMINO,2- DINITROTOLUENE,4,6-	4.0E+01	noncarcinogenic effects				4.0E+01	noncarcinogenic effects
AMINO,4- DINITROTOLUENE,2,6-	4.0E+01	noncarcinogenic effects				4.0E+01	noncarcinogenic effects
ANTHRACENE	1.8E+03	noncarcinogenic effects				1.8E+03	noncarcinogenic effects
ANTIMONY	6.0E+00	HDOH Primary MCL	6.0E+00			8.0E+00	noncarcinogenic effects
ARSENIC	1.0E+01	HDOH Primary MCL	1.0E+01			5.2E-02	carcinogenic effects
ATRAZINE	3.0E+00	HDOH Primary MCL	3.0E+00			3.4E-01	carcinogenic effects
BARIUM	2.0E+03	HDOH Primary MCL	2.0E+03			4.0E+03	noncarcinogenic effects
BENOMYL	1.0E+03	noncarcinogenic effects				1.0E+03	noncarcinogenic effects
BENZENE	5.0E+00	HDOH Primary MCL	5.0E+00			4.8E-01	carcinogenic effects
BENZO(a)ANTHRACENE	2.9E-02	mutagenic effects				2.9E-02	mutagenic effects
BENZO(a)PYRENE	2.0E-01	HDOH Primary MCL	2.0E-01			2.2E-02	mutagenic effects
BENZO(b)FLUORANTHENE	2.2E-01	mutagenic effects				2.2E-01	mutagenic effects
BENZO(g,h,i)PERYLENE	8.0E+02	noncarcinogenic effects				8.0E+02	noncarcinogenic effects
BENZO(k)FLUORANTHENE	2.2E+00	mutagenic effects				2.2E+00	mutagenic effects
BERYLLIUM	4.0E+00	HDOH Primary MCL	4.0E+00			4.0E+01	noncarcinogenic effects
BIPHENYL, 1,1-	8.3E-01	noncarcinogenic effects				8.3E-01	noncarcinogenic effects
BIS(2-CHLOROETHYL)ETHER	1.4E-02	carcinogenic effects				1.4E-02	carcinogenic effects
BIS(2-CHLORO-1-METHYLETHYL)ETHER	3.7E-01	carcinogenic effects				3.7E-01	carcinogenic effects
BIS(2-ETHYLHEXYL)PHTHALATE	6.0E+00	HDOH Primary MCL	6.0E+00			5.6E+00	carcinogenic effects
BORON	4.0E+03	noncarcinogenic effects				4.0E+03	noncarcinogenic effects
BROMODICHLOROMETHANE	1.4E-01	carcinogenic effects				1.4E-01	carcinogenic effects
BROMOFORM	8.0E+01	HDOH Primary MCL	8.0E+01		Total Trihalomethanes	3.4E+00	carcinogenic effects
BROMOMETHANE	7.6E+00	noncarcinogenic effects				7.6E+00	noncarcinogenic effects
CADMIUM	5.0E+00	HDOH Primary MCL	5.0E+00			2.0E+01	noncarcinogenic effects
CARBON TETRACHLORIDE	5.0E+00	HDOH Primary MCL	5.0E+00			5.1E-01	carcinogenic effects
CHLORDANE (TECHNICAL)	2.0E+00	HDOH Primary MCL	2.0E+00			4.5E-02	carcinogenic effects
CHLOROANILINE, p-	3.9E-01	carcinogenic effects				3.9E-01	carcinogenic effects
CHLOROBENZENE	1.0E+02	HDOH Primary MCL	1.0E+02			8.3E+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	2.2E-01	carcinogenic effects
CHLOROMETHANE	1.9E+02	noncarcinogenic effects				1.9E+02	noncarcinogenic effects
CHLOROPHENOL, 2-	2.9E+01	noncarcinogenic effects				2.9E+01	noncarcinogenic effects
CHROMIUM (Total)	1.0E+02	HDOH Primary MCL	1.0E+02				not applicable
CHROMIUM III	3.0E+04	noncarcinogenic effects				3.0E+04	noncarcinogenic effects
CHROMIUM VI	4.3E+00	mutagenic effects				4.3E+00	mutagenic effects
CHRYSENE	2.2E+01	mutagenic effects				2.2E+01	mutagenic effects
COBALT	6.0E+00	noncarcinogenic effects				6.0E+00	noncarcinogenic effects
COPPER	1.3E+03	HDOH Primary MCL	1.3E+03			8.0E+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
CYANIDE (Free)	2.0E+02	HDOH Primary MCL	2.0E+02			1.5E+00	noncarcinogenic effects
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	7.1E-01	carcinogenic effects				7.1E-01	carcinogenic effects
DALAPON	2.0E+02	HDOH Primary MCL	2.0E+02			6.0E+02	noncarcinogenic effects
DIBENZO(a,h)ANTHTRACENE	2.2E-02	mutagenic effects				2.2E-02	mutagenic effects
DIBROMO,1,2- CHLOROPROPANE,3-	4.0E-02	HDOH Primary MCL	4.0E-02			3.3E-04	mutagenic effects
DIBROMOCHLOROMETHANE	9.3E-01	carcinogenic effects				9.3E-01	carcinogenic effects
DIBROMOETHANE, 1,2-	4.0E-02	HDOH Primary MCL	4.0E-02			7.5E-03	carcinogenic effects
DICHLOROBENZENE, 1,2-	6.0E+02	HDOH Primary MCL	6.0E+02			3.4E+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			4.9E-01	carcinogenic effects
DICHLOROBENZIDINE, 3,3-	1.7E-01	carcinogenic effects				1.7E-01	carcinogenic effects
DICHLORODIPHENYLDICHLOROETHANE (DDD)	3.2E-01	carcinogenic effects				3.2E-01	carcinogenic effects
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	4.6E-02	carcinogenic effects				4.6E-02	carcinogenic effects
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	2.3E-01	carcinogenic effects				2.3E-01	carcinogenic effects
DICHLOROETHANE, 1,1-	2.8E+00	carcinogenic effects				2.8E+00	carcinogenic effects
DICHLOROETHANE, 1,2-	5.0E+00	USEPA MCL		5.0E+00	USEPA MCL	1.7E-01	carcinogenic effects
DICHLOROETHYLENE, 1,1-	7.0E+00	HDOH Primary MCL	7.0E+00			2.9E+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			1.2E+02	noncarcinogenic effects
DICHLOROPHENOL, 2,4-	6.0E+01	noncarcinogenic effects				6.0E+01	noncarcinogenic effects
DICHLOROPHENOXYACETIC ACID (2,4-D)	7.0E+01	HDOH Primary MCL	7.0E+01			2.0E+02	noncarcinogenic effects
DICHLOROPROPANE, 1,2-	5.0E+00	HDOH Primary MCL	5.0E+00			8.8E-01	carcinogenic effects
DICHLOROPROPENE, 1,3-	5.0E-01	carcinogenic effects				5.0E-01	carcinogenic effects
DIELDRIN	1.1E-02	carcinogenic effects				1.1E-02	carcinogenic effects
DIETHYLPHTHALATE	1.6E+04	noncarcinogenic effects				1.6E+04	noncarcinogenic effects
DIMETHYLPHENOL, 2,4-	4.0E+02	noncarcinogenic effects				4.0E+02	noncarcinogenic effects
DIMETHYLPHTHALATE	2.0E+05	noncarcinogenic effects				2.0E+05	noncarcinogenic effects
DINITROBENZENE, 1,3-	2.0E+00	noncarcinogenic effects				2.0E+00	noncarcinogenic effects
DINITROPHENOL, 2,4-	4.0E+01	noncarcinogenic effects				4.0E+01	noncarcinogenic effects
DINITROTOLUENE, 2,4- (2,4-DNT)	2.5E-01	carcinogenic effects				2.5E-01	carcinogenic effects
DINITROTOLUENE, 2,6- (2,6-DNT)	5.2E-02	carcinogenic effects				5.2E-02	carcinogenic effects
DIOXANE, 1,4-	4.6E-01	carcinogenic effects				4.6E-01	carcinogenic effects
DIOXINS (TEQ)	3.0E-05	HDOH Primary MCL	3.0E-05			1.2E-07	carcinogenic effects
DIURON	4.0E+01	noncarcinogenic effects				4.0E+01	noncarcinogenic effects
ENDOSULFAN	1.2E+02	noncarcinogenic effects				1.2E+02	noncarcinogenic effects
ENDRIN	2.0E+00	HDOH Primary MCL	2.0E+00			6.0E+00	noncarcinogenic effects
ETHANOL		not available					
ETHYLBENZENE	7.0E+02	HDOH Primary MCL	7.0E+02			1.7E+00	carcinogenic effects
FLUORANTHENE	8.0E+02	noncarcinogenic effects				8.0E+02	noncarcinogenic effects
FLUORENE	2.4E+02	noncarcinogenic effects				2.4E+02	noncarcinogenic effects
GLYPHOSATE	7.0E+02	HDOH Primary MCL	7.0E+02			2.0E+03	noncarcinogenic effects
HEPTACHLOR	4.0E-01	HDOH Primary MCL	4.0E-01			3.5E-03	carcinogenic effects
HEPTACHLOR EPOXIDE	2.0E-01	HDOH Primary MCL	2.0E-01			1.7E-03	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
HEXACHLOROBENZENE	1.0E+00	HDOH Primary MCL	1.0E+00			9.8E-03	carcinogenic effects
HEXACHLOROBUTADIENE	2.0E-01	carcinogenic effects				2.0E-01	carcinogenic effects
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	2.0E-01	HDOH Primary MCL	2.0E-01			7.1E-02	carcinogenic effects
HEXACHLOROETHANE	4.0E-01	carcinogenic effects				4.0E-01	carcinogenic effects
HEXAZINONE	6.6E+02	noncarcinogenic effects				6.6E+02	noncarcinogenic effects
INDENO(1,2,3-cd)PYRENE	2.2E-01	mutagenic effects				2.2E-01	mutagenic effects
ISOPHORONE	8.2E+01	carcinogenic effects				8.2E+01	carcinogenic effects
LEAD	1.5E+01	HDOH Primary MCL	1.5E+01				
MERCURY	2.0E+00	HDOH Primary MCL	2.0E+00			6.0E+00	noncarcinogenic effects
METHOXYCHLOR	4.0E+01	HDOH Primary MCL	4.0E+01			1.0E+02	noncarcinogenic effects
METHYL ETHYL KETONE	5.6E+03	noncarcinogenic effects				5.6E+03	noncarcinogenic effects
METHYL ISOBUTYL KETONE	6.3E+03	noncarcinogenic effects				6.3E+03	noncarcinogenic effects
METHYL MERCURY	2.0E+00	noncarcinogenic effects				2.0E+00	noncarcinogenic effects
METHYL TERT BUTYL ETHER	1.4E+01	carcinogenic effects				1.4E+01	carcinogenic effects
METHYLENE CHLORIDE	5.0E+00	USEPA MCL		5.0E+00	USEPA MCL	1.0E+01	mutagenic effects
METHYLNAPHTHALENE, 1-	2.7E+01	carcinogenic effects				2.7E+01	carcinogenic effects
METHYLNAPHTHALENE, 2-	2.4E+01	noncarcinogenic effects				2.4E+01	noncarcinogenic effects
MOLYBDENUM	1.0E+02	noncarcinogenic effects				1.0E+02	noncarcinogenic effects
NAPHTHALENE	1.7E+01	CDPH notification level		1.7E+01	CDPH notification level	1.7E-01	carcinogenic effects
NICKEL	4.0E+02	noncarcinogenic effects				4.0E+02	noncarcinogenic effects
NITROBENZENE	1.4E-01	carcinogenic effects				1.4E-01	carcinogenic effects
NITROGLYCERIN	2.0E+00	noncarcinogenic effects				2.0E+00	noncarcinogenic effects
NITROTOLUENE, 2-	3.5E-01	carcinogenic effects				3.5E-01	carcinogenic effects
NITROTOLUENE, 3-	2.0E+00	noncarcinogenic effects				2.0E+00	noncarcinogenic effects
NITROTOLUENE, 4-	4.9E+00	carcinogenic effects				4.9E+00	carcinogenic effects
PENTACHLOROPHENOL	1.0E+00	HDOH Primary MCL	1.0E+00			1.9E-01	carcinogenic effects
PENTAERYTHRITOLTETRANITRATE (PETN)	1.9E+01	carcinogenic effects				1.9E+01	carcinogenic effects
PERCHLORATE	1.5E+01	USEPA MCL		1.5E+01	USEPA MCL	1.4E+01	noncarcinogenic effects
PHENANTHRENE	2.1E+02	noncarcinogenic effects				2.1E+02	noncarcinogenic effects
PHENOL	6.0E+03	noncarcinogenic effects				6.0E+03	noncarcinogenic effects
POLYCHLORINATED BIPHENYLS (PCBs)	5.0E-01	HDOH Primary MCL	5.0E-01			7.9E-03	carcinogenic effects
PROPICONAZOLE	2.0E+03	noncarcinogenic effects				2.0E+03	noncarcinogenic effects
PYRENE	1.8E+02	noncarcinogenic effects				1.8E+02	noncarcinogenic effects
SELENIUM	5.0E+01	HDOH Primary MCL	5.0E+01			1.0E+02	noncarcinogenic effects
SILVER	1.0E+02	noncarcinogenic effects				1.0E+02	noncarcinogenic effects
SIMAZINE	4.0E+00	HDOH Primary MCL	4.0E+00			6.5E-01	carcinogenic effects
STYRENE	1.0E+02	HDOH Primary MCL	1.0E+02			1.4E+03	noncarcinogenic effects
TERBACIL	2.6E+02	noncarcinogenic effects				2.6E+02	noncarcinogenic effects
tert-BUTYL ALCOHOL	5.2E+00	carcinogenic effects				5.2E+00	carcinogenic effects
TETRACHLOROETHANE, 1,1,1,2-	6.1E-01	carcinogenic effects				6.1E-01	carcinogenic effects
TETRACHLOROETHANE, 1,1,2,2-	7.8E-02	carcinogenic effects				7.8E-02	carcinogenic effects
TETRACHLOROETHYLENE	5.0E+00	HDOH Primary MCL	5.0E+00			7.4E-01	carcinogenic effects
TETRACHLOROPHENOL, 2,3,4,6-	6.0E+02	noncarcinogenic effects				6.0E+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
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	1.0E+03	noncarcinogenic effects				1.0E+03	noncarcinogenic effects
THALLIUM	2.0E+00	HDOH Primary MCL	2.0E+00			2.0E-01	noncarcinogenic effects
TOLUENE	1.0E+03	HDOH Primary MCL	1.0E+03			1.4E+03	noncarcinogenic effects
TOXAPHENE	3.0E+00	HDOH Primary MCL	3.0E+00			7.1E-02	carcinogenic effects
TPH (gasolines)	3.0E+02	noncarcinogenic effects				3.0E+02	noncarcinogenic effects
TPH (middle distillates)	4.0E+02	noncarcinogenic effects				4.0E+02	noncarcinogenic effects
TPH (residual fuels)	2.4E+03	noncarcinogenic effects				2.4E+03	noncarcinogenic effects
TRICHLOROBENZENE, 1,2,4-	7.0E+01	HDOH Primary MCL	7.0E+01			2.7E+00	carcinogenic effects
TRICHLOROETHANE, 1,1,1-	2.0E+02	HDOH Primary MCL	2.0E+02			8.3E+03	noncarcinogenic effects
TRICHLOROETHANE, 1,1,2-	5.0E+00	HDOH Primary MCL	5.0E+00			2.8E-01	carcinogenic effects
TRICHLOROETHYLENE	5.0E+00	HDOH Primary MCL	5.0E+00			2.4E-01	mutagenic effects
TRICHLOROPHENOL, 2,4,5-	2.0E+03	noncarcinogenic effects				2.0E+03	noncarcinogenic effects
TRICHLOROPHENOL, 2,4,6-	7.1E+00	carcinogenic effects				7.1E+00	carcinogenic effects
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	2.0E+02	noncarcinogenic effects				2.0E+02	noncarcinogenic effects
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	5.0E+01	HDOH Primary MCL	5.0E+01			1.6E+02	noncarcinogenic effects
TRICHLOROPROPANE, 1,2,3-	6.0E-01	HDOH Primary MCL	6.0E-01			7.2E-04	mutagenic effects
TRICHLOROPROPENE, 1,2,3-	6.2E-01	noncarcinogenic effects				6.2E-01	noncarcinogenic effects
TRIFLURALIN	1.0E+01	carcinogenic effects				1.0E+01	carcinogenic effects
TRINITROBENZENE, 1,3,5-	6.0E+02	noncarcinogenic effects				6.0E+02	noncarcinogenic effects
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.0E+01	noncarcinogenic effects				4.0E+01	noncarcinogenic effects
TRINITROTOLUENE, 2,4,6- (TNT)	2.6E+00	carcinogenic effects				2.6E+00	carcinogenic effects
VANADIUM	1.0E+02	noncarcinogenic effects				1.0E+02	noncarcinogenic effects
VINYL CHLORIDE	2.0E+00	HDOH Primary MCL	2.0E+00			2.0E-02	carcinogenic effects
XYLENES	1.0E+04	HDOH Primary MCL	1.0E+04			2.1E+02	noncarcinogenic effects
ZINC	6.0E+03	noncarcinogenic effects				6.0E+03	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	3.5E+02	noncarcinogenic effects			3.5E+02
ACENAPHTHYLENE	2.4E+02	noncarcinogenic effects			2.4E+02
ACETONE	1.4E+04	noncarcinogenic effects			1.4E+04
ALDRIN	1.1E-03	carcinogenic effects	1.1E-03		2.0E+00
AMETRYN	1.8E+02	noncarcinogenic effects			1.8E+02
AMINO,2- DINITROTOLUENE,4,6-	4.0E+01	noncarcinogenic effects			4.0E+01
AMINO,4- DINITROTOLUENE,2,6-	4.0E+01	noncarcinogenic effects			4.0E+01
ANTHRACENE	1.8E+03	noncarcinogenic effects			1.8E+03
ANTIMONY	8.0E+00	noncarcinogenic effects			8.0E+00
ARSENIC	5.2E-02	carcinogenic effects	5.2E-02		6.0E+00
ATRAZINE	3.4E-01	carcinogenic effects	3.4E-01		7.0E+02
BARIUM	4.0E+03	noncarcinogenic effects			4.0E+03
BENOMYL	1.0E+03	noncarcinogenic effects			1.0E+03
BENZENE	4.8E-01	carcinogenic effects	4.8E-01		3.5E+01
BENZO(a)ANTHRACENE	2.9E-02	mutagenic effects	8.4E-02	2.9E-02	
BENZO(a)PYRENE	2.2E-02	mutagenic effects	7.8E-02	2.2E-02	6.0E+00
BENZO(b)FLUORANTHENE	2.2E-01	mutagenic effects	7.8E-01	2.2E-01	
BENZO(g,h,i)PERYLENE	8.0E+02	noncarcinogenic effects			8.0E+02
BENZO(k)FLUORANTHENE	2.2E+00	mutagenic effects	7.8E+00	2.2E+00	
BERYLLIUM	4.0E+01	noncarcinogenic effects			4.0E+01
BIPHENYL, 1,1-	8.3E-01	noncarcinogenic effects	9.7E+00		8.3E-01
BIS(2-CHLOROETHYL)ETHER	1.4E-02	carcinogenic effects	1.4E-02		
BIS(2-CHLORO-1-METHYLETHYL)ETHER	3.7E-01	carcinogenic effects	3.7E-01		2.1E+02
BIS(2-ETHYLHEXYL)PHTHALATE	5.6E+00	carcinogenic effects	5.6E+00		4.0E+02
BORON	4.0E+03	noncarcinogenic effects			4.0E+03
BROMODICHLOROMETHANE	1.4E-01	carcinogenic effects	1.4E-01		1.2E+02
BROMOFORM	3.4E+00	carcinogenic effects	3.4E+00		4.0E+02
BROMOMETHANE	7.6E+00	noncarcinogenic effects			7.6E+00
CADMIUM	2.0E+01	noncarcinogenic effects			2.0E+01
CARBON TETRACHLORIDE	5.1E-01	carcinogenic effects	5.1E-01		5.8E+01
CHLORDANE (TECHNICAL)	4.5E-02	carcinogenic effects	4.5E-02		1.3E+00
CHLOROANILINE, p-	3.9E-01	carcinogenic effects	3.9E-01		8.0E+01
CHLOROBENZENE	8.3E+01	noncarcinogenic effects			8.3E+01
CHLOROETHANE	2.1E+04	noncarcinogenic effects			2.1E+04
CHLOROFORM	2.2E-01	carcinogenic effects	2.2E-01		1.0E+02
CHLOROMETHANE	1.9E+02	noncarcinogenic effects			1.9E+02
CHLOROPHENOL, 2-	2.9E+01	noncarcinogenic effects			2.9E+01
CHROMIUM (Total)		not applicable			
CHROMIUM III	3.0E+04	noncarcinogenic effects			3.0E+04
CHROMIUM VI	4.3E+00	mutagenic effects	1.6E+01	4.3E+00	6.0E+01
CHRYSENE	2.2E+01	mutagenic effects	7.8E+01	2.2E+01	
COBALT	6.0E+00	noncarcinogenic effects			6.0E+00
COPPER	8.0E+02	noncarcinogenic effects			8.0E+02
CYANIDE (Free)	1.5E+00	noncarcinogenic effects			1.5E+00
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	7.1E-01	carcinogenic effects	7.1E-01		6.0E+01
DALAPON	6.0E+02	noncarcinogenic effects			6.0E+02
DIBENZO(a,h)ANTHTRACENE	2.2E-02	mutagenic effects	7.8E-02	2.2E-02	
DIBROMO,1,2- CHLOROPROPANE,3-	3.3E-04	mutagenic effects	9.3E-04	3.3E-04	3.8E-01
DIBROMOCHLOROMETHANE	9.3E-01	carcinogenic effects	9.3E-01		1.2E+02
DIBROMOETHANE, 1,2-	7.5E-03	carcinogenic effects	7.5E-03		1.7E+01
DICHLOROBENZENE, 1,2-	3.4E+02	noncarcinogenic effects			3.4E+02
DICHLOROBENZENE, 1,3-	1.8E+02	noncarcinogenic effects			1.8E+02
DICHLOROBENZENE, 1,4-	4.9E-01	carcinogenic effects	4.9E-01		7.6E+02
DICHLOROBENZIDINE, 3,3-	1.7E-01	carcinogenic effects	1.7E-01		
DICHLORODIPHENYLDICHLOROETHANE (DDD)	3.2E-01	carcinogenic effects	3.2E-01		
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	4.6E-02	carcinogenic effects	4.6E-02		
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	2.3E-01	carcinogenic effects	2.3E-01		1.0E+01
DICHLOROETHANE, 1,1-	2.8E+00	carcinogenic effects	2.8E+00		1.2E+03
DICHLOROETHANE, 1,2-	1.7E-01	carcinogenic effects	1.7E-01		1.3E+01
DICHLOROETHYLENE, 1,1-	2.9E+02	noncarcinogenic effects			2.9E+02
DICHLOROETHYLENE, Cis 1,2-	1.2E+01	noncarcinogenic effects			1.2E+01
DICHLOROETHYLENE, Trans 1,2-	1.2E+02	noncarcinogenic effects			1.2E+02
DICHLOROPHENOL, 2,4-	6.0E+01	noncarcinogenic effects			6.0E+01
DICHLOROPHENOXYACETIC ACID (2,4-D)	2.0E+02	noncarcinogenic effects			2.0E+02
DICHLOROPROPANE, 1,2-	8.8E-01	carcinogenic effects	8.8E-01		8.3E+00
DICHLOROPROPENE, 1,3-	5.0E-01	carcinogenic effects	5.0E-01		3.9E+01
DIELDRIN	1.1E-02	carcinogenic effects	1.1E-02		1.6E+00
DIETHYLPHTHALATE	1.6E+04	noncarcinogenic effects			1.6E+04
DIMETHYLPHENOL, 2,4-	4.0E+02	noncarcinogenic effects			4.0E+02
DIMETHYLPHTHALATE	2.0E+05	noncarcinogenic effects			2.0E+05
DINITROBENZENE, 1,3-	2.0E+00	noncarcinogenic effects			2.0E+00
DINITROPHENOL, 2,4-	4.0E+01	noncarcinogenic effects			4.0E+01
DINITROTOLUENE, 2,4- (2,4-DNT)	2.5E-01	carcinogenic effects	2.5E-01		4.0E+01
DINITROTOLUENE, 2,6- (2,6-DNT)	5.2E-02	carcinogenic effects	5.2E-02		6.0E+00

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
DIOXANE, 1,4-	4.6E-01	carcinogenic effects	4.6E-01		5.7E+01
DIOXINS (TEQ)	1.2E-07	carcinogenic effects	1.2E-07		3.7E-05
DIURON	4.0E+01	noncarcinogenic effects			4.0E+01
ENDOSULFAN	1.2E+02	noncarcinogenic effects			1.2E+02
ENDRIN	6.0E+00	noncarcinogenic effects			6.0E+00
ETHANOL					
ETHYLBENZENE	1.7E+00	carcinogenic effects	1.7E+00		1.0E+03
FLUORANTHENE	8.0E+02	noncarcinogenic effects			8.0E+02
FLUORENE	2.4E+02	noncarcinogenic effects			2.4E+02
GLYPHOSATE	2.0E+03	noncarcinogenic effects			2.0E+03
HEPTACHLOR	3.5E-03	carcinogenic effects	3.5E-03		1.0E+01
HEPTACHLOR EPOXIDE	1.7E-03	carcinogenic effects	1.7E-03		2.6E-01
HEXACHLOROBENZENE	9.8E-03	carcinogenic effects	9.8E-03		1.6E+01
HEXACHLOROBUTADIENE	2.0E-01	carcinogenic effects	2.0E-01		2.0E+01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	7.1E-02	carcinogenic effects	7.1E-02		6.0E+00
HEXACHLOROETHANE	4.0E-01	carcinogenic effects	4.0E-01		1.1E+01
HEXAZINONE	6.6E+02	noncarcinogenic effects			6.6E+02
INDENO(1,2,3-cd)PYRENE	2.2E-01	mutagenic effects	7.8E-01	2.2E-01	
ISOPHORONE	8.2E+01	carcinogenic effects	8.2E+01		4.0E+03
LEAD					
MERCURY	6.0E+00	noncarcinogenic effects			6.0E+00
METHOXYCHLOR	1.0E+02	noncarcinogenic effects			1.0E+02
METHYL ETHYL KETONE	5.6E+03	noncarcinogenic effects			5.6E+03
METHYL ISOBUTYL KETONE	6.3E+03	noncarcinogenic effects			6.3E+03
METHYL MERCURY	2.0E+00	noncarcinogenic effects			2.0E+00
METHYL TERT BUTYL ETHER	1.4E+01	carcinogenic effects	1.4E+01		6.3E+03
METHYLENE CHLORIDE	1.0E+01	mutagenic effects	3.6E+01	1.0E+01	1.1E+02
METHYLNAPHTHALENE, 1-	2.7E+01	carcinogenic effects	2.7E+01		4.1E+02
METHYLNAPHTHALENE, 2-	2.4E+01	noncarcinogenic effects			2.4E+01
MOLYBDENUM	1.0E+02	noncarcinogenic effects			1.0E+02
NAPHTHALENE	1.7E-01	carcinogenic effects	1.7E-01		6.2E+00
NICKEL	4.0E+02	noncarcinogenic effects			4.0E+02
NITROBENZENE	1.4E-01	carcinogenic effects	1.4E-01		1.3E+01
NITROGLYCERIN	2.0E+00	noncarcinogenic effects	4.6E+00		2.0E+00
NITROTOLUENE, 2-	3.5E-01	carcinogenic effects	3.5E-01		5.3E+00
NITROTOLUENE, 3-	2.0E+00	noncarcinogenic effects			2.0E+00
NITROTOLUENE, 4-	4.9E+00	carcinogenic effects	4.9E+00		8.0E+01
PENTACHLOROPHENOL	1.9E-01	carcinogenic effects	1.9E-01		1.0E+02
PENTAERYTHRITOLTETRANITRATE (PETN)	1.9E+01	carcinogenic effects	1.9E+01		4.0E+01
PERCHLORATE	1.4E+01	noncarcinogenic effects			1.4E+01
PHENANTHRENE	2.1E+02	noncarcinogenic effects			2.1E+02
PHENOL	6.0E+03	noncarcinogenic effects			6.0E+03
POLYCHLORINATED BIPHENYLS (PCBs)	7.9E-03	carcinogenic effects	7.9E-03		4.0E-01
PROPICONAZOLE	2.0E+03	noncarcinogenic effects			2.0E+03
PYRENE	1.8E+02	noncarcinogenic effects			1.8E+02
SELENIUM	1.0E+02	noncarcinogenic effects			1.0E+02
SILVER	1.0E+02	noncarcinogenic effects			1.0E+02
SIMAZINE	6.5E-01	carcinogenic effects	6.5E-01		1.0E+02
STYRENE	1.4E+03	noncarcinogenic effects			1.4E+03
TERBACIL	2.6E+02	noncarcinogenic effects			2.6E+02
tert-BUTYL ALCOHOL	5.2E+00	carcinogenic effects	5.2E+00		
TETRACHLOROETHANE, 1,1,1,2-	6.1E-01	carcinogenic effects	6.1E-01		1.8E+02
TETRACHLOROETHANE, 1,1,2,2-	7.8E-02	carcinogenic effects	7.8E-02		4.0E+02
TETRACHLOROETHYLENE	7.4E-01	carcinogenic effects	7.4E-01		4.9E+01
TETRACHLOROPHENOL, 2,3,4,6-	6.0E+02	noncarcinogenic effects			6.0E+02
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	1.0E+03	noncarcinogenic effects			1.0E+03
THALLIUM	2.0E-01	noncarcinogenic effects			2.0E-01
TOLUENE	1.4E+03	noncarcinogenic effects			1.4E+03
TOXAPHENE	7.1E-02	carcinogenic effects	7.1E-02		
TPH (gasolines)	3.0E+02	noncarcinogenic effects			3.0E+02
TPH (middle distillates)	4.0E+02	noncarcinogenic effects			4.0E+02
TPH (residual fuels)	2.4E+03	noncarcinogenic effects			2.4E+03
TRICHLOROBENZENE, 1,2,4-	2.7E+00	carcinogenic effects	2.7E+00		4.1E+00
TRICHLOROETHANE, 1,1,1-	8.3E+03	noncarcinogenic effects			8.3E+03
TRICHLOROETHANE, 1,1,2-	2.8E-01	carcinogenic effects	2.8E-01		4.1E-01
TRICHLOROETHYLENE	2.4E-01	mutagenic effects	7.6E-01	2.4E-01	2.9E+00
TRICHLOROPHENOL, 2,4,5-	2.0E+03	noncarcinogenic effects			2.0E+03
TRICHLOROPHENOL, 2,4,6-	7.1E+00	carcinogenic effects	7.1E+00		2.0E+01
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	2.0E+02	noncarcinogenic effects			2.0E+02
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	1.6E+02	noncarcinogenic effects			1.6E+02
TRICHLOROPROPANE, 1,2,3-	7.2E-04	mutagenic effects	2.6E-03	7.2E-04	6.2E-01
TRICHLOROPROPENE, 1,2,3-	6.2E-01	noncarcinogenic effects			6.2E-01
TRIFLURALIN	1.0E+01	carcinogenic effects	1.0E+01		1.5E+02
TRINITROBENZENE, 1,3,5-	6.0E+02	noncarcinogenic effects			6.0E+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
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.0E+01	noncarcinogenic effects			4.0E+01
TRINITROTOLUENE, 2,4,6- (TNT)	2.6E+00	carcinogenic effects	2.6E+00		1.0E+01
VANADIUM	1.0E+02	noncarcinogenic effects			1.0E+02
VINYL CHLORIDE	2.0E-02	carcinogenic effects	2.0E-02	2.8E-02	4.7E+01
XYLENES	2.1E+02	noncarcinogenic effects			2.1E+02
ZINC	6.0E+03	noncarcinogenic effects			6.0E+03

