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Contract No. N62474-88-D-5086

Contract Task Order 0142

Navy Engineer-in-Charge: Dave Song

PRC Project Manager: Jim Sickles

NAVAL STATION TREASURE ISLAND
HUNTERS POINT ANNEX

# HEALTH-BASED LEVELS FOR CONTAMINANTS OF POTENTIAL CONCERN

Prepared By

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March 22, 1994

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30 June 1994

From: Commander, Western Division, Naval Facilities Engineering Command
To: Distribution

Subj: HEALTH-BASED LEVELS FOR HUNTERS POINT ANNEX

Encl: (1 Health-Based Levels for Contaminants of Potential Concern
Naval Station Treasure Island, Hunters Point Annex dated 22 March 1994

1. Enclosure (1) is provided per your request. HBLs were derived for residential and industrial/commercial scenarios for surface soils (0 to 2 feet below ground surface [bgs]), subsurface soils (deeper than 2 feet bgs), and groundwater at Naval Station Treasure Island, Hunters Point Annex (HPA). The HBLs were developed to be used as screening levels for the interim remedial action at HPA.

2. Should you have any questions regarding this matter, please contact Mr. Dave Song, Code 09ER1DS at (415) 244-2561.

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By direction

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March 22, 1994

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**Subject:** **Health-Based Levels for Soils and Groundwater at Naval Station Treasure Island, Hunters Point Annex Contract No. N62474-88-D-5086, Contract Task Order 0142**

Dear Mr. Song:

Per your request, PRC Environmental Management, Inc. (PRC) has enclosed Health-Based Levels (HBL) for Contaminants of Potential Concern (COPC). HBLs were derived for residential and industrial/commercial scenarios for surface soils (0 to 2 feet below ground surface [bgs]), subsurface soils (deeper than 2 feet bgs), and groundwater at Naval Station Treasure Island, Hunters Point Annex (HPA). The HBLs were developed to be used as screening levels for the interim remedial action at HPA. The enclosed document is a revision to the previously developed HBLs based on responses to regulator comments in past risk assessments at HPA and the updating of toxicity factors.

Please note the following changes based on responses to regulator comments:

- Previously, cumulative HBLs were developed and presented for individual components of total petroleum hydrocarbons (TPH) and total oil and grease (TOG), as well as for each as a mixture. HBLs for TPH and TOG as mixtures have been removed, while HBLs for individual components of TPH and TOG are still presented.

- Individual HBLs were developed for children (6 years) and adults (30 years) for both carcinogenic and noncarcinogenic HBLs. However, for the residential scenario, it was requested that HBLs consider the exposure to COPCs from 0 to 30 years of age, specifically 6 years as a child and 24 years as an adult. Therefore, for carcinogenic HBLs (HBLc), which are evaluated for average lifetime exposure rather than an individual HBLc for each adult and child, a cumulative HBLc was developed based on time-weighted values for 0 to 30 years of age. Noncarcinogenic HBLs (HBLn), on the other hand, are evaluated for subchronic and chronic exposures and therefore continue to be developed individually for the child (6 years) and adult (24 years).

- The child's body weight in developing HBLc has been reduced from 70 kilograms (kg) to 15 kg.

contains recycled fiber and is recyclable

- As recommended in the *Risk Assessment Guidance for Superfund (RAGS)*, Volume I, Part B, the hierarchy for obtaining federal dose-response toxicity values for HBLs is the on-line Integrated Risk Information System (IRIS), followed by Health Effects Assessment Summary Tables (HEAST). Other sources used to obtain toxicity values for HBLs include the Superfund Health Risk Technical Support Center (SHRTSC) and the State of Massachusetts Department of Environmental Protection (MDEP). California State Environmental Protection Agency (Cal/EPA) carcinogenic slope factors (SF) were added to the tables and compared with the federal SFs obtained from the hierarchy. The most health protective SF was selected to derive the carcinogenic HBLc. Cal/EPA has yet to develop reference dose (RfD) values for noncarcinogens.

If you have any questions, please call Diana Auyeung or me at (415) 543-4880.

Sincerely,

Jim Sickles

Jim Sickles
Project Manager

DA/da

Enclosure (1)

cc: David Leland, Harding Lawson Associates
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## 1.0 INTRODUCTION

A health-based level (HBL) is an estimate of a maximum exposure contaminant concentration in a medium that is protective of human health. As agreed upon by the regulatory agencies and the Navy, HBLs are to be used as a reference for determining any removal or interim remedial needs for contaminated soils at HPA (HLA 1992). The PRC methodology used to estimate the chemical-specific HBLs for surface soil, subsurface soil, and groundwater is discussed below.

## 2.0 METHODOLOGY FOR CHEMICAL-SPECIFIC HEALTH-BASED LEVEL DERIVATION

The chemical-specific HBLs (Tables 1 and 2) were developed based on a set of target risks and exposure parameters without considering the cumulative effects of exposure to multiple contaminants. The surface soil HBLs are calculated assuming exposure to individual chemicals in surface soil through ingestion and dermal contact. As recommended in *Risk Assessment Guidance for Superfund (RAGS)*, Volume I, Part B (EPA 1991a), the soil-to-air volatilization factor (K) for volatile organic compounds (VOC) (compounds with a Henry's Law constant of greater than $1 \times 10^{-5}$ atmospheric-cubic meter per mole [atm-$m^3$/mole] and a molecular weight of less than 200 grams per mole [g/mole]) is not included in the analysis due to the insignificant contribution of VOCs to the total risk posed in surface soils. The HBLs for subsurface soils were developed using a leaching model that considers contaminants leaching from the soil into the underlying groundwater. The chemical-specific groundwater HBLs are calculated assuming exposure to the individual chemicals through ingestion of groundwater and inhalation of VOCs volatilized from groundwater during household uses (EPA 1991b). Additionally, please note that chemicals of potential concern (COPC) background concentrations at HPA were not considered in determining the HBLs.

The derivation of HBLs involves the reverse calculation procedure of the risk assessment (EPA 1990a), using appropriate population exposure data and target risk levels. In calculating these HBLs, EPA's reasonable maximum exposure (RME) methods regarding intake assumptions and toxicity values (EPA 1989a, 1990a through 1990c, 1991a through 1991c, 1992a through 1992c, and 1993a through 1993e) were searched and applied. Tables 3 and 4 list the oral and inhalation toxicity values, such as slope factors (SF), chronic reference doses (RfD) for adults, and subchronic RfDs for children. The values regarding soil ingestion rate, body weight, exposure duration, exposure

frequency, averaging time, and soil-to-skin adherence factor were taken from EPA guidance documents (EPA 1989a, 1990b, 1991a, 1991b, and 1992c) and are also listed in Tables 5 through 8. Use of relative absorption factors (RAF) is recommended by EPA (EPA 1989a) to address exposure routes and transport media (EPA 1989a, MDEP 1992, National Library of Medicine [NLM] 1993). Note that these RAFs are different from the oral and dermal absorption factors (OAF and DAF). The calculation of route- and medium-specific RAFs (EPA 1989a, MDEP 1992) listed in Tables 3 and 4 and presented in the equations in Tables 5 through 8 is as follows:

Soil Ingestion:

$RAF_o$ = OAF via diet or soil ingestion divided by OAF by route and medium in the study used as the basis for the derivation of the toxicity value of the chemical (MDEP 1992, ATSDR 1989a through 1989d, 1990a through 1990f, 1991a through 1991i, and 1992a through 1992f).

Dermal Contact to Soil:

$RAF_d$ = DAF from soil (MDEP 1992, Ryan and others 1987) divided by OAF by route and medium in the study used as the basis for the derivation of the toxicity value of the chemical (MDEP 1992, ATSDR 1989a through 1989d, 1990a through 1990f, 1991a through 1991i, and 1992a through 1992f).

Water Ingestion:

$RAF_w$ = OAF via water ingestion divided by OAF by route and medium in the study used as the basis for the derivation of the toxicity value of the chemical (MDEP 1992, ATSDR 1989a through 1989d, 1990a through 1990f, 1991a through 1991i, and 1992a through 1992f).

The use of the RME cases for all potential pathways of concern in the calculation of HBLs provides an additional step of conservatism in the risk assessment process (EPA 1989a, 1989b). According to EPA, multiple-pathway RME risks may consist of RME risks for one pathway with the sum of typical (average) risks for other pathways. In other words, in real situations, the same individual may not experience the RME from more than one pathway over the same period of time (EPA 1989a, 1989b).

The target risk levels used in the calculation of HBLs correspond to an excess cancer risk of 1 in 10,000 exposed people, expressed as $10^{-4}$, $1 \times 10^{-4}$, 1E-04, or 0.0001, for carcinogenic effects and a hazard index (HI) of 1 for noncarcinogenic effects (EPA 1991c). Currently, the acceptable excess cancer risk range for regulatory purposes is $10^{-4}$ to $10^{-6}$, with $10^{-6}$ being the point of departure (EPA 1990a, 1991c), depending upon site-specific exposures and conditions. To estimate the HBLs corresponding to a 1E-05 or a 1E-06 excess cancer risk level, HBLs based on carcinogenic effects presented in the tables of this report should be divided by a factor of 10 or 100, respectively.

## 3.0 SUMMARY OF DETERMINATIONS

For contaminants that have both carcinogenic and noncarcinogenic toxicity values, separate HBLs were derived based on each type of health effect. Under the residential scenario, the most health-protective HBLs based on either carcinogenic or noncarcinogenic effects and on either adult or child exposure should be used as reference concentrations for comparison with site-specific chemical concentration data (Table 1). Under the commercial/industrial scenario, the most health-protective HBLs based on either carcinogenic or noncarcinogenic effects on adult worker exposure should be used as reference concentrations (Table 2).

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## TABLES

**GENERAL NOTE :**

Health-based levels (HBL) could not be determined for the following list of chemicals found at Hunters Point Annex (HPA) because slope factors (SF) and reference doses (RfD) that are needed to calculate HBLs are not available.