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	1.5E+01	3.2E+02	1.5E+01	5.7E+02	2.0E+01	3.2E+02
ACENAPHTHYLENE	1.3E+01	3.0E+02	1.3E+01	3.0E+02	3.1E+02	3.0E+02
ACETONE	1.5E+03	1.5E+04	1.7E+03	1.5E+04	1.5E+03	2.8E+04
ALDRIN	1.4E-04	1.3E+00	3.5E-02	3.0E+00	1.4E-04	1.3E+00
AMETRYN	7.0E+02	1.8E+03	7.0E+02	1.8E+03	7.0E+02	1.8E+03
AMINO,2- DINITROTOLUENE,4,6-	1.8E+01	1.6E+02	1.8E+01	1.6E+02	2.0E+01	1.8E+02
AMINO,4- DINITROTOLUENE,2,6-	1.1E+01	9.8E+01	1.1E+01	9.8E+01	1.1E+01	9.8E+01
ANTHRACENE	2.0E-02	1.8E-01	2.0E-02	1.8E-01	7.3E-01	1.3E+01
ANTIMONY	3.0E+01	1.8E+02	1.3E+02	3.0E+03	3.0E+01	1.8E+02
ARSENIC	3.6E+01	6.9E+01	1.9E+02	3.6E+02	3.6E+01	6.9E+01
ATRAZINE	1.2E+01	3.3E+02	1.2E+01	3.3E+02	1.2E+01	3.3E+02
BARIUM	2.2E+02	2.0E+03	2.2E+02	2.0E+03	2.2E+02	2.0E+03
BENOMYL	1.4E-01	2.8E+00	1.4E-01	2.8E+00	1.4E-01	2.8E+00
BENZENE	7.1E+01	1.7E+03	1.6E+02	1.8E+03	7.1E+01	1.7E+03
BENZO(a)ANTHRACENE	2.7E-02	3.0E+02	4.7E+00	3.0E+02	2.7E-02	3.0E+02
BENZO(a)PYRENE	6.0E-02	3.0E+02	6.0E-02	3.0E+02	3.0E-01	3.0E+02
BENZO(b)FLUORANTHENE	6.8E-01	3.0E+02	2.6E+00	3.0E+02	6.8E-01	3.0E+02
BENZO(g,h,i)PERYLENE	4.4E-01	3.0E+02	4.4E-01	3.0E+02	4.4E-01	3.0E+02
BENZO(k)FLUORANTHENE	6.4E-01	3.0E+02	6.4E-01	3.0E+02	6.4E-01	3.0E+02
BERYLLIUM	6.6E-01	3.5E+01	1.1E+01	4.3E+01	6.6E-01	3.5E+01
BIPHENYL, 1,1-	6.5E+00	2.6E+01	6.5E+00	2.6E+01	1.4E+01	2.6E+01
BIS(2-CHLOROETHYL)ETHER	2.4E+03	2.4E+04	2.4E+03	2.4E+04	2.4E+03	2.4E+04
BIS(2-CHLORO-1-METHYLETHYL)ETHER	3.7E-01	3.7E-01	3.7E-01	3.7E-01	3.7E-01	3.7E-01
BIS(2-ETHYLHEXYL)PHTHALATE	3.0E+00	2.7E+01	3.0E+00	2.7E+01	3.0E+00	2.7E+01
BORON	1.0E+03	3.4E+04	7.2E+03	3.4E+04	1.0E+03	3.4E+04
BROMODICHLOROMETHANE	3.4E+02	3.1E+03	3.4E+02	3.1E+03	3.4E+02	3.1E+03
BROMOFORM	2.3E+02	1.1E+03	2.3E+02	1.1E+03	3.2E+02	2.3E+03
BROMOMETHANE	1.6E+01	3.8E+01	1.6E+01	3.8E+01	1.6E+01	3.8E+01
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	7.7E+01	1.2E+04	9.8E+00	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-	1.9E+01	4.6E+02	1.9E+01	4.6E+02	1.9E+01	4.6E+02
CHLOROBENZENE	2.5E+01	2.2E+02	2.5E+01	2.2E+02	6.4E+01	1.1E+03
CHLOROETHANE	2.1E+04	2.1E+04	2.1E+04	2.1E+04	2.1E+04	2.1E+04
CHLOROFORM	2.8E+01	4.9E+02	1.4E+02	9.6E+03	2.8E+01	4.9E+02
CHLOROMETHANE	1.9E+02	1.9E+02	1.9E+02	1.9E+02	1.9E+02	1.9E+02
CHLOROPHENOL, 2-	3.2E+01	4.0E+02	3.2E+01	1.4E+03	4.0E+02	4.0E+02
CHROMIUM (Total)	1.1E+01	1.6E+01	1.1E+01	1.6E+01	5.0E+01	1.0E+03
CHROMIUM III	2.0E+01	5.7E+02	7.4E+01	5.7E+02	2.0E+01	5.7E+02
CHROMIUM VI	1.1E+01	1.6E+01	1.1E+01	1.6E+01	5.0E+01	1.1E+03
CHRYSENE	2.0E+00	3.0E+02	4.7E+00	3.0E+02	2.0E+00	3.0E+02
COBALT	1.9E+01	1.2E+02	1.9E+01	1.2E+02	2.3E+01	1.5E+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)
COPPER	2.9E+00	2.9E+00	6.0E+00	6.0E+00	2.9E+00	2.9E+00
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)	7.9E+01	5.2E+02	7.9E+01	5.2E+02	1.9E+02	7.0E+02
DALAPON	3.0E+02	3.0E+03	3.0E+02	3.0E+03	3.0E+02	3.0E+03
DIBENZO(a,h)ANTHTRACENE	8.0E-01	3.0E+02	8.0E-01	3.0E+02	7.1E+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	3.4E+01	2.9E+03	3.2E+02	2.9E+03	3.4E+01	2.9E+03
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	2.3E+01	3.7E+02	1.4E+01	6.6E+02
DICHLOROBENZENE, 1,3-	2.2E+01	3.7E+02	2.2E+01	3.7E+02	7.1E+01	6.6E+02
DICHLOROBENZENE, 1,4-	9.4E+00	3.7E+02	9.4E+00	3.7E+02	1.5E+01	6.6E+02
DICHLOROBENZIDINE, 3,3-	4.5E+00	4.1E+01	4.5E+00	4.1E+01	4.5E+00	4.1E+01
DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.1E-02	1.9E-01	1.1E-02	1.9E-01	1.1E-02	1.9E-01
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	4.1E-01	7.0E+00	4.1E-01	7.0E+00	4.1E-01	7.0E+00
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	8.3E+02	4.1E+02	3.7E+03	4.7E+01	8.3E+02
DICHLOROETHANE, 1,2-	9.1E+02	3.8E+04	2.0E+03	3.9E+04	9.1E+02	3.8E+04
DICHLOROETHYLENE, 1,1-	2.5E+01	3.9E+03	1.3E+02	3.9E+03	2.5E+01	7.5E+04
DICHLOROETHYLENE, Cis 1,2-	6.2E+02	5.5E+03	6.2E+02	5.5E+03	6.2E+02	5.5E+03
DICHLOROETHYLENE, Trans 1,2-	5.6E+02	1.0E+04	5.6E+02	1.0E+04	5.6E+02	1.0E+04
DICHLOROPHENOL, 2,4-	1.1E+01	6.7E+02	1.1E+01	6.7E+02	7.9E+02	7.9E+02
DICHLOROPHENOXYACETIC ACID (2,4-D)	7.0E+01	1.3E+02	7.9E+01	1.3E+02	7.0E+01	1.3E+02
DICHLOROPROPANE, 1,2-	5.2E+02	3.4E+03	5.2E+02	7.7E+03	5.2E+02	3.4E+03
DICHLOROPROPENE, 1,3-	6.0E-02	2.6E+02	1.7E+00	2.0E+03	6.0E-02	2.6E+02
DIELDRIN	1.9E-03	7.1E-01	1.9E-03	2.5E+00	1.9E-03	7.1E-01
DIETHYLPHTHALATE	2.1E+02	9.8E+02	2.2E+02	9.8E+02	2.1E+02	1.8E+03
DIMETHYLPHENOL, 2,4-	1.2E+02	7.0E+02	1.2E+02	7.0E+02	1.2E+02	1.1E+03
DIMETHYLPHTHALATE	1.1E+03	3.2E+03	1.1E+03	3.2E+03	2.9E+03	3.2E+03
DINITROBENZENE, 1,3-	1.0E+01	1.0E+02	2.2E+01	1.0E+02	1.0E+01	1.1E+02
DINITROPHENOL, 2,4-	1.4E+01	3.8E+02	7.1E+01	3.8E+02	1.4E+01	3.8E+02
DINITROTOLUENE, 2,4- (2,4-DNT)	9.1E+00	1.1E+02	4.4E+01	1.1E+02	9.1E+00	2.0E+02
DINITROTOLUENE, 2,6- (2,6-DNT)	8.1E+01	1.1E+02	8.1E+01	1.1E+02	8.1E+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)	3.1E-09	3.0E-03	3.1E-09	3.0E-03	3.1E-09	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	7.3E+00	1.4E+02	6.1E+01	1.1E+04	7.3E+00	1.4E+02
FLUORANTHENE	8.0E-01	1.3E+01	8.0E-01	1.3E+03	7.1E+00	1.3E+01
FLUORENE	3.9E+00	3.0E+02	1.9E+01	3.0E+02	3.9E+00	3.0E+02
GLYPHOSATE	1.8E+03	2.2E+04	1.8E+03	2.2E+04	1.8E+03	2.2E+04

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	3.6E-03	5.3E-02	3.8E-03	5.2E-01	3.6E-03	5.3E-02
HEPTACHLOR EPOXIDE	3.6E-03	5.3E-02	3.8E-03	5.2E-01	3.6E-03	5.3E-02
HEXACHLOROBENZENE	3.0E-04	3.0E-04	3.0E-04	3.0E-04	3.0E-04	3.0E-04
HEXACHLOROBUTADIENE	3.0E-01	1.1E+01	1.0E+00	3.0E+01	3.0E-01	1.1E+01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	6.3E-02	1.6E-01	8.0E-02	2.0E+00	6.3E-02	1.6E-01
HEXACHLOROETHANE	1.2E+01	3.1E+02	1.2E+01	3.3E+02	1.2E+01	3.1E+02
HEXAZINONE	1.7E+04	1.4E+05	1.7E+04	1.4E+05	1.7E+04	1.4E+05
INDENO(1,2,3-cd)PYRENE	2.8E-01	3.0E+02	2.8E-01	3.0E+02	2.8E-01	3.0E+02
ISOPHORONE	9.2E+02	4.3E+03	9.2E+02	3.9E+04	9.2E+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	7.0E-01	3.0E-02	7.0E-01	3.0E-02	7.0E-01
METHYL ETHYL KETONE	1.4E+04	2.0E+05	2.2E+04	2.0E+05	1.4E+04	2.4E+05
METHYL ISOBUTYL KETONE	1.7E+02	2.2E+03	1.7E+02	2.2E+03	1.7E+02	2.2E+03
METHYL MERCURY	2.8E-03	9.9E-02	2.8E-03	9.9E-02	2.8E-03	9.9E-02
METHYL TERT BUTYL ETHER	7.3E+02	6.5E+03	7.3E+02	6.5E+03	1.8E+04	5.3E+04
METHYLENE CHLORIDE	1.5E+03	8.5E+03	1.5E+03	8.5E+03	2.2E+03	2.6E+04
METHYLNAPHTHALENE, 1-	2.1E+00	3.7E+01	2.1E+00	3.7E+01	2.1E+00	3.7E+01
METHYLNAPHTHALENE, 2-	4.7E+00	4.2E+01	4.7E+00	4.2E+01	7.2E+01	8.6E+01
MOLYBDENUM	3.7E+02	7.2E+03	8.0E+02	7.2E+03	3.7E+02	1.6E+04
NAPHTHALENE	1.2E+01	7.7E+02	2.1E+01	7.7E+02	1.2E+01	7.8E+02
NICKEL	5.0E+00	5.0E+00	5.0E+00	5.0E+00	8.3E+00	7.5E+01
NITROBENZENE	3.8E+02	2.0E+03	3.8E+02	9.0E+03	3.8E+02	2.0E+03
NITROGLYCERIN	1.8E+01	1.6E+02	1.8E+01	1.6E+02	1.8E+01	1.6E+02
NITROTOLUENE, 2-	7.1E+01	6.4E+02	7.1E+01	6.4E+02	7.1E+01	6.4E+02
NITROTOLUENE, 3-	4.2E+01	3.8E+02	4.2E+01	3.8E+02	4.2E+01	3.8E+02
NITROTOLUENE, 4-	4.6E+01	4.1E+02	4.6E+01	4.1E+02	4.6E+01	4.1E+02
PENTACHLOROPHENOL	7.9E+00	1.3E+01	1.3E+01	2.0E+01	7.9E+00	1.3E+01
PENTAERYTHRITOLTETRANITRATE (PETN)	8.5E+05	8.5E+05	8.5E+05	8.5E+05	8.5E+05	8.5E+05
PERCHLORATE	6.0E+02	5.0E+03	6.0E+02	5.0E+03	6.0E+02	5.0E+03
PHENANTHRENE	2.3E+00	3.0E+02	2.3E+00	3.0E+02	4.6E+00	3.0E+02
PHENOL	5.8E+01	3.0E+02	1.6E+02	4.7E+03	5.8E+01	3.0E+02
POLYCHLORINATED BIPHENYLS (PCBs)	1.4E-02	2.0E+00	1.4E-02	2.0E+00	3.0E-02	1.0E+01
PROPICONAZOLE	9.5E+01	4.3E+02	9.5E+01	4.3E+02	9.5E+01	4.3E+02
PYRENE	4.6E+00	3.0E+02	4.6E+00	3.0E+02	1.0E+01	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-01	1.0E+00	1.0E+00	1.0E+00	1.0E-01	2.3E+00
SIMAZINE	9.0E+00	8.0E+01	9.0E+00	8.0E+01	9.0E+00	8.0E+01
STYRENE	3.2E+01	2.9E+02	3.2E+01	2.9E+02	3.2E+01	2.9E+02
TERBACIL	2.6E+02	2.6E+02	1.2E+03	2.3E+04	2.6E+02	2.6E+02
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-	1.1E+01	7.7E+02	8.5E+01	3.1E+03	1.1E+01	7.7E+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)**
TETRACHLOROETHANE, 1,1,2,2-	2.0E+02	9.1E+02	2.0E+02	9.1E+02	6.1E+02	3.0E+03
TETRACHLOROETHYLENE	5.3E+01	1.8E+03	5.3E+01	1.8E+03	1.5E+02	3.4E+03
TETRACHLOROPHENOL, 2,3,4,6-	1.2E+00	1.1E+01	1.2E+00	1.1E+01	1.2E+00	1.1E+01
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	2.2E+02	1.2E+03	2.2E+02	1.2E+03	3.3E+02	1.9E+03
THALLIUM	6.0E+00	4.7E+02	6.0E+00	4.7E+02	1.2E+01	7.1E+02
TOLUENE	9.8E+00	2.1E+03	6.2E+01	5.8E+03	9.8E+00	2.1E+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-	1.1E+02	4.2E+02	1.3E+02	4.2E+02	1.1E+02	7.0E+02
TRICHLOROETHANE, 1,1,1-	1.1E+01	6.0E+03	7.6E+01	6.0E+03	1.1E+01	1.0E+04
TRICHLOROETHANE, 1,1,2-	7.3E+02	5.2E+03	7.3E+02	6.0E+03	1.2E+03	5.2E+03
TRICHLOROETHYLENE	4.7E+01	7.0E+02	2.0E+02	1.5E+04	4.7E+01	7.0E+02
TRICHLOROPHENOL, 2,4,5-	1.9E+00	1.7E+01	1.9E+00	1.7E+01	1.2E+01	2.6E+02
TRICHLOROPHENOL, 2,4,6-	4.9E+00	3.9E+01	4.9E+00	3.9E+01	6.5E+00	3.9E+01
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	2.7E+02	3.0E+01	2.7E+02	5.0E+01	2.7E+02
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	1.1E+00	2.1E+01	1.1E+00	2.1E+01	1.1E+00	2.1E+01
TRINITROBENZENE, 1,3,5-	1.0E+01	2.7E+01	1.1E+01	2.7E+01	1.0E+01	3.0E+01
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.0E+01	4.0E+01	4.0E+01	4.0E+01	4.0E+01	4.0E+01
TRINITROTOLUENE, 2,4,6- (TNT)	1.3E+01	2.1E+02	1.3E+01	2.1E+02	9.0E+01	5.7E+02
VANADIUM	2.7E+01	9.0E+01	2.7E+01	1.2E+02	8.1E+01	9.0E+01
VINYL CHLORIDE	9.3E+02	8.4E+03	9.3E+02	8.4E+03	9.3E+02	8.4E+03
XYLENES	1.3E+01	2.3E+02	2.7E+01	2.4E+02	1.3E+01	2.3E+02
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	1.5E+01	USEPA Chronic FW	1.5E+01	USEPA Chronic FW	2.0E+01	USEPA Chronic SW
ACENAPHTHYLENE	1.3E+01	USEPA Chronic FW	1.3E+01	USEPA Chronic FW	3.1E+02	USEPA Chronic SW
ACETONE	1.5E+03	USEPA Chronic SW	1.7E+03	USEPA Chronic FW	1.5E+03	USEPA Chronic SW
ALDRIN	1.4E-04	USEPA Chronic SW	3.5E-02	USEPA Chronic FW	1.4E-04	USEPA Chronic SW
AMETRYN	7.0E+02	USEPA Off Pesticides (FW)	7.0E+02	USEPA Off Pesticides	7.0E+02	USEPA Off Pesticides (FW)
AMINO,2- DINITROTOLUENE,4,6-	1.8E+01	USEPA Chronic FW	1.8E+01	USEPA Chronic FW	2.0E+01	USEPA Chronic SW
AMINO,4- DINITROTOLUENE,2,6-	1.1E+01	USEPA Reg IV (FW)	1.1E+01	USEPA Chronic FW	1.1E+01	USEPA Reg IV (FW)
ANTHRACENE	2.0E-02	USEPA Chronic FW	2.0E-02	USEPA Chronic FW	7.3E-01	USEPA Chronic SW
ANTIMONY	3.0E+01	USEPA Chronic SW	1.3E+02	USEPA Chronic FW	3.0E+01	USEPA Chronic SW
ARSENIC	3.6E+01	Hawaii Chronic SW WQS	1.9E+02	Hawaii Chronic FW WQS	3.6E+01	Hawaii Chronic SW WQS
ATRAZINE	1.2E+01	USEPA Reg IV (FW)	1.2E+01	USEPA Chronic FW	1.2E+01	USEPA Reg IV (FW)
BARIUM	2.2E+02	USEPA Chronic SW	2.2E+02	USEPA Chronic FW	2.2E+02	USEPA Chronic SW
BENOMYL	1.4E-01	5% USGS 2012 FW acute	1.4E-01	5% USGS 2012 acute	1.4E-01	5% USGS 2012 FW acute
BENZENE	7.1E+01	USEPA Chronic SW	1.6E+02	USEPA Chronic FW	7.1E+01	USEPA Chronic SW
BENZO(a)ANTHRACENE	2.7E-02	USEPA Chronic SW	4.7E+00	USEPA Chronic FW	2.7E-02	USEPA Chronic SW
BENZO(a)PYRENE	6.0E-02	USEPA Chronic FW	6.0E-02	USEPA Chronic FW	3.0E-01	USEPA Chronic SW
BENZO(b)FLUORANTHENE	6.8E-01	USEPA Chronic SW	2.6E+00	USEPA Chronic FW	6.8E-01	USEPA Chronic SW
BENZO(g,h,i)PERYLENE	4.4E-01	USEPA Chronic SW	4.4E-01	USEPA Chronic FW	4.4E-01	USEPA Chronic SW
BENZO(k)FLUORANTHENE	6.4E-01	USEPA Chronic SW	6.4E-01	USEPA Chronic FW	6.4E-01	USEPA Chronic SW
BERYLLIUM	6.6E-01	USEPA Chronic SW	1.1E+01	USEPA Chronic FW	6.6E-01	USEPA Chronic SW
BIPHENYL, 1,1-	6.5E+00	USEPA Chronic FW	6.5E+00	USEPA Chronic FW	1.4E+01	USEPA Chronic SW
BIS(2-CHLOROETHYL)ETHER	2.4E+03	USDOE Chronic (FW)	2.4E+03	USDOE Chronic	2.4E+03	USDOE Chronic (FW)
BIS(2-CHLORO-1-METHYLETHYL)ETHER	3.7E-01	=Drinking Water Toxicity	3.7E-01	=Drinking Water Toxicity)	3.7E-01	=Drinking Water Toxicity
BIS(2-ETHYLHEXYL)PHTHALATE	3.0E+00	USEPA Chronic SW	3.0E+00	USEPA Chronic FW	3.0E+00	USEPA Chronic SW
BORON	1.0E+03	USEPA Chronic SW	7.2E+03	USEPA Chronic FW	1.0E+03	USEPA Chronic SW
BROMODICHLOROMETHANE	3.4E+02	USEPA Reg IV (FW)	3.4E+02	USEPA Chronic FW	3.4E+02	USEPA Reg IV (FW)
BROMOFORM	2.3E+02	USEPA Chronic FW	2.3E+02	USEPA Chronic FW	3.2E+02	USEPA Chronic SW
BROMOMETHANE	1.6E+01	USEPA Reg IV (FW)	1.6E+01	USEPA Chronic FW	1.6E+01	USEPA Reg IV (FW)
CADMIUM	3.0E+00	Hawaii Chronic FW WQS	3.0E+00	Hawaii Chronic FW WQS	9.3E+00	Hawaii Chronic SW WQS
CARBON TETRACHLORIDE	9.8E+00	USEPA Chronic SW	7.7E+01	USEPA Chronic FW	9.8E+00	USEPA Chronic SW
CHLORDANE (TECHNICAL)	4.0E-03	Hawaii Chronic SW WQS	4.3E-03	Hawaii Chronic FW WQS	4.0E-03	Hawaii Chronic SW WQS
CHLOROANILINE, p-	1.9E+01	USEPA Reg IV (FW)	1.9E+01	USEPA Chronic FW	1.9E+01	USEPA Reg IV (FW)
CHLOROBENZENE	2.5E+01	USEPA Chronic FW	2.5E+01	USEPA Chronic FW	6.4E+01	USEPA Chronic SW
CHLOROETHANE	2.1E+04	=Drinking Water Toxicity	2.1E+04	=Drinking Water Toxicity)	2.1E+04	=Drinking Water Toxicity
CHLOROFORM	2.8E+01	USEPA Chronic SW	1.4E+02	USEPA Chronic FW	2.8E+01	USEPA Chronic SW
CHLOROMETHANE	1.9E+02	=Drinking Water Toxicity	1.9E+02	=Drinking Water Toxicity)	1.9E+02	=Drinking Water Toxicity
CHLOROPHENOL, 2-	3.2E+01	USEPA Chronic FW	3.2E+01	USEPA Chronic FW	4.0E+02	USEPA Chronic SW
CHROMIUM (Total)	1.1E+01	Reg IV Cr VI	1.1E+01	Reg IV Cr VI	5.0E+01	Reg IV Cr VI
CHROMIUM III	2.0E+01	USEPA Chronic SW	7.4E+01	USEPA Chronic FW	2.0E+01	USEPA Chronic SW
CHROMIUM VI	1.1E+01	Hawaii Chronic FW WQS	1.1E+01	Hawaii Chronic FW WQS	5.0E+01	Hawaii Chronic SW WQS
CHRYSENE	2.0E+00	USEPA Chronic SW	4.7E+00	USEPA Chronic FW	2.0E+00	USEPA Chronic SW
COBALT	1.9E+01	USEPA Chronic FW	1.9E+01	USEPA Chronic FW	2.3E+01	USEPA Chronic SW

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	Hawaii Chronic SW WQS	6.0E+00	Hawaii Chronic FW WQS	2.9E+00	Hawaii Chronic SW WQS
CYANIDE (Free)	1.0E+00	Hawaii Chronic SW WQS	5.2E+00	Hawaii Chronic FW WQS	1.0E+00	Hawaii Chronic SW WQS
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	7.9E+01	USEPA Chronic FW	7.9E+01	USEPA Chronic FW	1.9E+02	USEPA Chronic SW
DALAPON	3.0E+02	USEPA AQUIRE (5% FW LC50)	3.0E+02	USEPA AQUIRE (5% FW LC50)	3.0E+02	USEPA AQUIRE (5% FW LC50)
DIBENZO(a,h)ANTHTRACENE	8.0E-01	USEPA Chronic FW	8.0E-01	USEPA Chronic FW	7.1E+00	USEPA Chronic SW
DIBROMO,1,2- CHLOROPROPANE,3-	4.0E-02	=Drinking Water Toxicity	4.0E-02	=Drinking Water Toxicity)	4.0E-02	=Drinking Water Toxicity
DIBROMOCHLOROMETHANE	3.4E+01	USEPA Chronic SW	3.2E+02	USEPA Chronic FW	3.4E+01	USEPA Chronic SW
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 Chronic SW	2.3E+01	USEPA Chronic FW	1.4E+01	USEPA Chronic SW
DICHLOROBENZENE, 1,3-	2.2E+01	USEPA Chronic FW	2.2E+01	USEPA Chronic FW	7.1E+01	USEPA Chronic SW
DICHLOROBENZENE, 1,4-	9.4E+00	USEPA Chronic FW	9.4E+00	USEPA Chronic FW	1.5E+01	USEPA Chronic SW
DICHLOROBENZIDINE, 3,3-	4.5E+00	USEPA Reg IV (FW)	4.5E+00	USEPA Chronic FW	4.5E+00	USEPA Reg IV (FW)
DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.1E-02	USEPA Chronic SW	1.1E-02	USEPA Chronic FW	1.1E-02	USEPA Chronic SW
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	4.1E-01	USEPA Reg IV (FW)	4.1E-01	USEPA Chronic FW	4.1E-01	USEPA Reg IV (FW)
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.0E-03	Hawaii Chronic SW WQS	1.0E-03	Hawaii Chronic FW WQS	1.0E-03	Hawaii Chronic SW WQS
DICHLOROETHANE, 1,1-	4.7E+01	USEPA Chronic SW	4.1E+02	USEPA Chronic FW	4.7E+01	USEPA Chronic SW
DICHLOROETHANE, 1,2-	9.1E+02	USEPA Chronic SW	2.0E+03	USEPA Chronic FW	9.1E+02	USEPA Chronic SW
DICHLOROETHYLENE, 1,1-	2.5E+01	USEPA Chronic SW	1.3E+02	USEPA Chronic FW	2.5E+01	USEPA Chronic SW
DICHLOROETHYLENE, Cis 1,2-	6.2E+02	USEPA Reg IV (FW)	6.2E+02	USEPA Chronic FW	6.2E+02	USEPA Reg IV (FW)
DICHLOROETHYLENE, Trans 1,2-	5.6E+02	USEPA Reg IV (FW)	5.6E+02	USEPA Chronic FW	5.6E+02	USEPA Reg IV (FW)
DICHLOROPHENOL, 2,4-	1.1E+01	USEPA Chronic FW	1.1E+01	USEPA Chronic FW	7.9E+02	USEPA Chronic SW
DICHLOROPHENOXYACETIC ACID (2,4-D)	7.0E+01	USEPA Chronic SW	7.9E+01	USEPA Chronic FW	7.0E+01	USEPA Chronic SW
DICHLOROPROPANE, 1,2-	5.2E+02	USEPA Reg IV (FW)	5.2E+02	USEPA Chronic FW	5.2E+02	USEPA Reg IV (FW)
DICHLOROPROPENE, 1,3-	6.0E-02	USEPA Chronic SW	1.7E+00	USEPA Chronic FW	6.0E-02	USEPA Chronic SW
DIELDRIN	1.9E-03	Hawaii Chronic SW WQS	1.9E-03	Hawaii Chronic FW WQS	1.9E-03	Hawaii Chronic SW WQS
DIETHYLPHTHALATE	2.1E+02	USEPA Chronic SW	2.2E+02	USEPA Chronic FW	2.1E+02	USEPA Chronic SW
DIMETHYLPHENOL, 2,4-	1.2E+02	USEPA Reg IV (FW)	1.2E+02	USEPA Chronic FW	1.2E+02	USEPA Reg IV (FW)
DIMETHYLPHTHALATE	1.1E+03	USEPA Chronic FW	1.1E+03	USEPA Chronic FW	2.9E+03	USEPA Chronic SW
DINITROBENZENE, 1,3-	1.0E+01	USEPA Chronic SW	2.2E+01	USEPA Chronic FW	1.0E+01	USEPA Chronic SW
DINITROPHENOL, 2,4-	1.4E+01	USEPA Chronic SW	7.1E+01	USEPA Chronic FW	1.4E+01	USEPA Chronic SW
DINITROTOLUENE, 2,4- (2,4-DNT)	9.1E+00	USEPA Chronic SW	4.4E+01	USEPA Chronic FW	9.1E+00	USEPA Chronic SW
DINITROTOLUENE, 2,6- (2,6-DNT)	8.1E+01	USEPA Reg IV (FW)	8.1E+01	USEPA Chronic FW	8.1E+01	USEPA Reg IV (FW)
DIOXANE, 1,4-	3.4E+05	Mohr (5% Acute FW LC 50)	3.4E+05	Mohr (5% Acute FW LC 50)	5.0E+05	Mohr (5% Acute SW LC 50)
DIOXINS (TEQ)	3.1E-09	USEPA Reg IV (FW)	3.1E-09	USEPA Chronic FW	3.1E-09	USEPA Reg IV (FW)
DIURON	6.0E+01	USEPA AQUIRE (50% FW EC50)	6.0E+01	USEPA AQUIRE (50% FW EC50)	6.0E+01	USEPA AQUIRE (50% FW EC50)
ENDOSULFAN	8.7E-03	Hawaii Chronic SW WQS	5.6E-02	Hawaii Chronic FW WQS	8.7E-03	Hawaii Chronic SW WQS
ENDRIN	2.3E-03	Hawaii Chronic SW WQS	2.3E-03	Hawaii Chronic FW WQS	2.3E-03	Hawaii Chronic SW WQS
ETHANOL		not available		not available		
ETHYLBENZENE	7.3E+00	USEPA Chronic SW	6.1E+01	USEPA Chronic FW	7.3E+00	USEPA Chronic SW
FLUORANTHENE	8.0E-01	USEPA Chronic FW	8.0E-01	USEPA Chronic FW	7.1E+00	USEPA Chronic SW
FLUORENE	3.9E+00	USEPA Chronic SW	1.9E+01	USEPA Chronic FW	3.9E+00	USEPA Chronic SW
GLYPHOSATE	1.8E+03	USEPA Off Pesticides (FW)	1.8E+03	USEPA Off Pesticides	1.8E+03	USEPA Off Pesticides (FW)

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
HEPTACHLOR	3.6E-03	Hawaii Chronic SW WQS	3.8E-03	Hawaii Chronic FW WQS	3.6E-03	Hawaii Chronic SW WQS
HEPTACHLOR EPOXIDE	3.6E-03	USEPA Chronic SW	3.8E-03	USEPA Chronic FW	3.6E-03	USEPA Chronic SW
HEXACHLOROBENZENE	3.0E-04	USEPA Reg IV (FW)	3.0E-04	USEPA Chronic FW	3.0E-04	USEPA Reg IV (FW)
HEXACHLOROBUTADIENE	3.0E-01	USEPA Chronic SW	1.0E+00	USEPA Chronic FW	3.0E-01	USEPA Chronic SW
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	6.3E-02	USEPA Chronic SW	8.0E-02	Hawaii Chronic FW WQS	6.3E-02	USEPA Chronic SW
HEXACHLOROETHANE	1.2E+01	USEPA Chronic SW	1.2E+01	USEPA Chronic FW	1.2E+01	USEPA Chronic SW
HEXAZINONE	1.7E+04	USEPA Off Pesticides (FW)	1.7E+04	USEPA Off Pesticides	1.7E+04	USEPA Off Pesticides (FW)
INDENO(1,2,3-cd)PYRENE	2.8E-01	USEPA Chronic SW	2.8E-01	USEPA Chronic FW	2.8E-01	USEPA Chronic SW
ISOPHORONE	9.2E+02	USEPA Reg IV (FW)	9.2E+02	USEPA Chronic FW	9.2E+02	USEPA Reg IV (FW)
LEAD	5.6E+00	Hawaii Chronic SW WQS	2.9E+01	Hawaii Chronic FW WQS	5.6E+00	Hawaii Chronic SW WQS
MERCURY	2.5E-02	Hawaii Chronic SW WQS	5.5E-01	Hawaii Chronic FW WQS	2.5E-02	Hawaii Chronic SW WQS
METHOXYCHLOR	3.0E-02	Hawaii Chronic SW WQS	3.0E-02	Hawaii Chronic FW WQS	3.0E-02	Hawaii Chronic SW WQS
METHYL ETHYL KETONE	1.4E+04	USEPA Chronic SW	2.2E+04	USEPA Chronic FW	1.4E+04	USEPA Chronic SW
METHYL ISOBUTYL KETONE	1.7E+02	USEPA Chronic SW	1.7E+02	USEPA Chronic FW	1.7E+02	USEPA Chronic SW
METHYL MERCURY	2.8E-03	USEPA Chronic SW	2.8E-03	USEPA Chronic FW	2.8E-03	USEPA Chronic SW
METHYL TERT BUTYL ETHER	7.3E+02	USEPA Chronic FW	7.3E+02	USEPA Chronic FW	1.8E+04	USEPA Chronic SW
METHYLENE CHLORIDE	1.5E+03	USEPA Chronic FW	1.5E+03	USEPA Chronic FW	2.2E+03	USEPA Chronic SW
METHYLNAPHTHALENE, 1-	2.1E+00	USEPA Chronic SW	2.1E+00	USEPA Chronic FW	2.1E+00	USEPA Chronic SW
METHYLNAPHTHALENE, 2-	4.7E+00	USEPA Chronic FW	4.7E+00	USEPA Chronic FW	7.2E+01	USEPA Chronic SW
MOLYBDENUM	3.7E+02	USEPA Chronic SW	8.0E+02	USEPA Chronic FW	3.7E+02	USEPA Chronic SW
NAPHTHALENE	1.2E+01	USEPA Chronic SW	2.1E+01	USEPA Chronic FW	1.2E+01	USEPA Chronic SW
NICKEL	5.0E+00	Hawaii Chronic FW WQS	5.0E+00	Hawaii Chronic FW WQS	8.3E+00	Hawaii Chronic SW WQS
NITROBENZENE	3.8E+02	USEPA Reg IV (FW)	3.8E+02	USEPA Chronic FW	3.8E+02	USEPA Reg IV (FW)
NITROGLYCERIN	1.8E+01	USEPA Reg IV (FW)	1.8E+01	USEPA Chronic FW	1.8E+01	USEPA Reg IV (FW)
NITROTOLUENE, 2-	7.1E+01	USEPA Reg IV (FW)	7.1E+01	USEPA Chronic FW	7.1E+01	USEPA Reg IV (FW)
NITROTOLUENE, 3-	4.2E+01	USEPA Reg IV (FW)	4.2E+01	USEPA Chronic FW	4.2E+01	USEPA Reg IV (FW)
NITROTOLUENE, 4-	4.6E+01	USEPA Reg IV (FW)	4.6E+01	USEPA Chronic FW	4.6E+01	USEPA Reg IV (FW)
PENTACHLOROPHENOL	7.9E+00	USEPA Chronic SW	1.3E+01	Hawaii Chronic FW WQS	7.9E+00	USEPA Chronic SW
PENTAERYTHRITOLTETRANITRATE (PETN)	8.5E+05	Pascoe et al. (chronic FW)	8.5E+05	Pascoe et al. (chronic FW)	8.5E+05	Pascoe et al. (chronic FW)
PERCHLORATE	6.0E+02	USEPA 2002	6.0E+02	USEPA 2002	6.0E+02	USEPA 2002
PHENANTHRENE	2.3E+00	USEPA Chronic FW	2.3E+00	USEPA Chronic FW	4.6E+00	USEPA Chronic SW
PHENOL	5.8E+01	USEPA Chronic SW	1.6E+02	USEPA Chronic FW	5.8E+01	USEPA Chronic SW
POLYCHLORINATED BIPHENYLS (PCBs)	1.4E-02	Hawaii Chronic FW WQS	1.4E-02	Hawaii Chronic FW WQS	3.0E-02	Hawaii Chronic SW WQS
PROPICONAZOLE	9.5E+01	USEPA Off Pesticides (FW)	9.5E+01	USEPA Off Pesticides	9.5E+01	USEPA Off Pesticides (FW)
PYRENE	4.6E+00	USEPA Chronic FW	4.6E+00	USEPA Chronic FW	1.0E+01	USEPA Chronic SW
SELENIUM	5.0E+00	Hawaii Chronic FW WQS	5.0E+00	Hawaii Chronic FW WQS	7.1E+01	Hawaii Chronic SW WQS
SILVER	1.0E-01	USEPA Chronic SW	1.0E+00	Hawaii Chronic FW WQS	1.0E-01	USEPA Chronic SW
SIMAZINE	9.0E+00	USEPA Reg IV (FW)	9.0E+00	USEPA Chronic FW	9.0E+00	USEPA Reg IV (FW)
STYRENE	3.2E+01	USEPA Reg IV (FW)	3.2E+01	USEPA Chronic FW	3.2E+01	USEPA Reg IV (FW)
TERBACIL	2.6E+02	=Drinking Water Toxicity	1.2E+03	USEPA Off Pesticides	2.6E+02	=Drinking Water Toxicity
tert-BUTYL ALCOHOL	1.8E+04	USEPA AQUIRE (10% FW LC0)	1.8E+04	USEPA AQUIRE (10% FW LC0)	1.8E+04	USEPA AQUIRE (10% FW LC0)
TETRACHLOROETHANE, 1,1,1,2-	1.1E+01	USEPA Chronic SW	8.5E+01	USEPA Chronic FW	1.1E+01	USEPA Chronic SW

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
TETRACHLOROETHANE, 1,1,2,2-	2.0E+02	USEPA Chronic FW	2.0E+02	USEPA Chronic FW	6.1E+02	USEPA Chronic SW
TETRACHLOROETHYLENE	5.3E+01	USEPA Chronic FW	5.3E+01	USEPA Chronic FW	1.5E+02	Hawaii Chronic SW WQS
TETRACHLOROPHENOL, 2,3,4,6-	1.2E+00	USEPA Reg IV (FW)	1.2E+00	USEPA Chronic FW	1.2E+00	USEPA Reg IV (FW)
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	2.2E+02	USEPA Chronic FW	2.2E+02	USEPA Chronic FW	3.3E+02	USEPA Chronic SW
THALLIUM	6.0E+00	USEPA Chronic FW	6.0E+00	USEPA Chronic FW	1.2E+01	USEPA Chronic SW
TOLUENE	9.8E+00	USEPA Chronic SW	6.2E+01	USEPA Chronic FW	9.8E+00	USEPA Chronic SW
TOXAPHENE	2.0E-04	Hawaii Chronic SW WQS	2.0E-04	Hawaii Chronic FW WQS	2.0E-04	Hawaii Chronic SW WQS
TPH (gasolines)	5.0E+02	CalEPA FW Chronic	5.0E+02	CalEPA FW Chronic	3.7E+03	CalEPA Chronic (SW)
TPH (middle distillates)	6.4E+02	CalEPA Chronic (FW)	6.4E+02	CalEPA FW Chronic	6.4E+02	CalEPA Chronic (FW)
TPH (residual fuels)	6.4E+02	CalEPA Chronic (FW)	6.4E+02	CaEPA FW Chronic	6.4E+02	CalEPA Chronic (FW)
TRICHLOROBENZENE, 1,2,4-	1.1E+02	USEPA Chronic SW	1.3E+02	USEPA Chronic FW	1.1E+02	USEPA Chronic SW
TRICHLOROETHANE, 1,1,1-	1.1E+01	USEPA Chronic SW	7.6E+01	USEPA Chronic FW	1.1E+01	USEPA Chronic SW
TRICHLOROETHANE, 1,1,2-	7.3E+02	USEPA Chronic FW	7.3E+02	USEPA Chronic FW	1.2E+03	USEPA Chronic SW
TRICHLOROETHYLENE	4.7E+01	USEPA Chronic SW	2.0E+02	USEPA Chronic FW	4.7E+01	USEPA Chronic SW
TRICHLOROPHENOL, 2,4,5-	1.9E+00	USEPA Chronic FW	1.9E+00	USEPA Chronic FW	1.2E+01	USEPA Chronic SW
TRICHLOROPHENOL, 2,4,6-	4.9E+00	USEPA Chronic FW	4.9E+00	USEPA Chronic FW	6.5E+00	USEPA Chronic SW
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 Chronic FW	3.0E+01	USEPA Chronic FW	5.0E+01	USEPA Chronic SW
TRICHLOROPROPANE, 1,2,3-	1.4E+01	USEPA AQUIRE (50% FW EC50)	1.4E+01	USEPA AQUIRE (50% FW EC50)	1.4E+01	USEPA AQUIRE (50% FW EC50)
TRICHLOROPROPENE, 1,2,3-	6.2E-01	=Drinking Water Toxicity	6.2E-01	=Drinking Water Toxicity)	6.2E-01	=Drinking Water Toxicity
TRIFLURALIN	1.1E+00	USEPA Reg IV (FW)	1.1E+00	USEPA Chronic FW	1.1E+00	USEPA Reg IV (FW)
TRINITROBENZENE, 1,3,5-	1.0E+01	USEPA Chronic SW	1.1E+01	USEPA Chronic FW	1.0E+01	USEPA Chronic SW
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.0E+01	=Drinking Water Toxicity	4.0E+01	=Drinking Water Toxicity)	4.0E+01	=Drinking Water Toxicity
TRINITROTOLUENE, 2,4,6- (TNT)	1.3E+01	USEPA Chronic FW	1.3E+01	USEPA Chronic FW	9.0E+01	USEPA Chronic SW
VANADIUM	2.7E+01	USEPA Chronic FW	2.7E+01	USEPA Chronic FW	8.1E+01	USEPA Chronic SW

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	9.3E+02	USEPA Reg. IV SW Chronic	9.3E+02	USEPA Chronic FW	9.3E+02	USEPA Reg. IV SW Chronic
XYLENES	1.3E+01	USEPA Chronic SW	2.7E+01	USEPA Chronic FW	1.3E+01	USEPA Chronic SW
ZINC	2.2E+01	Hawaii Chronic FW WQS	2.2E+01	Hawaii Chronic FW WQS	8.6E+01	Hawaii Chronic SW WQS

Notes:

1. Refer to Table D-4d and D-4e for summary of aquatic habitat goal sources. Used for selection of groundwater action levels.
2. Estuarine Goal = Lowest of Freshwater vs Saltwater chronic goals.
3. Drinking water goal substituted as aquatic habitat goal if latter was not available (see text).

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	Hawaii Acute SW WQS	5.7E+02	Hawaii Acute FW WQS	3.2E+02	Hawaii Acute SW WQS
ACENAPHTHYLENE	3.0E+02	CCME 2002	3.0E+02	CCME 2002	3.0E+02	CCME 2002
ACETONE	1.5E+04	USEPA Acute FW	1.5E+04	USEPA Acute FW	2.8E+04	USEPA Acute SW
ALDRIN	1.3E+00	Hawaii Acute SW WQS	3.0E+00	Hawaii Acute FW WQS	1.3E+00	Hawaii Acute SW WQS
AMETRYN	1.8E+03	USEPA Off Pesticides (FW)	1.8E+03	USEPA Off Pesticides	1.8E+03	USEPA Off Pesticides (FW)
AMINO,2- DINITROTOLUENE,4,6-	1.6E+02	USEPA Acute FW	1.6E+02	USEPA Acute FW	1.8E+02	USEPA Acute SW
AMINO,4- DINITROTOLUENE,2,6-	9.8E+01	USEPA Reg IV (FW)	9.8E+01	USEPA Acute FW	9.8E+01	USEPA Reg IV (FW)
ANTHRACENE	1.8E-01	USEPA Acute FW	1.8E-01	USEPA Acute FW	1.3E+01	USEPA Acute SW
ANTIMONY	1.8E+02	USEPA Acute SW	3.0E+03	Hawaii Acute FW WQS	1.8E+02	USEPA Acute SW
ARSENIC	6.9E+01	Hawaii Acute SW WQS	3.6E+02	Hawaii Acute FW WQS	6.9E+01	Hawaii Acute SW WQS
ATRAZINE	3.3E+02	USEPA Reg IV (FW)	3.3E+02	USEPA Acute FW	3.3E+02	USEPA Reg IV (FW)
BARIUM	2.0E+03	USEPA Acute SW	2.0E+03	USEPA Acute FW	2.0E+03	USEPA Acute SW
BENOMYL	2.8E+00	USGS Acute (FW)	2.8E+00	USGS 2012	2.8E+00	USGS Acute (FW)
BENZENE	1.7E+03	Hawaii Acute SW WQS	1.8E+03	Hawaii Acute FW WQS	1.7E+03	Hawaii Acute SW WQS
BENZO(a)ANTHRACENE	3.0E+02	CCME 2002	3.0E+02	CCME 2002	3.0E+02	CCME 2002
BENZO(a)PYRENE	3.0E+02	CCME 2002	3.0E+02	CCME 2002	3.0E+02	CCME 2002
BENZO(b)FLUORANTHENE	3.0E+02	CCME 2002	3.0E+02	CCME 2002	3.0E+02	CCME 2002
BENZO(g,h,i)PERYLENE	3.0E+02	CCME 2002	3.0E+02	CCME 2002	3.0E+02	CCME 2002
BENZO(k)FLUORANTHENE	3.0E+02	CCME 2002	3.0E+02	CCME 2002	3.0E+02	CCME 2002
BERYLLIUM	3.5E+01	USEPA Acute SW	4.3E+01	Hawaii Acute FW WQS	3.5E+01	USEPA Acute SW
BIPHENYL, 1,1-	2.6E+01	USEPA Reg IV (FW)	2.6E+01	USEPA Acute FW	2.6E+01	USEPA Reg IV (FW)
BIS(2-CHLOROETHYL)ETHER	2.4E+04	USDOE Acute (FW)	2.4E+04	USDOE Acute	2.4E+04	USDOE Acute (FW)
BIS(2-CHLORO-1-METHYLETHYL)ETHER	3.7E-01	=Drinking Water Toxicity	3.7E-01	=Drinking Water Toxicity	3.7E-01	=Drinking Water Toxicity
BIS(2-ETHYLHEXYL)PHTHALATE	2.7E+01	USEPA Acute SW	2.7E+01	USEPA Acute FW	2.7E+01	USEPA Acute SW
BORON	3.4E+04	USEPA Reg IV (FW)	3.4E+04	USEPA Acute FW	3.4E+04	USEPA Reg IV (FW)
BROMODICHLOROMETHANE	3.1E+03	USEPA Reg IV (FW)	3.1E+03	USEPA Acute FW	3.1E+03	USEPA Reg IV (FW)
BROMOFORM	1.1E+03	USEPA Acute FW	1.1E+03	USEPA Acute FW	2.3E+03	USEPA Acute SW
BROMOMETHANE	3.8E+01	USEPA Reg IV (FW)	3.8E+01	USEPA Acute FW	3.8E+01	USEPA Reg IV (FW)
CADMIUM	3.0E+00	Hawaii Acute FW WQS	3.0E+00	Hawaii Acute FW WQS	4.3E+01	Hawaii Acute SW WQS
CARBON TETRACHLORIDE	1.2E+04	Hawaii Acute FW WQS	1.2E+04	Hawaii Acute FW WQS	1.6E+04	Hawaii Acute SW WQS
CHLORDANE (TECHNICAL)	9.0E-02	Hawaii Acute SW WQS	2.4E+00	Hawaii Acute FW WQS	9.0E-02	Hawaii Acute SW WQS
CHLOROANILINE, p-	4.6E+02	USEPA Reg IV (FW)	4.6E+02	USEPA Acute FW	4.6E+02	USEPA Reg IV (FW)
CHLOROBENZENE	2.2E+02	USEPA Acute FW	2.2E+02	USEPA Acute FW	1.1E+03	USEPA Acute SW
CHLOROETHANE	2.1E+04	=Drinking Water Toxicity	2.1E+04	=Drinking Water Toxicity	2.1E+04	=Drinking Water Toxicity
CHLOROFORM	4.9E+02	USEPA Acute SW	9.6E+03	Hawaii Acute FW WQS	4.9E+02	USEPA Acute SW
CHLOROMETHANE	1.9E+02	=Drinking Water Toxicity	1.9E+02	=Drinking Water Toxicity	1.9E+02	=Drinking Water Toxicity
CHLOROPHENOL, 2-	4.0E+02	USEPA Reg IV (SW chronic)	1.4E+03	Hawaii Acute FW WQS	4.0E+02	USEPA Reg IV (SW chronic)
CHROMIUM (Total)	1.6E+01	Reg IV Cr VI	1.6E+01	Reg IV Cr VI	1.0E+03	Reg IV Cr VI
CHROMIUM III	5.7E+02	USEPA Reg IV (FW)	5.7E+02	USEPA Acute FW	5.7E+02	USEPA Reg IV (FW)
CHROMIUM VI	1.6E+01	Hawaii Acute FW WQS	1.6E+01	Hawaii Acute FW WQS	1.1E+03	Hawaii Acute SW WQS
CHRYSENE	3.0E+02	CCME 2002	3.0E+02	CCME 2002	3.0E+02	CCME 2002
COBALT	1.2E+02	USEPA Acute FW	1.2E+02	USEPA Acute FW	1.5E+03	USEPA Acute SW
COPPER	2.9E+00	Hawaii Acute SW WQS	6.0E+00	Hawaii Acute FW WQS	2.9E+00	Hawaii Acute SW WQS
CYANIDE (Free)	1.0E+00	Hawaii Acute SW WQS	2.2E+01	Hawaii Acute FW WQS	1.0E+00	Hawaii 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
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	5.2E+02	USEPA Acute FW	5.2E+02	USEPA Acute FW	7.0E+02	USEPA Acute SW
DALAPON	3.0E+03	USEPA AQUIRE (50% FW LC50)	3.0E+03	USEPA AQUIRE (50% FW LC50)	3.0E+03	USEPA AQUIRE (50% FW LC50)
DIBENZO(a,h)ANTHTRACENE	3.0E+02	CCME 2002	3.0E+02	CCME 2002	3.0E+02	CCME 2002
DIBROMO-3-CHLOROPROPANE, 1,2-	4.0E-02	=Drinking Water Toxicity	4.0E-02	=Drinking Water Toxicity	4.0E-02	=Drinking Water Toxicity
DIBROMOCHLOROMETHANE	2.9E+03	USEPA Reg IV (FW)	2.9E+03	USEPA Acute FW	2.9E+03	USEPA Reg IV (FW)
DIBROMOETHANE, 1,2-	1.4E+03	50% MOEE FW Chronic AWQC	1.4E+03	50% MOEE FW Chronic AWQC	1.4E+03	50% MOEE FW Chronic AWQC
DICHLOROBENZENE, 1,2-	3.7E+02	Hawaii Acute FW WQS	3.7E+02	Hawaii Acute FW WQS	6.6E+02	Hawaii Acute SW WQS
DICHLOROBENZENE, 1,3-	3.7E+02	Hawaii Acute FW WQS	3.7E+02	Hawaii Acute FW WQS	6.6E+02	Hawaii Acute SW WQS
DICHLOROBENZENE, 1,4-	3.7E+02	Hawaii Acute FW WQS	3.7E+02	Hawaii Acute FW WQS	6.6E+02	Hawaii Acute SW WQS
DICHLOROBENZIDINE, 3,3-	4.1E+01	USEPA Reg IV (FW)	4.1E+01	USEPA Acute FW	4.1E+01	USEPA Reg IV (FW)
DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.9E-01	USEPA Acute SW	1.9E-01	USEPA Acute FW	1.9E-01	USEPA Acute SW
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	7.0E+00	USEPA Reg IV (FW)	7.0E+00	USEPA Acute FW	7.0E+00	USEPA Reg IV (FW)
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.3E-02	Hawaii Acute SW WQS	1.1E+00	Hawaii Acute FW WQS	1.3E-02	Hawaii Acute SW WQS
DICHLOROETHANE, 1,1-	8.3E+02	USEPA Acute SW	3.7E+03	USEPA Acute FW	8.3E+02	USEPA Acute SW
DICHLOROETHANE, 1,2-	3.8E+04	Hawaii Acute SW WQS	3.9E+04	Hawaii Acute FW WQS	3.8E+04	Hawaii Acute SW WQS
DICHLOROETHYLENE, 1,1-	3.9E+03	Hawaii Acute FW WQS	3.9E+03	Hawaii Acute FW WQS	7.5E+04	Hawaii Acute SW WQS
DICHLOROETHYLENE, Cis 1,2-	5.5E+03	USEPA Reg IV (FW)	5.5E+03	USEPA Acute FW	5.5E+03	USEPA Reg IV (FW)
DICHLOROETHYLENE, Trans 1,2-	1.0E+04	USEPA Reg IV (FW)	1.0E+04	USEPA Acute FW	1.0E+04	USEPA Reg IV (FW)
DICHLOROPHENOL, 2,4-	6.7E+02	Hawaii Acute FW WQS	6.7E+02	Hawaii Acute FW WQS	7.9E+02	USEPA Reg IV (SW chronic)
DICHLOROPHENOXYACETIC ACID (2,4-D)	1.3E+02	USEPA Reg IV (FW)	1.3E+02	USEPA Acute FW	1.3E+02	USEPA Reg IV (FW)
DICHLOROPROPANE, 1,2-	3.4E+03	Hawaii Acute SW WQS	7.7E+03	Hawaii Acute FW WQS	3.4E+03	Hawaii Acute SW WQS
DICHLOROPROPENE, 1,3-	2.6E+02	Hawaii Acute SW WQS	2.0E+03	Hawaii Acute FW WQS	2.6E+02	Hawaii Acute SW WQS
DIELDRIN	7.1E-01	Hawaii Acute SW WQS	2.5E+00	Hawaii Acute FW WQS	7.1E-01	Hawaii Acute SW WQS
DIETHYLPHTHALATE	9.8E+02	USEPA Acute FW	9.8E+02	USEPA Acute FW	1.8E+03	USEPA Acute SW
DIMETHYLPHENOL, 2,4-	7.0E+02	Hawaii Acute FW WQS	7.0E+02	Hawaii Acute FW WQS	1.1E+03	USEPA Reg IV (FW)
DIMETHYLPHTHALATE	3.2E+03	USEPA Reg IV (FW)	3.2E+03	USEPA Acute FW	3.2E+03	USEPA Reg IV (FW)
DINITROBENZENE, 1,3-	1.0E+02	USEPA Acute FW	1.0E+02	USEPA Acute FW	1.1E+02	USEPA Acute SW
DINITROPHENOL, 2,4-	3.8E+02	0.0E+00	3.8E+02	USEPA Acute FW	3.8E+02	0.0E+00
DINITROTOLUENE, 2,4- (2,4-DNT)	1.1E+02	Hawaii Acute FW WQS	1.1E+02	Hawaii Acute FW WQS	2.0E+02	Hawaii Acute SW WQS
DINITROTOLUENE, 2,6- (2,6-DNT)	1.1E+02	Hawaii Acute FW WQS	1.1E+02	Hawaii Acute FW WQS	2.0E+02	Hawaii Acute SW WQS
DIOXANE, 1,4-	3.4E+06	Mohr (50% FW LC50)	3.4E+06	Mohr (50% FW LC50)	5.0E+06	Mohr (50% SW LC50)
DIOXINS (TEQ)	3.0E-03	USEPA Reg IV (FW)	3.0E-03	Hawaii Acute FW WQS	3.0E-03	USEPA Reg IV (FW)
DIURON	2.0E+02	USEPA AQUIRE (50% FW LC50)	2.0E+02	USEPA AQUIRE (50% FW LC50)	5.5E+02	USEPA AQUIRE (50% SW LC50)
ENDOSULFAN	3.4E-02	Hawaii Acute SW WQS	2.2E-01	Hawaii Acute FW WQS	3.4E-02	Hawaii Acute SW WQS
ENDRIN	3.7E-02	Hawaii Acute SW WQS	1.8E-01	Hawaii Acute FW WQS	3.7E-02	Hawaii Acute SW WQS
ETHANOL		not available		not available		
ETHYLBENZENE	1.4E+02	Hawaii Acute SW WQS	1.1E+04	Hawaii Acute FW WQS	1.4E+02	Hawaii Acute SW WQS
FLUORANTHENE	1.3E+01	Hawaii Acute SW WQS	1.3E+03	Hawaii Acute FW WQS	1.3E+01	Hawaii Acute SW WQS
FLUORENE	3.0E+02	CCME 2002	3.0E+02	CCME 2002	3.0E+02	CCME 2002
GLYPHOSATE	2.2E+04	USEPA Off Pesticides (FW)	2.2E+04	USEPA Off Pesticides	2.2E+04	USEPA Off Pesticides (FW)
HEPTACHLOR	5.3E-02	Hawaii Acute SW WQS	5.2E-01	Hawaii Acute FW WQS	5.3E-02	Hawaii Acute SW WQS
HEPTACHLOR EPOXIDE	5.3E-02	USEPA Acute SW	5.2E-01	USEPA Acute FW	5.3E-02	USEPA Acute SW
HEXACHLOROBENZENE	3.0E-04	USEPA Reg IV (FW chronic)	3.0E-04	USEPA Reg IV (FW chronic)	3.0E-04	USEPA Reg IV (FW chronic)
HEXACHLOROBUTADIENE	1.1E+01	Hawaii Acute SW WQS	3.0E+01	Hawaii Acute FW WQS	1.1E+01	Hawaii 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
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	1.6E-01	Hawaii Acute SW WQS	2.0E+00	Hawaii Acute FW WQS	1.6E-01	Hawaii Acute SW WQS
HEXACHLOROETHANE	3.1E+02	Hawaii Acute SW WQS	3.3E+02	Hawaii Acute FW WQS	3.1E+02	Hawaii Acute SW WQS
HEXAZINONE	1.4E+05	USEPA Off Pesticides (FW)	1.4E+05	USEPA Off Pesticides	1.4E+05	USEPA Off Pesticides (FW)
INDENO(1,2,3-cd)PYRENE	3.0E+02	CCME 2002	3.0E+02	CCME 2002	3.0E+02	CCME 2002
ISOPHORONE	4.3E+03	Hawaii Acute SW WQS	3.9E+04	Hawaii Acute FW WQS	4.3E+03	Hawaii Acute SW WQS
LEAD	2.9E+01	Hawaii Acute FW WQS	2.9E+01	Hawaii Acute FW WQS	1.4E+02	Hawaii Acute SW WQS
MERCURY	2.1E+00	Hawaii Acute SW WQS	2.4E+00	Hawaii Acute FW WQS	2.1E+00	Hawaii Acute SW WQS
METHOXYCHLOR	7.0E-01	USEPA Reg IV (FW)	7.0E-01	USEPA Acute FW	7.0E-01	USEPA Reg IV (FW)
METHYL ETHYL KETONE	2.0E+05	USEPA Acute FW	2.0E+05	USEPA Acute FW	2.4E+05	USEPA Acute SW
METHYL ISOBUTYL KETONE	2.2E+03	USEPA Acute SW	2.2E+03	USEPA Acute FW	2.2E+03	USEPA Acute SW
METHYL MERCURY	9.9E-02	USEPA Acute SW	9.9E-02	USEPA Acute FW	9.9E-02	USEPA Acute SW
METHYL TERT BUTYL ETHER	6.5E+03	USEPA Acute FW	6.5E+03	USEPA Acute FW	5.3E+04	USEPA Acute SW
METHYLENE CHLORIDE	8.5E+03	USEPA Acute FW	8.5E+03	USEPA Acute FW	2.6E+04	USEPA Acute SW
METHYLNAPHTHALENE, 1-	3.7E+01	USEPA Acute SW	3.7E+01	USEPA Acute FW	3.7E+01	USEPA Acute SW
METHYLNAPHTHALENE, 2-	4.2E+01	USEPA Acute FW	4.2E+01	USEPA Acute FW	8.6E+01	USEPA Acute SW
MOLYBDENUM	7.2E+03	USEPA Acute FW	7.2E+03	USEPA Acute FW	1.6E+04	USEPA Acute SW
NAPHTHALENE	7.7E+02	Hawaii Acute FW WQS	7.7E+02	Hawaii Acute FW WQS	7.8E+02	Hawaii Acute SW WQS
NICKEL	5.0E+00	Hawaii Acute FW WQS	5.0E+00	Hawaii Acute FW WQS	7.5E+01	Hawaii Acute SW WQS
NITROBENZENE	2.0E+03	Hawaii Acute SW WQS	9.0E+03	Hawaii Acute FW WQS	2.0E+03	Hawaii Acute SW WQS
NITROGLYCERIN	1.6E+02	USEPA Reg IV (FW)	1.6E+02	USEPA Acute FW	1.6E+02	USEPA Reg IV (FW)
NITROTOLUENE, 2-	6.4E+02	USEPA Reg IV (FW)	6.4E+02	USEPA Acute FW	6.4E+02	USEPA Reg IV (FW)
NITROTOLUENE, 3-	3.8E+02	USEPA Reg IV (FW)	3.8E+02	USEPA Acute FW	3.8E+02	USEPA Reg IV (FW)
NITROTOLUENE, 4-	4.1E+02	USEPA Reg IV (FW)	4.1E+02	USEPA Acute FW	4.1E+02	USEPA Reg IV (FW)
PENTACHLOROPHENOL	1.3E+01	Hawaii Acute SW WQS	2.0E+01	Hawaii Acute FW WQS	1.3E+01	Hawaii Acute SW WQS
PENTAERYTHRITOLTETRANITRATE (PETN)	8.5E+05	Pascoe et al. (chronic FW)	8.5E+05	Pascoe et al. (chronic FW)	8.5E+05	Pascoe et al. (chronic FW)
PERCHLORATE	5.0E+03	USEPA 2002	5.0E+03	USEPA 2002	5.0E+03	USEPA 2002
PHENANTHRENE	3.0E+02	CCME 2002	3.0E+02	CCME 2002	3.0E+02	CCME 2002
PHENOL	3.0E+02	USEPA Acute SW	4.7E+03	Hawaii Acute FW WQS	3.0E+02	USEPA Acute SW
POLYCHLORINATED BIPHENYLS (PCBs)	2.0E+00	Hawaii Acute FW WQS	2.0E+00	Hawaii Acute FW WQS	1.0E+01	Hawaii Acute SW WQS
PROPICONAZOLE	4.3E+02	USEPA Off Pesticides (FW)	4.3E+02	USEPA Off Pesticides	4.3E+02	USEPA Off Pesticides (FW)
PYRENE	3.0E+02	CCME 2002	3.0E+02	CCME 2002	3.0E+02	CCME 2002
SELENIUM	2.0E+01	Hawaii Acute FW WQS	2.0E+01	Hawaii Acute FW WQS	3.0E+02	Hawaii Acute SW WQS
SILVER	1.0E+00	Hawaii Acute FW WQS	1.0E+00	Hawaii Acute FW WQS	2.3E+00	Hawaii Acute SW WQS
SIMAZINE	8.0E+01	USEPA Reg IV (FW)	8.0E+01	USEPA Acute FW	8.0E+01	USEPA Reg IV (FW)
STYRENE	2.9E+02	USEPA Reg IV (FW)	2.9E+02	USEPA Acute FW	2.9E+02	USEPA Reg IV (FW)
TERBACIL	2.6E+02	=Drinking Water Toxicity	2.3E+04	USEPA Off Pesticides	2.6E+02	=Drinking Water Toxicity
tert-BUTYL ALCOHOL	1.8E+05	USEPA AQUIRE (FW LC0)	1.8E+05	USEPA AQUIRE (FW LC0)	1.8E+05	USEPA AQUIRE (FW LC0)
TETRACHLOROETHANE, 1,1,1,2-	7.7E+02	USEPA Reg IV (FW)	3.1E+03	Hawaii Acute FW WQS	7.7E+02	USEPA Reg IV (FW)
TETRACHLOROETHANE, 1,1,2,2-	9.1E+02	USEPA Acute FW	9.1E+02	USEPA Acute FW	3.0E+03	Hawaii Acute SW WQS
TETRACHLOROETHYLENE	1.8E+03	Hawaii Acute FW WQS	1.8E+03	Hawaii Acute FW WQS	3.4E+03	Hawaii Acute SW WQS
TETRACHLOROPHENOL, 2,3,4,6-	1.1E+01	USEPA Reg IV (FW)	1.1E+01	USEPA Acute FW	1.1E+01	USEPA Reg IV (FW)
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	1.2E+03	USEPA Acute FW	1.2E+03	USEPA Acute FW	1.9E+03	USEPA Acute SW
THALLIUM	4.7E+02	Hawaii Acute FW WQS	4.7E+02	Hawaii Acute FW WQS	7.1E+02	Hawaii Acute SW WQS
TOLUENE	2.1E+03	Hawaii Acute SW WQS	5.8E+03	Hawaii Acute FW WQS	2.1E+03	Hawaii 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
TOXAPHENE	2.1E-01	Hawaii Acute SW WQS	7.3E-01	Hawaii Acute FW WQS	2.1E-01	Hawaii 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-	4.2E+02	USEPA Acute FW	4.2E+02	USEPA Acute FW	7.0E+02	USEPA Acute SW
TRICHLOROETHANE, 1,1,1-	6.0E+03	Hawaii Acute FW WQS	6.0E+03	Hawaii Acute FW WQS	1.0E+04	Hawaii Acute SW WQS
TRICHLOROETHANE, 1,1,2-	5.2E+03	USEPA Acute SW	6.0E+03	Hawaii Acute FW WQS	5.2E+03	USEPA Acute SW
TRICHLOROETHYLENE	7.0E+02	Hawaii Acute SW WQS	1.5E+04	Hawaii Acute FW WQS	7.0E+02	Hawaii Acute SW WQS
TRICHLOROPHENOL, 2,4,5-	1.7E+01	USEPA Acute FW	1.7E+01	USEPA Acute FW	2.6E+02	USEPA Acute SW
TRICHLOROPHENOL, 2,4,6-	3.9E+01	USEPA Reg IV (FW)	3.9E+01	USEPA Acute FW	3.9E+01	USEPA Reg IV (FW)
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)	2.7E+02	USEPA Reg IV (FW)	2.7E+02	USEPA Acute FW	2.7E+02	USEPA Reg IV (FW)
TRICHLOROPROPANE, 1,2,3-	1.4E+02	USEPA AQUIRE (5xFW EC50)	1.4E+02	USEPA AQUIRE (5xFW EC50)	1.4E+02	USEPA AQUIRE (5xFW EC50)
TRICHLOROPROPENE, 1,2,3-	6.2E-01	=Drinking Water Toxicity	6.2E-01	=Drinking Water Toxicity	6.2E-01	=Drinking Water Toxicity
TRIFLURALIN	2.1E+01	USEPA Reg IV (FW)	2.1E+01	USEPA Acute FW	2.1E+01	USEPA Reg IV (FW)
TRINITROBENZENE, 1,3,5-	2.7E+01	USEPA Acute FW	2.7E+01	USEPA Acute FW	3.0E+01	USEPA Acute SW
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.0E+01	=Drinking Water Toxicity	4.0E+01	=Drinking Water Toxicity	4.0E+01	=Drinking Water Toxicity
TRINITROTOLUENE, 2,4,6- (TNT)	2.1E+02	USEPA Acute FW	2.1E+02	USEPA Acute FW	5.7E+02	USEPA Acute SW
VANADIUM	9.0E+01	USEPA Acute SW	1.2E+02	USEPA Acute FW	9.0E+01	USEPA Acute SW
VINYL CHLORIDE	8.4E+03	USEPA Reg IV SW Acute	8.4E+03	USEPA Acute FW	8.4E+03	USEPA Reg IV SW Acute
XYLENES	2.3E+02	USEPA Acute SW	2.4E+02	USEPA Acute FW	2.3E+02	USEPA Acute SW
ZINC	2.2E+01	Hawaii Acute FW WQS	2.2E+01	Hawaii Acute FW WQS	9.5E+01	Hawaii Acute SW WQS

Notes:

1. Refer to Table D-4d and D-4e for summary of aquatic habitat goal sources. Used for selection of groundwater action levels.
2. Estuarine Goal = Lowest of Freshwater vs Saltwater chronic goals.
3. Drinking water goal substituted as aquatic habitat goal if latter was not available (see text).

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				
BENOMYL				
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-CHLORO-1-METHYLETHYL)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

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, 1,3-		3.7E+02		6.6E+02
DICHLOROBENZENE, 1,4-		3.7E+02		6.6E+02
DICHLOROBENZIDINE, 3,3-				
DICHLORODIPHENYLDICHLOROETHANE (DDD)				
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)				
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.0E-03	1.1E+00	1.0E-03	1.3E-02
DICHLOROETHANE, 1,1-				
DICHLOROETHANE, 1,2-		3.9E+04		3.8E+04
DICHLOROETHYLENE, 1,1-		3.9E+03		7.5E+04
DICHLOROETHYLENE, Cis 1,2-				
DICHLOROETHYLENE, Trans 1,2-				
DICHLOROPHENOL, 2,4-		6.7E+02		
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		1.4E+02
FLUORANTHENE		1.3E+03		1.3E+01
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

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**
NITROBENZENE		9.0E+03		2.0E+03
NITROGLYCERIN				
NITROTOLUENE, 2-				
NITROTOLUENE, 3-				
NITROTOLUENE, 4-				
PENTACHLOROPHENOL	1.3E+01	2.0E+01		1.3E+01
PENTAERYTHRITOLTETRANITRATE (PETN)				
PERCHLORATE				
PHENANTHRENE				
PHENOL		4.7E+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, October 2012.