- Aluminum
- 2-Butoxyethanol
- Carbazole
- 4-Chloro-3-methylphenol
- Cobalt
- 1,3-Dichlorobenzene
- Ethanol
- delta-Hexachlorocyclohexane (delta-BHC)
- 2-Hexanone
- Isopropyl Alcohol
- Magnesium
- 4-Methylphenol
- 4-Nitrophenol
- Potassium
- Sodium
- Total Asbestos
- Amphibole Asbestos
- Calcium
- Chloride
- Chrysotile Asbestos
- Dibenzofuran
- Dichloroprop
- Fecal Coliform
- Iron
- Lead
- 2-Methyl-4,6-dinitrophenol
- Nitrate as N
- 1-Pentanol
- Orthophosphate as P
- Sulfate
- Total Dissolved Solids

**TABLE 1**
**HEALTH-BASED LEVELS FOR ORGANIC AND INORGANIC CHEMICALS IN SURFACE SOILS, SUBSURFACE SOILS, AND GROUNDWATER AT HUNTERS POINT ANNEX**
**RESIDENTIAL SCENARIO – ADULT/CHILD RECEPTORS**
**(Sheet 1 of 3)**

| Analyte | SURFACE SOIL (0-2 feet below ground surface) | | | | SUBSURFACE SOIL (>2 feet below ground surface) | | | | GROUNDWATER | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Child HBLa mg/kg | Adult HBLa mg/kg | Residential HBLc mg/kg | Reference HBL mg/kg | Child HBLa mg/kg | Adult HBLa mg/kg | Residential HBLc mg/kg | Reference HBL mg/kg | Child HBLa mg/L | Adult HBLa mg/L | Residential HBLc mg/L | Reference HBL mg/L |
| **VOLATILES** | | | | | | | | | | | | |
| Acetone | 3.3E+04 | 1.5E+04 | | 1.5E+04 | 8.1E+00 | 3.4E+00 | | 3.4E+00 | 1.8E+00 | 7.7E-01 | | 7.7E-01 |
| Benzene | 1.9E+03 | 8.9E+02 | 9.6E+02 | 8.9E+02 | 3.1E+00 | 3.7E+00 | 7.3E+00 | 3.1E+00 | 1.9E-02 | 2.2E-02 | 4.4E-02 | 1.9E-02 |
| Bromoform | 6.6E+03 | 3.0E+03 | 1.0E+04 | 3.0E+03 | 8.5E+01 | 3.6E+01 | 2.2E+02 | 3.6E+01 | 3.7E-01 | 1.5E-01 | 9.6E-01 | 1.5E-01 |
| Carbon disulfide | 3.3E+03 | 1.5E+04 | | 3.3E+03 | 7.4E-01 | 3.5E+00 | | 7.4E-01 | 6.0E-03 | 2.8E-02 | | 6.0E-03 |
| Carbon tetrachloride | 2.3E+02 | 1.1E+02 | 5.5E+02 | 1.1E+02 | 6.7E+01 | 2.2E+01 | 2.6E+01 | 2.2E+01 | 7.6E-02 | 2.5E-02 | 2.9E-02 | 2.5E-02 |
| Chlorobenzene | 6.6E+03 | 3.0E+03 | | 3.0E+03 | 7.6E+01 | 3.4E+01 | | 3.4E+01 | 1.1E-01 | 5.2E-02 | | 5.2E-02 |
| Chloroethane | 6.6E+02 | 3.0E+03 | | 6.6E+02 | 2.0E+01 | 4.7E+01 | | 2.0E+01 | 3.0E-01 | 7.1E-01 | | 3.0E-01 |
| Chloroform | 3.3E+02 | 1.5E+03 | 1.0E+03 | 3.3E+02 | 9.9E+00 | 2.7E+01 | 4.8E+00 | 4.8E+00 | 1.1E-01 | 3.0E-01 | 5.4E-02 | 5.4E-02 |
| Chloromethane | | | 6.4E+03 | 6.4E+03 | | | 5.1E+00 | 5.1E+00 | | | 5.9E-01 | 5.9E-01 |
| Dichloroethane (1,1-) | 2.5E+04 | 1.2E+04 | 9.1E+02 | 9.1E+02 | 1.4E+02 | 5.5E+01 | 2.9E+00 | 2.9E+00 | 2.3E+00 | 9.2E-01 | 4.8E-02 | 4.8E-02 |
| Dichloroethane (1,2-) | 6.6E+03 | 3.0E+03 | 9.1E+02 | 9.1E+02 | 9.2E-01 | 3.6E+00 | 1.4E+00 | 9.2E-01 | 3.3E-02 | 1.3E-01 | 4.8E-02 | 3.3E-02 |
| Dichloroethene (1,1-) | 3.0E+02 | 1.4E+03 | 1.3E+02 | 1.3E+02 | 3.7E-01 | 1.7E+00 | 2.3E+00 | 3.7E-01 | 2.9E-03 | 1.3E-02 | 1.8E-02 | 2.9E-03 |
| Dichloroethene (1,2-) | 3.0E+02 | 1.4E+03 | | 3.0E+02 | 1.4E+01 | 3.5E+01 | | 1.4E+01 | 1.2E-01 | 3.0E-01 | | 1.2E-01 |
| Dichloropropane (1,2-) | 1.2E+02 | 1.7E+02 | 1.2E+03 | 1.2E+02 | 6.9E-01 | 8.6E-01 | 6.6E+00 | 6.9E-01 | 6.8E-03 | 8.5E-03 | 6.5E-02 | 6.8E-03 |
| Dichloropropene (1,3-) | 9.9E+01 | 4.5E+01 | 4.6E+02 | 4.5E+01 | 5.1E-01 | 4.9E-01 | 1.3E+00 | 4.9E-01 | 9.5E-03 | 9.1E-03 | 2.4E-02 | 9.1E-03 |
| Ethyl benzene | 2.1E+04 | 8.4E+03 | | 8.4E+03 | 1.3E+03 | 3.6E+03 | | 1.3E+03 | 6.0E-01 | 1.6E+00 | | 6.0E-01 |
| Methyl ethyl ketone | 6.6E+03 | 9.0E+04 | | 6.6E+03 | 1.6E+01 | 1.9E+01 | | 1.6E+01 | 2.1E+00 | 2.5E+00 | | 2.1E+00 |
| Methyl isobutyl ketone | 1.7E+04 | 7.5E+03 | | 7.5E+03 | 1.9E+01 | 8.2E+00 | | 8.2E+00 | 4.5E-01 | 2.0E-01 | | 2.0E-01 |
| Methylene chloride | 2.0E+03 | 9.0E+03 | 5.9E+03 | 2.0E+03 | 5.3E+00 | 1.5E+01 | 2.7E+00 | 2.7E+00 | 6.2E-01 | 1.7E+00 | 3.1E-01 | 3.1E-01 |
| Styrene | 6.6E+04 | 3.0E+04 | | 3.0E+04 | 9.2E+02 | 1.1E+03 | | 9.2E+02 | 1.7E+00 | 2.0E+00 | | 1.7E+00 |
| Tetrachloroethane (1,1,1,2-) | 9.7E+02 | 4.4E+03 | 3.1E+03 | 9.7E+02 | 2.6E+01 | 1.1E+02 | 8.0E+01 | 2.6E+01 | 5.5E-02 | 2.3E-01 | 1.7E-01 | 5.5E-02 |
| Tetrachloroethane (1,1,2,2-) | | | 4.0E+02 | 4.0E+02 | | | 5.2E+00 | 5.2E+00 | | | 2.2E-02 | 2.2E-02 |
| Tetrachloroethene | 3.3E+03 | 1.5E+03 | 1.6E+03 | 1.5E+03 | 7.2E+02 | 2.6E+02 | 3.3E+02 | 2.6E+02 | 9.9E-01 | 3.5E-01 | 4.5E-01 | 3.5E-01 |
| Toluene | 5.9E+04 | 2.6E+04 | | 2.6E+04 | 5.7E+02 | 4.7E+02 | | 4.7E+02 | 1.1E+00 | 9.3E-01 | | 9.3E-01 |
| Trichloroethane (1,1,1-) | 3.0E+04 | 1.4E+04 | | 1.4E+04 | 1.3E+03 | 4.6E+02 | | 4.6E+02 | 4.2E+00 | 1.5E+00 | | 1.5E+00 |
| Trichloroethane (1,1,2-) | 1.3E+03 | 6.0E+02 | 1.4E+03 | 6.0E+02 | 8.2E+00 | 3.4E+00 | 8.6E+00 | 3.4E+00 | 7.4E-02 | 3.1E-02 | 7.7E-02 | 3.1E-02 |
| Trichloroethene | 6.6E+02 | 3.0E+02 | 7.5E+03 | 3.0E+02 | 2.0E+01 | 1.6E+01 | 1.6E+02 | 1.6E+01 | 7.9E-02 | 6.4E-02 | 6.4E-01 | 6.4E-02 |
| Tichlorofluoromethane | 2.3E+04 | 4.5E+04 | | 2.3E+04 | 9.7E+02 | 5.3E+02 | | 5.3E+02 | 3.0E+00 | 1.7E+00 | | 1.7E+00 |
| Trichloro-1,2,2-trifluoroethane (1,1,2- | 9.9E+04 | 4.5E+06 | | 9.9E+04 | 4.9E+03 | 3.0E+04 | | 4.9E+03 | 1.3E+01 | 7.8E+01 | | 1.3E+01 |
| Vinyl acetate | 3.3E+04 | 1.5E+05 | | 3.3E+04 | 4.5E+00 | 2.1E+01 | | 4.5E+00 | 1.2E-01 | 5.5E-01 | | 1.2E-01 |
| Vinyl chloride | | | 1.6E+02 | 1.6E+02 | | | 1.3E-01 | 1.3E-01 | | | 7.9E-03 | 7.9E-03 |
| Xylenes | 1.2E+05 | 2.6E+05 | | 1.2E+05 | 9.6E+01 | 4.4E+02 | | 9.6E+01 | 1.8E-01 | 8.3E-01 | | 1.8E-01 |
| **SEMIVOLATILES** | | | | | | | | | | | | |
| Acenaphthene | 1.3E+04 | 5.0E+03 | | 5.0E+03 | 8.6E+04 | 2.0E+04 | | 2.0E+04 | 9.4E+00 | 2.2E+00 | | 2.2E+00 |
| Acenaphthylene | 9.3E+02 | 3.7E+03 | | 9.3E+02 | 3.4E+03 | 8.0E+03 | | 3.4E+03 | 6.9E-01 | 1.6E+00 | | 6.9E-01 |
| Anthracene | 4.7E+04 | 1.8E+04 | | 1.8E+04 | 1.3E+06 | 3.1E+05 | | 3.1E+05 | 4.7E+01 | 1.1E+01 | | 1.1E+01 |
| Benzo(a)anthracene | 9.3E+02 | 3.7E+03 | 4.1E+01 | 4.1E+01 | 1.9E+06 | 4.5E+06 | 6.7E+04 | 6.7E+04 | 6.9E-01 | 1.6E+00 | 2.4E-02 | 2.4E-02 |
| Benzo(a)pyrene | 9.3E+02 | 3.7E+03 | 4.1E+00 | 4.1E+00 | 7.6E+06 | 1.8E+07 | 2.6E+04 | 2.6E+04 | 6.9E-01 | 1.6E+00 | 2.4E-03 | 2.4E-03 |
| Benzo(b)fluoranthene | 9.3E+02 | 3.7E+03 | 4.1E+01 | 4.1E+01 | 7.6E+05 | 1.8E+06 | 2.6E+04 | 2.6E+04 | 6.9E-01 | 1.6E+00 | 2.4E-02 | 2.4E-02 |