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

	Freshwater						Marine					
CONTAMINANT	**USEPA Reg IV Chronic**	**USEPA Reg IV Acute**	**Other Chronic**	**Basis**	**Other Acute**	**Basis**	**USEPA Reg IV Chronic**	**USEPA Reg IV Acute**	**Other Chronic**	**Basis**	**Other Acute**	**Basis**
ACENAPHTHENE	1.5E+01				3.0E+02	CCME 2002	2.0E+01				3.0E+02	CCME 2002
ACENAPHTHYLENE	1.3E+01				3.0E+02	CCME 2002	3.1E+02				3.0E+02	CCME 2002
ACETONE	1.7E+03	1.5E+04					1.5E+03	2.8E+04				
ALDRIN	3.5E-02	3.0E+00					1.4E-04	1.3E+00				
AMETRYN			7.0E+02	USEPA Off Pesticides	1.8E+03	USEPA Off Pesticides			7.0E+02	USEPA Off Pesticides (FW)	1.8E+03	USEPA Off Pesticides (FW)
AMINO,2- DINITROTOLUENE,4,6-	1.8E+01	1.6E+02					2.0E+01	1.8E+02				
AMINO,4- DINITROTOLUENE,2,6-	1.1E+01	9.8E+01							1.1E+01	USEPA Reg IV (FW)	9.8E+01	USEPA Reg IV (FW)
ANTHRACENE	2.0E-02	1.8E-01					7.3E-01	1.3E+01			3.0E+02	CCME 2002
ANTIMONY	1.3E+02	3.0E+02					3.0E+01	1.8E+02				
ARSENIC	1.5E+02	3.4E+02					3.6E+01	6.9E+01				
ATRAZINE	1.2E+01	3.3E+02							1.2E+01	USEPA Reg IV (FW)	3.3E+02	USEPA Reg IV (FW)
BARIUM	2.2E+02	2.0E+03					2.2E+02	2.0E+03				
BENOMYL			1.4E-01	5% USGS 2012 acute	2.8E+00	USGS 2012			1.4E-01	5% USGS 2012 FW acute	2.8E+00	USGS Acute (FW)
BENZENE	1.6E+02	7.0E+02					7.1E+01				7.0E+02	USEPA Reg IV (FW)
BENZO(a)ANTHRACENE	4.7E+00				3.0E+02	CCME 2002	2.7E-02				3.0E+02	CCME 2002
BENZO(a)PYRENE	6.0E-02				3.0E+02	CCME 2002	3.0E-01				3.0E+02	CCME 2002
BENZO(b)FLUORANTHENE	2.6E+00				3.0E+02	CCME 2002	6.8E-01				3.0E+02	CCME 2002
BENZO(g,h,i)PERYLENE	4.4E-01				3.0E+02	CCME 2002	4.4E-01				3.0E+02	CCME 2002
BENZO(k)FLUORANTHENE	6.4E-01				3.0E+02	CCME 2002	6.4E-01				3.0E+02	CCME 2002
BERYLLIUM	1.1E+01	9.3E+01					6.6E-01	3.5E+01				
BIPHENYL, 1,1-	6.5E+00	2.6E+01					1.4E+01				2.6E+01	USEPA Reg IV (FW)
BIS(2-CHLOROETHYL)ETHER			2.4E+03	USDOE Chronic	2.4E+04	USDOE Acute			2.4E+03	USDOE Chronic (FW)	2.4E+04	USDOE Acute (FW)
BIS(2-CHLORO-1-METHYLETHYL)ETHER												
BIS(2-ETHYLHEXYL)PHTHALATE	3.0E+00	2.7E+01					3.0E+00	2.7E+01				
BORON	7.2E+03	3.4E+04					1.0E+03				3.4E+04	USEPA Reg IV (FW)
BROMODICHLOROMETHANE	3.4E+02	3.1E+03							3.4E+02	USEPA Reg IV (FW)	3.1E+03	USEPA Reg IV (FW)
BROMOFORM	2.3E+02	1.1E+03					3.2E+02	2.3E+03				
BROMOMETHANE	1.6E+01	3.8E+01							1.6E+01	USEPA Reg IV (FW)	3.8E+01	USEPA Reg IV (FW)
CADMIUM	2.5E-01	2.0E+00					8.8E+00	4.0E+01				
CARBON TETRACHLORIDE	7.7E+01	6.9E+02					9.8E+00	1.8E+02				
CHLORDANE (TECHNICAL)	4.3E-03	2.4E+00					5.9E-04	4.0E-03				
CHLOROANILINE, p-	1.9E+01	4.6E+02							1.9E+01	USEPA Reg IV (FW)	4.6E+02	USEPA Reg IV (FW)
CHLOROBENZENE	2.5E+01	2.2E+02					6.4E+01	1.1E+03				
CHLOROETHANE												
CHLOROFORM	1.4E+02	1.3E+03					2.8E+01	4.9E+02				
CHLOROMETHANE												
CHLOROPHENOL, 2-	3.2E+01	2.9E+02					4.0E+02				4.0E+02	USEPA Reg IV (SW chronic)
CHROMIUM (Total)			1.1E+01	Reg IV Cr VI	1.6E+01	Reg IV Cr VI			5.0E+01	Reg IV Cr VI	1.0E+03	Reg IV Cr VI
CHROMIUM III	7.4E+01	5.7E+02					2.0E+01				5.7E+02	USEPA Reg IV (FW)
CHROMIUM VI	1.1E+01	1.6E+01					5.0E+01	1.1E+03				
CHRYSENE	4.7E+00				3.0E+02	CCME 2002	2.0E+00				3.0E+02	CCME 2002
COBALT	1.9E+01	1.2E+02					2.3E+01	1.5E+03				
COPPER	9.0E+00	1.3E+01					3.1E+00	4.8E+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)	7.9E+01	5.2E+02					1.9E+02	7.0E+02				
DALAPON			3.0E+02	USEPA AQUIRE (5% FW LC50)	3.0E+03	USEPA AQUIRE (50% FW LC50)			3.0E+02	USEPA AQUIRE (5% FW LC50)	3.0E+03	USEPA AQUIRE (50% FW LC50)
DIBENZO(a,h)ANTHTRACENE	8.0E-01			\	3.0E+02	CCME 2002	7.1E+00				3.0E+02	CCME 2002
DIBROMO-3-CHLOROPROPANE, 1,2-												
DIBROMOCHLOROMETHANE	3.2E+02	2.9E+03					3.4E+01				2.9E+03	USEPA Reg IV (FW)
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	1.4E+03	50% MOEE FW Chronic AWQC
DICHLOROBENZENE, 1,2-	2.3E+01	1.3E+02					1.4E+01	2.6E+02				
DICHLOROBENZENE, 1,3-	2.2E+01	7.9E+01					7.1E+01	6.3E+02				
DICHLOROBENZENE, 1,4-	9.4E+00	5.7E+01					1.5E+01	1.8E+02				
DICHLOROBENZIDINE, 3,3-	4.5E+00	4.1E+01							4.5E+00	USEPA Reg IV (FW)	4.1E+01	USEPA Reg IV (FW)
DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.1E-02	1.9E-01					1.1E-02	1.9E-01				
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	4.1E-01	7.0E+00							4.1E-01	USEPA Reg IV (FW)	7.0E+00	USEPA Reg IV (FW)
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	3.2E-03	1.1E+00					1.0E-03	1.3E-01				
DICHLOROETHANE, 1,1-	4.1E+02	3.7E+03					4.7E+01	8.3E+02				
DICHLOROETHANE, 1,2-	2.0E+03	8.2E+03					9.1E+02	8.8E+03				
DICHLOROETHYLENE, 1,1-	1.3E+02	1.2E+03					2.5E+01	4.5E+02				
DICHLOROETHYLENE, Cis 1,2-	6.2E+02	5.5E+03							6.2E+02	USEPA Reg IV (FW)	5.5E+03	USEPA Reg IV (FW)
DICHLOROETHYLENE, Trans 1,2-	5.6E+02	1.0E+04							5.6E+02	USEPA Reg IV (FW)	1.0E+04	USEPA Reg IV (FW)
DICHLOROPHENOL, 2,4-	1.1E+01	1.1E+02					7.9E+02				7.9E+02	USEPA Reg IV (SW chronic)
DICHLOROPHENOXYACETIC ACID (2,4-D)	7.9E+01	1.3E+02					7.0E+01				1.3E+02	USEPA Reg IV (FW)
DICHLOROPROPANE, 1,2-	5.2E+02	3.3E+03						3.4E+03	5.2E+02	USEPA Reg IV (FW)		
DICHLOROPROPENE, 1,3-	1.7E+00	1.5E+01					6.0E-02	9.9E-01				

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

	Freshwater						Marine					
CONTAMINANT	**USEPA Reg IV Chronic**	**USEPA Reg IV Acute**	**Other Chronic**	**Basis**	**Other Acute**	**Basis**	**USEPA Reg IV Chronic**	**USEPA Reg IV Acute**	**Other Chronic**	**Basis**	**Other Acute**	**Basis**
DIELDRIN	5.6E-02	2.4E-01					1.9E-03	7.1E-01				
DIETHYLPHTHALATE	2.2E+02	9.8E+02					2.1E+02	1.8E+03				
DIMETHYLPHENOL, 2,4-	1.2E+02	1.1E+03							1.2E+02	USEPA Reg IV (FW)	1.1E+03	USEPA Reg IV (FW)
DIMETHYLPHTHALATE	1.1E+03	3.2E+03					2.9E+03				3.2E+03	USEPA Reg IV (FW)
DINITROBENZENE, 1,3-	2.2E+01	1.0E+02					1.0E+01	1.1E+02				USEPA Reg IV (FW)
DINITROPHENOL, 2,4-	7.1E+01	3.8E+02					1.4E+01				3.8E+02	
DINITROTOLUENE, 2,4- (2,4-DNT)	4.4E+01	3.9E+02					9.1E+00	2.0E+02				
DINITROTOLUENE, 2,6- (2,6-DNT)	8.1E+01	7.3E+02						2.0E+02	8.1E+01	USEPA Reg IV (FW)		
DIOXANE, 1,4-			3.4E+05	Mohr (5% Acute FW LC 50)	3.4E+06	Mohr (50% FW LC50)			5.0E+05	Mohr (5% Acute SW LC 50)	5.0E+06	Mohr (50% SW LC50)
DIOXINS (TEQ)	3.1E-09	3.0E-03							3.1E-09	USEPA Reg IV (FW)	3.0E-03	USEPA Reg IV (FW)
DIURON			6.0E+01	USEPA AQUIRE (50% FW EC50)	2.0E+02	USEPA AQUIRE (50% FW LC50)			6.0E+01	USEPA AQUIRE (50% FW EC50)	5.5E+02	USEPA AQUIRE (50% SW LC50)
ENDOSULFAN	1.0E-02	1.1E-01					8.7E-03	3.4E-02				
ENDRIN	3.6E-02	8.6E-02					2.3E-03	3.7E-02				
ETHANOL												
ETHYLBENZENE	6.1E+01	5.5E+02					7.3E+00	1.3E+02				
FLUORANTHENE	8.0E-01				3.0E+02	CCME 2002	7.1E+00				3.0E+02	CCME 2002
FLUORENE	1.9E+01				3.0E+02	CCME 2002	3.9E+00				3.0E+02	CCME 2002
GLYPHOSATE			1.8E+03	USEPA Off Pesticides	2.2E+04	USEPA Off Pesticides			1.8E+03	USEPA Off Pesticides (FW)	2.2E+04	USEPA Off Pesticides (FW)
HEPTACHLOR	3.8E-03	5.2E-01					3.6E-03	5.3E-02				
HEPTACHLOR EPOXIDE	3.8E-03	5.2E-01					3.6E-03	5.3E-02				
HEXACHLOROBENZENE	3.0E-04				3.0E-04	USEPA Reg IV (FW chronic)			3.0E-04	USEPA Reg IV (FW)	3.0E-04	USEPA Reg IV (FW chronic)
HEXACHLOROBUTADIENE	1.0E+00	1.0E+01					3.0E-01	3.0E+00				
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	1.1E-01	9.5E-01					6.3E-02	1.6E-01				
HEXACHLOROETHANE	1.2E+01	2.1E+02					1.2E+01	2.1E+02				
HEXAZINONE			1.7E+04	USEPA Off Pesticides	1.4E+05	USEPA Off Pesticides			1.7E+04	USEPA Off Pesticides (FW)	1.4E+05	USEPA Off Pesticides (FW)
INDENO(1,2,3-cd)PYRENE	2.8E-01				3.0E+02	CCME 2002	2.8E-01				3.0E+02	CCME 2002
ISOPHORONE	9.2E+02	7.5E+03							9.2E+02	USEPA Reg IV (FW)	7.5E+03	USEPA Reg IV (FW)
LEAD	2.5E+00	6.5E+01					8.1E+00	2.1E+02				
MERCURY	7.7E-01	1.4E+00					9.4E-01	1.8E+00				
METHOXYCHLOR	3.0E-02	7.0E-01					1.9E-02				7.0E-01	USEPA Reg IV (FW)
METHYL ETHYL KETONE	2.2E+04	2.0E+05					1.4E+04	2.4E+05				
METHYL ISOBUTYL KETONE	1.7E+02	2.2E+03					1.7E+02	2.2E+03				
METHYL MERCURY	2.8E-03	9.9E-02					2.8E-03	9.9E-02				
METHYL TERT BUTYL ETHER	7.3E+02	6.5E+03					1.8E+04	5.3E+04				
METHYLENE CHLORIDE	1.5E+03	8.5E+03					2.2E+03	2.6E+04				
METHYLNAPHTHALENE, 1-	2.1E+00	3.7E+01					2.1E+00	3.7E+01				
METHYLNAPHTHALENE, 2-	4.7E+00	4.2E+01					7.2E+01	8.6E+01				
MOLYBDENUM	8.0E+02	7.2E+03					3.7E+02	1.6E+04				
NAPHTHALENE	2.1E+01	1.7E+02					1.2E+01	1.9E+02				
NICKEL	5.2E+01	4.7E+02					8.2E+00	7.4E+01				
NITROBENZENE	3.8E+02	2.0E+03						2.0E+03	3.8E+02	USEPA Reg IV (FW)		
NITROGLYCERIN	1.8E+01	1.6E+02							1.8E+01	USEPA Reg IV (FW)	1.6E+02	USEPA Reg IV (FW)
NITROTOLUENE, 2-	7.1E+01	6.4E+02							7.1E+01	USEPA Reg IV (FW)	6.4E+02	USEPA Reg IV (FW)
NITROTOLUENE, 3-	4.2E+01	3.8E+02							4.2E+01	USEPA Reg IV (FW)	3.8E+02	USEPA Reg IV (FW)
NITROTOLUENE, 4-	4.6E+01	4.1E+02							4.6E+01	USEPA Reg IV (FW)	4.1E+02	USEPA Reg IV (FW)
PENTACHLOROPHENOL	1.5E+01	1.9E+01					7.9E+00	1.3E+01				
PENTAERYTHRITOLTETRANITRATE (PETN)			8.5E+05	Pascoe et al. (chronic FW)	8.5E+05	Pascoe et al. (chronic FW)			8.5E+05	Pascoe et al. (chronic FW)	8.5E+05	Pascoe et al. (chronic FW)
PERCHLORATE			6.0E+02	USEPA 2002	5.0E+03	USEPA 2002			6.0E+02	USEPA 2002	5.0E+03	USEPA 2002
PHENANTHRENE	2.3E+00				3.0E+02	CCME 2002	4.6E+00				3.0E+02	CCME 2002
PHENOL	1.6E+02	4.7E+03					5.8E+01	3.0E+02				
POLYCHLORINATED BIPHENYLS (PCBs)	7.4E-05	1.4E-02							7.4E-05	USEPA Reg IV (FW)	1.4E-02	USEPA Reg IV (FW)
PROPICONAZOLE			9.5E+01	USEPA Off Pesticides	4.3E+02	USEPA Off Pesticides			9.5E+01	USEPA Off Pesticides (FW)	4.3E+02	USEPA Off Pesticides (FW)
PYRENE	4.6E+00				3.0E+02	CCME 2002	1.0E+01				3.0E+02	CCME 2002
SELENIUM	5.0E+00	2.0E+01					7.1E+01	2.9E+02				
SILVER	6.0E-02	3.2E+00					1.0E-01	1.9E+00				
SIMAZINE	9.0E+00	8.0E+01							9.0E+00	USEPA Reg IV (FW)	8.0E+01	USEPA Reg IV (FW)
STYRENE	3.2E+01	2.9E+02							3.2E+01	USEPA Reg IV (FW)	2.9E+02	USEPA Reg IV (FW)
TERBACIL			1.2E+03	USEPA Off Pesticides	2.3E+04	USEPA Off Pesticides						
tert-BUTYL ALCOHOL			1.8E+04	USEPA AQUIRE (10% FW LC0)	1.8E+05	USEPA AQUIRE (FW LC0)			1.8E+04	USEPA AQUIRE (10% FW LC0)	1.8E+05	USEPA AQUIRE (FW LC0)
TETRACHLOROETHANE, 1,1,1,2-	8.5E+01	7.7E+02					1.1E+01				7.7E+02	USEPA Reg IV (FW)
TETRACHLOROETHANE, 1,1,2,2-	2.0E+02	9.1E+02					6.1E+02	2.1E+03				
TETRACHLOROETHYLENE	5.3E+01	4.3E+02					9.8E+01	8.3E+02				
TETRACHLOROPHENOL, 2,3,4,6-	1.2E+00	1.1E+01							1.2E+00	USEPA Reg IV (FW)	1.1E+01	USEPA Reg IV (FW)
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	2.2E+02	1.2E+03					3.3E+02	1.9E+03				
THALLIUM	6.0E+00	5.4E+01					1.2E+01	1.1E+02				
TOLUENE	6.2E+01	5.6E+02					9.8E+00	1.2E+02				

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

	Freshwater						Marine					
CONTAMINANT	**USEPA Reg IV Chronic**	**USEPA Reg IV Acute**	**Other Chronic**	**Basis**	**Other Acute**	**Basis**	**USEPA Reg IV Chronic**	**USEPA Reg IV Acute**	**Other Chronic**	**Basis**	**Other Acute**	**Basis**
TOXAPHENE	2.0E-04	7.3E-01					2.0E-04	2.1E-01				
TPH (gasolines)			5.0E+02	CalEPA FW Chronic	5.0E+03	Ceiling Level			3.7E+03	CalEPA Chronic (SW)	5.0E+03	Ceiling Level
TPH (middle distillates)			6.4E+02	CalEPA FW Chronic	2.5E+03	Ceiling Level			6.4E+02	CalEPA Chronic (FW)	2.5E+03	Ceiling Level
TPH (residual fuels)			6.4E+02	CaEPA FW Chronic	2.5E+03	Ceiling Level			6.4E+02	CalEPA Chronic (FW)	2.5E+03	Ceiling Level
TRICHLOROBENZENE, 1,2,4-	1.3E+02	4.2E+02					1.1E+02	7.0E+02				
TRICHLOROETHANE, 1,1,1-	7.6E+01	6.9E+02					1.1E+01	2.0E+02				
TRICHLOROETHANE, 1,1,2-	7.3E+02	3.2E+03					1.2E+03	5.2E+03				
TRICHLOROETHYLENE	2.0E+02	2.0E+03					4.7E+01	4.4E+02				
TRICHLOROPHENOL, 2,4,5-	1.9E+00	1.7E+01					1.2E+01	2.6E+02				
TRICHLOROPHENOL, 2,4,6-	4.9E+00	3.9E+01					6.5E+00				3.9E+01	USEPA Reg IV (FW)
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	6.9E+02	USEPA Reg. V FW Chronic
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	3.0E+01	2.7E+02					5.0E+01				2.7E+02	USEPA Reg IV (FW)
TRICHLOROPROPANE, 1,2,3-			1.4E+01	USEPA AQUIRE (50% FW EC50)	1.4E+02	USEPA AQUIRE (5xFW EC50)			1.4E+01	USEPA AQUIRE (50% FW EC50)	1.4E+02	USEPA AQUIRE (5xFW EC50)
TRICHLOROPROPENE, 1,2,3-												
TRIFLURALIN	1.1E+00	2.1E+01							1.1E+00	USEPA Reg IV (FW)	2.1E+01	USEPA Reg IV (FW)
TRINITROBENZENE, 1,3,5-	1.1E+01	2.7E+01					1.0E+01	3.0E+01				
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)												
TRINITROTOLUENE, 2,4,6- (TNT)	1.3E+01	2.1E+02					9.0E+01	5.7E+02				
VANADIUM	2.7E+01	1.2E+02					8.1E+01	9.0E+01				
VINYL CHLORIDE	9.3E+02	8.4E+03							9.3E+02	USEPA Reg. IV SW Chronic	8.4E+03	USEPA Reg IV SW Acute
XYLENES	2.7E+01	2.4E+02					1.3E+01	2.3E+02	1.0E+02	5% Acute SW LC 50	1.0E+03	50% SW LC50
ZINC	1.2E+02	1.2E+02					8.1E+01	9.0E+01				

References:

Primary sources USEPA Region IV (2015) and USEPA Office of Pesticides Aquatic Life Benchmarks database (USEPA 2016b; accessed July 2016). See also USDOE (1997), MOEE (1996), USEPA (2002), USEPA Reg 5 (2003), Pascoe et al. (2010). USEPA AQUIRE ecotox database refered to for pesticides that lacked published, aquatic toxicity screening levels (USEPA 2008b).

Notes:

Used for development of groundwater and soil action levels.
See text for prioritization and selection of surface water quality action levels.
Red: Screening level based on bioaccumulation.
1,4 Dioxane: LC 50 values for presented in "Solvent Stabilizers White Paper" (Mohr 2001).
Perchlorate: Chronic and acute goals from "Perchlorate Environmental Contamination" (USEPA 2002).
tert Buytl Alcohol (TBA): Chronic aquatic goal based on in-house review of USEPA ECOTOX database for TBA (USEPA 2008b). Ten percent of LC0 concentration for Lepomis macrochirus (Bluegill) selected as most conservative goal of data presented.
AWQC: Aquatic Water Quality Criteria
EC50: 50% Effects Concentration
LC0: 0% Lethal Concentration
LC50: 50% Lethal Concentration
FW: Freshwater
SW: Saltwater
TPH Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.
USDOE: US Dept of Energy (Oak Ridge National Laboratories)
USDOE: US Dept of Energy (Oak Ridge National Laboratories)
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				
BENOMYL				
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-CHLORO-1-METHYLETHYL)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				

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
COPPER				
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				

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	9.0E-05	HI DOH Fish Consumption	9.0E-05	7.9E-05
HEPTACHLOR EPOXIDE	3.9E-05	USEPA Aquatic Organism Consumption		3.9E-05
HEXACHLOROBENZENE	2.4E-04	HI DOH Fish Consumption	2.4E-04	2.9E-04
HEXACHLOROBUTADIENE	1.6E+01	HI DOH Fish Consumption	1.6E+01	1.8E+01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	2.0E-02	HI DOH Fish Consumption	2.0E-02	6.3E-02
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-				

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
TETRACHLOROETHANE, 1,1,2,2-	3.5E+00	HI DOH Fish Consumption	3.5E+00	4.0E+00
TETRACHLOROETHYLENE	2.9E+00	HI DOH Fish Consumption	2.90E+00	3.3E+00
TETRACHLOROPHENOL, 2,3,4,6-				
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)				
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	-
BENOMYL	
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-CHLORO-1-METHYLETHYL)ETHER	-
BIS(2-ETHYLHEXYL)PHTHALATE	-
BORON	7.0E+02
BROMODICHLOROMETHANE	-
BROMOFORM	-
BROMOMETHANE	-
CADMIUM	1.0E+01
CARBON TETRACHLORIDE	-
CHLORDANE (TECHNICAL)	-
CHLOROANILINE, p-	-
CHLOROBENZENE	-
CHLOROETHANE	-
CHLOROFORM	-
CHLOROMETHANE	-
CHLOROPHENOL, 2-	-
CHROMIUM (Total)	-
CHROMIUM III	-
CHROMIUM VI	1.0E+02
CHRYSENE	-
COBALT	5.0E+01
COPPER	2.0E+02
CYANIDE (Free)	-
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	-
DALAPON	-
DIBENZO(a,h)ANTHTRACENE	-
DIBROMO,1,2- CHLOROPROPANE,3-	-
DIBROMOCHLOROMETHANE	-
DIBROMOETHANE, 1,2-	-
DICHLOROBENZENE, 1,2-	-
DICHLOROBENZENE, 1,3-	-
DICHLOROBENZENE, 1,4-	-
DICHLOROBENZIDINE, 3,3-	-

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

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

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

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

References:

A Compiliation of Water Quality Goals (RWQCBCV 2007).

Notes:

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

TABLE E. SOIL ACTION LEVELS FOR LEACHING CONCERNS

					Target Groundwater Concentrations				Soil Leaching Action Levels			
					Drinking Water IS Threatened		Drinking Water NOT Threatened		Drinking Water IS Threatened		Drinking Water NOT Threatened	
CONTAMINANT	Organic Carbon Coefficient (Koc) (cm^3/g)	Henry's Law Constant (H) ($atm\text{-}m^3/mol$)	Dilution/ Atenuation Factor (DAF)	Saturation Limit (mg/kg)	Target Groundwater Concentration (Surface Water Within 150m; Table D-1a) (ug/L)	Target Groundwater Concentration (Surface Water NOT Within 150m; Table D-1b) (ug/L)	Target Groundwater Concentration (Surface Water Within 150m; Table D-1c) (ug/L)	Target Groundwater Concentration (Surface Water NOT Within 150m; Table D-1d) (ug/L)	Soil Leaching Action Level (Surface Water Within 150m) (mg/kg)	Soil Leaching Action Level (Surface Water NOT Within 150m) (mg/kg)	Soil Leaching Action Level (Surface Water Within 150m) (mg/kg)	Soil Leaching Action Level (Surface Water NOT Within 150m) (mg/kg)
#ACENAPHTHENE	5.03E+03	1.80E-04	8.36E+02	1.2E+02	1.5E+01	2.0E+01	1.5E+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	1.3E+01	2.4E+02	1.3E+01	3.0E+02	5.5E+00	1.0E+02	5.5E+00	1.3E+02
ACETONE	2.60E+00	3.90E-05	6.74E-01	1.2E+05	1.5E+03	1.4E+04	1.5E+03	1.5E+04	1.0E+00	9.5E+00	1.0E+00	1.0E+01
#ALDRIN	8.20E+04	4.40E-05	1.36E+04	8.4E+00	1.4E-04	1.1E-03	1.4E-04	1.3E+00	8.4E+00	8.4E+00	8.4E+00	1.8E+01
AMETRYN	4.28E+02	2.40E-09	7.11E+01	5.6E+02	1.8E+02	1.8E+02	7.0E+02	1.8E+03	1.3E+01	1.3E+01	5.0E+01	1.3E+02
AMINO,2- DINITROTOLUENE,4,6-	2.83E+02	3.30E-11	4.70E+01	2.2E+03	1.8E+01	4.0E+01	1.8E+01	1.6E+02	8.5E-01	1.9E+00	8.5E-01	7.5E+00
AMINO,4- DINITROTOLUENE,2,6-	2.83E+02	3.30E-11	4.70E+01	2.2E+03	1.1E+01	4.0E+01	1.1E+01	9.8E+01	5.2E-01	1.9E+00	5.2E-01	4.6E+00
#ANTHRACENE	1.64E+04	5.60E-05	2.72E+03	4.2E+00	2.0E-02	1.8E-01	2.0E-02	1.8E-01	4.2E+00	4.2E+00	4.2E+00	4.2E+00
ANTIMONY					6.0E+00	6.0E+00	3.0E+01	1.8E+02	(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	2.40E-09	3.73E+01	5.1E+01	3.0E+00	3.0E+00	1.2E+01	3.3E+02	1.1E-01	1.1E-01	4.5E-01	1.2E+01
BARIUM					2.2E+02	2.0E+03	2.2E+02	2.0E+03	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
BENOMYL	3.36E+02	4.93E-12	5.58E+01	8.0E+00	1.4E-01	2.8E+00	1.4E-01	2.8E+00	7.8E-03	1.6E-01	7.8E-03	1.6E-01
BENZENE	1.50E+02	5.60E-03	5.97E+01	1.9E+03	5.0E+00	5.0E+00	7.1E+01	1.7E+03	3.0E-01	3.0E-01	4.3E+00	1.0E+02
#BENZO(a)ANTHRACENE	1.77E+05	1.20E-05	2.94E+04	1.0E+01	2.7E-02	2.9E-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	4.60E-07	9.75E+04	5.6E+00	6.0E-02	2.0E-01	6.0E-02	8.0E-01	5.9E+00	2.0E+01	5.9E+00	7.8E+01
#BENZO(b)FLUORANTHENE	5.99E+05	6.60E-07	9.95E+04	5.4E+00	2.2E-01	2.2E-01	6.8E-01	7.5E-01	2.1E+01	2.1E+01	6.8E+01	7.5E+01
#BENZO(g,h,i)PERYLENE	1.60E+06	1.44E-07	2.66E+05	2.5E+00	1.3E-01	1.3E-01	1.3E-01	1.3E-01	3.5E+01	3.5E+01	3.5E+01	3.5E+01
#BENZO(k)FLUORANTHENE	5.87E+05	5.80E-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					6.6E-01	4.0E+00	6.6E-01	3.5E+01	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
#BIPHENYL, 1,1-	5.13E+03	3.10E-04	8.53E+02	2.3E+02	5.0E-01	5.0E-01	5.0E+00	5.0E+00	2.3E+02	2.3E+02	2.3E+02	2.3E+02
BIS(2-CHLOROETHYL)ETHER	3.22E+01	1.70E-05	5.45E+00	5.0E+03	1.4E-02	1.4E-02	1.8E+02	1.8E+02	7.5E-05	7.5E-05	9.6E-01	9.6E-01
BIS(2-CHLORO-1-METHYLETHYL)ETHER	6.10E+01	1.13E-04	1.08E+01	7.9E+02	3.7E-01	3.7E-01	3.7E-01	3.7E-01	4.0E-03	4.0E-03	4.0E-03	4.0E-03
BIS(2-ETHYLHEXYL)PHTHALATE	1.20E+05	2.70E-07	1.99E+04	1.9E+02	3.0E+00	6.0E+00	3.0E+00	2.7E+01	1.9E+02	1.9E+02	1.9E+02	5.4E+02
BORON					1.0E+03	4.0E+03	1.0E+03	3.4E+04	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
BROMODICHLOROMETHANE	3.18E+01	2.10E-03	1.83E+01	9.3E+02	1.4E-01	1.4E-01	1.1E+02	1.1E+02	2.5E-03	2.5E-03	2.1E+00	2.1E+00
BROMOFORM	3.18E+01	5.40E-04	8.63E+00	9.1E+02	8.0E+01	8.0E+01	2.3E+02	1.1E+03	6.9E-01	6.9E-01	2.0E+00	9.5E+00
BROMOMETHANE	1.32E+01	7.30E-03	4.75E+01	3.6E+03	7.6E+00	7.6E+00	1.6E+01	3.8E+01	3.6E-01	3.6E-01	7.6E-01	1.8E+00
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	2.80E-02	1.81E+02	4.5E+02	5.0E+00	5.0E+00	9.8E+00	1.1E+02	9.1E-01	9.1E-01	1.8E+00	2.0E+01
#CHLORDANE (TECHNICAL)	6.75E+04	4.90E-05	1.12E+04	2.3E+01	4.0E-03	9.0E-02	4.0E-03	9.0E-02	2.3E+01	2.3E+01	2.3E+01	2.3E+01
CHLOROANILINE, p-	1.13E+02	1.20E-06	1.87E+01	3.0E+03	3.9E-01	3.9E-01	1.9E+01	4.6E+02	7.3E-03	7.3E-03	3.6E-01	8.6E+00
CHLOROBENZENE	2.34E+02	3.10E-03	5.81E+01	7.6E+02	2.5E+01	5.0E+01	2.5E+01	2.2E+02	1.5E+00	2.9E+00	1.5E+00	1.3E+01
CHLOROETHANE	2.17E+01	1.10E-02	7.19E+01	2.1E+03	1.6E+01	1.6E+01	1.6E+02	1.6E+02	1.2E+00	1.2E+00	1.2E+01	1.2E+01
CHLOROFORM	3.18E+01	3.70E-03	2.82E+01	2.5E+03	2.8E+01	7.0E+01	2.8E+01	1.1E+02	7.9E-01	2.0E+00	7.9E-01	3.1E+00
CHLOROMETHANE	1.32E+01	8.80E-03	5.68E+01	1.3E+03	1.9E+02	1.9E+02	1.9E+02	1.9E+02	1.1E+01	1.1E+01	1.1E+01	1.1E+01
CHLOROPHENOL, 2-	3.88E+02	1.10E-05	6.45E+01	2.7E+04	1.8E-01	1.8E-01	1.8E+00	1.8E+00	1.2E-02	1.2E-02	1.2E-01	1.2E-01
CHROMIUM (Total)					1.1E+01	1.6E+01	1.1E+01	1.6E+01	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
CHROMIUM III					2.0E+01	5.7E+02	2.0E+01	5.7E+02	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
CHROMIUM VI					4.3E+00	4.3E+00	1.1E+01	1.6E+01	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
#CHRYSENE	1.81E+05	5.20E-06	3.00E+04	2.2E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	3.0E+01	3.0E+01	3.0E+01	3.0E+01
COBALT					6.0E+00	6.0E+00	1.9E+01	1.2E+02	(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)		1.00E-04			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	2.00E-11	1.48E+01	3.8E+01	7.1E-01	7.1E-01	7.9E+01	5.2E+02	1.0E-02	1.0E-02	1.2E+00	7.7E+00
DALAPON	3.20E+00	5.70E-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	1.40E-07	3.17E+05	2.9E+01	2.2E-02	2.2E-02	8.0E-01	1.3E+00	2.9E+01	2.9E+01	2.5E+02	4.0E+02
DIBROMO,1,2- CHLOROPROPANE,3-	1.16E+02	1.50E-04	2.02E+01	9.8E+02	4.0E-02	4.0E-02	4.0E-02	4.0E-02	8.1E-04	8.1E-04	8.1E-04	8.1E-04
DIBROMOCHLOROMETHANE	3.18E+01	7.80E-04	1.01E+01	8.0E+02	9.3E-01	9.3E-01	3.4E+01	2.9E+03	9.4E-03	9.4E-03	3.4E-01	2.9E+01
DIBROMOETHANE, 1,2-	3.96E+01	6.50E-04	1.06E+01	1.3E+03	4.0E-02	4.0E-02	1.9E+01	1.9E+01	4.2E-04	4.2E-04	2.0E-01	2.0E-01
DICHLOROBENZENE, 1,2-	3.83E+02	1.90E-03	7.54E+01	3.8E+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	2.2E+01	3.7E+02	5.7E-01	5.7E-01	2.5E+00	4.2E+01
DICHLOROBENZENE, 1,4-	3.75E+02	2.40E-03	7.72E+01	1.9E+02	5.0E+00	5.0E+00	9.4E+00	1.1E+02	3.9E-01	3.9E-01	7.3E-01	8.5E+00
DICHLOROBENZIDINE, 3,3-	3.19E+03	2.80E-11	5.30E+02	6.0E+01	1.7E-01	1.7E-01	4.5E+00	4.1E+01	9.2E-02	9.2E-02	2.4E+00	2.2E+01
#DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.18E+05	6.60E-06	1.95E+04	6.3E+01	1.1E-02	1.9E-01	1.1E-02	1.9E-01	6.3E+01	6.3E+01	6.3E+01	6.3E+01
#DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.18E+05	4.20E-05	1.95E+04	2.8E+01	4.6E-02	4.6E-02	4.1E-01	7.0E+00	2.8E+01	2.8E+01	2.8E+01	1.4E+02
#DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.69E+05	8.30E-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	5.60E-03	4.00E+01	1.7E+03	2.8E+00	2.8E+00	4.7E+01	8.3E+02	1.1E-01	1.1E-01	1.9E+00	3.3E+01
DICHLOROETHANE, 1,2-	3.96E+01	1.20E-03	1.40E+01	3.0E+03	5.0E+00	5.0E+00	1.8E+02	1.8E+02	7.0E-02	7.0E-02	2.6E+00	2.6E+00
DICHLOROETHYLENE, 1,1-	3.18E+01	2.60E-02	1.67E+02	1.2E+03	7.0E+00	7.0E+00	2.5E+01	3.9E+03	1.2E+00	1.2E+00	4.2E+00	6.5E+02
DICHLOROETHYLENE, Cis 1,2-	3.96E+01	4.10E-03	3.20E+01	2.4E+03	7.0E+01	7.0E+01	6.2E+02	1.3E+03	2.2E+00	2.2E+00	2.0E+01	4.1E+01
DICHLOROETHYLENE, Trans 1,2-	3.96E+01	9.40E-03	6.49E+01	1.9E+03	1.0E+02	1.0E+02	5.6E+02	2.6E+03	6.5E+00	6.5E+00	3.6E+01	1.7E+02
DICHLOROPHENOL, 2,4-	1.47E+02	4.30E-06	2.44E+01	5.5E+03	3.0E-01	3.0E-01	3.0E+00	3.0E+00	7.3E-03	7.3E-03	7.3E-02	7.3E-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)
DICHLOROPHENOXYACETIC ACID (2,4-D)	2.96E+01	3.50E-08	4.92E+00	1.9E+02	7.0E+01	7.0E+01	7.0E+01	1.3E+02	3.4E-01	3.4E-01	3.4E-01	6.4E-01
DICHLOROPROPANE, 1,2-	6.07E+01	2.80E-03	2.75E+01	1.4E+03	5.0E+00	5.0E+00	1.0E+02	1.0E+02	1.4E-01	1.4E-01	2.7E+00	2.7E+00
DICHLOROPROPENE, 1,3-	7.22E+01	3.60E-03	3.43E+01	1.6E+03	6.0E-02	5.0E-01	6.0E-02	2.6E+02	2.1E-03	1.7E-02	2.1E-03	8.9E+00
#DIELDRIN	2.01E+04	1.00E-05	3.34E+03	2.4E+01	1.9E-03	1.1E-02	1.9E-03	7.1E-01	2.4E+01	2.4E+01	2.4E+01	2.4E+01
DIETHYLPHTHALATE	1.05E+02	6.10E-07	1.74E+01	7.9E+02	2.1E+02	9.8E+02	2.1E+02	9.8E+02	3.7E+00	1.7E+01	3.7E+00	1.7E+01
DIMETHYLPHENOL, 2,4-	4.92E+02	9.50E-07	8.16E+01	2.4E+04	1.2E+02	4.0E+02	1.2E+02	7.0E+02	9.8E+00	3.3E+01	9.8E+00	5.7E+01
DIMETHYLPHTHALATE	1.40E+02	1.05E-07	2.32E+01	4.7E+03	1.1E+03	3.2E+03	1.1E+03	3.2E+03	2.6E+01	7.4E+01	2.6E+01	7.4E+01
DINITROBENZENE, 1,3-	3.52E+02	4.90E-08	5.84E+01	1.2E+03	2.0E+00	2.0E+00	1.0E+01	1.0E+02	1.2E-01	1.2E-01	5.8E-01	5.8E+00
DINITROPHENOL, 2,4-	4.61E+02	8.60E-08	7.65E+01	8.0E+03	1.4E+01	4.0E+01	1.4E+01	3.8E+02	1.1E+00	3.1E+00	1.1E+00	2.9E+01
DINITROTOLUENE, 2,4- (2,4-DNT)	5.76E+02	5.40E-08	9.55E+01	7.1E+02	2.5E-01	2.5E-01	9.1E+00	1.1E+02	2.4E-02	2.4E-02	8.7E-01	1.1E+01
DINITROTOLUENE, 2,6- (2,6-DNT)	5.87E+02	7.50E-07	9.75E+01	6.6E+02	5.2E-02	5.2E-02	8.1E+01	1.1E+02	5.1E-03	5.1E-03	7.9E+00	1.1E+01
DIOXANE, 1,4-	2.60E+00	4.80E-06	4.61E-01	1.2E+05	4.6E-01	4.6E-01	5.0E+04	5.0E+04	2.1E-04	2.1E-04	2.3E+01	2.3E+01
#DIOXINS (TEQ)	2.49E+05	5.00E-05	4.14E+04	3.0E-01	3.1E-09	3.0E-05	3.1E-09	3.0E-03	3.0E-01	3.0E-01	3.0E-01	3.0E-01
DIURON	1.09E+02	5.00E-10	1.81E+01	3.2E+01	4.0E+01	4.0E+01	6.0E+01	2.0E+02	7.3E-01	7.3E-01	1.1E+00	3.6E+00
#ENDOSULFAN	6.76E+03	6.50E-05	1.12E+03	1.3E+01	8.7E-03	3.4E-02	8.7E-03	3.4E-02	1.3E+01	1.3E+01	1.3E+01	1.3E+01
#ENDRIN	2.01E+04	6.40E-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	7.90E-03	1.23E+02	4.8E+02	7.3E+00	3.0E+01	7.3E+00	1.4E+02	9.0E-01	3.7E+00	9.0E-01	1.7E+01
#FLUORANTHENE	5.55E+04	8.90E-06	9.20E+03	8.7E+01	8.0E-01	1.3E+01	8.0E-01	1.3E+01	8.7E+01	1.2E+02	8.7E+01	1.2E+02
#FLUORENE	9.16E+03	9.60E-05	1.52E+03	9.3E+01	3.9E+00	2.4E+02	3.9E+00	3.0E+02	9.3E+01	3.6E+02	9.3E+01	4.6E+02
GLYPHOSATE	2.10E+03	2.10E-12	3.49E+02	1.3E+05	7.0E+02	7.0E+02	1.8E+03	2.2E+04	2.4E+02	2.4E+02	6.3E+02	7.5E+03
#HEPTACHLOR	4.13E+04	2.90E-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	1.70E-03	1.04E+03	2.3E-01	3.0E-04	3.0E-04	3.0E-04	3.0E-04	2.3E-01	2.3E-01	2.3E-01	2.3E-01
HEXACHLOROBUTADIENE	8.45E+02	1.00E-02	2.02E+02	1.7E+01	2.0E-01	2.0E-01	3.0E-01	1.1E+01	4.1E-02	4.1E-02	6.1E-02	2.2E+00
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	2.81E+03	5.10E-06	4.66E+02	1.2E+02	6.3E-02	1.6E-01	6.3E-02	1.6E-01	2.9E-02	7.5E-02	2.9E-02	7.5E-02
HEXACHLOROETHANE	1.97E+02	3.90E-03	5.69E+01	6.6E+01	4.0E-01	4.0E-01	1.2E+01	1.0E+02	2.3E-02	2.3E-02	6.8E-01	5.7E+00
HEXAZINONE	1.29E+02	2.30E-12	2.15E+01	2.9E+04	6.6E+02	6.6E+02	1.7E+04	5.0E+04	1.4E+01	1.4E+01	3.7E+02	1.1E+03
#INDENO(1,2,3-cd)PYRENE	1.95E+06	3.50E-07	3.24E+05	2.2E+00	9.5E-02	9.5E-02	9.5E-02	9.5E-02	3.1E+01	3.1E+01	3.1E+01	3.1E+01
ISOPHORONE	6.50E+01	6.60E-06	1.08E+01	5.9E+03	8.2E+01	8.2E+01	9.2E+02	4.3E+03	8.9E-01	8.9E-01	1.0E+01	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	2.00E-07	4.46E+03	1.6E+01	3.0E-02	7.0E-01	3.0E-02	7.0E-01	1.6E+01	1.6E+01	1.6E+01	1.6E+01
METHYL ETHYL KETONE	4.51E+00	5.70E-05	1.10E+00	2.8E+04	5.6E+03	5.6E+03	1.4E+04	5.0E+04	6.2E+00	6.2E+00	1.5E+01	5.5E+01
METHYL ISOBUTYL KETONE	1.26E+01	1.40E-04	2.96E+00	3.4E+03	1.7E+02	1.3E+03	1.7E+02	2.2E+03	5.0E-01	3.8E+00	5.0E-01	6.5E+00
METHYL MERCURY					2.8E-03	9.9E-02	2.8E-03	9.9E-02	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
METHYL TERT BUTYL ETHER	1.16E+01	5.90E-04	5.58E+00	8.9E+03	5.0E+00	5.0E+00	7.3E+02	1.8E+03	2.8E-02	2.8E-02	4.1E+00	1.0E+01
METHYLENE CHLORIDE	2.17E+01	3.30E-03	2.41E+01	3.3E+03	5.0E+00	5.0E+00	1.5E+03	8.5E+03	1.2E-01	1.2E-01	3.6E+01	2.0E+02
METHYLNAPHTHALENE, 1-	2.53E+03	5.10E-04	4.23E+02	3.9E+02	2.1E+00	1.0E+01	2.1E+00	3.7E+01	8.9E-01	4.2E+00	8.9E-01	1.6E+01
METHYLNAPHTHALENE, 2-	2.48E+03	5.20E-04	4.15E+02	3.7E+02	4.7E+00	1.0E+01	4.7E+00	4.2E+01	1.9E+00	4.1E+00	1.9E+00	1.7E+01
MOLYBDENUM					1.0E+02	1.0E+02	3.7E+02	7.2E+03	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
NAPHTHALENE	1.54E+03	4.40E-04	2.59E+02	2.9E+02	1.2E+01	1.7E+01	1.2E+01	2.1E+02	3.1E+00	4.4E+00	3.1E+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	2.40E-05	3.77E+01	3.0E+03	1.4E-01	1.4E-01	3.8E+02	2.0E+03	5.3E-03	5.3E-03	1.4E+01	7.5E+01
NITROGLYCERIN	1.16E+02	8.70E-08	1.92E+01	1.1E+03	2.0E+00	2.0E+00	1.8E+01	1.6E+02	3.9E-02	3.9E-02	3.5E-01	3.1E+00
NITROTOLUENE, 2-	3.71E+02	1.30E-05	6.16E+01	1.5E+03	3.5E-01	3.5E-01	7.1E+01	6.4E+02	2.2E-02	2.2E-02	4.4E+00	3.9E+01
NITROTOLUENE, 3-	3.63E+02	9.30E-06	6.03E+01	1.1E+03	2.0E+00	2.0E+00	4.2E+01	3.8E+02	1.2E-01	1.2E-01	2.5E+00	2.3E+01
NITROTOLUENE, 4-	3.63E+02	5.60E-06	6.03E+01	1.0E+03	4.9E+00	4.9E+00	4.6E+01	4.1E+02	2.9E-01	2.9E-01	2.8E+00	2.5E+01
PENTACHLOROPHENOL	5.92E+02	2.50E-08	9.83E+01	5.1E+01	1.0E+00	1.0E+00	7.9E+00	1.3E+01	9.8E-02	9.8E-02	7.8E-01	1.3E+00
PENTAERYTHRITOLTETRANITRATE (PETN)	6.48E+02	1.30E-09	1.08E+02	1.7E+02	1.9E+01	1.9E+01	2.2E+04	2.2E+04	2.1E+00	2.1E+00	2.3E+03	2.3E+03
PERCHLORATE					1.5E+01	1.5E+01	6.0E+02	5.0E+03	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	2.3E+00	2.1E+02	2.3E+00	3.0E+02	6.9E+01	5.0E+02	6.9E+01	7.0E+02
PHENOL	1.87E+02	3.30E-07	3.11E+01	1.0E+05	5.8E+01	3.0E+02	5.8E+01	3.0E+02	1.8E+00	9.3E+00	1.8E+00	9.3E+00
#POLYCHLORINATED BIPHENYLS (PCBs)	1.31E+05	2.80E-04	2.17E+04	3.4E+01	1.4E-02	5.0E-01	1.4E-02	2.0E+00	3.4E+01	3.4E+01	3.4E+01	4.3E+01
PROPICONAZOLE	1.56E+03	1.70E-09	2.58E+02	1.0E+03	9.5E+01	4.3E+02	9.5E+01	4.3E+02	2.5E+01	1.1E+02	2.5E+01	1.1E+02
#PYRENE	5.43E+04	1.20E-05	9.02E+03	4.4E+01	4.6E+00	6.8E+01	4.6E+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-01	1.0E+00	1.0E-01	1.0E+00	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
SIMAZINE	1.47E+02	9.40E-10	2.43E+01	6.1E+00	4.0E+00	4.0E+00	9.0E+00	8.0E+01	9.7E-02	9.7E-02	2.2E-01	1.9E+00
STYRENE	4.46E+02	2.80E-03	9.14E+01	8.7E+02	1.0E+01	1.0E+01	3.2E+01	1.1E+02	9.1E-01	9.1E-01	2.9E+00	1.0E+01
TERBACIL	5.01E+01	1.20E-10	8.32E+00	2.8E+02	2.6E+02	2.6E+02	2.6E+02	2.6E+02	2.2E+00	2.2E+00	2.2E+00	2.2E+00
tert-BUTYL ALCOHOL	3.70E+01	1.17E-05	6.21E+00	3.2E+05	5.2E+00	5.2E+00	1.8E+04	5.0E+04	3.2E-02	3.2E-02	1.1E+02	3.1E+02
TETRACHLOROETHANE, 1,1,1,2-	8.60E+01	2.50E-03	2.98E+01	6.8E+02	6.1E-01	6.1E-01	1.1E+01	7.7E+02	1.8E-02	1.8E-02	3.2E-01	2.3E+01

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)
TETRACHLOROETHANE, 1,1,2,2-	9.49E+01	3.70E-04	1.81E+01	1.9E+03	7.8E-02	7.8E-02	2.0E+02	2.4E+02	1.4E-03	1.4E-03	3.6E+00	4.3E+00
TETRACHLOROETHYLENE	9.49E+01	1.80E-02	1.27E+02	1.7E+02	5.0E+00	5.0E+00	5.3E+01	1.9E+02	6.4E-01	6.4E-01	6.8E+00	2.5E+01
TETRACHLOROPHENOL, 2,3,4,6-	2.80E+02	8.80E-06	4.65E+01	4.1E+01	1.2E+00	1.1E+01	1.2E+00	1.1E+01	5.6E-02	5.1E-01	5.6E-02	5.1E-01
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	5.32E+02	8.70E-10	8.82E+01	1.6E+01	2.2E+02	1.0E+03	2.2E+02	1.2E+03	1.9E+01	8.8E+01	1.9E+01	1.1E+02
THALLIUM					2.0E+00	2.0E+00	6.0E+00	4.7E+02	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
TOLUENE	2.34E+02	6.60E-03	7.98E+01	8.2E+02	9.8E+00	4.0E+01	9.8E+00	4.0E+02	7.8E-01	3.2E+00	7.8E-01	3.2E+01
#TOXAPHENE	7.72E+04	6.00E-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)	1.78E+03	3.30E-01	2.34E+03	2.0E+03	3.0E+02	3.0E+02	5.0E+02	5.0E+03	7.0E+02	7.0E+02	1.2E+03	5.0E+03
TPH (middle distillates)	1.78E+03	3.30E-01	2.34E+03	6.8E+02	4.0E+02	4.0E+02	6.4E+02	2.5E+03	9.4E+02	9.4E+02	1.5E+03	5.0E+03
TPH (residual fuels)					5.0E+02	5.0E+02	6.4E+02	2.5E+03	1.0E+03	1.0E+03	1.5E+03	5.0E+03
TRICHLOROBENZENE, 1,2,4-	1.36E+03	1.40E-03	2.34E+02	4.0E+02	7.0E+01	7.0E+01	1.1E+02	4.2E+02	1.6E+01	1.6E+01	2.6E+01	9.8E+01
TRICHLOROETHANE, 1,1,1-	4.39E+01	1.70E-02	1.13E+02	6.4E+02	1.1E+01	2.0E+02	1.1E+01	6.0E+03	1.2E+00	2.3E+01	1.2E+00	6.8E+02
TRICHLOROETHANE, 1,1,2-	6.07E+01	8.20E-04	1.52E+01	2.2E+03	5.0E+00	5.0E+00	1.1E+02	1.1E+02	7.6E-02	7.6E-02	1.6E+00	1.6E+00
TRICHLOROETHYLENE	6.07E+01	9.90E-03	7.15E+01	6.9E+02	5.0E+00	5.0E+00	4.7E+01	2.1E+02	3.6E-01	3.6E-01	3.4E+00	1.5E+01
TRICHLOROPHENOL, 2,4,5-	1.60E+03	1.60E-06	2.65E+02	1.2E+04	1.9E+00	1.7E+01	1.9E+00	1.7E+01	5.0E-01	4.5E+00	5.0E-01	4.5E+00
TRICHLOROPHENOL, 2,4,6-	3.81E+02	2.60E-06	6.33E+01	1.9E+03	4.9E+00	7.1E+00	4.9E+00	3.9E+01	3.1E-01	4.5E-01	3.1E-01	2.5E+00
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	1.07E+02	8.70E-09	1.78E+01	2.1E+02	2.0E+02	2.0E+02	6.9E+02	6.9E+02	3.6E+00	3.6E+00	1.2E+01	1.2E+01
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	1.75E+02	9.10E-09	2.91E+01	8.2E+01	3.0E+01	5.0E+01	3.0E+01	2.7E+02	8.7E-01	1.5E+00	8.7E-01	7.9E+00
TRICHLOROPROPANE, 1,2,3-	1.16E+02	3.40E-04	2.13E+01	1.4E+03	6.0E-01	6.0E-01	1.4E+01	1.4E+02	1.3E-02	1.3E-02	3.0E-01	3.0E+00
TRICHLOROPROPENE, 1,2,3-	1.16E+02	1.80E-02	1.31E+02	3.1E+02	6.2E-01	6.2E-01	6.2E-01	6.2E-01	8.1E-02	8.1E-02	8.1E-02	8.1E-02
#TRIFLURALIN	1.64E+04	1.00E-04	2.72E+03	1.8E+01	1.1E+00	1.0E+01	1.1E+00	2.1E+01	1.8E+01	2.8E+01	1.8E+01	5.6E+01
TRINITROBENZENE, 1,3,5-	1.68E+03	6.50E-09	2.79E+02	2.8E+03	1.0E+01	2.7E+01	1.0E+01	2.7E+01	2.8E+00	7.5E+00	2.8E+00	7.5E+00
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.61E+03	2.70E-09	7.64E+02	2.1E+03	4.0E+01	4.0E+01	4.0E+01	4.0E+01	3.1E+01	3.1E+01	3.1E+01	3.1E+01
TRINITROTOLUENE, 2,4,6- (TNT)	2.81E+03	2.10E-08	4.67E+02	2.0E+03	2.6E+00	2.6E+00	1.3E+01	2.1E+02	1.2E+00	1.2E+00	6.1E+00	9.8E+01
VANADIUM					2.7E+01	9.0E+01	2.7E+01	9.0E+01	(Use batch test)	(Use batch test)	(Use batch test)	(Use batch test)
VINYL CHLORIDE	2.17E+01	2.80E-02	1.77E+02	3.9E+03	2.0E+00	2.0E+00	1.8E+01	1.8E+01	3.5E-01	3.5E-01	3.3E+00	3.3E+00
XYLENES	3.83E+02	6.60E-03	1.05E+02	2.6E+02	1.3E+01	2.0E+01	1.3E+01	2.3E+02	1.4E+00	2.1E+00	1.4E+00	2.4E+01
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 Screening Levels guidance (USEPA 2016, see Appendix 2).

Physio-Chemical constants for chemicals from USEPA RSLs guidance (USEPA 2016) 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 E-2. [1]SOIL VApOR ACTION LEVELS FOR EVALUATION OF VADOSE-ZONE LEACHATE AND PROTECTION OF DRINKING WATER AQUIFERS

([2]volatile hydrocarbons, solvents, explosives and fumigants)

CHEMICAL	Physical State		[2]Potential Vapor-Phase COPC?	[3]Henry's Law Constant (H')	[4]Target Groundwater Screening Level (µg/L)	[1]Soil Vapor Action Level
				(unitless)	(ug/L)	(ug/m3)
ACENAPHTHENE	V	S	No	-	-	-
ACENAPHTHYLENE	V	S	No	-	-	-
ACETONE	V	L	Yes	1.60E-03	1.4E+04	4.5E+05
ALDRIN	SV	S	No	-	-	-
AMETRYN	NV	S	No	-	-	-
AMINO,2- DINITROTOLUENE,3,6-	NV	S	No	-	-	-
AMINO,4- DINITROTOLUENE,2,6-	NV	S	No	-	-	-
ANTHRACENE	V	S	No	-	-	-
ANTIMONY	NV	S	No	-	-	-
ARSENIC	NV	S	No	-	-	-
ATRAZINE	NV	S	No	-	-	-
BARIUM	NV	S	No	-	-	-
BENOMYL	NV	S	No	-	-	-
BENZENE	V	L	Yes	2.50E-01	5.0E+00	2.5E+04
BENZO(a)ANTHRACENE	SV	S	No	-	-	-
BENZO(a)PYRENE	NV	S	No	-	-	-
BENZO(b)FLUORANTHENE	NV	S	No	-	-	-
BENZO(g,h,i)PERYLENE	NV	S	No	-	-	-
BENZO(k)FLUORANTHENE	NV	S	No	-	-	-
BERYLLIUM	NV	S	No	-	-	-
BIPHENYL, 1,1-	V	S	Yes	1.30E-02	5.0E-01	1.3E+02
BIS(2-CHLOROETHYL)ETHER	V	L	Yes	7.00E-04	1.4E-02	1.9E-01
BIS(2-CHLORO-1-METHYLETHYL)ETHER	V	L	Yes	4.63E-03	3.7E-01	3.5E+01
BIS(2-ETHYLHEXYL)PHTHALATE	NV	S	No	-	-	-
BORON	NV	S	No	-	-	-
BROMODICHLOROMETHANE	V	L	Yes	8.70E-02	1.4E-01	2.4E+02
BROMOFORM	SV	S	No	-	-	-
BROMOMETHANE	V	G	Yes	3.00E-01	7.6E+00	4.6E+04
CADMIUM	NV	S	No	-	-	-
CARBON TETRACHLORIDE	V	L	Yes	1.10E+00	5.0E+00	1.1E+05
CHLORDANE (TECHNICAL)	SV	S	No	-	-	-
CHLOROANILINE, p-	NV	S	No	-	-	-
CHLOROBENZENE	V	L	Yes	1.30E-01	5.0E+01	1.3E+05
CHLOROETHANE	V	G	Yes	4.50E-01	1.6E+01	1.4E+05
CHLOROFORM	V	L	Yes	1.50E-01	7.0E+01	2.1E+05
CHLOROMETHANE	V	G	Yes	3.60E-01	1.9E+02	1.4E+06
CHLOROPHENOL, 2-	V	L	Yes	4.60E-04	1.8E-01	1.7E+00
CHROMIUM (Total)	NV	S	No	-	-	-
CHROMIUM III	NV	S	No	-	-	-
CHROMIUM VI	NV	S	No	-	-	-
CHRYSENE	NV	S	No	-	-	-
COBALT	NV	S	No	-	-	-
COPPER	NV	S	No	-	-	-
CYANIDE (Free)	V	S	No	-	-	-
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	NV	S	No	-	-	-
DALAPON	NV	L	No	-	-	-
DIBENZO(a,h)ANTHTRACENE	NV	S	No	-	-	-
DIBROMO,1,2- CHLOROPROPANE,3-	V	L	Yes	6.00E-03	4.0E-02	4.8E+00
DIBROMOCHLOROMETHANE	V	S	Yes	3.20E-02	9.3E-01	5.9E+02
DIBROMOETHANE, 1,2-	V	S	Yes	2.70E-02	4.0E-02	2.2E+01
DICHLOROBENZENE, 1,2-	V	L	Yes	7.80E-02	1.0E+01	1.6E+04
DICHLOROBENZENE, 1,3-	V	L	Yes	7.79E-02	5.0E+00	7.8E+03
DICHLOROBENZENE, 1,4-	V	S	Yes	9.90E-02	5.0E+00	9.9E+03
DICHLOROBENZIDINE, 3,3-	NV	S	No	-	-	-
DICHLORODIPHENYLDICHLOROETHANE (DDD)	NV	S	No	-	-	-
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	SV	S	No	-	-	-
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	NV	S	No	-	-	-
DICHLOROETHANE, 1,1-	V	L	Yes	2.30E-01	2.8E+00	1.3E+04
DICHLOROETHANE, 1,2-	V	L	Yes	4.80E-02	5.0E+00	4.8E+03

TABLE E-2. [1]SOIL VApOR ACTION LEVELS FOR EVALUATION OF VADOSE-ZONE LEACHATE AND PROTECTION OF DRINKING WATER AQUIFERS

([2]volatile hydrocarbons, solvents, explosives and fumigants)

CHEMICAL	Physical State		[2]Potential Vapor-Phase COPC?	[3]Henry's Law Constant (H')	[4]Target Groundwater Screening Level (µg/L)	[1]Soil Vapor Action Level
				(unitless)	(ug/L)	(ug/m3)
DICHLOROETHYLENE, 1,1-	V	L	Yes	1.10E+00	7.0E+00	1.5E+05
DICHLOROETHYLENE, Cis 1,2-	V	L	Yes	1.70E-01	7.0E+01	2.4E+05
DICHLOROETHYLENE, Trans 1,2-	V	L	Yes	3.80E-01	1.0E+02	7.6E+05
DICHLOROPHENOL, 2,4-	NV	S	No	-	-	-
DICHLOROPHENOXYACETIC ACID (2,4-D)	NV	S	No	-	-	-
DICHLOROPROPANE, 1,2-	V	L	Yes	1.20E-01	5.0E+00	1.2E+04
DICHLOROPROPENE, 1,3-	V	L	Yes	1.50E-01	5.0E-01	1.5E+03
DIELDRIN	NV	S	No	-	-	-
DIETHYLPHTHALATE	NV	S	No	-	-	-
DIMETHYLPHENOL, 2,4-	NV	S	Yes	3.90E-05	4.0E+02	-
DIMETHYLPHTHALATE	NV	S	No	-	-	-
DINITROBENZENE, 1,3-	NV	S	No	-	-	-
DINITROPHENOL, 2,4-	NV	S	No	-	-	-
DINITROTOLUENE, 2,4- (2,4-DNT)	NV	S	No	-	-	-
DINITROTOLUENE, 2,6- (2,6-DNT)	NV	S	No	-	-	-
DIOXANE, 1,4-	V	L	No	-	-	-
DIOXIN (TEQ)	SV	S	No	-	-	-
DIURON	NV	S	No	-	-	-
ENDOSULFAN	SV	S	No	-	-	-
ENDRIN	NV	S	No	-	-	-
ETHANOL	V	L	No	-	-	-
ETHYLBENZENE	V	L	Yes	3.20E-01	3.0E+01	1.9E+05
FLUORANTHENE	NV	S	No	-	-	-
FLUORENE	V	S	No	-	-	-
GLYPHOSATE	NV	S	No	-	-	-
HEPTACHLOR	SV	S	No	-	-	-
HEPTACHLOR EPOXIDE	SV	S	No	-	-	-
HEXACHLOROBENZENE	SV	S	No	-	-	-
HEXACHLOROBUTADIENE	SV	S	No	-	-	-
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	NV	S	No	-	-	-
HEXACHLOROETHANE	SV	S	No	-	-	-
HEXAZINONE	NV	S	No	-	-	-
INDENO(1,2,3-cd)PYRENE	NV	S	No	-	-	-
ISOPHORONE	NV	L	No	-	-	-
LEAD	NV	S	No	-	-	-
MERCURY	NV	S	No	-	-	-
METHOXYCHLOR	NV	S	No	-	-	-
METHYL ETHYL KETONE	V	L	Yes	2.30E-03	5.6E+03	2.6E+05
METHYL ISOBUTYL KETONE	V	L	Yes	5.60E-03	1.3E+03	1.5E+05
METHYL MERCURY	NV	S	No	-	-	-
METHYL TERT BUTYL ETHER	V	L	Yes	2.40E-02	5.0E+00	2.4E+03
METHYLENE CHLORIDE	V	L	Yes	1.30E-01	5.0E+00	1.3E+04
METHYLNAPHTHALENE, 1-	V	S	No	-	-	-
METHYLNAPHTHALENE, 2-	V	S	No	-	-	-
MOLYBDENUM	NV	S	No	-	-	-
NAPHTHALENE	V	S	Yes	1.80E-02	1.7E+01	6.1E+03
NICKEL	NV	S	No	-	-	-
NITROBENZENE	V	L	Yes	9.80E-04	1.4E-01	2.8E+00
NITROGLYCERIN	NV	L	No	-	-	-
NITROTOLUENE, 2-	V	S	Yes	5.10E-04	3.5E-01	3.6E+00
NITROTOLUENE, 3-	NV	S	Yes	3.80E-04	2.0E+00	-
NITROTOLUENE, 4-	NV	S	No	-	-	-
PENTACHLOROPHENOL	NV	S	No	-	-	-
PENTAERYTHRITOLTETRANITRATE (PETN)	NV	S	No	-	-	-
PERCHLORATE	NV	S	No	-	-	-
PHENANTHRENE	V	S	No	-	-	-
PHENOL	NV	S	No	-	-	-
POLYCHLORINATED BIPHENYLS (PCBs)	SV	S	No	-	-	-

TABLE E-2. [1]SOIL VApOR ACTION LEVELS FOR EVALUATION OF VADOSE-ZONE LEACHATE AND PROTECTION OF DRINKING WATER AQUIFERS

([2]volatile hydrocarbons, solvents, explosives and fumigants)

CHEMICAL	Physical State		[2]Potential Vapor-Phase COPC?	[3]Henry's Law Constant (H')	[4]Target Groundwater Screening Level (µg/L)	[1]Soil Vapor Action Level
				(unitless)	(ug/L)	(ug/m3)
PROPICONAZOLE	NV	L	No	-	-	-
PYRENE	V	S	No	-	-	-
SELENIUM	NV	S	No	-	-	-
SILVER	NV	S	No	-	-	-
SIMAZINE	NV	S	No	-	-	-
STYRENE	V	L	Yes	1.10E-01	1.0E+01	2.2E+04
TERBACIL	NV	S	No	-	-	-
tert-BUTYL ALCOHOL	V	L	Yes	4.80E-04	5.2E+00	5.0E+01
TETRACHLOROETHANE, 1,1,1,2-	V	L	Yes	1.00E-01	6.1E-01	1.2E+03
TETRACHLOROETHANE, 1,1,2,2-	V	L	Yes	1.50E-02	7.8E-02	2.3E+01
TETRACHLOROETHYLENE	V	L	Yes	7.20E-01	5.0E+00	7.2E+04
TETRACHLOROPHENOL, 2,3,4,6-	NV	S	No	-	-	-
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	NV	S	No	-	-	-
THALLIUM	NV	S	No	-	-	-
TOLUENE	V	L	Yes	2.70E-01	4.0E+01	2.2E+05
TOXAPHENE	NV	S	No	-	-	-
TPH (gasolines)	V	L	Yes	1.39E+01	3.0E+02	8.2E+07
TPH (middle distillates)	V	L	Yes	1.39E+01	4.0E+02	1.1E+08
TPH (residual fuels)	NV	L	No	-	-	-
TRICHLOROBENZENE, 1,2,4-	V	S	Yes	5.80E-02	7.0E+01	8.1E+04
TRICHLOROETHANE, 1,1,1-	V	L	Yes	7.00E-01	2.0E+02	2.8E+06
TRICHLOROETHANE, 1,1,2-	V	L	Yes	3.40E-02	5.0E+00	3.4E+03
TRICHLOROETHYLENE	V	L	Yes	4.00E-01	5.0E+00	4.0E+04
TRICHLOROPHENOL, 2,4,5-	NV	S	No	-	-	-
TRICHLOROPHENOL, 2,4,6-	NV	S	No	-	-	-
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	NV	S	No	-	-	-
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	NV	S	No	-	-	-
TRICHLOROPROPANE, 1,2,3-	V	L	Yes	1.40E-02	6.0E-01	1.7E+02
TRICHLOROPROPENE, 1,2,3-	V	L	Yes	7.20E-01	6.2E-01	8.9E+03
TRIFLURALIN	SV	S	No	-	-	-
TRINITROBENZENE, 1,3,5-	NV	S	No	-	-	-
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	NV	S	No	-	-	-
TRINITROTOLUENE, 2,4,6- (TNT)	NV	S	No	-	-	-
VANADIUM	NV	S	No	-	-	-
VINYL CHLORIDE	V	G	Yes	1.10E+00	2.0E+00	4.4E+04
XYLENES	V	L	Yes	2.70E-01	2.0E+01	1.1E+05
ZINC	NV	S	No	-	-	-

Notes:

1. Equivalent concentration of VOC in vadose-zone, soil gas when concentration in pore water/leachate is equal to drinking water screening level times a default dilution-attenuation factor of twenty; see Section 3.5 in Appendix 1 text and Section 4.3.4 in Volume 1). Downward attenuation during migration through the vadose zone (e.g., via volatilization)not considered; most applicable to vapors from leachate in close proximity to the water table.

2. Common petroleum, chlorinated solvent or agricultural fumigant volatile chemicals of potential concern or related breakdown products (refer also to Section 9 of the Hawai'i DOH Technical Guidance Manual (HDOH 2016). Petroleum VOCs focus on TPHg, TPHmd, BTEX, MTBE and naphthalene.