**TABLE 1 (Continued)**
**HEALTH-BASED LEVELS FOR ORGANIC AND INORGANIC CHEMICALS IN SURFACE SOILS, SUBSURFACE SOILS, AND GROUNDWATER AT HUNTERS POINT ANNEX**
**RESIDENTIAL SCENARIO**
**(Sheet 2 of 3)**

| Analyte | SURFACE SOIL (0-2 feet below ground surface) | | | | SUBSURFACE SOIL (>2 feet below ground surface) | | | | GROUNDWATER | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Child HBLa mg/kg | Adult HBLa mg/kg | Residential HBLc mg/kg | Reference HBL mg/kg | Child HBLa mg/kg | Adult HBLa mg/kg | Residential HBLc mg/kg | Reference HBL mg/kg | Child HBLa mg/L | Adult HBLa mg/L | Residential HBLc mg/L | Reference HBL mg/L |
| Benzo(ghi)perylene | 9.3E+02 | 3.7E+03 | | 9.3E+02 | 2.2E+06 | 5.1E+06 | | 2.2E+06 | 6.9E-01 | 1.6E+00 | | 6.9E-01 |
| Benzo(k)fluoranthene | 9.3E+02 | 3.7E+03 | 4.1E+02 | 4.1E+02 | 7.6E+05 | 1.8E+06 | 2.6E+05 | 2.6E+05 | 6.9E-01 | 1.6E+00 | 2.4E-01 | 2.4E-01 |
| Benzoic acid | 1.3E+05 | 6.0E+05 | | 1.3E+05 | 5.8E+03 | 1.3E+04 | | 5.8E+03 | 6.3E+01 | 1.5E+02 | | 6.3E+01 |
| Bis(2-ethylhexyl)phthalate | 1.2E+03 | 8.2E+03 | 1.4E+04 | 1.2E+03 | 1.3E+09 | 2.9E+09 | 8.3E+09 | 1.3E+09 | 3.1E-01 | 7.3E-01 | 2.1E+00 | 3.1E-01 |
| Butylbenzylphthalate | 6.6E+04 | 3.0E+04 | | 3.0E+04 | 1.1E+04 | 2.5E+03 | | 2.5E+03 | 3.1E+01 | 7.3E+00 | | 7.3E+00 |
| Chloronaphthalene (2-) | 2.7E+04 | 1.2E+04 | | 1.2E+04 | 2.4E+04 | 5.5E+03 | | 5.5E+03 | 1.3E+01 | 2.9E+00 | | 2.9E+00 |
| Chlorophenol (2-) | 1.7E+03 | 7.5E+02 | | 7.5E+02 | 1.1E+02 | 2.7E+01 | | 2.7E+01 | 7.8E-01 | 1.8E-01 | | 1.8E-01 |
| Chrysene | 9.3E+02 | 3.7E+03 | 4.1E+03 | 9.3E+02 | 2.8E+05 | 6.4E+05 | 9.6E+05 | 2.8E+05 | 6.9E-01 | 1.6E+00 | 2.4E+00 | 6.9E-01 |
| Di-n-butylphthalate | 3.3E+04 | 1.5E+04 | | 1.5E+04 | 5.3E+06 | 1.2E+06 | | 1.2E+06 | 1.6E+01 | 3.7E+00 | | 3.7E+00 |
| Di-n-octylphthalate | 6.6E+02 | 3.0E+03 | | 6.6E+02 | 1.2E+04 | 2.8E+04 | | 1.2E+04 | 3.1E-01 | 7.3E-01 | | 3.1E-01 |
| Dibenzo(a,h)anthracene | 1.6E+03 | 7.3E+03 | 7.4E+00 | 7.4E+00 | 4.5E+06 | 1.1E+07 | 1.6E+04 | 1.6E+04 | 6.9E-01 | 1.6E+00 | 2.4E-03 | 2.4E-03 |
| Dichlorobenzene (1,2-) | 3.0E+04 | 1.4E+04 | | 1.4E+04 | 4.8E+04 | 1.1E+04 | | 1.1E+04 | 1.4E+01 | 3.3E+00 | | 3.3E+00 |
| Dichlorobenzene (1,4-) | 7.6E+03 | 3.5E+04 | 2.1E+03 | 2.1E+03 | 1.2E+04 | 2.9E+04 | 2.5E+03 | 2.5E+03 | 3.6E+00 | 8.4E+00 | 7.2E-01 | 7.2E-01 |
| Dichlorobenzidine (3,3'-) | | | 6.9E+01 | 6.9E+01 | | | 7.5E+01 | 7.5E+01 | | | 2.4E-02 | 2.4E-02 |
| Diethylphthalate | 2.7E+05 | 1.2E+05 | | 1.2E+05 | 3.5E+04 | 8.2E+03 | | 8.2E+03 | 1.3E+02 | 2.9E+01 | | 2.9E+01 |
| Dimethylphenol (2,4-) | 6.6E+03 | 3.0E+03 | | 3.0E+03 | 6.0E+02 | 1.4E+02 | | 1.4E+02 | 3.1E+00 | 7.3E-01 | | 7.3E-01 |
| Dimethylphthalate | 3.3E+05 | 1.5E+06 | | 3.3E+05 | 5.0E+04 | 1.2E+05 | | 5.0E+04 | 1.6E+02 | 3.7E+02 | | 1.6E+02 |
| Dinitrophenol (2,4-) | 6.6E+01 | 3.0E+02 | | 6.6E+01 | 1.0E+00 | 2.4E+00 | | 1.0E+00 | 3.1E-02 | 7.3E-02 | | 3.1E-02 |
| Dinitrotoluene (2,4-) | 6.6E+01 | 3.0E+02 | | 6.6E+01 | 2.8E+00 | 6.6E+00 | | 2.8E+00 | 3.1E-02 | 7.3E-02 | | 3.1E-02 |
| Fluoranthene | 8.4E+03 | 3.4E+03 | | 3.4E+03 | 4.8E+05 | 1.1E+05 | | 1.1E+05 | 6.3E+00 | 1.5E+00 | | 1.5E+00 |
| Fluorene | 8.4E+03 | 3.4E+03 | | 3.4E+03 | 9.1E+04 | 2.1E+04 | | 2.1E+04 | 6.3E+00 | 1.5E+00 | | 1.5E+00 |
| Hydrazine | | | 2.8E+01 | 2.8E+01 | | | 1.9E-03 | 1.9E-03 | | | 9.6E-03 | 9.6E-03 |
| Indeno(1,2,3-cd)pyrene | 9.3E+02 | 3.7E+03 | 4.1E+01 | 4.1E+01 | 2.2E+06 | 5.1E+06 | 7.7E+04 | 7.7E+04 | 6.9E-01 | 1.6E+00 | 2.4E-02 | 2.4E-02 |
| Methylnaphthalene (2-) | 1.3E+03 | 6.0E+03 | | 1.3E+03 | 3.8E+03 | 8.8E+03 | | 3.8E+03 | 6.3E-01 | 1.5E+00 | | 6.3E-01 |
| Methylphenol (2-) | 1.7E+04 | 7.5E+03 | | 7.5E+03 | 3.4E+02 | 8.0E+01 | | 8.0E+01 | 7.8E+00 | 1.8E+00 | | 1.8E+00 |
| Napthalene | 1.3E+03 | 6.0E+03 | | 1.3E+03 | 1.2E+03 | 2.7E+03 | | 1.2E+03 | 6.3E-01 | 1.5E+00 | | 6.3E-01 |
| Nitroaniline (2-) | 6.6E+01 | 3.0E+01 | | 3.0E+01 | 2.8E+00 | 6.4E-01 | | 6.4E-01 | 3.1E-02 | 7.3E-03 | | 7.3E-03 |
| Nitrosodiphenylamine (n-) | | | 9.2E+03 | 9.2E+03 | | | 7.7E+03 | 7.7E+03 | | | 3.2E+00 | 3.2E+00 |
| Nitrosodipropylamine (n-) | | | 1.2E+01 | 1.2E+01 | | | 1.1E+00 | 1.1E+00 | | | 4.1E-03 | 4.1E-03 |
| Pentachlorophenol | 9.9E+02 | 4.5E+03 | 6.9E+02 | 6.9E+02 | 5.0E+05 | 1.2E+06 | 2.6E+05 | 2.6E+05 | 4.7E-01 | 1.1E+00 | 2.4E-01 | 2.4E-01 |
| Phenanthrene | 9.3E+02 | 3.7E+03 | | 9.3E+02 | 1.9E+04 | 4.5E+04 | | 1.9E+04 | 6.9E-01 | 1.6E+00 | | 6.9E-01 |
| Phenol | 1.0E+04 | 3.3E+03 | | 3.3E+03 | 1.1E+02 | 2.2E+01 | | 2.2E+01 | 9.4E+00 | 1.8E+00 | | 1.8E+00 |
| Pyrene | 6.3E+03 | 2.5E+03 | | 2.5E+03 | 3.6E+05 | 8.3E+04 | | 8.3E+04 | 4.7E+00 | 1.1E+00 | | 1.1E+00 |
| Trichlorobenzene (1,2,4-) | 3.3E+02 | 1.5E+03 | | 3.3E+02 | 2.9E+03 | 6.7E+03 | | 2.9E+03 | 1.6E-01 | 3.7E-01 | | 1.6E-01 |
| Trichlorophenol (2,4,5-) | 3.3E+04 | 1.5E+04 | | 1.5E+04 | 2.8E+03 | 6.5E+02 | | 6.5E+02 | 1.6E+01 | 3.7E+00 | | 3.7E+00 |
| **PESTICIDES/PCBs** | | | | | | | | | | | | |
| Aldrin | 9.9E-01 | 4.5E+00 | 4.9E+00 | 9.9E-01 | 4.6E+01 | 1.1E+02 | 1.7E+02 | 4.6E+01 | 4.7E-04 | 1.1E-03 | 1.7E-03 | 4.7E-04 |
| Aroclor-1260 | 4.4E+00 | 2.1E+01 | 1.5E+01 | 4.4E+00 | 9.2E+01 | 2.2E+02 | 2.2E+02 | 9.2E+01 | 1.6E-03 | 3.7E-03 | 3.8E-03 | 1.6E-03 |
| BHC (alpha-) | | | 1.3E+01 | 1.3E+01 | | | 3.5E+01 | 3.5E+01 | | | 4.6E-03 | 4.6E-03 |
| BHC (beta-) | | | 4.6E+01 | 4.6E+01 | | | 1.2E+02 | 1.2E+02 | | | 1.6E-02 | 1.6E-02 |