3. Physio-Chemical constants for chemicals from USEPA Region IX (USEPA 2012) or Ontario MOEE (MOEE 1996) when not available (see Table J).

4. Lowest of drinking water goals based on toxicity and taste and odors (see Table D-1a).

TPH -Total Petroleum Hydrocarbons. See Appendix 1, Section 6 for discussion of different TPH categories.

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	-	-	-	-
BENOMYL	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	1.9E+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-CHLORO-1-METHYLETHYL)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+03	2.5E+03	1.0E+03	2.5E+03	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	3.6E+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	2.7E+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	-	-	-

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
DIBROMO-3-CHLOROPROPANE, 1,2-	5.0E+02	9.8E+02	5.0E+02	1.0E+03	9.8E+02	8.00E-01	-	-	-
DIBROMOCHLOROMETHANE	1.0E+02	5.0E+02	1.0E+02	5.0E+02	NA	7.60E+01	-	-	-
DIBROMOETHANE, 1,2-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.20E+01	2.00E+05	2.60E+01	4.62E-01
DICHLOROBENZENE, 1,2-	3.8E+02	3.8E+02	1.0E+03	2.5E+03	3.8E+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	3.0E+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	2.4E+03	2.15E+02	-	-	-
DICHLOROETHYLENE, Trans 1,2-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	1.9E+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	1.2E+05	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	1.0E+05	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	-	-	-	-

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
MERCURY	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	2.0E-03	-	-	-
METHOXYCHLOR	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.4E-06	-	-	-
METHYL ETHYL KETONE	5.0E+02	1.0E+03	5.0E+02	1.0E+03	2.8E+04	1.00E+02	3.20E+04	1.10E+01	9.09E+00
METHYL ISOBUTYL KETONE	1.0E+02	5.0E+02	1.0E+02	5.0E+02	3.4E+03	1.00E+01	4.20E+02	1.00E-01	1.00E+02
METHYL MERCURY	1.0E+02	5.0E+02	1.0E+02	5.0E+02	NA	-	-	-	-
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	2.0E+03	3.00E+02	1.10E+03	2.50E-01	1.20E+03
TPH (middle distillates)	5.0E+02	6.8E+02	5.0E+02	1.0E+03	6.8E+02	1.00E+00	5.00E+03	7.00E-01	1.43E+00
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	2.2E+03	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	-	-	-	-

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
TRICHLOROPHENOL, 2,4,6-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	1.2E-02	3.00E-01	3.60E-05	3.33E+02
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	3.75E-05	-	-	-
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	2.58E-06	-	-	-
TRICHLOROPROPANE, 1,2,3-	1.0E+02	5.0E+02	1.0E+02	5.0E+02	1.4E+03	3.69E+00	-	-	-
TRICHLOROPROPENE, 1,2,3-	1.0E+02	3.1E+02	1.0E+02	5.0E+02	3.1E+02	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	2.6E+02	2.6E+02	5.0E+02	1.0E+03	2.6E+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 and ORTs from New Jersey Dept of Health (NJDPH 2008, 2010); ORTs for TPHg (0.25ppm) and TPHmd (0.7ppm) adjusted to ug/m3 based assumed MWs noted for TPHg and TPHd in Table H.

References for vapor pressure and odor threshold data (in order of use, see USEPA (1992) for additiona ORT values):

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	-	-	-	-
BENOMYL	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
BENZENE	1.0E+03	1.9E+03	1.0E+03	2.5E+03	1.9E+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-CHLORO-1-METHYLETHYL)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	2.5E+03	5.0E+03	2.5E+03	5.0E+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	3.6E+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	2.7E+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-	9.8E+02	9.8E+02	1.0E+03	2.5E+03	9.8E+02	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-	3.8E+02	3.8E+02	2.5E+03	5.0E+03	3.8E+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	2.5E+03	1.0E+03	2.5E+03	3.0E+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	2.4E+03	2.15E+02	-	-	-
DICHLOROETHYLENE, Trans 1,2-	1.0E+03	1.9E+03	1.0E+03	2.5E+03	1.9E+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	1.2E+05	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	1.0E+05	5.65E+01	1.92E+04	1.00E+01	5.65E+00
ETHYLBENZENE	4.8E+02	4.8E+02	1.0E+03	2.5E+03	4.8E+02	1.00E+01	2.00E+03	4.50E-01	2.22E+01
FLUORANTHENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	5.00E-06	-	-	-
FLUORENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	3.20E-04	-	-	-
GLYPHOSATE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	4.30E-10	-	-	-
HEPTACHLOR	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	3.00E-04	3.00E+02	2.00E-02	1.50E-02
HEPTACHLOR EPOXIDE	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	2.60E-06	3.00E+02	1.90E-02	1.37E-04
HEXACHLOROBENZENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.10E-05	-	-	-
HEXACHLOROBUTADIENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.50E-01	1.20E+04	1.10E+00	1.36E-01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	9.40E-06	-	-	-
HEXACHLOROETHANE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.10E-01	-	-	-
HEXAZINONE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.25E-07	-	-	-
INDENO(1,2,3-cd)PYRENE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.00E-06	-	-	-
ISOPHORONE	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	4.38E-01	-	-	-
LEAD	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-
MERCURY	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.00E-03	-	-	-
METHOXYCHLOR	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.40E-06	-	-	-

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

CONTAMINANT	[2]Final Unrestricted Land Use Action Level	Final Industrial/ Commercial Land Use Action Level	[2]Raw Unrestricted Action Level	Raw Industrial/ Commercial Action Level	Soil Saturation Limit (mg/kg)	Vapor Pressure (VP) (Torr @ 20-30 °C)	50 Percentile Odor Recognition Threshold (ORT) (ug/m^3)	50 Percentile Odor Recognition Threshold (ORT) (ppm-v)	Odor Index
METHYL 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)	2.0E+03	2.0E+03	5.0E+03	5.0E+03	2.0E+03	3.00E+02	1.00E+03	2.50E-01	1.20E+03
TPH (middle distillates)	5.0E+03	5.0E+03	5.0E+03	5.0E+03	NA	5.00E+00	1.00E+03	7.00E-01	7.14E+00
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	1.0E+03	5.0E+02	1.0E+03	2.2E+03	2.25E+01	-	-	-
TRICHLOROETHYLENE	6.9E+02	6.9E+02	2.5E+03	5.0E+03	6.9E+02	7.70E+01	1.36E+06	2.49E+02	3.09E-01
TRICHLOROPHENOL, 2,4,5-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	NA	-	-	-	-
TRICHLOROPHENOL, 2,4,6-	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	1.20E-02	3.00E-01	3.60E-05	3.33E+02
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	3.75E-05	-	-	-
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	1.0E+03	2.5E+03	1.0E+03	2.5E+03	NA	2.58E-06	-	-	-

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
TRICHLOROPROPANE, 1,2,3-	5.0E+02	1.0E+03	5.0E+02	1.0E+03	1.4E+03	3.69E+00	-	-	-
TRICHLOROPROPENE, 1,2,3-	3.1E+02	3.1E+02	5.0E+02	1.0E+03	3.1E+02	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	2.6E+02	2.6E+02	1.0E+03	2.5E+03	2.6E+02	6.00E+00	4.41E+02	1.00E-01	6.00E+01
ZINC	2.5E+03	5.0E+03	2.5E+03	5.0E+03	NA	-	-	-	-

Notes:

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

Odor Index = VP/ORT in ppm-v

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

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

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

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

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

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

Ceiling Levels for TPH after guidance from Massachusetts Department of Environmental Protection (MADEP 1997a).

50% ORT of 0.13 ppm-v for MTBE from information in CaEPA Public Health Goal for MTBE (CalEPA 1999).

TPH VP values from NIOSH (2002); TPHd ORT value from ATSDR (2001a). TPHg ORT based on threshold of 0.2ppm (AHC 2004; worst-case gasoline with TAME) and assumed MW of 108 (refer to Table H); ORT in ug/m^3 = 200 ppbv x (104/24)= 900; rounded to 1,000 ug/m^3.

TPH(middle distillate fuels) gross contamination action level for isolated soils at commercial/industrial sites set at 5,000 mg/kg, based on profession judgement.

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

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

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

CHEMICAL PARAMETER	Final Action Level	Basis	Solubility (1/2)	Taste And Odor Threshold	Basis	Upper Limit
ACENAPHTHENE	2.0E+01	Taste & Odors	2.0E+03	2.0E+01	Ontario MOEE	5.0E+04
ACENAPHTHYLENE	2.0E+03	Solubility	2.0E+03	-	-	5.0E+04
ACETONE	2.0E+04	Taste & Odors	5.0E+08	2.0E+04	Amoore & Hautala	5.0E+04
ALDRIN	8.5E+00	Solubility	8.5E+00	1.7E+01	Ontario MOEE	5.0E+04
AMETRYN	5.0E+04	Upper Limit	1.0E+05	-	-	5.0E+04
AMINO,2- DINITROTOLUENE,4,6-	5.0E+04	Upper Limit	6.1E+05	-	-	5.0E+04
AMINO,4- DINITROTOLUENE,2,6-	5.0E+04	Upper Limit	6.1E+05	-	-	5.0E+04
ANTHRACENE	2.2E+01	Solubility	2.2E+01	-	-	5.0E+04
ANTIMONY	5.0E+04	Upper Limit		-	-	5.0E+04
ARSENIC	5.0E+04	Upper Limit		-	-	5.0E+04
ATRAZINE	2.0E+01	Taste & Odors	1.8E+04	2.0E+01	Young et al	5.0E+04
BARIUM	5.0E+04	Upper Limit		-	-	5.0E+04
BENOMYL	1.9E+03	Solubility	1.9E+03	-	-	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	8.0E-01	Solubility	8.0E-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	3.7E+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-CHLORO-1-METHYLETHYL)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	5.7E+06	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	4.8E+07	1.7E+02	Amoore & Hautala	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
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	1.3E+00	Solubility	1.3E+00	-	-	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	7.8E+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	4.3E+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	3.2E+06	-	-	5.0E+04
DICHLOROETHYLENE, Trans 1,2-	2.6E+02	Taste & Odors	2.3E+06	2.6E+02	Amoore & Hautala	5.0E+04
DICHLOROPHENOL, 2,4-	3.0E-01	Taste & Odors	2.8E+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	9.8E+01	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	1.0E+05	-	-	5.0E+04
DINITROTOLUENE, 2,6- (2,6-DNT)	5.0E+04	Upper Limit	9.1E+04	-	-	5.0E+04
DIOXANE, 1,4-	5.0E+04	Upper Limit	5.0E+08	2.3E+05	Amoore & Hautala	5.0E+04
DIOXINS (TEQ)	1.0E-01	Solubility	1.0E-01	-	-	5.0E+04
DIURON	2.1E+04	Solubility	2.1E+04	-	-	5.0E+04
ENDOSULFAN	1.6E+02	Solubility	1.6E+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	8.5E+02	Solubility	8.5E+02	-	-	5.0E+04
GLYPHOSATE	5.0E+04	Upper Limit	5.3E+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

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
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	3.7E+03	Solubility	3.7E+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	5.0E+04	Upper Limit	3.5E+07	-	-	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	1.2E+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	2.5E+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	7.9E+03	Taste & Odors	4.1E+07	7.9E+03	Amoore & Hautala	5.0E+04
POLYCHLORINATED BIPHENYLS (PCBs)	2.2E+01	Solubility	2.2E+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)	2.5E+03	Solubility	2.5E+03	-	-	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

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
TOXAPHENE	1.4E+02	Taste & Odors	2.8E+02	1.4E+02	USEPA 2nd MCL	5.0E+04
TPH (gasolines)	5.0E+02	Taste & Odors	7.5E+04	5.0E+02	(see footnotes)	5.0E+04
TPH (middle distillates)	5.0E+02	Taste & Odors	2.6E+04	5.0E+02	(see footnotes)	5.0E+04
TPH (residual fuels)	5.0E+02	Taste & Odors		5.0E+02	(see footnotes)	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	2.3E+06	-	-	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)	3.6E+04	Solubility	3.6E+04	-	-	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	1.7E+05	-	-	5.0E+04
TRIFLURALIN	9.0E+01	Solubility	9.0E+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	5.8E+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	5.3E+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 review of published literature (refer to Section 6.6 in Appendix 1).

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	1.8E+04	Solubility	1.8E+04	-	-	5.0E+04
BARIUM	5.0E+04	Upper Limit		-	-	5.0E+04
BENOMYL	1.9E+03	Solubility	1.9E+03	-	-	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	8.0E-01	Solubility	8.0E-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	3.7E+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-CHLORO-1-METHYLETHYL)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	5.7E+06	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	4.8E+07	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	1.3E+00	Solubility	1.3E+00	-	-	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	7.8E+04	1.0E+02	Ontario MOEE	5.0E+04
DICHLOROBENZENE, 1,3-	5.0E+04	Upper Limit	7.8E+04	-	-	5.0E+04
DICHLOROBENZENE, 1,4-	1.1E+02	Nuisance Odors	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	4.3E+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	3.2E+06	-	-	5.0E+04
DICHLOROETHYLENE, Trans 1,2-	2.6E+03	Nuisance Odors	2.3E+06	2.6E+03	Ontario MOEE	5.0E+04
DICHLOROPHENOL, 2,4-	3.0E+00	Nuisance Odors	2.8E+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	9.8E+01	Solubility	9.8E+01	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	1.0E+05	-	-	5.0E+04
DINITROTOLUENE, 2,6- (2,6-DNT)	5.0E+04	Upper Limit	9.1E+04	-	-	5.0E+04
DIOXANE, 1,4-	5.0E+04	Upper Limit	5.0E+08	-	-	5.0E+04
DIOXINS (TEQ)	1.0E-01	Solubility	1.0E-01	-	-	5.0E+04
DIURON	2.1E+04	Solubility	2.1E+04	-	-	5.0E+04
ENDOSULFAN	1.6E+02	Solubility	1.6E+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	8.5E+02	Solubility	8.5E+02	-	-	5.0E+04
GLYPHOSATE	5.0E+04	Upper Limit	5.3E+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	3.7E+03	Solubility	3.7E+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	5.0E+04	Upper Limit	3.5E+07	-	-	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	1.2E+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	2.5E+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	Amoore & Hautala	5.0E+04
POLYCHLORINATED BIPHENYLS (PCBs)	2.2E+01	Solubility	2.2E+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)	2.5E+03	Solubility	2.5E+03	-	-	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)	5.0E+03	Nuisance Odors	2.6E+04	5.0E+03	MADEP	5.0E+04
TPH (residual fuels)	5.0E+03	Nuisance Odors		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	2.3E+06	-	-	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)	3.6E+04	Solubility	3.6E+04	-	-	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	1.7E+05	-	-	5.0E+04
TRIFLURALIN	9.0E+01	Solubility	9.0E+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	5.8E+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	5.3E+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	1.8E+04	2.0E+01	Young et al	5.0E+04
BARIUM	5.0E+04	Upper Limit		-	-	5.0E+04
BENOMYL	1.9E+03	Solubility	1.9E+03	-	-	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	8.0E-01	Solubility	8.0E-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	3.7E+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-CHLORO-1-METHYLETHYL)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	5.7E+06	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	4.8E+07	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	1.3E+00	Solubility	1.3E+00	-	-	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	7.8E+04	1.0E+01	USEPA 2nd MCL	5.0E+04
DICHLOROBENZENE, 1,3-	5.0E+04	Upper Limit	7.8E+04	-	-	5.0E+04
DICHLOROBENZENE, 1,4-	5.0E+00	Taste & Odors	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	4.3E+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	3.2E+06	-	-	5.0E+04
DICHLOROETHYLENE, Trans 1,2-	2.6E+02	Taste & Odors	2.3E+06	2.6E+02	Amoore & Hautala	5.0E+04
DICHLOROPHENOL, 2,4-	3.0E-01	Taste & Odors	2.8E+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	9.8E+01	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	1.0E+05	-	-	5.0E+04
DINITROTOLUENE, 2,6- (2,6-DNT)	5.0E+04	Upper Limit	9.1E+04	-	-	5.0E+04
DIOXANE, 1,4-	5.0E+04	Upper Limit	5.0E+08	2.3E+05	Amoore & Hautala	5.0E+04
DIOXINS (TEQ)	1.0E-01	Solubility	1.0E-01	-	-	5.0E+04
DIURON	2.1E+04	Solubility	2.1E+04	-	-	5.0E+04
ENDOSULFAN	1.6E+02	Solubility	1.6E+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	8.5E+02	Solubility	8.5E+02	-	-	5.0E+04
GLYPHOSATE	5.0E+04	Upper Limit	5.3E+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

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
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	3.7E+03	Solubility	3.7E+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	5.0E+04	Upper Limit	3.5E+07	-	-	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	1.2E+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	2.5E+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	7.9E+03	Taste & Odors	4.1E+07	7.9E+03	Amoore & Hautala	5.0E+04
POLYCHLORINATED BIPHENYLS (PCBs)	2.2E+01	Solubility	2.2E+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)	2.5E+03	Solubility	2.5E+03	-	-	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

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
TOXAPHENE	1.4E+02	Taste & Odors	2.8E+02	1.4E+02	USEPA 2nd MCL	5.0E+04
TPH (gasolines)	5.0E+02	Taste & Odors	7.5E+04	5.0E+02	(see footnotes)	5.0E+04
TPH (middle distillates)	5.0E+02	Taste & Odors	2.6E+04	5.0E+02	(see footnotes)	5.0E+04
TPH (residual fuels)	5.0E+02	Taste & Odors		5.0E+02	(see footnotes)	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	2.3E+06	-	-	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)	3.6E+04	Solubility	3.6E+04	-	-	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	1.7E+05	-	-	5.0E+04
TRIFLURALIN	9.0E+01	Solubility	9.0E+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	5.8E+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	5.3E+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 review of published literature (refer to Section 6.6 in Appendix 1).

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	1.8E+04	Solubility	1.8E+04	-	-	5.0E+04
BARIUM	5.0E+04	Upper Limit		-	-	5.0E+04
BENOMYL	1.9E+03	Solubility	1.9E+03	-	-	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	8.0E-01	Solubility	8.0E-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	3.7E+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-CHLORO-1-METHYLETHYL)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	5.7E+06	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	4.8E+07	1.7E+02	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
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	1.3E+00	Solubility	1.3E+00	-	-	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	7.8E+04	1.0E+01	Ontario MOEE	5.0E+04
DICHLOROBENZENE, 1,3-	5.0E+04	Upper Limit	7.8E+04	-	-	5.0E+04
DICHLOROBENZENE, 1,4-	1.1E+01	Nuisance Odors	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	4.3E+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	3.2E+06	-	-	5.0E+04
DICHLOROETHYLENE, Trans 1,2-	2.6E+02	Nuisance Odors	2.3E+06	2.6E+02	Ontario MOEE	5.0E+04
DICHLOROPHENOL, 2,4-	3.0E-01	Nuisance Odors	2.8E+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	9.8E+01	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	1.0E+05	-	-	5.0E+04
DINITROTOLUENE, 2,6- (2,6-DNT)	5.0E+04	Upper Limit	9.1E+04	-	-	5.0E+04
DIOXANE, 1,4-	5.0E+04	Upper Limit	5.0E+08	-	-	5.0E+04
DIOXINS (TEQ)	1.0E-01	Solubility	1.0E-01	-	-	5.0E+04
DIURON	2.1E+04	Solubility	2.1E+04	-	-	5.0E+04
ENDOSULFAN	1.6E+02	Solubility	1.6E+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	8.5E+02	Solubility	8.5E+02	-	-	5.0E+04
GLYPHOSATE	5.0E+04	Upper Limit	5.3E+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

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
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	3.7E+03	Solubility	3.7E+03	1.2E+04	Ontario MOEE	5.0E+04
HEXACHLOROETHANE	1.0E+01	Nuisance Odors	2.5E+04	1.0E+01	Ontario MOEE	5.0E+04
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	5.0E+04	Upper Limit	3.5E+07	-	-	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	1.2E+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	2.5E+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	Amoore & Hautala	5.0E+04
POLYCHLORINATED BIPHENYLS (PCBs)	2.2E+01	Solubility	2.2E+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)	2.5E+03	Solubility	2.5E+03	-	-	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

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
TOXAPHENE	1.4E+02	Nuisance Odors	2.8E+02	1.4E+02	USEPA 2nd MCL	5.0E+04
TPH (gasolines)	5.0E+03	Nuisance Odors	7.5E+04	5.0E+03	MADEP	5.0E+04
TPH (middle distillates)	5.0E+03	Nuisance Odors	2.6E+04	5.0E+03	MADEP	5.0E+04
TPH (residual fuels)	5.0E+03	Nuisance Odors		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	2.3E+06	-	-	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)	3.6E+04	Solubility	3.6E+04	-	-	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	1.7E+05	-	-	5.0E+04
TRIFLURALIN	9.0E+01	Solubility	9.0E+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	5.8E+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	5.3E+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	Vapor Pressure	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)	(mm Hg)	(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	2.20E-03	1.80E-04	7.50E-03	1.0	0.13			6.0E-02	2.4E-01
ACENAPHTHYLENE	V	S	152	2.50E+03	6.08E-02	7.88E-06	3.93E+00	9.12E-04	1.45E-03	5.95E-02	1.0	0.13			4.0E-02	1.6E-01
ACETONE	V	L	58	2.60E+00	1.10E-01	1.10E-05	1.00E+06	2.32E+02	3.90E-05	1.60E-03	1.0				9.0E-01	3.1E+01
ALDRIN	SV	S	365	8.20E+04	2.30E-02	5.80E-06	1.70E-02	1.20E-04	4.40E-05	1.80E-03	1.0		3.4E+00	4.9E-03	1.0E-04	
AMETRYN	NV	S	227	4.28E+02	5.10E-02	6.00E-06	2.09E+02	2.70E-06	2.40E-09	9.90E-08	1.0	0.1			9.0E-03	
AMINO,2- DINITROTOLUENE,4,6-	NV	S	197	2.83E+02	5.60E-02	6.60E-06	1.22E+03	1.10E-05	3.30E-11	1.30E-09	1.0	0.006			2.0E-03	
AMINO,4- DINITROTOLUENE,2,6-	NV	S	197	2.83E+02	5.60E-02	6.60E-06	1.22E+03	1.10E-05	3.30E-11	1.30E-09	1.0	0.009			2.0E-03	
ANTHRACENE	V	S	178	1.64E+04	3.90E-02	7.90E-06	4.30E-02	6.50E-06	5.60E-05	2.30E-03	1.0	0.13			3.0E-01	1.2E+00
ANTIMONY	NV	S	122								0.15				4.0E-04	
ARSENIC	NV	S	75								1.0	0.03	1.5E+00	4.3E-03	3.0E-04	1.5E-05
ATRAZINE	NV	S	216	2.25E+02	2.60E-02	6.80E-06	3.50E+01	2.90E-07	2.40E-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
BENOMYL	NV	S	230	3.36E+02	4.33E-02	5.06E-06	3.80E+00	3.70E-09	4.93E-12	2.16E-10	1	0.1			5.0E-02	
BENZENE	V	L	78	1.50E+02	9.00E-02	1.00E-05	1.79E+03	9.48E+01	5.60E-03	2.50E-01	1.0		5.5E-02	7.8E-06	4.0E-03	3.0E-02
BENZO(a)ANTHRACENE	SV	S	228	1.77E+05	2.60E-02	6.70E-06	9.40E-03	2.10E-07	1.20E-05	4.90E-04	1.0	0.13	1.0E-01	6.0E-05		
BENZO(a)PYRENE	NV	S	252	5.87E+05	4.80E-02	5.60E-06	1.60E-03	5.50E-09	4.60E-07	1.90E-05	1.0	0.13	1.0E+00	6.0E-04	3.0E-04	2.00E-06
BENZO(b)FLUORANTHENE	NV	S	252	5.99E+05	4.80E-02	5.60E-06	1.50E-03	5.00E-07	6.60E-07	2.70E-05	1.0	0.13	1.0E-01	6.0E-05		
BENZO(g,h,i)PERYLENE	NV	S	276	1.60E+06	4.80E-02	5.60E-06	2.60E-04	1.00E-10	1.44E-07	5.90E-06	1.0	0.13			4.0E-02	
BENZO(k)FLUORANTHENE	NV	S	252	5.87E+05	4.80E-02	5.60E-06	8.00E-04	9.70E-10	5.80E-07	2.40E-05	1.0	0.13	1.0E-02	6.0E-06		
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	7.48E+00	8.90E-03	3.10E-04	1.30E-02	1.0		8.0E-03		5.0E-01	4.0E-04
BIS(2-CHLOROETHYL)ETHER	V	L	143	3.22E+01	5.70E-02	8.70E-06	1.72E+04	1.55E+00	1.70E-05	7.00E-04	1.0		1.1E+00	3.3E-04		
BIS(2-CHLORO-1-METHYLETHYL)ETHER	V	L	171	6.10E+01	6.31E-02	6.40E-06	1.70E+03	5.30E-01	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	1.70E-02	4.20E-06	2.70E-01	1.40E-07	2.70E-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	5.00E+01	2.10E-03	8.70E-02	1.0		6.2E-02	3.7E-05	2.0E-02	8.0E-02
BROMOFORM	SV	S	253	3.18E+01	3.60E-02	1.00E-05	3.10E+03	5.40E+00	5.40E-04	2.20E-02	1.0		7.9E-03	1.1E-06	2.0E-02	
BROMOMETHANE	V	G	95	1.32E+01	1.00E-01	1.40E-05	1.52E+04	1.62E+03	7.30E-03	3.00E-01	1.0				1.4E-03	5.0E-03
CADMIUM	NV	S	112								0.025	0.001		1.8E-03	1.0E-03	1.0E-05
CARBON TETRACHLORIDE	V	L	154	4.39E+01	5.70E-02	9.80E-06	7.93E+02	1.15E+02	2.80E-02	1.10E+00	1.0		7.0E-02	6.0E-06	4.0E-03	1.0E-01
CHLORDANE (TECHNICAL)	SV	S	410	6.75E+04	2.10E-02	5.40E-06	5.60E-02	1.00E-05	4.90E-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	2.70E-02	1.20E-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	1.20E+01	3.10E-03	1.30E-01	1.0				2.0E-02	5.0E-02
CHLOROETHANE	V	G	65	2.17E+01	1.00E-01	1.20E-05	6.71E+03	1.01E+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	1.97E+02	3.70E-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	4.30E+03	8.80E-03	3.60E-01	1.0					9.0E-02
CHLOROPHENOL, 2-	V	L	129	3.88E+02	6.60E-02	9.50E-06	1.13E+04	2.50E+00	1.10E-05	4.60E-04	1.0				5.0E-03	2.0E-02
CHROMIUM (Total)	NV	S	52								0.0					
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	2.60E-02	6.70E-06	2.00E-03	6.20E-09	5.20E-06	2.10E-04	1.0	0.13	1.0E-03	6.0E-07		
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		2.10E-01	2.50E-05	9.54E+04	3.08E+02	1.00E-04	4.20E-03	1.0				6.0E-04	8.00E-04
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	NV	S	222	8.91E+01	3.10E-02	8.50E-06	5.97E+01	4.10E-09	2.00E-11	8.20E-10	1.0	0.015	1.1E-01		3.0E-03	
DALAPON	NV	L	143	3.20E+00	6.00E-02	9.40E-06	5.02E+05	1.50E-01	5.70E-08	2.30E-06	1.0	0.1			3.0E-02	
DIBENZO(a,h)ANTHTRACENE	NV	S	278	1.91E+06	4.50E-02	5.20E-06	2.50E-03	9.60E-10	1.40E-07	5.80E-06	1.0	0.13	1.0E+00	6.0E-04		
DIBROMO,1,2- CHLOROPROPANE,3-	V	L	236	1.16E+02	3.20E-02	8.90E-06	1.23E+03	5.80E-01	1.50E-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	5.54E+00	7.80E-04	3.20E-02	1.0		8.4E-02		2.0E-02	8.0E-02
DIBROMOETHANE, 1,2-	V	S	188	3.96E+01	4.30E-02	1.00E-05	3.91E+03	1.12E+01	6.50E-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	1.56E+02	1.36E+00	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	2.15E+00	1.90E-03	7.79E-02	1.0				3.00E-02	1.2E-01
DICHLOROBENZENE, 1,4-	V	S	147	3.75E+02	5.50E-02	8.70E-06	8.13E+01	1.74E+00	2.40E-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	4.70E-02	5.50E-06	3.10E+00	2.60E-07	2.80E-11	1.20E-09	1.0	0.1	4.5E-01	3.4E-04		
DICHLORODIPHENYLDICHLOROETHANE (DDD)	NV	S	320	1.18E+05	4.10E-02	4.70E-06	9.00E-02	1.40E-06	6.60E-06	2.70E-04	1.0	0.1	2.4E-01	6.9E-05		
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	SV	S	318	1.18E+05	2.30E-02	5.90E-06	4.00E-02	6.00E-06	4.20E-05	1.70E-03	1.0		3.4E-01	9.7E-05		