TABLE 1 (Continued)

HEALTH-BASED LEVELS FOR ORGANIC AND INORGANIC CHEMICALS IN SURFACE SOILS, SUBSURFACE SOILS, AND GROUNDWATER AT HUNTERS POINT ANNEX

RESIDENTIAL SCENARIO

(Sheet 3 of 3)

| Analyte | SURFACE SOIL (0-2 feet below ground surface) | | | | SUBSURFACE SOIL (>2 feet below ground surface) | | | | GROUNDWATER | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Child HBLn mg/kg | Adult HBLn mg/kg | Residential HBLc mg/kg | Reference HBL mg/kg | Child HBLn mg/kg | Adult HBLn mg/kg | Residential HBLc mg/kg | Reference HBL mg/kg | Child HBLn mg/L | Adult HBLn mg/L | Residential HBLc mg/L | Reference HBL mg/L |
| BHC (gamma-) = Lindane | 9.9E+01 | 4.5E+01 | 6.4E+01 | 4.5E+01 | 1.0E+02 | 2.4E+01 | 4.8E+01 | 2.4E+01 | 4.7E-02 | 1.1E-02 | 2.2E-02 | 1.1E-02 |
| Chlordane | 1.7E+00 | 7.5E+00 | 5.4E+01 | 1.7E+00 | 2.6E+02 | 6.1E+02 | 6.2E+03 | 2.6E+02 | 9.4E-04 | 2.2E-03 | 2.2E-02 | 9.4E-04 |
| D (2,4-) | 4.4E+02 | 2.3E+03 | | 4.4E+02 | 6.3E+00 | 1.5E+01 | | 6.3E+00 | 1.6E-01 | 3.7E-01 | | 1.6E-01 |
| DB (2,4-) | 2.7E+03 | 1.2E+03 | | 1.2E+03 | 5.0E+02 | 1.2E+02 | | 1.2E+02 | 1.3E+00 | 2.9E-01 | | 2.9E-01 |
| DDD | | | 2.7E+02 | 2.7E+02 | | | 1.1E+06 | 1.1E+06 | | | 1.2E-01 | 1.2E-01 |
| DDE | | | 1.9E+02 | 1.9E+02 | | | 1.3E+05 | 1.3E+05 | | | 8.5E-02 | 8.5E-02 |
| DDT | 1.3E+01 | 5.7E+01 | 1.9E+02 | 1.3E+01 | 3.8E+03 | 8.9E+03 | 4.1E+04 | 3.8E+03 | 7.8E-03 | 1.8E-02 | 8.5E-02 | 7.8E-03 |
| Dieldrin | 1.7E+00 | 7.5E+00 | 5.2E+00 | 1.7E+00 | 1.2E+01 | 2.7E+01 | 2.7E+01 | 1.2E+01 | 7.8E-04 | 1.8E-03 | 1.8E-03 | 7.8E-04 |
| Endosulfan | 2.0E+02 | 9.0E+02 | | 2.0E+02 | 5.9E+02 | 1.4E+03 | | 5.9E+02 | 9.4E-02 | 2.2E-01 | | 9.4E-02 |
| Endrin | 9.9E+00 | 4.5E+01 | | 9.9E+00 | 6.3E+00 | 1.5E+01 | | 6.3E+00 | 4.7E-03 | 1.1E-02 | | 4.7E-03 |
| Heptachlor | 1.7E+01 | 7.5E+01 | 1.4E+01 | 1.4E+01 | 1.9E+02 | 4.4E+02 | 1.2E+02 | 1.2E+02 | 7.8E-03 | 1.8E-02 | 5.1E-03 | 5.1E-03 |
| Heptachlor epoxide | 4.3E-01 | 2.0E+00 | 6.4E+00 | 4.3E-01 | 8.9E-01 | 2.1E+00 | 9.7E+00 | 8.9E-01 | 2.0E-04 | 4.7E-04 | 2.2E-03 | 2.0E-04 |
| Isophorone | 6.6E+04 | 3.0E+04 | 8.7E+04 | 3.0E+04 | 1.6E+03 | 3.7E+02 | 1.5E+03 | 3.7E+02 | 3.1E+01 | 7.3E+00 | 3.0E+01 | 7.3E+00 |
| MCPA | 1.7E+01 | 7.5E+01 | | 1.7E+01 | 1.7E+01 | 7.5E+01 | | 1.7E+01 | 7.8E-03 | 1.8E-02 | | 7.8E-03 |
| MCPP | 3.3E+02 | 1.5E+02 | | 1.5E+02 | 3.3E+02 | 1.5E+02 | | 1.5E+02 | 1.6E-01 | 3.7E-02 | | 3.7E-02 |
| Methoxychlor | 1.7E+02 | 7.5E+02 | | 1.7E+02 | 1.6E+04 | 3.7E+04 | | 1.6E+04 | 7.8E-02 | 1.8E-01 | | 7.8E-02 |
| T (2,4,5-) | 3.3E+03 | 1.5E+03 | | 1.5E+03 | 6.4E+02 | 1.5E+02 | | 1.5E+02 | 1.6E+00 | 3.7E-01 | | 3.7E-01 |
| TP (2,4,5) | 2.7E+02 | 1.2E+03 | | 2.7E+02 | 6.5E+02 | 1.5E+03 | | 6.5E+02 | 1.3E-01 | 2.9E-01 | | 1.3E-01 |
| METALS | | | | | | | | | | | | |
| Antimony | 2.8E+01 | 2.1E+02 | | 2.8E+01 | 2.8E+01 | 6.6E+01 | | 2.8E+01 | 6.3E-03 | 1.5E-02 | | 6.3E-03 |
| Arsenic | 1.7E+01 | 1.0E+02 | 9.1E+01 | 1.7E+01 | 9.4E+01 | 2.2E+02 | 3.2E+02 | 9.4E+01 | 4.7E-03 | 1.1E-02 | 1.6E-02 | 4.7E-03 |
| Barium | 4.3E+03 | 2.9E+04 | | 4.3E+03 | 6.6E+03 | 1.5E+04 | | 6.6E+03 | 1.1E+00 | 2.6E+00 | | 1.1E+00 |
| Beryllium | 2.8E+02 | 1.7E+03 | 2.3E+01 | 2.3E+01 | 5.1E+03 | 1.2E+04 | 2.7E+02 | 2.7E+02 | 7.8E-02 | 1.8E-01 | 4.1E-03 | 4.1E-03 |
| Cadmium | 2.7E+01 | 1.1E+02 | | 2.7E+01 | 1.0E+01 | 1.2E+01 | | 1.0E+01 | 1.6E-02 | 1.8E-02 | | 1.6E-02 |
| Chromium (total) | 4.7E+05 | 2.5E+05 | | 2.5E+05 | 1.3E+07 | 3.1E+06 | | 3.1E+06 | 1.6E+02 | 3.7E+01 | | 3.7E+01 |
| Chromium VI | 9.3E+02 | 1.2E+03 | | 9.3E+02 | 2.7E+04 | 1.6E+04 | | 1.6E+04 | 3.1E-01 | 1.8E-01 | | 1.8E-01 |
| Copper | 6.6E+03 | 2.5E+04 | | 6.6E+03 | 4.8E+03 | 4.7E+03 | | 4.7E+03 | 1.4E+00 | 1.4E+00 | | 1.4E+00 |
| Cyanide | 1.1E+03 | 6.8E+03 | | 1.1E+03 | 3.1E+00 | 7.3E+00 | | 3.1E+00 | 3.1E-01 | 7.3E-01 | | 3.1E-01 |
| Manganese | 8.6E+03 | 5.8E+04 | | 8.6E+03 | 1.4E+04 | 1.2E+03 | | 1.2E+03 | 2.2E+00 | 1.8E-01 | | 1.8E-01 |
| Mercury | 1.2E+01 | 5.9E+01 | | 1.2E+01 | 4.7E+00 | 1.1E+01 | | 4.7E+00 | 4.7E-03 | 1.1E-02 | | 4.7E-03 |
| Molybdenum | 3.8E+02 | 3.4E+03 | | 3.8E+02 | 1.6E+02 | 3.7E+02 | | 1.6E+02 | 7.8E-02 | 1.8E-01 | | 7.8E-02 |
| Nickel | 1.4E+03 | 1.1E+04 | | 1.4E+03 | 1.7E+03 | 4.1E+03 | | 1.7E+03 | 1.2E-01 | 2.7E-01 | | 1.2E-01 |
| Nitrate | 5.3E+04 | 2.4E+05 | | 5.3E+04 | 5.0E-02 | 1.2E-01 | | 5.0E-02 | 2.5E+01 | 5.8E+01 | | 2.5E+01 |
| Selenium | 3.9E+02 | 3.5E+03 | | 3.9E+02 | 2.3E+03 | 5.5E+03 | | 2.3E+03 | 7.8E-02 | 1.8E-01 | | 7.8E-02 |
| Silver | 2.9E+02 | 1.9E+03 | | 2.9E+02 | 3.5E+02 | 8.2E+02 | | 3.5E+02 | 7.8E-02 | 1.8E-01 | | 7.8E-02 |
| Thallium | 5.5E+01 | 4.2E+01 | | 4.2E+01 | 1.9E+03 | 4.4E+02 | | 4.4E+02 | 1.3E-02 | 2.9E-03 | | 2.9E-03 |
| Vanadium | 3.5E+02 | 2.0E+03 | | 3.5E+02 | 1.1E+04 | 2.6E+04 | | 1.1E+04 | 1.1E-01 | 2.6E-01 | | 1.1E-01 |
| Zinc | 2.3E+04 | 2.0E+05 | | 2.3E+04 | 1.4E+04 | 3.4E+04 | | 1.4E+04 | 3.6E+00 | 8.4E+00 | | 3.6E+00 |

NOTES:

Blank cells indicate toxicity value not availiable to determine Health-Based evel