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	Vapor Pressure	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)	(mm Hg)	(atm-m^3/mol)	(unitless)	(unitless)	(unitless)	(mg/kg-d)$^{-1}$	(ug/m^3)$^{-1}$	(mg/kg-d)	(mg/m^3)
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	NV	S	354	1.69E+05	3.80E-02	4.40E-06	5.50E-03	1.60E-07	8.30E-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	2.27E+02	5.60E-03	2.30E-01	1.0		5.7E-03	1.6E-06	2.0E-01	8.0E-01
DICHLOROETHANE, 1,2-	V	L	99	3.96E+01	8.60E-02	1.10E-05	8.60E+03	7.90E+01	1.20E-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	6.00E+02	2.60E-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	6.41E+03	2.00E+02	4.10E-03	1.70E-01	1.0				2.0E-03	8.0E-03
DICHLOROETHYLENE, Trans 1,2-	V	L	97	3.96E+01	8.80E-02	1.10E-05	4.52E+03	3.31E+02	9.40E-03	3.80E-01	1.0				2.0E-02	8.0E-02
DICHLOROPHENOL, 2,4-	NV	S	163	1.47E+02	4.90E-02	8.70E-06	5.55E+03	9.00E-02	4.30E-06	1.80E-04	1.0	0.1			3.0E-03	
DICHLOROPHENOXYACETIC ACID (2,4-D)	NV	S	221	2.96E+01	2.80E-02	7.30E-06	6.77E+02	8.30E-05	3.50E-08	1.40E-06	1.0	0.05			1.0E-02	
DICHLOROPROPANE, 1,2-	V	L	113	6.07E+01	7.30E-02	9.70E-06	2.80E+03	5.33E+01	2.80E-03	1.20E-01	1.0		3.7E-02	3.7E-06	4.0E-02	4.0E-03
DICHLOROPROPENE, 1,3-	V	L	111	7.22E+01	7.60E-02	1.00E-05	2.80E+03	3.40E+01	3.60E-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	2.30E-02	6.00E-06	1.95E-01	5.90E-06	1.00E-05	4.10E-04	1.0	0.1	7.0E+00	4.6E-03	8.0E-05	
DIETHYLPHTHALATE	NV	S	222	1.05E+02	2.60E-02	6.70E-06	1.08E+03	2.10E-03	6.10E-07	2.50E-05	1.0	0.1			8.0E-01	
DIMETHYLPHENOL, 2,4-	NV	S	122	4.92E+02	6.20E-02	8.30E-06	7.87E+03	1.00E-01	9.50E-07	3.90E-05	1.0	0.1			2.0E-02	
DIMETHYLPHTHALATE	NV	S	194	1.40E+02			5.00E+03	3.08E-01	1.05E-07	4.31E-06	1.0	0.10			1.00E+01	
DINITROBENZENE, 1,3-	NV	S	168	3.52E+02	4.80E-02	9.20E-06	5.33E+02	9.00E-04	4.90E-08	2.00E-06	1.0	0.1			1.0E-04	
DINITROPHENOL, 2,4-	NV	S	184	4.61E+02	4.10E-02	9.10E-06	2.79E+03	3.90E-04	8.60E-08	3.50E-06	1.0	0.1			2.0E-03	
DINITROTOLUENE, 2,4- (2,4-DNT)	NV	S	182	5.76E+02	3.80E-02	7.90E-06	2.00E+02	1.50E-04	5.40E-08	2.20E-06	1.0	0.102	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	1.82E+02	5.70E-04	7.50E-07	3.10E-05	1.0	0.099	1.5E+00		3.0E-04	
DIOXANE, 1,4-	V	L	88	2.60E+00	8.70E-02	1.10E-05	1.00E+06	3.80E+01	4.80E-06	2.00E-04	1.0		1.0E-01	5.0E-06	3.0E-02	3.0E-02
DIOXINS (TEQ)	SV	S	356	2.49E+05	4.70E-02	6.80E-06	2.00E-04	1.50E-09	5.00E-05	2.00E-03	1.0	0.03	1.3E+05	3.8E+01	3.3E-09	4.0E-08
DIURON	NV	S	233	1.09E+02	5.00E-02	5.90E-06	4.20E+01	6.90E-08	5.00E-10	2.10E-08	1.0	0.1			2.0E-03	
ENDOSULFAN	SV	S	407	6.76E+03	2.20E-02	5.80E-06	3.25E-01	1.70E-07	6.50E-05	2.70E-03	1.0				6.0E-03	
ENDRIN	NV	S	381	2.01E+04	3.60E-02	4.20E-06	2.50E-01	3.00E-06	6.40E-06	2.60E-04	1.0	0.1			3.0E-04	
ETHANOL	V	L	46	3.09E-01			1.00E+06	5.30E+01	6.29E-06	2.58E-04	1.0					
ETHYLBENZENE	V	L	106	4.46E+02	6.80E-02	8.50E-06	1.69E+02	9.60E+00	7.90E-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	2.80E-02	7.20E-06	2.60E-01	9.20E-06	8.90E-06	3.60E-04	1.0	0.13			4.0E-02	
FLUORENE	V	S	166	9.16E+03	4.40E-02	7.90E-06	1.69E+00	6.00E-04	9.60E-05	3.90E-03	1.0	0.13			4.0E-02	1.6E-01
GLYPHOSATE	NV	S	169	2.10E+03	6.20E-02	7.30E-06	1.05E+04	9.80E-08	2.10E-12	8.60E-11	1.0	0.1			1.0E-01	
HEPTACHLOR	SV	S	373	4.13E+04	2.20E-02	5.70E-06	1.80E-01	4.00E-04	2.90E-04	1.20E-02	1.0		4.5E+00	1.3E-03	5.0E-04	
HEPTACHLOR EPOXIDE	SV	S	389	1.01E+04	2.40E-02	6.20E-06	2.00E-01	2.00E-05	2.10E-05	8.60E-04	1.0		9.1E+00	2.6E-03	1.3E-05	
HEXACHLOROBENZENE	SV	S	285	6.20E+03	2.90E-02	7.80E-06	6.20E-03	1.80E-05	1.70E-03	7.00E-02	1.0		1.6E+00	4.6E-04	8.0E-04	
HEXACHLOROBUTADIENE	SV	S	261	8.45E+02	2.70E-02	7.00E-06	3.20E+00	2.20E-01	1.00E-02	4.20E-01	1.0		7.8E-02	2.2E-05	1.0E-03	
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	NV	S	291	2.81E+03	4.30E-02	5.10E-06	7.30E+00	4.20E-05	5.10E-06	2.10E-04	1.0	0.04	1.1E+00	3.1E-04	3.0E-04	
HEXACHLOROETHANE	SV	S	237	1.97E+02	3.20E-02	8.90E-06	5.00E+01	2.10E-01	3.90E-03	1.60E-01	1.0		4.0E-02	1.1E-05	7.0E-04	3.0E-02
HEXAZINONE	NV	S	252	1.29E+02	2.50E-02	6.30E-06	3.30E+04	2.30E-07	2.30E-12	9.20E-11	1.0	0.1			3.3E-02	
INDENO(1,2,3-cd)PYRENE	NV	S	276	1.95E+06	4.50E-02	5.20E-06	1.90E-04	1.30E-10	3.50E-07	1.40E-05	1.0	0.13	1.0E-01	6.0E-05		
ISOPHORONE	NV	L	138	6.50E+01	5.30E-02	7.50E-06	1.20E+04	4.40E-01	6.60E-06	2.70E-04	1.0	0.1	9.5E-04		2.0E-01	2.0E+00
LEAD	NV	S	207								1.0					
MERCURY	NV	S	201				6.90E+04				0.1				3.0E-04	3.0E-04
METHOXYCHLOR	NV	S	346	2.69E+04	2.20E-02	5.60E-06	1.00E-01	2.60E-06	2.00E-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	9.06E+01	5.70E-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	1.99E+01	1.40E-04	5.60E-03	1.0					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	2.50E+02	5.90E-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	4.35E+02	3.30E-03	1.30E-01	1.0		2.0E-03	1.0E-08	6.0E-03	6.0E-01
METHYLNAPHTHALENE, 1-	V	S	142	2.53E+03	5.30E-02	7.80E-06	2.58E+01	6.70E-02	5.10E-04	2.10E-02	1.0	0.13	2.9E-02		7.0E-02	2.8E-01
METHYLNAPHTHALENE, 2-	V	S	142	2.48E+03	5.20E-02	7.80E-06	2.46E+01	5.50E-02	5.20E-04	2.10E-02	1.0	0.13			4.0E-03	1.6E-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	8.50E-02	4.40E-04	1.80E-02	1.0	0.13		3.4E-05	2.0E-02	3.0E-03
NICKEL	NV	S	59								0.04				2.0E-02	9.0E-05
NITROBENZENE	V	L	123	2.26E+02	6.80E-02	9.40E-06	2.09E+03	2.45E-01	2.40E-05	9.80E-04	1.0			4.0E-05	2.0E-03	9.0E-03
NITROGLYCERIN	NV	L	227	1.16E+02	2.90E-02	7.70E-06	1.38E+03	4.00E-04	8.70E-08	3.50E-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	1.90E-01	1.30E-05	5.10E-04	1.0		2.2E-01		9.0E-04	3.6E-03
NITROTOLUENE, 3-	NV	S	137	3.63E+02	5.90E-02	8.70E-06	5.00E+02	2.05E-01	9.30E-06	3.80E-04	1.0	0.10			1.00E-04	
NITROTOLUENE, 4-	NV	S	137	3.63E+02	5.70E-02	8.40E-06	4.42E+02	1.60E-02	5.60E-06	2.30E-04	1.0	0.1	1.6E-02		4.0E-03	1.60E-02
PENTACHLOROPHENOL	NV	S	266	5.92E+02	3.00E-02	8.00E-06	1.40E+01	1.10E-04	2.50E-08	1.00E-06	1.0	0.25	4.0E-01	5.1E-06	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	Vapor Pressure	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)	(mm Hg)	(atm-m^3/mol)	(unitless)	(unitless)	(unitless)	(mg/kg-d)$^{-1}$	(ug/m^3)$^{-1}$	(mg/kg-d)	(mg/m^3)
PENTAERYTHRITOLTETRANITRATE (PETN)	NV	S	316	6.48E+02	2.60E-02	6.80E-06	4.30E+01	5.50E-09	1.30E-09	5.40E-08	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	3.50E-01	3.30E-07	1.40E-05	1.0	0.1			3.0E-01	2.0E-01
POLYCHLORINATED BIPHENYLS (PCBs)	SV	S	326	1.31E+05	2.40E-02	6.10E-06	4.30E-02	7.70E-05	2.80E-04	1.20E-02	1.0	0.14	2.0E+00	5.7E-04	2.0E-05	
PROPICONAZOLE	NV	L	342	1.56E+03	2.10E-02	5.30E-06	1.10E+02	4.20E-07	1.70E-09	7.00E-08	1.0	0.1			1.0E-01	
PYRENE	V	S	202	5.43E+04	2.80E-02	7.20E-06	1.35E-01	4.50E-06	1.20E-05	4.90E-04	1.0	0.13			3.0E-02	1.2E-01
SELENIUM	NV	S	81					1.40E-10			1.0				5.0E-03	2.0E-02
SILVER	NV	S	108								0.04				5.0E-03	
SIMAZINE	NV	S	202	1.47E+02	2.80E-02	7.40E-06	6.20E+00	2.20E-08	9.40E-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	6.40E+00	2.80E-03	1.10E-01	1.0				2.0E-01	1.0E+00
TERBACIL	NV	S	217	5.01E+01	2.70E-02	7.20E-06	7.10E+02	4.70E-07	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	4.07E+01	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	1.20E+01	2.50E-03	1.00E-01	1.0		2.6E-02	7.4E-06	3.0E-02	1.2E-01
TETRACHLOROETHANE, 1,1,2,2-	V	L	168	9.49E+01	4.90E-02	9.30E-06	2.83E+03	4.62E+00	3.70E-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	1.85E+01	1.80E-02	7.20E-01	1.0		2.1E-02	6.1E-06	6.0E-03	4.0E-02
TETRACHLOROPHENOL, 2,3,4,6-	NV	S	232	2.80E+02	5.00E-02	5.90E-06	2.30E+01	6.70E-04	8.80E-06	3.60E-04	1.0	0.1			3.0E-02	
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	NV	S	296	5.32E+02	4.30E-02	5.00E-06	5.00E+00	3.30E-14	8.70E-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	2.84E+01	6.60E-03	2.70E-01	1.0				8.0E-02	5.0E+00
TOXAPHENE	NV	S	414	7.72E+04	3.20E-02	3.80E-06	5.50E-01	6.70E-06	6.00E-06	2.50E-04	1.0	0.1	1.1E+00	3.2E-04		
TPH (gasolines)	V	L	119	1.78E+03	7.00E-02	1.00E-05	1.50E+02	3.00E+02	3.30E-01	1.39E+01	1.0	0.10			3.00E-02	2.81E-01
TPH (middle distillates)	V	L	201	1.78E+03	7.00E-02	1.00E-05	5.10E+01	1.00E+00	3.30E-01	1.39E+01	1.0	0.10			2.00E-02	1.26E-01
TPH (residual fuels)	NV	L	236								1.0				1.20E-01	
TRICHLOROBENZENE, 1,2,4-	V	S	181	1.36E+03	4.00E-02	8.40E-06	4.90E+01	4.60E-01	1.40E-03	5.80E-02	1.0		2.9E-02		1.0E-02	2.0E-03
TRICHLOROETHANE, 1,1,1-	V	L	133	4.39E+01	6.50E-02	9.60E-06	1.29E+03	1.24E+02	1.70E-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	4.59E+03	2.30E+01	8.20E-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	6.90E+01	9.90E-03	4.00E-01	1.0		4.6E-02	4.1E-06	5.0E-04	2.0E-03
TRICHLOROPHENOL, 2,4,5-	NV	S	198	1.60E+03	3.10E-02	8.10E-06	1.20E+03	7.50E-03	1.60E-06	6.60E-05	1.0	0.1			1.0E-01	
TRICHLOROPHENOL, 2,4,6-	NV	S	198	3.81E+02	3.10E-02	8.10E-06	8.00E+02	8.00E-03	2.60E-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	2.90E-02	7.80E-06	2.78E+02	3.80E-05	8.70E-09	3.50E-07	1.0	0.1			1.0E-02	
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	NV	S	270	1.75E+02	2.30E-02	5.90E-06	7.10E+01	1.00E-05	9.10E-09	3.70E-07	1.0	0.1			8.0E-03	
TRICHLOROPROPANE, 1,2,3-	V	L	147	1.16E+02	5.70E-02	9.20E-06	1.75E+03	3.69E+00	3.40E-04	1.40E-02	1.0		3.0E+01		4.0E-03	3.0E-04
TRICHLOROPROPENE, 1,2,3-	V	L	145	1.16E+02	5.90E-02	9.40E-06	3.34E+02	4.40E+00	1.80E-02	7.20E-01	1.0				3.0E-03	3.0E-04
TRIFLURALIN	SV	S	335	1.64E+04	2.20E-02	5.60E-06	1.80E-01	4.60E-05	1.00E-04	4.20E-03	1.0		7.7E-03		7.5E-03	
TRINITROBENZENE, 1,3,5-	NV	S	213	1.68E+03	2.90E-02	7.70E-06	2.78E+02	6.40E-06	6.50E-09	2.70E-07	1.0	0.019			3.0E-02	
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	NV	S	287	4.61E+03	2.60E-02	6.70E-06	7.40E+01	5.70E-08	2.70E-09	1.10E-07	1.0	0.00065			2.0E-03	
TRINITROTOLUENE, 2,4,6- (TNT)	NV	S	227	2.81E+03	3.00E-02	7.90E-06	1.15E+02	8.00E-06	2.10E-08	8.50E-07	1.0	0.032	3.0E-02		5.0E-04	
VANADIUM	NV	S	51								0.026				5.0E-03	1.0E-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	Vapor Pressure	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)	(mm Hg)	(atm-m^3/mol)	(unitless)	(unitless)	(unitless)	(mg/kg-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	2.98E+03	2.80E-02	1.10E+00	1.0		7.2E-01	4.4E-06	3.0E-03	1.0E-01
XYLENES	V	L	106	3.83E+02	6.90E-02	8.50E-06	1.06E+02	8.00E+00	6.60E-03	2.70E-01	1.0				2.0E+00	1.0E-01
ZINC	NV	S	67								1.0				3.0E-01	

General Notes:

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

Chemical considered to be "volatile" if Henry's number (atm m3/mole) >0.00001 or VP >1 mm Hg and molecular weight <200, and "semi-volatile" if molecular weight >200.

Physio-chemical constants and toxicity factors primarily from USEPA RSL guidance (USEPA 2017). Other references include: 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.

Reference Concentration (RfC) for volatile noncarcinogens calculated based on oral reference dose if not available in USEPA RSL guidance (see Section 1.3; RfC = RfD x 80kg 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, dibromomethane, 1,3 dichlorobenzene, 1,1 dichloroethane, cis 1,2-dichloroethylene, trans 1,2-dichloroethylene, 2,4-dimethylphenol, fluorene, 1 & 2-methylnaphthalene, 2-nitrotoluene, 3-nitrotoluene, phenanthrene, pyrene, 1,1,1,2-tetrachloroethane, 2,4,5-trichlorophenol.

Notes on Individual Chemicals

Antimony toxicty factors based on metallic forms.

Total Chromium action levels based assumed background (refer to Section 2.8 in Volume 1).

Cyanide action levels based on CN-

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.)

Dioxins TEQ cancer slope factors based on 2,3,7,8-TCDD; see HDOH 2010 for background of noncancer toxicity factors.

Ethanol toxicity factors not available (refer to Section 5.3.3 in Appendix 1.

Mercury toxicity factors based on mercuric salts.

Nickel toxicity factors based on soluble salts.

PCB constants and toxicity factors based on Arochlor 1254.

Thallium toxicity factors based on soluble salts.

TBA vapor pressure from *Management of MtBE Impacted Sites* (RWQCB 2001).

Tetrachloroethylene - Cancer-based toxicity factors from CalEPA 2016; noncancer toxicity factors from USEPA 2016.

TPH -Total Petroleum Hydrocarbons. See Section 6 of text for discussion of different TPH categories. TPH physiochemical constants based on C0-C10 aromatic compounds published in MADEP 2002 with noted exceptions (primarily affects soil leaching models). Molecular weights from ATSDR (gasolines) and NIOSH (middle distillates). TPHg solubility after USACE 1998. TPHg and TPHd vapor pressures from NJDEP 2008 and 2010, respectively.

TPHg and TPHmd solubilities from USACE 1998. TPH as gasolines and middle distillates diffusivity constants based on xylenes. Required for direct exposure models - Does not significantly affect action levels. See Chapter 5 of Appendix 1.

TPH toxicity factors discussed in Appendix 1, Chapter 6.

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

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 (mg/kg)	[2]Mutagens (mg/kg)	[3]Noncarcinogens (Final) (mg/kg)	[3]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
ACENAPHTHENE	6.6E+02	noncarcinogenic effects			6.6E+02	3.3E+03	NA
ACENAPHTHYLENE	3.4E+02	noncarcinogenic effects			3.4E+02	1.7E+03	NA
ACETONE	1.2E+04	noncarcinogenic effects			1.2E+04	6.1E+04	1.2E+05
ALDRIN	3.9E+00	noncarcinogenic effects	1.7E+01		3.9E+00	7.8E+00	NA
AMETRYN	1.1E+02	noncarcinogenic effects			1.1E+02	5.7E+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	3.5E+03	noncarcinogenic effects			3.5E+03	1.7E+04	NA
ANTIMONY	6.3E+00	noncarcinogenic effects			6.3E+00	3.1E+01	NA
ARSENIC	2.3E+01	HDOH 2010	4.1E+01		2.2E+01	2.2E+01	NA
ATRAZINE	2.3E+00	carcinogenic effects	2.3E+00		4.4E+02	2.2E+03	NA
BARIUM	3.1E+03	noncarcinogenic effects			3.1E+03	1.5E+04	NA
BENOMYL	6.3E+02	noncarcinogenic effects			6.3E+02	3.2E+03	NA
BENZENE	1.2E+00	carcinogenic effects	1.2E+00		1.7E+01	8.5E+01	1.9E+03
BENZO(a)ANTHRACENE	1.1E+01	mutagenic effects	4.8E+01	1.1E+01			NA
BENZO(a)PYRENE	3.6E+00	noncarcinogenic effects	2.5E+01	5.6E+00	3.6E+00	1.8E+01	NA
BENZO(b)FLUORANTHENE	1.1E+01	mutagenic effects	4.9E+01	1.1E+01			NA
BENZO(g,h,i)PERYLENE	4.8E+02	noncarcinogenic effects			4.8E+02	2.4E+03	NA
BENZO(k)FLUORANTHENE	1.1E+02	mutagenic effects	4.9E+02	1.1E+02			NA
BERYLLIUM	3.1E+01	noncarcinogenic effects	1.6E+03		3.1E+01	1.6E+02	NA
BIPHENYL, 1,1-	1.0E+01	noncarcinogenic effects	8.4E+01		1.0E+01	5.1E+01	NA
BIS(2-CHLOROETHYL)ETHER	2.4E-01	carcinogenic effects	2.4E-01				5.0E+03
BIS(2-CHLORO-1-METHYLETHYL)ETHER	3.7E+00	carcinogenic effects	3.7E+00		3.1E+02	1.6E+03	7.9E+02
BIS(2-ETHYLHEXYL)PHTHALATE	3.7E+01	carcinogenic effects	3.7E+01		2.5E+02	1.3E+03	NA
BORON	3.1E+03	noncarcinogenic effects			3.1E+03	1.6E+04	NA
BROMODICHLOROMETHANE	3.2E-01	carcinogenic effects	3.2E-01		5.8E+01	2.9E+02	9.3E+02
BROMOFORM	2.0E+01	carcinogenic effects	2.0E+01		3.1E+02	1.6E+03	NA
BROMOMETHANE	1.5E+00	noncarcinogenic effects			1.5E+00	7.4E+00	3.6E+03
CADMIUM	1.4E+01	noncarcinogenic effects	2.1E+03		1.4E+01	7.1E+01	NA
CARBON TETRACHLORIDE	7.1E-01	carcinogenic effects	7.1E-01		2.2E+01	1.1E+02	4.5E+02
CHLORDANE (TECHNICAL)	1.7E+01	carcinogenic effects	1.7E+01		3.5E+01	3.5E+01	NA
CHLOROANILINE, p-	2.6E+00	carcinogenic effects	2.6E+00		5.1E+01	2.5E+02	NA
CHLOROBENZENE	5.9E+01	noncarcinogenic effects			5.9E+01	2.9E+02	7.6E+02
CHLOROETHANE	2.1E+03	saturation limit			3.0E+03	1.5E+04	2.1E+03
CHLOROFORM	3.4E-01	carcinogenic effects	3.4E-01		4.2E+01	2.1E+02	2.5E+03
CHLOROMETHANE	2.4E+01	noncarcinogenic effects			2.4E+01	1.2E+02	1.3E+03
CHLOROPHENOL, 2-	7.0E+01	noncarcinogenic effects			7.0E+01	3.5E+02	2.7E+04
CHROMIUM (Total)		not available					
CHROMIUM III	2.3E+04	noncarcinogenic effects			2.3E+04	1.2E+05	NA
CHROMIUM VI	3.0E+01	mutagenic effects	1.3E+02	3.0E+01	4.7E+01	2.3E+02	NA
CHRYSENE	1.1E+03	mutagenic effects	4.9E+03	1.1E+03			NA
COBALT	4.7E+00	noncarcinogenic effects	4.2E+02		4.7E+00	2.3E+01	NA
COPPER	6.3E+02	noncarcinogenic effects			6.3E+02	3.1E+03	NA
CYANIDE (Free)	4.8E+00	noncarcinogenic effects			4.8E+00	2.4E+01	NA
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	5.9E+00	carcinogenic effects	5.9E+00		4.5E+01	2.3E+02	NA
DALAPON	3.8E+02	noncarcinogenic effects			3.8E+02	1.9E+03	NA
DIBENZO(a,h)ANTHTRACENE	1.1E+00	mutagenic effects	4.9E+00	1.1E+00			NA

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

CHEMICAL	Final Action Level (mg/kg)	Basis	[2]Carcinogens (mg/kg)	[2]Mutagens (mg/kg)	[3]Noncarcinogens (Final) (mg/kg)	[3]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
DIBROMO,1,2- CHLOROPROPANE,3-	5.7E-03	mutagenic effects	1.6E-02	5.7E-03	9.9E-01	5.0E+00	9.8E+02
DIBROMOCHLOROMETHANE	8.0E+00	carcinogenic effects	8.0E+00		9.8E+01	4.9E+02	NA
DIBROMOETHANE, 1,2-	3.9E-02	carcinogenic effects	3.9E-02		1.6E+01	7.8E+01	NA
DICHLOROBENZENE, 1,2-	3.8E+02	saturation limit			3.9E+02	1.9E+03	3.8E+02
DICHLOROBENZENE, 1,3-	2.0E+02	noncarcinogenic effects			2.0E+02	1.0E+03	6.0E+02
DICHLOROBENZENE, 1,4-	2.8E+00	carcinogenic effects	2.8E+00		6.9E+02	3.5E+03	NA
DICHLOROBENZIDINE, 3,3-	1.2E+00	carcinogenic effects	1.2E+00				NA
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.2E+00	carcinogenic effects	2.2E+00				NA
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.9E+00	carcinogenic effects	1.9E+00				NA
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.8E+00	carcinogenic effects	1.8E+00		7.3E+00	3.7E+01	NA
DICHLOROETHANE, 1,1-	3.8E+00	carcinogenic effects	3.8E+00		3.4E+02	1.7E+03	1.7E+03
DICHLOROETHANE, 1,2-	5.0E-01	carcinogenic effects	5.0E-01		6.7E+00	3.4E+01	3.0E+03
DICHLOROETHYLENE, 1,1-	4.9E+01	noncarcinogenic effects			4.9E+01	2.4E+02	1.2E+03
DICHLOROETHYLENE, Cis 1,2-	3.9E+00	noncarcinogenic effects			3.9E+00	2.0E+01	2.4E+03
DICHLOROETHYLENE, Trans 1,2-	2.9E+01	noncarcinogenic effects			2.9E+01	1.4E+02	1.9E+03
DICHLOROPHENOL, 2,4-	3.8E+01	noncarcinogenic effects			3.8E+01	1.9E+02	NA
DICHLOROPHENOXYACETIC ACID (2,4-D)	1.4E+02	noncarcinogenic effects			1.4E+02	7.0E+02	NA
DICHLOROPROPANE, 1,2-	2.6E+00	carcinogenic effects	2.6E+00		3.4E+00	1.7E+01	1.4E+03
DICHLOROPROPENE, 1,3-	1.9E+00	carcinogenic effects	1.9E+00		1.5E+01	7.7E+01	1.6E+03
DIELDRIN	2.5E+00	noncarcinogenic effects	7.5E+00		2.5E+00	5.1E+00	NA
DIETHYLPHTHALATE	1.0E+04	noncarcinogenic effects			1.0E+04	5.1E+04	NA
DIMETHYLPHENOL, 2,4-	2.5E+02	noncarcinogenic effects			2.5E+02	1.3E+03	NA
DIMETHYLPHTHALATE	1.3E+05	noncarcinogenic effects			1.3E+05	6.3E+05	NA
DINITROBENZENE, 1,3-	1.3E+00	noncarcinogenic effects			1.3E+00	6.3E+00	NA
DINITROPHENOL, 2,4-	2.5E+01	noncarcinogenic effects			2.5E+01	1.3E+02	NA
DINITROTOLUENE, 2,4- (2,4-DNT)	1.7E+00	carcinogenic effects	1.7E+00		2.5E+01	1.3E+02	NA
DINITROTOLUENE, 2,6- (2,6-DNT)	3.5E-01	carcinogenic effects	3.5E-01		3.8E+00	1.9E+01	NA
DIOXANE, 1,4-	5.3E+00	carcinogenic effects	5.3E+00		1.7E+02	8.5E+02	1.2E+05
DIOXINS (TEQ)	2.4E-04	HDOH 2010a					
DIURON	2.5E+01	noncarcinogenic effects			2.5E+01	1.3E+02	NA
ENDOSULFAN	9.4E+01	noncarcinogenic effects			9.4E+01	4.7E+02	NA
ENDRIN	3.8E+00	noncarcinogenic effects			3.8E+00	1.9E+01	NA
ETHANOL		not available					
ETHYLBENZENE	6.2E+01	carcinogenic effects	6.2E+01		7.1E+02	3.5E+03	4.8E+02
FLUORANTHENE	4.8E+02	noncarcinogenic effects			4.8E+02	2.4E+03	NA
FLUORENE	4.6E+02	noncarcinogenic effects			4.6E+02	2.3E+03	NA
GLYPHOSATE	1.3E+03	noncarcinogenic effects			1.3E+03	6.3E+03	NA
HEPTACHLOR	1.3E+00	carcinogenic effects	1.3E+00		7.8E+00	3.9E+01	NA
HEPTACHLOR EPOXIDE	2.0E-01	noncarcinogenic effects	6.9E-01		2.0E-01	1.0E+00	NA
HEXACHLOROBENZENE	2.2E-01	carcinogenic effects	2.2E-01		1.3E+01	6.3E+01	NA
HEXACHLOROBUTADIENE	1.3E+00	carcinogenic effects	1.3E+00		1.6E+01	7.8E+01	NA
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	5.5E-01	carcinogenic effects	5.5E-01		4.3E+00	2.1E+01	NA
HEXACHLOROETHANE	2.0E+00	carcinogenic effects	2.0E+00		9.1E+00	4.6E+01	NA
HEXAZINONE	4.2E+02	noncarcinogenic effects			4.2E+02	2.1E+03	NA
INDENO(1,2,3-cd)PYRENE	1.1E+01	mutagenic effects	4.9E+01	1.1E+01			NA
ISOPHORONE	5.5E+02	carcinogenic effects	5.5E+02		2.5E+03	1.3E+04	NA
LEAD	2.0E+02	noncarcinogenic effects			2.0E+02		NA

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

CHEMICAL	Final Action Level (mg/kg)	Basis	[2]Carcinogens (mg/kg)	[2]Mutagens (mg/kg)	[3]Noncarcinogens (Final) (mg/kg)	[3]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
MERCURY	4.7E+00	noncarcinogenic effects			4.7E+00	2.3E+01	NA
METHOXYCHLOR	6.3E+01	noncarcinogenic effects			6.3E+01	3.2E+02	NA
METHYL ETHYL KETONE	5.6E+03	noncarcinogenic effects			5.6E+03	2.8E+04	2.8E+04
METHYL ISOBUTYL KETONE	3.4E+03	saturation limit			7.2E+03	3.6E+04	3.4E+03
METHYL MERCURY	1.6E+00	noncarcinogenic effects			1.6E+00	7.8E+00	NA
METHYL TERT BUTYL ETHER	5.0E+01	carcinogenic effects	5.0E+01		3.3E+03	1.7E+04	8.9E+03
METHYLENE CHLORIDE	5.8E+01	mutagenic effects	2.2E+02	5.8E+01	7.2E+01	3.6E+02	3.3E+03
METHYLNAPHTHALENE, 1-	1.7E+02	carcinogenic effects	1.7E+02		6.8E+02	3.4E+03	NA
METHYLNAPHTHALENE, 2-	3.9E+01	noncarcinogenic effects			3.9E+01	2.0E+02	NA
MOLYBDENUM	7.8E+01	noncarcinogenic effects			7.8E+01	3.9E+02	NA
NAPHTHALENE	2.8E+01	noncarcinogenic effects	4.2E+01		2.8E+01	1.4E+02	NA
NICKEL	3.1E+02	noncarcinogenic effects			3.1E+02	1.5E+03	NA
NITROBENZENE	5.6E+00	carcinogenic effects	5.6E+00		2.6E+01	1.3E+02	3.0E+03
NITROGLYCERIN	1.3E+00	noncarcinogenic effects	3.1E+01		1.3E+00	6.3E+00	NA
NITROTOLUENE, 2-	3.1E+00	carcinogenic effects	3.1E+00		1.2E+01	6.2E+01	NA
NITROTOLUENE, 3-	1.3E+00	noncarcinogenic effects			1.3E+00	6.3E+00	NA
NITROTOLUENE, 4-	3.3E+01	carcinogenic effects	3.3E+01		5.1E+01	2.5E+02	NA
PENTACHLOROPHENOL	9.8E-01	carcinogenic effects	9.8E-01		4.9E+01	2.5E+02	NA
PENTAERYTHRITOLTETRANITRATE (PETN)	2.5E+01	noncarcinogenic effects	1.3E+02		2.5E+01	1.3E+02	NA
PERCHLORATE	1.1E+01	noncarcinogenic effects			1.1E+01	5.5E+01	NA
PHENANTHRENE	4.6E+02	noncarcinogenic effects			4.6E+02	2.3E+03	NA
PHENOL	3.8E+03	noncarcinogenic effects			3.8E+03	1.9E+04	NA
POLYCHLORINATED BIPHENYLS (PCBs)	1.2E+00	noncarcinogenic effects	2.3E+00		1.2E+00	1.2E+00	NA
PROPICONAZOLE	1.3E+03	noncarcinogenic effects			1.3E+03	6.3E+03	NA
PYRENE	3.6E+02	noncarcinogenic effects			3.6E+02	1.8E+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	4.4E+00	carcinogenic effects	4.4E+00		6.3E+01	3.2E+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	8.2E+02	NA
tert-BUTYL ALCOHOL	9.0E+01	carcinogenic effects	9.0E+01				3.2E+05
TETRACHLOROETHANE, 1,1,1,2-	2.2E+00	carcinogenic effects	2.2E+00		1.2E+02	5.9E+02	6.8E+02
TETRACHLOROETHANE, 1,1,2,2-	6.4E-01	carcinogenic effects	6.4E-01		3.1E+02	1.6E+03	1.9E+03
TETRACHLOROETHYLENE	1.1E+00	carcinogenic effects	1.1E+00		1.7E+01	8.7E+01	1.7E+02
TETRACHLOROPHENOL, 2,3,4,6-	3.8E+02	noncarcinogenic effects			3.8E+02	1.9E+03	NA
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	7.7E+02	noncarcinogenic effects			7.7E+02	3.9E+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	4.8E-01	carcinogenic effects	4.8E-01				NA
TPH (gasolines)	4.5E+02	noncarcinogenic effects			4.5E+02	4.5E+02	2.0E+03
TPH (middle distillates)	2.2E+02	noncarcinogenic effects			2.2E+02	2.2E+02	6.8E+02
TPH (residual fuels)	9.4E+03	noncarcinogenic effects			9.4E+03	9.4E+03	NA
TRICHLOROBENZENE, 1,2,4-	1.2E+01	noncarcinogenic effects	2.3E+01		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	1.2E+00		3.2E-01	1.6E+00	2.2E+03
TRICHLOROETHYLENE	8.9E-01	noncarcinogenic effects	-	9.4E-01	8.9E-01	4.4E+00	6.9E+02
TRICHLOROPHENOL, 2,4,5-	1.3E+03	noncarcinogenic effects			1.3E+03	6.3E+03	NA

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

CHEMICAL	Final Action Level (mg/kg)	Basis	[2]Carcinogens (mg/kg)	[2]Mutagens (mg/kg)	[3]Noncarcinogens (Final) (mg/kg)	[3]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
TRICHLOROPHENOL, 2,4,6-	1.3E+01	noncarcinogenic effects	4.8E+01		1.3E+01	6.3E+01	NA
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	1.3E+02	noncarcinogenic effects			1.3E+02	6.3E+02	NA
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	1.0E+02	noncarcinogenic effects			1.0E+02	5.1E+02	NA
TRICHLOROPROPANE, 1,2,3-	5.0E-03	mutagenic effects	2.2E-02	5.0E-03	1.1E+00	5.3E+00	1.4E+03
TRICHLOROPROPENE, 1,2,3-	1.6E-01	noncarcinogenic effects			1.6E-01	7.9E-01	3.1E+02
TRIFLURALIN	8.7E+01	carcinogenic effects	8.7E+01		1.2E+02	5.9E+02	NA
TRINITROBENZENE, 1,3,5-	4.5E+02	noncarcinogenic effects			4.5E+02	2.2E+03	NA
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	3.1E+01	noncarcinogenic effects			3.1E+01	1.6E+02	NA
TRINITROTOLUENE, 2,4,6- (TNT)	7.3E+00	noncarcinogenic effects	2.1E+01		7.3E+00	3.6E+01	NA
VANADIUM	7.8E+01	noncarcinogenic effects			7.8E+01	3.9E+02	NA
VINYL CHLORIDE	5.9E-02	mutagenic effects	-	5.9E-02	1.5E+01	7.4E+01	3.9E+03
XYLENES	1.3E+02	noncarcinogenic effects			1.3E+02	6.5E+02	2.6E+02
ZINC	4.7E+03	noncarcinogenic effects			4.7E+03	2.3E+04	NA

Primary source: USEPA Regional Screening Levels (USEPA 2017), modified as noted below and described in Appendix 1, Sections 1.4 and 4.2.2.

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 (see Sections 1.4 and 4.2.2). Target ECR of 10^{-5} used for Technical Chlordane and PCBs,ethylbenzene and cacinogenic PAHs with the exception of Benzo(a)pyrene. Target risk of $5x10^{-5}$ used for benzo(a)pyrene to allow focus on noncancer action levels. Target risk of 10^{-4} applied to aldrin, arsenic, dieldrin, TEQ dioxins and hexavalent chromium to reflect higher confidence in noncancer toxicity factors and/or background and other factors. Arsenic and TEQ dioxin action levels published separately (see Volume 1, Section 4.3.1.2).

3. Noncarcinogens: Final action level based on default target hazard quotient = 0.2 unless otherwise noted (see Sections 1.4 and 4.2.2). TPH action levels based on HQ of 1.0 (see below footnote and Sections 3.2 and 6.0 in text). Action levels for thallium and 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 - Action 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).

5. 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 (Final) (mg/kg)	[2]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
ACENAPHTHENE	6.3E+03	noncarcinogenic effects		6.3E+03	3.2E+04	NA
ACENAPHTHYLENE	2.5E+03	noncarcinogenic effects		2.5E+03	1.3E+04	NA
ACETONE	1.2E+05	saturation limit		1.2E+05	6.2E+05	1.2E+05
ALDRIN	5.1E+01	noncarcinogenic effects	7.1E+01	5.1E+01	1.0E+02	NA
AMETRYN	1.3E+03	noncarcinogenic effects		1.3E+03	6.5E+03	NA
AMINO,2- DINITROTOLUENE,4,6-	4.0E+02	noncarcinogenic effects		4.0E+02	2.0E+03	NA
AMINO,4- DINITROTOLUENE,2,6-	3.9E+02	noncarcinogenic effects		3.9E+02	2.0E+03	NA
ANTHRACENE	3.7E+04	noncarcinogenic effects		3.7E+04	1.9E+05	NA
ANTIMONY	8.2E+01	noncarcinogenic effects		8.2E+01	4.1E+02	NA
ARSENIC	9.5E+01	HDOH 2010	1.7E+02	2.7E+02	2.7E+02	NA
ATRAZINE	8.7E+00	carcinogenic effects	8.7E+00	5.0E+03	2.5E+04	NA
BARIUM	4.3E+03	trench/construction worker		3.8E+04	1.9E+05	NA
BENOMYL	7.2E+03	noncarcinogenic effects		7.2E+03	3.6E+04	NA
BENZENE	5.2E+00	carcinogenic effects	5.2E+00	8.7E+01	4.3E+02	1.9E+03
BENZO(a)ANTHRACENE	1.8E+02	carcinogenic effects	1.8E+02			NA
BENZO(a)PYRENE	1.5E+01	trench/construction worker	9.2E+01	3.9E+01	1.9E+02	NA
BENZO(b)FLUORANTHENE	1.8E+02	carcinogenic effects	1.8E+02			NA
BENZO(g,h,i)PERYLENE	5.3E+03	noncarcinogenic effects		5.3E+03	2.6E+04	NA
BENZO(k)FLUORANTHENE	1.8E+03	carcinogenic effects	1.8E+03			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	3.6E+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-CHLORO-1-METHYLETHYL)ETHER	1.6E+01	carcinogenic effects	1.6E+01	2.0E+03	1.0E+04	7.9E+02
BIS(2-ETHYLHEXYL)PHTHALATE	1.4E+02	carcinogenic effects	1.4E+02	2.9E+03	1.4E+04	NA
BORON	4.1E+04	noncarcinogenic effects		4.1E+04	2.0E+05	NA
BROMODICHLOROMETHANE	1.4E+00	carcinogenic effects	1.4E+00	2.8E+02	1.4E+03	9.3E+02
BROMOFORM	8.8E+01	carcinogenic effects	8.8E+01	4.1E+03	2.0E+04	NA
BROMOMETHANE	6.5E+00	noncarcinogenic effects		6.5E+00	3.3E+01	3.6E+03
CADMIUM	7.2E+01	trench/construction worker	9.3E+03	1.7E+02	8.6E+02	NA
CARBON TETRACHLORIDE	3.1E+00	carcinogenic effects	3.1E+00	1.2E+02	6.1E+02	4.5E+02
CHLORDANE (TECHNICAL)	6.8E+01	carcinogenic effects	6.8E+01		4.0E+02	NA
CHLOROANILINE, p-	1.0E+01	carcinogenic effects	1.0E+01	5.7E+02	2.9E+03	NA
CHLOROBENZENE	2.8E+02	noncarcinogenic effects		2.8E+02	1.4E+03	7.6E+02
CHLOROETHANE	2.1E+03	saturation limit		1.3E+04	6.3E+04	2.1E+03
CHLOROFORM	1.5E+00	carcinogenic effects	1.5E+00	2.2E+02	1.1E+03	2.5E+03
CHLOROMETHANE	1.0E+02	noncarcinogenic effects		1.0E+02	5.1E+02	1.3E+03
CHLOROPHENOL, 2-	7.4E+02	noncarcinogenic effects		7.4E+02	3.7E+03	2.7E+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	1.8E+04	carcinogenic effects	1.8E+04			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)	3.0E+01	noncarcinogenic effects		3.0E+01	1.5E+02	NA
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	2.4E+01	carcinogenic effects	2.4E+01	5.8E+02	2.9E+03	NA
DALAPON	4.3E+03	noncarcinogenic effects		4.3E+03	2.2E+04	NA
DIBENZO(a,h)ANTHTRACENE	1.8E+01	carcinogenic effects	1.8E+01			NA
DIBROMO,1,2- CHLOROPROPANE,3-	7.0E-02	carcinogenic effects	7.0E-02	5.3E+00	2.7E+01	9.8E+02

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 (Final) (mg/kg)	[2]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
DIBROMOCHLOROMETHANE	3.4E+01	carcinogenic effects	3.4E+01	5.2E+02	2.6E+03	NA
DIBROMOETHANE, 1,2-	1.7E-01	carcinogenic effects	1.7E-01	7.1E+01	3.5E+02	NA
DICHLOROBENZENE, 1,2-	3.8E+02	saturation limit		2.0E+03	1.0E+04	3.8E+02
DICHLOROBENZENE, 1,3-	6.0E+02	saturation limit		1.2E+03	6.1E+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-	4.5E+00	carcinogenic effects	4.5E+00			NA
DICHLORODIPHENYLDICHLOROETHANE (DDD)	8.4E+00	carcinogenic effects	8.4E+00			NA
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	8.2E+00	carcinogenic effects	8.2E+00			NA
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	7.5E+00	carcinogenic effects	7.5E+00	9.1E+01	4.5E+02	NA
DICHLOROETHANE, 1,1-	1.7E+01	carcinogenic effects	1.7E+01	1.5E+03	7.6E+03	1.7E+03
DICHLOROETHANE, 1,2-	2.2E+00	carcinogenic effects	2.2E+00	3.0E+01	1.5E+02	3.0E+03
DICHLOROETHYLENE, 1,1-	2.1E+02	noncarcinogenic effects		2.1E+02	1.1E+03	1.2E+03
DICHLOROETHYLENE, Cis 1,2-	1.8E+01	noncarcinogenic effects		1.8E+01	9.0E+01	2.4E+03
DICHLOROETHYLENE, Trans 1,2-	1.3E+02	noncarcinogenic effects		1.3E+02	6.4E+02	1.9E+03
DICHLOROPHENOL, 2,4-	4.3E+02	noncarcinogenic effects		4.3E+02	2.2E+03	NA
DICHLOROPHENOXYACETIC ACID (2,4-D)	1.7E+03	noncarcinogenic effects		1.7E+03	8.4E+03	NA
DICHLOROPROPANE, 1,2-	1.1E+01	carcinogenic effects	1.1E+01	1.4E+01	7.1E+01	1.4E+03
DICHLOROPROPENE, 1,3-	8.3E+00	carcinogenic effects	8.3E+00	6.6E+01	3.3E+02	1.6E+03
DIELDRIN	2.9E+01	carcinogenic effects	2.9E+01	2.9E+01	5.7E+01	NA
DIETHYLPHTHALATE	1.1E+05	noncarcinogenic effects		1.1E+05	5.7E+05	NA
DIMETHYLPHENOL, 2,4-	2.9E+03	noncarcinogenic effects		2.9E+03	1.4E+04	NA
DIMETHYLPHTHALATE	1.0E+06	maximum		1.4E+06	7.2E+06	NA
DINITROBENZENE, 1,3-	1.4E+01	noncarcinogenic effects		1.4E+01	7.2E+01	NA
DINITROPHENOL, 2,4-	2.9E+02	noncarcinogenic effects		2.9E+02	1.4E+03	NA
DINITROTOLUENE, 2,4- (2,4-DNT)	6.4E+00	carcinogenic effects	6.4E+00	2.9E+02	1.4E+03	NA
DINITROTOLUENE, 2,6- (2,6-DNT)	1.3E+00	carcinogenic effects	1.3E+00	4.3E+01	2.2E+02	NA
DIOXANE, 1,4-	2.2E+01	carcinogenic effects	2.2E+01	9.5E+02	4.7E+03	1.2E+05
DIOXINS (TEQ)	1.5E-03	HDOH 2010a				
DIURON	2.9E+02	noncarcinogenic effects		2.9E+02	1.4E+03	NA
ENDOSULFAN	1.2E+03	noncarcinogenic effects		1.2E+03	6.1E+03	NA
ENDRIN	4.3E+01	noncarcinogenic effects		4.3E+01	2.2E+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	5.3E+03	noncarcinogenic effects		5.3E+03	2.6E+04	NA
FLUORENE	4.7E+03	noncarcinogenic effects		4.7E+03	2.3E+04	NA
GLYPHOSATE	1.4E+04	noncarcinogenic effects		1.4E+04	7.2E+04	NA
HEPTACHLOR	5.6E+00	carcinogenic effects	5.6E+00	1.0E+02	5.1E+02	NA
HEPTACHLOR EPOXIDE	2.7E+00	noncarcinogenic effects	2.9E+00	2.7E+00	1.3E+01	NA
HEXACHLOROBENZENE	9.4E-01	carcinogenic effects	9.4E-01	1.6E+02	8.2E+02	NA
HEXACHLOROBUTADIENE	5.5E+00	carcinogenic effects	5.5E+00	2.0E+02	1.0E+03	NA
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	2.2E+00	carcinogenic effects	2.2E+00	5.2E+01	2.6E+02	NA
HEXACHLOROETHANE	8.5E+00	carcinogenic effects	8.5E+00	8.8E+01	4.4E+02	NA
HEXAZINONE	4.7E+03	noncarcinogenic effects		4.7E+03	2.4E+04	NA
INDENO(1,2,3-cd)PYRENE	1.8E+02	carcinogenic effects	1.8E+02			NA
ISOPHORONE	2.1E+03	carcinogenic effects	2.1E+03	2.9E+04	1.4E+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	7.2E+02	noncarcinogenic effects		7.2E+02	3.6E+03	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 (Final) (mg/kg)	[2]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
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		3.0E+04	1.5E+05	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	6.2E+02	noncarcinogenic effects	9.6E+02	6.2E+02	3.1E+03	3.3E+03
METHYLNAPHTHALENE, 1-	4.5E+02	trench/construction worker	6.4E+02	5.8E+03	2.9E+04	NA
METHYLNAPHTHALENE, 2-	3.3E+02	noncarcinogenic effects		3.3E+02	1.7E+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	7.4E+02	trench/construction worker		3.9E+03	2.0E+04	NA
NITROBENZENE	2.4E+01	carcinogenic effects	2.4E+01	2.5E+02	1.2E+03	3.0E+03
NITROGLYCERIN	1.4E+01	noncarcinogenic effects	1.2E+02	1.4E+01	7.2E+01	NA
NITROTOLUENE, 2-	1.3E+01	carcinogenic effects	1.3E+01	1.3E+02	6.6E+02	NA
NITROTOLUENE, 3-	1.4E+01	noncarcinogenic effects		1.4E+01	7.2E+01	NA
NITROTOLUENE, 4-	1.3E+02	carcinogenic effects	1.3E+02	5.7E+02	2.9E+03	NA
PENTACHLOROPHENOL	3.5E+00	carcinogenic effects	3.5E+00	5.0E+02	2.5E+03	NA
PENTAERYTHRITOLTETRANITRATE (PETN)	2.9E+02	noncarcinogenic effects	5.0E+02	2.9E+02	1.4E+03	NA
PERCHLORATE	1.4E+02	noncarcinogenic effects		1.4E+02	7.2E+02	NA
PHENANTHRENE	4.9E+03	noncarcinogenic effects		4.9E+03	2.4E+04	NA
PHENOL	4.3E+04	noncarcinogenic effects		4.3E+04	2.2E+05	NA
POLYCHLORINATED BIPHENYLS (PCBs)	8.6E+00	carcinogenic effects	8.6E+00	1.3E+01	1.3E+01	NA
PROPICONAZOLE	1.4E+04	noncarcinogenic effects		1.4E+04	7.2E+04	NA
PYRENE	3.9E+03	noncarcinogenic effects		3.9E+03	1.9E+04	NA
SELENIUM	1.0E+03	noncarcinogenic effects		1.0E+03	5.1E+03	NA
SILVER	1.0E+03	noncarcinogenic effects		1.0E+03	5.1E+03	NA
SIMAZINE	1.7E+01	carcinogenic effects	1.7E+01	7.2E+02	3.6E+03	NA
STYRENE	8.7E+02	saturation limit		7.4E+03	3.7E+04	8.7E+02
TERBACIL	1.9E+03	noncarcinogenic effects		1.9E+03	9.3E+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	5.9E+02	3.0E+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	5.0E+00	carcinogenic effects	5.0E+00	8.4E+01	4.2E+02	1.7E+02
TETRACHLOROPHENOL, 2,3,4,6-	4.3E+03	noncarcinogenic effects		4.3E+03	2.2E+04	NA
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	1.0E+04	noncarcinogenic effects		1.0E+04	5.0E+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	1.8E+00	carcinogenic effects	1.8E+00			NA
TPH (gasolines)	2.0E+03	saturation limit		2.2E+03	2.2E+03	2.0E+03
TPH (middle distillates)	6.8E+02	saturation limit		1.0E+03	1.0E+03	6.8E+02
TPH (residual fuels)	1.2E+05	noncarcinogenic effects		1.2E+05	1.2E+05	NA
TRICHLOROBENZENE, 1,2,4-	5.5E+01	noncarcinogenic effects	9.9E+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	2.2E+03
TRICHLOROETHYLENE	4.0E+00	noncarcinogenic effects	6.4E+00	4.0E+00	2.0E+01	6.9E+02
TRICHLOROPHENOL, 2,4,5-	1.4E+04	noncarcinogenic effects		1.4E+04	7.2E+04	NA
TRICHLOROPHENOL, 2,4,6-	1.4E+02	noncarcinogenic effects	1.8E+02	1.4E+02	7.2E+02	NA
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	1.4E+03	noncarcinogenic effects		1.4E+03	7.2E+03	NA
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	1.1E+03	noncarcinogenic effects		1.1E+03	5.7E+03	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 (Final) (mg/kg)	[2]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
TRICHLOROPROPANE, 1,2,3-	9.5E-02	carcinogenic effects	9.5E-02	4.5E+00	2.2E+01	1.4E+03
TRICHLOROPROPENE, 1,2,3-	6.7E-01	noncarcinogenic effects		6.7E-01	3.3E+00	3.1E+02
TRIFLURALIN	3.7E+02	carcinogenic effects	3.7E+02	1.5E+03	7.7E+03	NA
TRINITROBENZENE, 1,3,5-	5.7E+03	noncarcinogenic effects		5.7E+03	2.8E+04	NA
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	4.1E+02	noncarcinogenic effects		4.1E+02	2.0E+03	NA
TRINITROTOLUENE, 2,4,6- (TNT)	8.4E+01	carcinogenic effects	8.4E+01	9.0E+01	4.5E+02	NA
VANADIUM	6.4E+02	trench/construction worker		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	2.6E+02	saturation limit		5.4E+02	2.7E+03	2.6E+02
ZINC	6.1E+04	noncarcinogenic effects		6.1E+04	3.1E+05	NA

Primary source: USEPA Regional Screening Levels (USEPA 2017), modified as noted below and described in Appendix 1, Sections 1.4 and 4.2.2.

Notes:

1. Carcinogens: Default target excess cancer risk = 10^{-6} unless otherwise noted (see Sections 1.4 and 4.2.2). Target ECR of 10^{-5} used for Technical Chlordane and PCBs,ethylbenzene and cacinogenic PAHs with the exception of Benzo(a)pyrene. Target risk of $5x10^{-5}$ used for benzo(a)pyrene to allow focus on noncancer action levels. Target risk of 10^{-4} applied to aldrin, arsenic, dieldrin, TEQ dioxins and hexavalent chromium to reflect higher confidence in noncancer toxicity factors and/or background and other factors. Arsenic and TEQ dioxin action levels published separately (see Volume 1, Section 4.3.1.2).

2. Noncarcinogens: Final action level based on default target hazard quotient = 0.2 unless otherwise noted (see Sections 1.4 and 4.2.2). TPH action levels based on HQ of 1.0 (see below footnote and Sections 3.2 and 6.0 in text). Action levels for thallium and 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 - Action 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 (Final) (mg/kg)	[2]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
ACENAPHTHENE	1.2E+04	noncarcinogenic effects		1.2E+04	5.9E+04	NA
ACENAPHTHYLENE	4.3E+03	noncarcinogenic effects		4.3E+03	2.1E+04	NA
ACETONE	1.2E+05	saturation limit		2.3E+05	1.2E+06	1.2E+05
ALDRIN	1.1E+02	noncarcinogenic effects	4.9E+02	1.1E+02	2.2E+02	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	7.2E+04	noncarcinogenic effects		7.2E+04	3.6E+05	NA
ANTIMONY	1.8E+02	noncarcinogenic effects		1.8E+02	8.8E+02	NA
ARSENIC	1.1E+02	carcinogenic effects	1.1E+02	3.1E+02	3.1E+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
BENOMYL	1.4E+04	noncarcinogenic effects		1.4E+04	7.2E+04	NA
BENZENE	2.9E+01	carcinogenic effects	2.9E+01	1.3E+02	6.7E+02	1.9E+03
BENZO(a)ANTHRACENE	1.3E+03	carcinogenic effects	1.3E+03			NA
BENZO(a)PYRENE	1.5E+01	noncarcinogenic effects	6.4E+02	1.5E+01	7.3E+01	NA
BENZO(b)FLUORANTHENE	1.3E+03	carcinogenic effects	1.3E+03			NA
BENZO(g,h,i)PERYLENE	1.0E+04	noncarcinogenic effects		1.0E+04	5.2E+04	NA
BENZO(k)FLUORANTHENE	1.3E+04	carcinogenic effects	1.3E+04			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	2.8E+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-CHLORO-1-METHYLETHYL)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	4.3E+02	2.1E+03	9.3E+02
BROMOFORM	5.1E+03	carcinogenic effects	5.1E+03	8.8E+03	4.4E+04	NA
BROMOMETHANE	9.7E+00	noncarcinogenic effects		9.7E+00	4.9E+01	3.6E+03
CADMIUM	7.2E+01	noncarcinogenic effects	2.5E+03	7.2E+01	3.6E+02	NA
CARBON TETRACHLORIDE	1.7E+01	carcinogenic effects	1.7E+01	1.9E+02	9.5E+02	4.5E+02
CHLORDANE (TECHNICAL)	4.9E+02	carcinogenic effects	4.9E+02	8.0E+02	8.0E+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		1.9E+04	9.3E+04	2.1E+03
CHLOROFORM	8.0E+00	carcinogenic effects	8.0E+00	3.4E+02	1.7E+03	2.5E+03
CHLOROMETHANE	1.5E+02	noncarcinogenic effects		1.5E+02	7.6E+02	1.3E+03
CHLOROPHENOL, 2-	1.4E+03	noncarcinogenic effects		1.4E+03	7.0E+03	2.7E+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	1.3E+05	carcinogenic effects	1.3E+05			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)	4.9E+01	noncarcinogenic effects		4.9E+01	2.4E+02	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	1.3E+02	carcinogenic effects	1.3E+02			NA
DIBROMO,1,2- CHLOROPROPANE,3-	3.7E-01	carcinogenic effects	3.7E-01	8.2E+00	4.1E+01	9.8E+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 (Final) (mg/kg)	[2]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
DIBROMOCHLOROMETHANE	2.6E+02	carcinogenic effects	2.6E+02	8.1E+02	4.1E+03	NA
DIBROMOETHANE, 1,2-	9.2E-01	carcinogenic effects	9.2E-01	1.1E+02	5.3E+02	NA
DICHLOROBENZENE, 1,2-	3.8E+02	saturation limit		3.1E+03	1.5E+04	3.8E+02
DICHLOROBENZENE, 1,3-	6.0E+02	saturation limit		1.9E+03	9.6E+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)	6.2E+02	carcinogenic effects	6.2E+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	2.3E+03	1.1E+04	1.7E+03
DICHLOROETHANE, 1,2-	1.2E+01	carcinogenic effects	1.2E+01	4.5E+01	2.2E+02	3.0E+03
DICHLOROETHYLENE, 1,1-	3.2E+02	noncarcinogenic effects		3.2E+02	1.6E+03	1.2E+03
DICHLOROETHYLENE, Cis 1,2-	2.7E+01	noncarcinogenic effects		2.7E+01	1.4E+02	2.4E+03
DICHLOROETHYLENE, Trans 1,2-	1.9E+02	noncarcinogenic effects		1.9E+02	9.7E+02	1.9E+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-	2.1E+01	noncarcinogenic effects	6.4E+01	2.1E+01	1.1E+02	1.4E+03
DICHLOROPROPENE, 1,3-	4.8E+01	carcinogenic effects	4.8E+01	9.8E+01	4.9E+02	1.6E+03
DIELDRIN	5.8E+01	noncarcinogenic effects	2.0E+02	5.8E+01	1.2E+02	NA
DIETHYLPHTHALATE	2.3E+05	noncarcinogenic effects		2.3E+05	1.2E+06	NA
DIMETHYLPHENOL, 2,4-	5.8E+03	noncarcinogenic effects		5.8E+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)	8.7E+01	noncarcinogenic effects	9.7E+01	8.7E+01	4.4E+02	NA
DIOXANE, 1,4-	1.5E+03	noncarcinogenic effects	1.6E+03	1.5E+03	7.4E+03	1.2E+05
DIOXINS (TEQ)	1.5E-03	HDOH 2010a	1.4E-02			
DIURON	5.8E+02	noncarcinogenic effects		5.8E+02	2.9E+03	NA
ENDOSULFAN	2.7E+03	noncarcinogenic effects		2.7E+03	1.3E+04	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	9.0E+03	noncarcinogenic effects		9.0E+03	4.5E+04	NA
GLYPHOSATE	2.9E+04	noncarcinogenic effects		2.9E+04	1.4E+05	NA
HEPTACHLOR	4.1E+01	carcinogenic effects	4.1E+01	2.2E+02	1.1E+03	NA
HEPTACHLOR EPOXIDE	5.8E+00	noncarcinogenic effects	2.2E+01	5.8E+00	2.9E+01	NA
HEXACHLOROBENZENE	5.9E+01	carcinogenic effects	5.9E+01	3.5E+02	1.8E+03	NA
HEXACHLOROBUTADIENE	3.1E+02	carcinogenic effects	3.1E+02	4.4E+02	2.2E+03	NA
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	1.1E+02	noncarcinogenic effects	1.6E+02	1.1E+02	5.5E+02	NA
HEXACHLOROETHANE	1.6E+02	noncarcinogenic effects	4.7E+02	1.6E+02	8.1E+02	NA
HEXAZINONE	9.6E+03	noncarcinogenic effects		9.6E+03	4.8E+04	NA
INDENO(1,2,3-cd)PYRENE	1.3E+03	carcinogenic effects	1.3E+03			NA
ISOPHORONE	5.8E+04	noncarcinogenic effects	1.5E+05	5.8E+04	2.9E+05	NA
LEAD	8.0E+02	commercial/industrial exposure				
MERCURY	1.3E+02	noncarcinogenic effects		1.3E+02	6.3E+02	NA
METHOXYCHLOR	1.4E+03	noncarcinogenic effects		1.4E+03	7.2E+03	NA

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

CHEMICAL	Final Action Level (mg/kg)	Basis	[1]Carcinogens (Risk = 10^{-5}) (mg/kg)	[2]Noncarcinogens (Final) (mg/kg)	[2]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
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		4.5E+04	2.2E+05	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	1.1E+03	noncarcinogenic effects	6.5E+03	1.1E+03	5.5E+03	3.3E+03
METHYLNAPHTHALENE, 1-	4.5E+02	carcinogenic effects	4.5E+02	1.0E+04	5.1E+04	NA
METHYLNAPHTHALENE, 2-	5.8E+02	noncarcinogenic effects		5.8E+02	2.9E+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	7.4E+02	noncarcinogenic effects		7.4E+02	3.7E+03	NA
NITROBENZENE	1.3E+02	carcinogenic effects	1.3E+02	4.5E+02	2.3E+03	3.0E+03
NITROGLYCERIN	2.9E+01	noncarcinogenic effects	8.5E+03	2.9E+01	1.4E+02	NA
NITROTOLUENE, 2-	1.0E+02	carcinogenic effects	1.0E+02	2.5E+02	1.3E+03	NA
NITROTOLUENE, 3-	2.9E+01	noncarcinogenic effects		2.9E+01	1.4E+02	NA
NITROTOLUENE, 4-	1.1E+03	noncarcinogenic effects	9.1E+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	5.9E+01	2.5E+01	2.5E+01	NA
PROPICONAZOLE	2.9E+04	noncarcinogenic effects		2.9E+04	1.4E+05	NA
PYRENE	7.7E+03	noncarcinogenic effects		7.7E+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	9.1E+02	4.5E+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	2.7E+01	carcinogenic effects	2.7E+01	1.3E+02	6.4E+02	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)	2.0E+03	saturation limit		3.4E+03	3.4E+03	2.0E+03
TPH (middle distillates)	6.8E+02	saturation limit		1.6E+03	1.6E+03	6.8E+02
TPH (residual fuels)	2.7E+05	noncarcinogenic effects		2.7E+05	2.7E+05	NA
TRICHLOROBENZENE, 1,2,4-	8.2E+01	noncarcinogenic effects	7.6E+02	8.2E+01	4.1E+02	NA
TRICHLOROETHANE, 1,1,1-	6.4E+02	saturation limit		1.2E+04	5.8E+04	6.4E+02
TRICHLOROETHANE, 1,1,2-	2.0E+00	noncarcinogenic effects	2.9E+01	2.0E+00	1.0E+01	2.2E+03
TRICHLOROETHYLENE	6.1E+00	noncarcinogenic effects	3.5E+01	6.1E+00	3.0E+01	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

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 (Final) (mg/kg)	[2]Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
TRICHLOROPROPANE, 1,2,3-	7.4E-01	carcinogenic effects	7.4E-01	6.7E+00	3.3E+01	1.4E+03
TRICHLOROPROPENE, 1,2,3-	9.9E-01	noncarcinogenic effects		9.9E-01	5.0E+00	3.1E+02
TRIFLURALIN	3.3E+03	noncarcinogenic effects	2.9E+04	3.3E+03	1.7E+04	NA
TRINITROBENZENE, 1,3,5-	1.2E+04	noncarcinogenic effects		1.2E+04	6.0E+04	NA
TRINITROPHENYLMETHYLNITRAMINE, 2,4,6- (TETRYL)	8.8E+02	noncarcinogenic effects		8.8E+02	4.4E+03	NA
TRINITROTOLUENE, 2,4,6- (TNT)	1.9E+02	noncarcinogenic effects	6.3E+03	1.9E+02	9.5E+02	NA
VANADIUM	6.4E+02	noncarcinogenic effects		6.4E+02	3.2E+03	NA
VINYL CHLORIDE	1.0E+01	carcinogenic effects	1.0E+01	1.2E+02	6.1E+02	3.9E+03
XYLENES	2.6E+02	saturation limit		8.1E+02	4.0E+03	2.6E+02
ZINC	1.3E+05	noncarcinogenic effects		1.3E+05	6.6E+05	NA

Primary source: USEPA Regional Screening Levels (USEPA 2017), modified as noted below and described in Appendix 1, Section 3.2.

1. Carcinogens: Default target excess cancer risk = 10^{-5} (see Sections 1.4 and 4.2.2). Target excess cancer risk of 10^{-6} used for volatile contaminants that are carcinogens. Target risk of 5x10-5 used for benzo(a)pyrene. Target risk of 10^{-4} applied to aldrin, dieldrin, TEQ dioxins and hexavalent chromium action levels to reflect on higher confidence in noncancer toxicity factors and/or background and other factors.

2. Noncarcinogens: Final action level based on default target hazard quotient = 0.2 unless noted (see Sections 1.4 and 4.2.2). TPH action levels based on HQ of 1.0 (see Section 3.2 in text). Action levels for Technical Chlordane and thallium based on HQ of 1.0. Action levels for aldrin and dieldrin (breakdown product of aldrin) based on HQ of 0.5. 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. Maximum dioxin screening level set equal to commercial/industrial screening level to address dietary contribution (see text).

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 2017).

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			
BENOMYL	C				5										
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-CHLORO-1-METHYLETHYL)ETHER	B2							5							
BIS(2-ETHYLHEXYL)PHTHALATE	?		6,7									7			No chronic toxicity factors.
BORON	D											3,5	4		
BROMODICHLOROMETHANE	B2		3							3,5					
BROMOFORM	B2		2,3,5							3	2,3				
BROMOMETHANE	D		1,2,4,5	2			1			1,2,3	2,3		2,3,4,5		
CADMIUM	B1/D									1,2,3,4,5			1,2,3		bone loss (1,3)
CARBON TETRACHLORIDE	B2		1,3,5		1					3	1				
CHLORDANE (TECHNICAL)	B2		2,3,5						2,4		3				
CHLOROANILINE, p-	?		2,5						4	2				2	
CHLOROBENZENE	D		1,2,4,5					2		1,2,3,4	2	1			
CHLOROETHANE	B		1		1,3										
CHLOROFORM	B2		1,2,3,5		1					1,2,3					
CHLOROMETHANE	C/D				3						2	2,3			
CHLOROPHENOL, 2-	D		1,3		1							1,4,5			
CHROMIUM (Total)	-														
CHROMIUM III	D							1					1	2	
CHROMIUM VI	A	M						1				1	1,5		
CHRYSENE	B2	M							3					3	No chronic toxicity factors.
COBALT	?			2									2	2	hearing (2)
COPPER	D		7										1,3	2	
CYANIDE (Free)	D			1,3		1,3,5		3			1,4,5		3		
CYCLO-1,3,5-TRIMETHYLENE-2,4,6-TRINITRAMINE (RDX)	C		3		3					3					
DALAPON	D									2,5,7					
DIBENZO(a,h)ANTHTRACENE	B2	M							3					2,3	
DIBROMO-3-CHLOROPROPANE, 1,2-	B2	M	1		1					2		1,2,3,4,5	1		
DIBROMOCHLOROMETHANE	C		5												
DIBROMOETHANE, 1,2-	B2				3							3	1,2		

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

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

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

CHEMICAL PARAMETER	Target Organs And Health Effects														
	[a]Carcinogen	[b]Mutagen	[c]Alimentary Tract	Cardiovascular	Developmental	Endocrine	Eye	Hematologic	Immune	Kidney	Nervous	Reproductive	Respiratory	[d]Skin	Other
METHYLENE CHLORIDE	B2	M	2,5	1						2	1				
METHYLNAPHTHALENE, 1-	C							4,5	3					3	= Fluorene
METHYLNAPHTHALENE, 2-	D							4,5	3					3	= Fluorene
MOLYBDENUM	D							5							
NAPHTHALENE	C						2	2	3				1,5	3	
NICKEL	A/D		1,5					1		5			1,2	2	
NITROBENZENE	D		1,2,3,4,5,6		2	4,5,6		2,3,4,5,6		4,5,6	1,6		2	6	
NITROGLYCERIN	?														Information not available
NITROTOLUENE, 2-	?		2					2				2			
NITROTOLUENE, 3-	D							2							
NITROTOLUENE, 4-	?		2					2				2			
PENTACHLOROPHENOL	B2		1,2,3,5		1,3			3	3	2,5	2,3	1	2,3		
PENTAERYTHRITOLTETRANITRATE (PETN)	?														Information not available
PERCHLORATE	D					7		2							
PHENANTHRENE	D							4,5	3					3	= Fluorene
PHENOL	D		1,2		3,5			1		1,2	1	4	1		
POLYCHLORINATED BIPHENYLS (PCBs)	B2		1,2,3		1,3	3	5	3	1,3,5			1,2,3		3	
PROPICONAZOLE	D		5												
PYRENE	D								3	4,5					
SELENIUM	D		1,2,5	1				5			1		1,2	2,3,5	Selenosis (3,5)
SILVER	D													2,3,5	
SIMAZINE	?				4,5			5,7						2	
STYRENE	C		3,4,5					4,5			1,2,4,5		2	2	
TERBACIL	D		5			5									
tert-BUTYL ALCOHOL	?														No chronic toxicity factors.
TETRACHLOROETHANE, 1,1,1,2-	C		5							5					
TETRACHLOROETHANE, 1,1,2,2-	C		2,3								2,3				
TETRACHLOROETHYLENE	C		1,2,5							1,2					
TETRACHLOROPHENOL, 2,3,4,6-	D		1		1							1			
TETRANITRO-1,3,5,7-TETRAAZOCYCLOOCTANE (HMX)	D														
THALLIUM	D		2	2			2	5			2,3	2,3		2	
TOLUENE	D		4,5		1,3					4,5	1,2,5	2	1,5		
TOXAPHENE	B2		3			3			3	3					
TPH (gasolines)	D		8					8		8	8				Decreased body weight
TPH (middle distillates)	D		8					8		8	8				Decreased body weight
TPH (residual fuels)	D		8					8		8	8				Decreased body weight
TRICHLOROBENZENE, 1,2,4-	D					4,5									
TRICHLOROETHANE, 1,1,1-	D		2,6	7							1				
TRICHLOROETHANE, 1,1,2-	C		5					6	7					2	
TRICHLOROETHYLENE	B2	M	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
(For general reference only. May not be adequately comprehensive for some chemicals. Some noted effects may be insignificant. Refer to original documents for additional information.)

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

Notes:

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

Carcinogen Classification

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

References:

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2. CDC, 2007, International Chemical Safety Cards: International Programme on Chemical Safety: United Nations Environment Program, International Labour Office and World Health Organization (accessed December 2007); published through US Department of Health and Human Services, Centers for Disease Control and Prevention, http://www.cdc.gov/niosh/ipcs/icstart.html
3. ATSDR, 2007, ToxFAQs™: Agency for Toxic Substances and Disease Registry (accessed December 2007), http://www.atsdr.cdc.gov/toxfaq.html
4. Illinois, 2001, Tiered Approach to Corrective Action Objectives (TACO): Illinois Environmental Protection Agency, Title 35, Subtitle G, Chapter I, Subchapter f, Part 742, Appendix A, Table E, Similar-Acting Noncarcinogenic Chemicals (accessed December 2007), http://www.ipcb.state.il.us/SLR/IPCBandIEPAEnvironmentalRegulations-Title35.asp
5. USEPA, 2007, IRIS: U.S. Environmental Protection Agency, IRIS Database (accessed December 2007); (Critical effect used for derivation of USEPA RfD as presented in IRIS database; may not be inclusive of all potentially significant health effects), http://www.epa.gov/iris/subst/index.html
6. ORNL, 2007, Risk Assessment Information System (RAIS), Toxicity Profiles: Oak Ridge National Laboratory/U.S. Department of Energy (accessed December 2007), RAGs A Format, especially Critical Effect used for derivation of RfDs, http://risk.lsd.ornl.gov/tox/rap_toxp.shtml
7. USEPA National Primary Drinking Water Standards (March 2001): U.S. Environmental Protection Agency, Office of Water, EPA 816-F-01-007, http://www.epa.gov/safewater/consumer/pdf/mcl.pdf (selectively used)
8. TPH whole product toxicity based review of TPH Working Group petroleum carbon fraction guidance (TPHWG 1998, Volume 4) and Massachusetts DEP VPH/EPH guidance (MADEP 2002a).
For additional online references, see also: Hazardous Substances (On-line) Database: U.S. National Library of Medicine, Toxicology Data Network, http://toxnet.nlm.nih.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
BENOMYL				
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-CHLORO-1-METHYLETHYL)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

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)
COPPER	2.4-450	2.5E+02	4.5E+02	2.5E+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)				
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				

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)
HEXACHLOROBENZENE				
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)				

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)
THALLIUM	<0.25-15	2.5E-01	1.5E+01	2.5E-01
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
BENOMYL	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-CHLORO-1-METHYLETHYL)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

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, 1,2-	site-specific	site-specific
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

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
METHYLNAPHTHALENE, 2-	site-specific	site-specific
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.