HBLn - Noncarcinogenic Health-Based Level

Reference HBL - Most health protective Health-Based Level for medium

HBLc - Carcinogenic Health-Based Level

**TABLE 2**
**HEALTH-BASED LEVELS FOR ORGANIC AND INORGANIC CHEMICALS IN SURFACE SOILS, SUBSURFACE SOILS, AND GROUNDWATER AT HUNTERS POINT ANNEX**
**INDUSTRIAL/COMMERCIAL SCENARIO - ADULT WORKERS**
**(Sheet 1 of 3)**

| Analyte | SURFACE SOIL (0-2 feet below ground surface) | | | SUBSURFACE SOIL (>2 feet below ground surface) | | | GROUNDWATER | | |
|---|---|---|---|---|---|---|---|---|---|
| | Adult Worker HBLa mg/kg | Adult Worker HBLc mg/kg | Reference HBL mg/kg | Adult Worker HBLa mg/kg | Adult Worker HBLc mg/kg | Reference HBL mg/kg | Adult Worker HBLa mg/L | Adult Worker HBLc mg/L | Reference HBL mg/L |
| **VOLATILES** | | | | | | | | | |
| Acetone | 2.3E+04 | | 2.3E+04 | 4.5E+01 | | 4.5E+01 | 1.0E+01 | | 1.0E+01 |
| Benzene | 1.4E+03 | 8.0E+02 | 8.0E+02 | 8.5E+01 | 4.8E+01 | 4.8E+01 | 5.1E-01 | 2.9E-01 | 2.9E-01 |
| Bromoform | 4.7E+03 | 8.3E+03 | 4.7E+03 | 4.7E+02 | 8.4E+02 | 4.7E+02 | 2.0E+00 | 3.6E+00 | 2.0E+00 |
| Carbon disulfide | 2.3E+04 | | 2.3E+04 | 1.3E+03 | | 1.3E+03 | 1.0E+01 | | 1.0E+01 |
| Carbon tetrachloride | 1.6E+02 | 4.4E+02 | 1.6E+02 | 6.3E+01 | 1.7E+02 | 6.3E+01 | 7.2E-02 | 1.9E-01 | 7.2E-02 |
| Chlorobenzene | 4.7E+03 | | 4.7E+03 | 1.3E+03 | | 1.3E+03 | 2.0E+00 | | 2.0E+00 |
| Chloroethane | 4.7E+03 | | 4.7E+03 | 1.3E+02 | | 1.3E+02 | 2.0E+00 | | 2.0E+00 |
| Chloroform | 2.3E+03 | 8.1E+02 | 8.1E+02 | 9.0E+01 | 3.1E+01 | 3.1E+01 | 1.0E+00 | 3.5E-01 | 3.5E-01 |
| Chloromethane | | 5.1E+03 | 5.1E+03 | | 1.9E+01 | 1.9E+01 | | 2.2E+00 | 2.2E+00 |
| Dichloroethane (1,1-) | 1.8E+04 | 7.2E+02 | 7.2E+02 | 4.7E+02 | 1.9E+01 | 1.9E+01 | 7.9E+00 | 3.1E-01 | 3.1E-01 |
| Dichloroethane (1,2-) | 4.7E+03 | 7.2E+02 | 7.2E+02 | 5.7E+01 | 8.8E+00 | 8.8E+00 | 2.0E+00 | 3.1E-01 | 3.1E-01 |
| Dichloroethene (1,1-) | 2.1E+03 | 1.1E+02 | 1.1E+02 | 1.2E+02 | 6.1E+00 | 6.1E+00 | 9.2E-01 | 4.7E-02 | 4.7E-02 |
| Dichloroethene (1,2-) | 2.1E+03 | | 2.1E+03 | 1.1E+02 | | 1.1E+02 | 9.2E-01 | | 9.2E-01 |
| Dichloropropane (1,2-) | 2.6E+02 | 9.7E+02 | 2.6E+02 | 1.1E+01 | 4.3E+01 | 1.1E+01 | 1.1E-01 | 4.2E-01 | 1.1E-01 |
| Dichloropropene (1,3-) | 7.0E+01 | 3.7E+02 | 7.0E+01 | 1.7E+00 | 8.6E+00 | 1.7E+00 | 3.1E-02 | 1.6E-01 | 3.1E-02 |
| Ethyl benzene | 1.2E+04 | | 1.2E+04 | 2.2E+04 | | 2.2E+04 | 1.0E+01 | | 1.0E+01 |
| Methyl ethyl ketone | 1.4E+05 | | 1.4E+05 | 4.8E+02 | | 4.8E+02 | 6.1E+01 | | 6.1E+01 |
| Methyl isobutyl ketone | 1.2E+04 | | 1.2E+04 | 2.1E+02 | | 2.1E+02 | 5.1E+00 | | 5.1E+00 |
| Methylene chloride | 1.4E+04 | 4.7E+03 | 4.7E+03 | 5.3E+01 | 1.8E+01 | 1.8E+01 | 6.1E+00 | 2.0E+00 | 2.0E+00 |
| Styrene | 4.7E+04 | | 4.7E+04 | 1.1E+04 | | 1.1E+04 | 2.0E+01 | | 2.0E+01 |
| Tetrachloroethane (1,1,1,2-) | 6.9E+03 | 2.5E+03 | 2.5E+03 | 1.4E+03 | 5.1E+02 | 5.1E+02 | 3.0E+00 | 1.1E+00 | 1.1E+00 |
| Tetrachloroethane (1,1,2,2-) | | 3.2E+02 | 3.2E+02 | | 3.3E+01 | 3.3E+01 | | 1.4E-01 | 1.4E-01 |
| Tetrachloroethene | 2.3E+03 | 1.3E+03 | 1.3E+03 | 7.4E+02 | 4.0E+02 | 4.0E+02 | 1.0E+00 | 5.5E-01 | 5.5E-01 |
| Toluene | 4.0E+04 | | 4.0E+04 | 1.0E+04 | | 1.0E+04 | 2.0E+01 | | 2.0E+01 |
| Trichloroethane (1,1,1-) | 2.1E+04 | | 2.1E+04 | 2.8E+03 | | 2.8E+03 | 9.2E+00 | | 9.2E+00 |
| Trichloroethane (1,1,2-) | 9.4E+02 | 1.2E+03 | 9.4E+02 | 4.6E+01 | 5.6E+01 | 4.6E+01 | 4.1E-01 | 5.0E-01 | 4.1E-01 |
| Trichloroethene | 4.7E+02 | 6.0E+03 | 4.7E+02 | 5.2E+01 | 6.6E+02 | 5.2E+01 | 2.0E-01 | 2.6E+00 | 2.0E-01 |
| Tichlorofluoromethane | 7.0E+04 | | 7.0E+04 | 9.8E+03 | | 9.8E+03 | 3.1E+01 | | 3.1E+01 |
| Trichloro-1,2,2-trifluoroethane (1,1,2- | 7.0E+06 | | 7.0E+06 | 1.2E+06 | | 1.2E+06 | 3.1E+03 | | 3.1E+03 |
| Vinyl acetate | 2.3E+05 | | 2.3E+05 | 3.9E+03 | | 3.9E+03 | 1.0E+02 | | 1.0E+02 |
| Vinyl chloride | | 2.9E+02 | 2.9E+02 | | 2.5E-01 | 2.5E-01 | | 1.5E-02 | 1.5E-02 |
| Xylenes | 4.0E+05 | | 4.0E+05 | 1.1E+05 | | 1.1E+05 | 2.0E+02 | | 2.0E+02 |
| **SEMIVOLATILES** | | | | | | | | | |
| Acenaphthene | 7.5E+03 | | 7.5E+03 | 5.6E+04 | | 5.6E+04 | 6.1E+00 | | 6.1E+00 |
| Acenaphthylene | 5.5E+03 | | 5.5E+03 | 2.2E+04 | | 2.2E+04 | 4.5E+00 | | 4.5E+00 |
| Anthracene | 2.6E+04 | | 2.6E+04 | 8.6E+05 | | 8.6E+05 | 3.1E+01 | | 3.1E+01 |
| Benzo(a)anthracene | 5.5E+03 | 2.9E+01 | 2.9E+01 | 1.3E+07 | 6.7E+04 | 6.7E+04 | 4.5E+00 | 2.4E-02 | 2.4E-02 |
| Benzo(a)pyrene | 5.5E+03 | 2.9E+00 | 2.9E+00 | 4.9E+07 | 2.6E+04 | 2.6E+04 | 4.5E+00 | 2.4E-03 | 2.4E-03 |
| Benzo(b)fluoranthene | 5.5E+03 | 2.9E+01 | 2.9E+01 | 4.9E+06 | 2.6E+04 | 2.6E+04 | 4.5E+00 | 2.4E-02 | 2.4E-02 |

TABLE 2 (Continued)
HEALTH-BASED LEVELS FOR ORGANIC AND INORGANIC CHEMICALS IN SURFACE SOILS, SUBSURFACE SOILS, AND GROUNDWATER AT HUNTERS POINT ANNEX
INDUSTRIAL/COMMERCIAL SCENARIO – ADULT WORKERS
(Sheet 2 of 3)

| Analyte | SURFACE SOIL (0–2 feet below ground surface) | | | SUBSURFACE SOIL (>2 feet below ground surface) | | | GROUNDWATER | | |
|---|---|---|---|---|---|---|---|---|---|
| | Adult HBLa mg/kg | Residential HBLc mg/kg | Reference HBL mg/kg | Adult HBLa mg/kg | Residential HBLc mg/kg | Reference HBL mg/kg | Adult HBLa mg/L | Residential HBLc mg/L | Reference HBL mg/L |
| Benzo(ghi)perylene | 5.5E+03 | | 5.5E+03 | 1.4E+07 | | 1.4E+07 | 4.5E+00 | | 4.5E+00 |
| Benzo(k)fluoranthene | 5.5E+03 | 2.9E+02 | 2.9E+02 | 4.9E+06 | 2.6E+05 | 2.6E+05 | 4.5E+00 | 2.4E-01 | 2.4E-01 |
| Benzoic acid | 9.4E+05 | | 9.4E+05 | 3.8E+04 | | 3.8E+04 | 4.1E+02 | | 4.1E+02 |
| Bis(2-ethylhexyl)phthalate | 1.6E+04 | 1.6E+04 | 1.6E+04 | 8.2E+09 | 8.2E+09 | 8.2E+09 | 2.0E+00 | 2.0E+00 | 2.0E+00 |
| Butylbenzylphthalate | 4.7E+04 | | 4.7E+04 | 6.9E+03 | | 6.9E+03 | 2.0E+01 | | 2.0E+01 |
| Chloronaphthalene (2-) | 1.9E+04 | | 1.9E+04 | 1.5E+04 | | 1.5E+04 | 8.2E+00 | | 8.2E+00 |
| Chlorophenol (2-) | 1.2E+03 | | 1.2E+03 | 7.5E+01 | | 7.5E+01 | 5.1E-01 | | 5.1E-01 |
| Chrysene | 5.5E+03 | 2.9E+03 | 2.9E+03 | 1.8E+06 | 9.5E+05 | 9.5E+05 | 4.5E+00 | 2.4E+00 | 2.4E+00 |
| Di-n-butylphthalate | 2.3E+04 | | 2.3E+04 | 3.5E+06 | | 3.5E+06 | 1.0E+01 | | 1.0E+01 |
| Di-n-octylphthalate | 4.7E+03 | | 4.7E+03 | 7.8E+04 | | 7.8E+04 | 2.0E+00 | | 2.0E+00 |
| Dibenzo(a,h)anthracene | 1.2E+04 | 6.0E+00 | 6.0E+00 | 3.0E+07 | 1.6E+04 | 1.6E+04 | 4.5E+00 | 2.4E-03 | 2.4E-03 |
| Dichlorobenzene (1,2-) | 2.1E+04 | | 2.1E+04 | 3.1E+04 | | 3.1E+04 | 9.2E+00 | | 9.2E+00 |
| Dichlorobenzene (1,4-) | 5.4E+04 | 1.6E+03 | 1.6E+03 | 8.0E+04 | 2.4E+03 | 2.4E+03 | 2.4E+01 | 7.2E-01 | 7.2E-01 |
| Dichlorobenzidine (3,3'-) | | 5.5E+01 | 5.5E+01 | | 7.4E+01 | 7.4E+01 | | 2.4E-02 | 2.4E-02 |
| Diethylphthalate | 1.9E+05 | | 1.9E+05 | 2.3E+04 | | 2.3E+04 | 8.2E+01 | | 8.2E+01 |
| Dimethylphenol (2,4-) | 4.7E+03 | | 4.7E+03 | 3.9E+02 | | 3.9E+02 | 2.0E+00 | | 2.0E+00 |
| Dimethylphthalate | 2.3E+06 | | 2.3E+06 | 3.3E+05 | | 3.3E+05 | 1.0E+03 | | 1.0E+03 |
| Dinitrophenol (2,4-) | 4.7E+02 | | 4.7E+02 | 6.8E+00 | | 6.8E+00 | 2.0E-01 | | 2.0E-01 |
| Dinitrotoluene (2,4-) | 4.7E+02 | | 4.7E+02 | 1.8E+01 | | 1.8E+01 | 2.0E-01 | | 2.0E-01 |
| Fluoranthene | 5.0E+03 | | 5.0E+03 | 3.1E+05 | | 3.1E+05 | 4.1E+00 | | 4.1E+00 |
| Fluorene | 5.0E+03 | | 5.0E+03 | 6.0E+04 | | 6.0E+04 | 4.1E+00 | | 4.1E+00 |
| Hydrazine | | 2.2E+01 | 2.2E+01 | | 1.9E-03 | 1.9E-03 | | 9.5E-03 | 9.5E-03 |
| Indeno(1,2,3-cd)pyrene | 5.5E+03 | 2.9E+01 | 2.9E+01 | 1.4E+07 | 7.6E+04 | 7.6E+04 | 4.5E+00 | 2.4E-02 | 2.4E-02 |
| Methylnaphthalene (2-) | 9.4E+03 | | 9.4E+03 | 2.5E+04 | | 2.5E+04 | 4.1E+00 | | 4.1E+00 |
| Methylphenol (2-) | 1.2E+04 | | 1.2E+04 | 2.2E+02 | | 2.2E+02 | 5.1E+00 | | 5.1E+00 |
| Napthalene | 9.4E+03 | | 9.4E+03 | 7.7E+03 | | 7.7E+03 | 4.1E+00 | | 4.1E+00 |
| Nitroaniline (2-) | 4.7E+01 | | 4.7E+01 | 1.8E+00 | | 1.8E+00 | 2.0E-02 | | 2.0E-02 |
| Nitrosodiphenylamine (n-) | | 7.3E+03 | 7.3E+03 | | 7.6E+03 | 7.6E+03 | | 3.2E+00 | 3.2E+00 |
| Nitrosodipropylamine (n-) | | 9.4E+00 | 9.4E+00 | | 1.1E+00 | 1.1E+00 | | 4.1E-03 | 4.1E-03 |
| Pentachlorophenol | 7.0E+03 | 5.5E+02 | 5.5E+02 | 3.2E+06 | 2.5E+05 | 2.5E+05 | 3.1E+00 | 2.4E-01 | 2.4E-01 |
| Phenanthrene | 5.5E+03 | | 5.5E+03 | 1.3E+05 | | 1.3E+05 | 4.5E+00 | | 4.5E+00 |
| Phenol | 4.9E+03 | | 4.9E+03 | 6.1E+01 | | 6.1E+01 | 5.1E+00 | | 5.1E+00 |
| Pyrene | 3.7E+03 | | 3.7E+03 | 2.3E+05 | | 2.3E+05 | 3.1E+00 | | 3.1E+00 |
| Trichlorobenzene (1,2,4-) | 2.3E+03 | | 2.3E+03 | 1.9E+04 | | 1.9E+04 | 1.0E+00 | | 1.0E+00 |
| Trichlorophenol (2,4,5-) | 2.3E+04 | | 2.3E+04 | 1.8E+03 | | 1.8E+03 | 1.0E+01 | | 1.0E+01 |
| PESTICIDES/PCBs | | | | | | | | | |
| Aldrin | 7.0E+00 | 3.9E+00 | 3.9E+00 | 3.0E+02 | 1.6E+02 | 1.6E+02 | 3.1E-03 | 1.7E-03 | 1.7E-03 |
| Aroclor-1260 | 3.4E+01 | 1.2E+01 | 1.2E+01 | 6.0E+02 | 2.2E+02 | 2.2E+02 | 1.0E-02 | 3.7E-03 | 3.7E-03 |
| BHC (alpha-) | | 1.0E+01 | 1.0E+01 | | 3.5E+01 | 3.5E+01 | | 4.5E-03 | 4.5E-03 |
| BHC (beta-) | | 3.7E+01 | 3.7E+01 | | 1.2E+02 | 1.2E+02 | | 1.6E-02 | 1.6E-02 |

TABLE 2 (Continued)

HEALTH-BASED LEVELS FOR ORGANIC AND INORGANIC CHEMICALS IN SURFACE SOILS, SUBSURFACE SOILS, AND GROUNDWATER AT HUNTERS POINT ANNEX

INDUSTRIAL/COMMERCIAL SCENARIO – ADULT WORKERS

(Sheet 3 of 3)

| Analyte | SURFACE SOIL (0–2 feet below ground surface) | | | SUBSURFACE SOIL (>2 feet below ground surface) | | | GROUNDWATER | | |
|---|---|---|---|---|---|---|---|---|---|
| | Adult HBLn mg/kg | Residential HBLc mg/kg | Reference HBL mg/kg | Adult HBLn mg/kg | Residential HBLc mg/kg | Reference HBL mg/kg | Adult HBLn mg/L | Residential HBLc mg/L | Reference HBL mg/L |
| BHC (gamma-) = Lindane | 7.0E+01 | 5.1E+01 | 5.1E+01 | 6.6E+01 | 4.8E+01 | 4.8E+01 | 3.1E-02 | 2.2E-02 | 2.2E-02 |
| Chlordane | 1.2E+01 | 4.1E+01 | 1.2E+01 | 1.7E+03 | 6.2E+03 | 1.7E+03 | 6.1E-03 | 2.2E-02 | 6.1E-03 |
| D (2,4-) | 3.7E+03 | | 3.7E+03 | 4.1E+01 | | 4.1E+01 | 1.0E+00 | | 1.0E+00 |
| DB (2,4-) | 1.9E+03 | | 1.9E+03 | 3.3E+02 | | 3.3E+02 | 8.2E-01 | | 8.2E-01 |
| DDD | | 2.0E+02 | 2.0E+02 | | 1.0E+06 | 1.0E+06 | | 1.2E-01 | 1.2E-01 |
| DDE | | 1.4E+02 | 1.4E+02 | | 1.3E+05 | 1.3E+05 | | 8.4E-02 | 8.4E-02 |
| DDT | 8.7E+01 | 1.4E+02 | 8.7E+01 | 2.5E+04 | 4.1E+04 | 2.5E+04 | 5.1E-02 | 8.4E-02 | 5.1E-02 |
| Dieldrin | 1.2E+01 | 4.1E+00 | 4.1E+00 | 7.6E+01 | 2.7E+01 | 2.7E+01 | 5.1E-03 | 1.8E-03 | 1.8E-03 |
| Endosulfan | 1.4E+03 | | 1.4E+03 | 3.9E+03 | | 3.9E+03 | 6.1E-01 | | 6.1E-01 |
| Endrin | 7.0E+01 | | 7.0E+01 | 4.1E+01 | | 4.1E+01 | 3.1E-02 | | 3.1E-02 |
| Heptachlor | 1.2E+02 | 1.2E+01 | 1.2E+01 | 1.2E+03 | 1.2E+02 | 1.2E+02 | 5.1E-02 | 5.0E-03 | 5.0E-03 |
| Heptachlor epoxide | 3.1E+00 | 5.1E+00 | 3.1E+00 | 5.8E+00 | 9.6E+00 | 5.8E+00 | 1.3E-03 | 2.2E-03 | 1.3E-03 |
| Isophorone | 4.7E+04 | 6.9E+04 | 4.7E+04 | 1.0E+03 | 1.5E+03 | 1.0E+03 | 2.0E+01 | 3.0E+01 | 2.0E+01 |
| MCPA | 1.2E+02 | | 1.2E+02 | 1.2E+02 | | 1.2E+02 | 5.1E-02 | | 5.1E-02 |
| MCPP | 2.3E+02 | | 2.3E+02 | 2.3E+02 | | 2.3E+02 | 1.0E-01 | | 1.0E-01 |
| Methoxychlor | 1.2E+03 | | 1.2E+03 | 1.0E+05 | | 1.0E+05 | 5.1E-01 | | 5.1E-01 |
| T (2,4,5-) | 2.3E+03 | | 2.3E+03 | 4.2E+02 | | 4.2E+02 | 1.0E+00 | | 1.0E+00 |
| TP (2,4,5) | 1.9E+03 | | 1.9E+03 | 4.3E+03 | | 4.3E+03 | 8.2E-01 | | 8.2E-01 |
| METALS | | | | | | | | | |
| Antimony | 4.6E+02 | | 4.6E+02 | 1.8E+02 | | 1.8E+02 | 4.1E-02 | | 4.1E-02 |
| Arsenic | 1.9E+02 | 9.6E+01 | 9.6E+01 | 6.1E+02 | 3.2E+02 | 3.2E+02 | 3.1E-02 | 1.6E-02 | 1.6E-02 |
| Barium | 5.6E+04 | | 5.6E+04 | 4.3E+04 | | 4.3E+04 | 7.2E+00 | | 7.2E+00 |
| Beryllium | 3.1E+03 | 2.5E+01 | 2.5E+01 | 3.3E+04 | 2.7E+02 | 2.7E+02 | 5.1E-01 | 4.1E-03 | 4.1E-03 |
| Cadmium | 1.7E+02 | | 1.7E+02 | 3.3E+01 | | 3.3E+01 | 5.1E-02 | | 5.1E-02 |
| Chromium (total) | 4.2E+05 | | 4.2E+05 | 8.7E+06 | | 8.7E+06 | 1.0E+02 | | 1.0E+02 |
| Chromium VI | 2.1E+03 | | 2.1E+03 | 4.3E+04 | | 4.3E+04 | 5.1E-01 | | 5.1E-01 |
| Copper | 6.6E+04 | | 6.6E+04 | 1.3E+04 | | 1.3E+04 | 3.8E+00 | | 3.8E+00 |
| Cyanide | 1.2E+04 | | 1.2E+04 | 2.0E+01 | | 2.0E+01 | 2.0E+00 | | 2.0E+00 |
| Manganese | 1.1E+05 | | 1.1E+05 | 3.3E+03 | | 3.3E+03 | 5.1E-01 | | 5.1E-01 |
| Mercury | 9.6E+01 | | 9.6E+01 | 3.1E+01 | | 3.1E+01 | 3.1E-02 | | 3.1E-02 |
| Molybdenum | 8.9E+03 | | 8.9E+03 | 1.0E+03 | | 1.0E+03 | 5.1E-01 | | 5.1E-01 |
| Nickel | 2.3E+04 | | 2.3E+04 | 1.1E+04 | | 1.1E+04 | 7.6E-01 | | 7.6E-01 |
| Nitrate | 3.8E+05 | | 3.8E+05 | 3.3E-01 | | 3.3E-01 | 1.6E+02 | | 1.6E+02 |
| Selenium | 9.5E+03 | | 9.5E+03 | 1.5E+04 | | 1.5E+04 | 5.1E-01 | | 5.1E-01 |
| Silver | 3.5E+03 | | 3.5E+03 | 2.3E+03 | | 2.3E+03 | 5.1E-01 | | 5.1E-01 |
| Thallium | 9.2E+01 | | 9.2E+01 | 1.2E+03 | | 1.2E+03 | 8.2E-03 | | 8.2E-03 |
| Vanadium | 3.5E+03 | | 3.5E+03 | 7.2E+04 | | 7.2E+04 | 7.2E-01 | | 7.2E-01 |
| Zinc | 5.3E+05 | | 5.3E+05 | 9.4E+04 | | 9.4E+04 | 2.4E+01 | | 2.4E+01 |

NOTES:

Blank cells indicate toxicity value not available to determine Health-Based Level

HBLn – Noncarcinogenic Health-Based Level

Reference HBL – Most health protective Health-Based Level for medium

HBLc – Carcinogenic Health-Based Level

**TABLE 3**
**REFERENCE DOSES, RELATIVE ABSORPTION FACTORS, AND SORPTION COEFFICIENTS FOR NONCARCINOGENIC HEALTH-BASED LEVELS (HBLn)**
**(Sheet 1 of 4)**

| Analyte | Chronic Oral RfDo mg/kg-d | Chronic Inh. RfDi mg/kg-d | Ref. | Subchronic Oral RfDo mg/kg-d | Subchronic Inh. RfDi mg/kg-d | Ref. | Noncarcinogenic RAF | | | | Org. Koc/ Inorg. Kd | Ref. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Soil Ingest. | Soil Dermal | Water Ingest. | Ref. | | |
| **VOLATILES** | | | | | | | | | | | | |
| Acetone | 1.0E-01 | 1.0E-01 | a/r | 1.0E+00 | 1.0E+00 | b/r | 1.0E+00 | 1.0E-01 | 1.0E+00 | m | 2.2E+00 | d |
| Benzene | 5.0E-03 | 2.6E-03 | c/c | 5.0E-02 | 9.1E-03 | c/c | 1.0E+00 | 8.0E-02 | 1.0E+00 | c | 8.3E+01 | d |
| Bromoform | 2.0E-02 | 2.0E-02 | a/r | 2.0E-01 | 2.0E-01 | b/r | 1.0E+00 | 1.0E-01 | 1.0E+00 | m | 1.2E+02 | e |
| Carbon disulfide | 1.0E-01 | 2.9E-03 | a/b | 1.0E-01 | 2.9E-03 | b/b | 1.0E+00 | 1.0E-01 | 1.0E+00 | m | 6.2E+01 | d |
| Carbon tetrachloride | 7.0E-04 | 1.2E-01 | a/c | 7.0E-03 | 1.2E-01 | c/c | 1.0E+00 | 1.0E-01 | 1.0E+00 | c | 4.4E+02 | d |
| Chlorobenzene | 2.0E-02 | 5.7E-03 | a/b | 2.0E-01 | 5.7E-02 | c/c | 1.0E+00 | 1.0E-01 | 1.0E+00 | c | 3.3E+02 | d |
| Chloroethane | 2.0E-02 | 2.9E+00 | q/a | 2.0E-02 | 2.9E+00 | q/b | 1.0E+00 | 1.0E-01 | 1.0E+00 | a,m | 3.3E+01 | i |
| Chloroform | 1.0E-02 | 1.9E-01 | a/c | 1.0E-02 | 1.9E-01 | b/c | 1.0E+00 | 1.0E-01 | 1.0E+00 | c | 4.4E+01 | d |
| Chloromethane | | | | | | | | | | | 4.3E+00 | d |
| Dichloroethane (1,1-) | 1.0E-01 | 1.4E-01 | b/b | 1.0E+00 | 1.4E+00 | b/b | 1.3E+00 | 1.3E-01 | 1.3E+00 | c | 3.0E+01 | e |
| Dichloroethane (1,2-) | 2.0E-02 | 1.6E-02 | c/c | 2.0E-01 | 1.6E-02 | c/c | 1.0E+00 | 1.0E-01 | 1.0E+00 | c | 1.4E+01 | d |
| Dichloroethene (1,1-) | 9.0E-03 | 1.4E-03 | a/c | 9.0E-03 | 1.4E-03 | b/c | 1.0E+00 | 1.0E-01 | 1.0E+00 | c | 6.5E+01 | d |
| Dichloroethene (1,2-) | 9.0E-03 | 3.1E-01 | b/c | 9.0E-03 | 3.1E-01 | b/c | 1.0E+00 | 1.0E-01 | 1.0E+00 | c | 5.9E+01 | d |
| Dichloropropane (1,2-) | 1.1E-03 | 1.1E-03 | r/a | 3.7E-03 | 3.7E-03 | r/b | 1.0E+00 | 1.0E-01 | 1.0E+00 | a,m | 5.1E+01 | d |
| Dichloropropene (1,3-) | 3.0E-04 | 5.7E-03 | a/a | 3.0E-03 | 5.7E-03 | b/b | 1.0E+00 | 1.0E-01 | 1.0E+00 | a,m | 2.7E+01 | d |
| Ethyl benzene | 1.0E-01 | 3.0E-01 | a/a | 1.0E+00 | 3.0E-01 | c/c | 1.0E+00 | 2.0E-01 | 1.0E+00 | c | 1.1E+03 | d |
| Methyl ethyl ketone | 6.0E-01 | 2.9E-01 | b/a | 2.0E-01 | 2.9E+00 | a/b | 1.0E+00 | 1.0E-01 | 1.0E+00 | c | 3.9E+00 | d |
| Methyl isobutyl ketone | 5.0E-02 | 2.3E-02 | b/b | 5.0E-01 | 2.3E-01 | b/b | 1.0E+00 | 1.0E-01 | 1.0E+00 | c | 2.1E+01 | d |
| Methylene chloride | 6.0E-02 | 8.6E-01 | a/b | 6.0E-02 | 8.6E-01 | b/b | 1.0E+00 | 1.0E-01 | 1.0E+00 | m | 4.3E+00 | d |
| Styrene | 2.0E-01 | 2.9E-01 | a/a | 2.0E+00 | 8.6E-01 | a/b | 1.0E+00 | 1.0E-01 | 1.0E+00 | a,m | 2.7E+02 | o |
| Tetrachloroethane (1,1,1,2-) | 3.0E-02 | 3.0E-02 | a/r | 3.0E-02 | 3.0E-02 | b/r | 1.0E+00 | 1.0E-01 | 1.0E+00 | m | 2.4E+02 | d |
| Tetrachloroethane (1,1,2,2-) | | | | | | | | | | | 1.2E+02 | e |
| Tetrachloroethene | 1.0E-02 | 1.3E+00 | a/c | 1.0E-01 | 1.3E+00 | b/c | 1.0E+00 | 1.0E-01 | 1.0E+00 | c | 3.6E+02 | d |
| Toluene | 2.0E-01 | 1.1E-01 | a/a | 2.0E+00 | 5.7E-01 | b/c | 1.0E+00 | 1.2E-01 | 1.0E+00 | c | 2.5E+02 | d |
| Trichloroethane (1,1,1-) | 9.0E-02 | 2.9E-01 | c/c | 9.0E-01 | 2.9E+00 | c/c | 1.0E+00 | 1.0E-01 | 1.0E+00 | c | 1.5E+02 | d |
| Trichloroethane (1,1,2-) | 4.0E-03 | 4.0E-03 | a/r | 4.0E-02 | 4.0E-02 | b/r | 1.0E+00 | 1.0E-01 | 1.0E+00 | m | 5.6E+01 | d |
| Trichloroethene | 2.0E-03 | 5.1E-02 | c/c | 2.0E-02 | 5.1E-02 | c/c | 1.0E+00 | 1.0E-01 | 1.0E+00 | c | 1.3E+02 | d |
| Tichlorofluoromethane | 3.0E-01 | 2.0E-01 | a/b | 7.0E-01 | 2.0E+00 | b/b | 1.0E+00 | 1.0E-01 | 1.0E+00 | c | 1.6E+02 | e |
| Trichloro-1,2,2-trifluoroethane (1,1,2-) | 3.0E+01 | 8.6E+00 | a/b | 3.0E+00 | 8.6E+00 | b/b | 1.0E+00 | 1.0E-01 | 1.0E+00 | c | 1.9E+02 | o |
| Vinyl acetate | 1.0E+00 | 5.7E-02 | b/a | 1.0E+00 | 5.7E-02 | b/b | 1.0E+00 | 1.0E-01 | 1.0E+00 | a,m | 1.9E+01 | o |
| Vinyl chloride | | | | | | | | | | | 8.2E+00 | d |
| Xylenes | 2.0E+00 | 8.6E-02 | a/c | 4.0E+00 | 8.6E-02 | c/c | 1.0E+00 | 1.2E-01 | 1.0E+00 | c | 2.7E+02 | d |
| **SEMIVOLATILES** | | | | | | | | | | | | |
| Acenaphthene | 6.0E-02 | | a | 6.0E-01 | | b | 1.0E+00 | 2.0E-01 | 1.0E+00 | c | 4.6E+03 | d |
| Acenaphthylene | 4.0E-02 | | q,l | 4.0E-02 | | q,l | 9.1E-01 | 1.8E-01 | 9.1E-01 | c | 2.5E+03 | d |
| Anthracene | 3.0E-01 | | a | 3.0E+00 | | b | 1.0E+00 | 2.9E-01 | 1.0E+00 | c | 1.4E+04 | e |
| Benzo(a)anthracene | 4.0E-02 | | q,l | 4.0E-02 | | q,l | 9.1E-01 | 1.8E-01 | 9.1E-01 | c | 1.4E+06 | d |
| Benzo(a)pyrene | 4.0E-02 | | q,l | 4.0E-02 | | q,l | 9.1E-01 | 1.8E-01 | 9.1E-01 | c | 5.5E+06 | d |
| Benzo(b)fluoranthene | 4.0E-02 | | q,l | 4.0E-02 | | q,l | 9.1E-01 | 1.8E-01 | 9.1E-01 | c | 5.5E+05 | d |

TABLE 3 (Continued)
REFERENCE DOSES, RELATIVE ABSORPTION FACTORS, AND SORPTION COEFFICIENTS
FOR NONCARCINOGENIC HEALTH-BASED LEVELS (HBLs)
(Sheet 2 of 4)

| Analyte | Chronic Oral RfDo mg/kg-d | Chronic Inh. RfDi mg/kg-d | Ref. | Subchronic Oral RfDo mg/kg-d | Subchronic Inh. RfDi mg/kg-d | Ref. | Noncarcinogenic RAF | | | | Org. Koc/ Inorg. Kd | Ref. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Soil Ingest. | Soil Dermal | Water Ingest. | Ref. | | |
| Benzo(ghi)perylene | 4.0E-02 | | q,l | 4.0E-02 | | q,l | 9.1E-01 | 1.8E-01 | 9.1E-01 | c | 1.6E+06 | e |
| Benzo(k)fluoranthene | 4.0E-02 | | q,l | 4.0E-02 | | q,l | 9.1E-01 | 1.8E-01 | 9.1E-01 | e | 5.5E+05 | e |
| Benzoic acid | 4.0E+00 | | a | 4.0E+00 | | b | 1.0E+00 | 1.0E-01 | 1.0E+00 | h,i | 4.6E+01 | o |
| Bis(2-ethylhexyl)phthalate | 2.0E-02 | | a | 2.0E-02 | | c | 1.0E+00 | 2.0E-02 | 1.0E+00 | c | 2.0E+09 | d |
| Butylbenzylphthalate | 2.0E-01 | | a | 2.0E+00 | | b | 1.0E+00 | 1.0E-01 | 1.0E+00 | h,i | 1.7E+02 | o |
| Chloronaphthalene (2-) | 8.0E-02 | | a | 8.0E-01 | | a | 1.0E+00 | 1.0E-01 | 1.0E+00 | a,h | 9.4E+02 | d |
| Chlorophenol (2-) | 5.0E-03 | | a | 5.0E-02 | | b | 1.0E+00 | 1.0E-01 | 1.0E+00 | h | 7.3E+01 | d |
| Chrysene | 4.0E-02 | | q,l | 4.0E-02 | | q,l | 9.1E-01 | 1.8E-01 | 9.1E-01 | c | 2.0E+05 | d |
| Di-n-butylphthalate | 1.0E-01 | | a | 1.0E+00 | | b | 1.0E+00 | 1.0E-01 | 1.0E+00 | h,i | 1.7E+05 | e |
| Di-n-octylphthalate | 2.0E-02 | | b | 2.0E-02 | | b | 1.0E+00 | 1.0E-01 | 1.0E+00 | h | 1.9E+04 | o |
| Dibenzo(a,h)anthracene | 4.0E-02 | | q,l | 4.0E-02 | | q,l | 9.1E-01 | 8.0E-02 | 9.1E-01 | c | 3.3E+06 | d |
| Dichlorobenzene (1,2-) | 9.0E-02 | | a | 9.0E-01 | | s | 1.0E+00 | 1.0E-01 | 1.0E+00 | h | 1.7E+03 | d |
| Dichlorobenzene (1,4-) | 2.3E-01 | | b,r | 2.3E-01 | | b,r | 1.0E+00 | 1.0E-01 | 1.0E+00 | h | 1.7E+03 | d |
| Dichlorobenzidine (3,3'-) | | | | | | | | | | | 1.6E+03 | e |
| Diethylphthalate | 8.0E-01 | | a | 8.0E+00 | | b | 1.0E+00 | 1.0E-01 | 1.0E+00 | h | 1.4E+02 | e |
| Dimethylphenol (2,4-) | 2.0E-02 | | a | 2.0E-01 | | b | 1.0E+00 | 1.0E-01 | 1.0E+00 | h | 9.6E+01 | d |
| Dimethylphthalate | 1.0E+01 | | b | 1.0E+01 | | b | 1.0E+00 | 1.0E-01 | 1.0E+00 | h | 1.6E+02 | o |
| Dinitrophenol (2,4-) | 2.0E-03 | | a | 2.0E-03 | | b | 1.0E+00 | 1.0E-01 | 1.0E+00 | a,h | 1.7E+01 | e |
| Dinitrotoluene (2,4-) | 2.0E-03 | | a | 2.0E-03 | | b | 1.0E+00 | 1.0E-01 | 1.0E+00 | h | 4.5E+01 | d |
| Fluoranthene | 4.0E-02 | | a | 4.0E-01 | | b | 1.0E+00 | 2.0E-01 | 1.0E+00 | c | 3.8E+04 | d |
| Fluorene | 4.0E-02 | | a | 4.0E-01 | | b | 1.0E+00 | 2.0E-01 | 1.0E+00 | c | 7.3E+03 | e |
| Hydrazine | | | | | | | | | | | 1.0E-01 | e |
| Indeno(1,2,3-cd)pyrene | 4.0E-02 | | q,l | 4.0E-02 | | q,l | 9.1E-01 | 1.8E-01 | 9.1E-01 | c | 1.6E+06 | d |
| Methylnaphthalene (2-) | 4.0E-02 | | q,l | 4.0E-02 | | q,l | 1.0E+00 | 1.0E-01 | 1.0E+00 | c | 3.0E+03 | f |
| Methylphenol (2-) | 5.0E-02 | | a | 5.0E-01 | | b | 1.0E+00 | 1.0E-01 | 1.0E+00 | a,h | 2.2E+01 | o |
| Napthalene | 4.0E-02 | | q | 4.0E-02 | | q | 1.0E+00 | 1.0E-01 | 1.0E+00 | c | 9.4E+02 | d |
| Nitroaniline (2-) | 2.0E-04 | | s | 2.0E-03 | | s | 1.0E+00 | 1.0E-01 | 1.0E+00 | h | 4.4E+01 | o |
| Nitrosodiphenylamine (n-) | | | | | | | | | | | 1.2E+03 | o |
| Nitrosodipropylamine (n-) | | | | | | | | | | | 1.3E+02 | i |
| Pentachlorophenol | 3.0E-02 | | a | 3.0E-02 | | b | 1.0E+00 | 1.0E-01 | 1.0E+00 | h | 5.3E+05 | d |
| Phenanthrene | 4.0E-02 | | q,l | 4.0E-02 | | q,l | 9.1E-01 | 1.8E-01 | 9.1E-01 | c | 1.4E+04 | e |
| Phenol | 5.0E-02 | | a | 6.0E-01 | | b | 1.0E+00 | 2.6E-01 | 1.0E+00 | c | 6.0E+00 | d |
| Pyrene | 3.0E-02 | | a | 3.0E-01 | | b | 1.0E+00 | 2.0E-01 | 1.0E+00 | c | 3.8E+04 | e |
| Trichlorobenzene (1,2,4-) | 1.0E-02 | | a | 1.0E-02 | | b | 1.0E+00 | 1.0E-01 | 1.0E+00 | h | 9.2E+03 | d |
| Trichlorophenol (2,4,5-) | 1.0E-01 | | a | 1.0E+00 | | b | 1.0E+00 | 1.0E-01 | 1.0E+00 | a,h | 8.9E+01 | e |
| PESTICIDES/PCBs | | | | | | | | | | | | |
| Aldrin | 3.0E-05 | | a | 3.0E-05 | | b | 1.0E+00 | 1.0E-01 | 1.0E+00 | h,i | 4.9E+04 | i |
| Aroclor-1260 | 1.0E-04 | | c | 1.0E-04 | | c | 8.5E-01 | 6.7E-02 | 1.0E+00 | c,i | 3.0E+04 | d |
| BHC (alpha-) | | | | | | | | | | | 3.8E+03 | e |
| BHC (beta-) | | | | | | | | | | | 3.8E+03 | e |

TABLE 3 (Continued)
REFERENCE DOSES, RELATIVE ABSORPTION FACTORS, AND SORPTION COEFFICIENTS
FOR NONCARCINOGENIC HEALTH-BASED LEVELS (HBLn)
(Sheet 3 of 4)

| Analyte | Chronic Oral RfDo mg/kg-d | Chronic Inh. RfDi mg/kg-d | Ref. | Subchronic Oral RfDo mg/kg-d | Subchronic Inh. RfDi mg/kg-d | Ref. | Noncarcinogenic RAF | | | | Org. Koc/ Inorg. Kd | Ref. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Soil Ingest. | Soil Dermal | Water Ingest. | Ref. | | |
| BHC (gamma-) = Lindane | 3.0E-04 | | a | 3.0E-03 | | b | 1.0E+00 | 1.0E-01 | 1.0E+00 | a,i | 1.1E+03 | e |
| Chlordane | 6.0E-05 | | a | 6.0E-05 | | b | 1.0E+00 | 1.3E-01 | 1.0E+00 | a,i | 1.4E+05 | d |
| D (2,4-) | 1.0E-02 | | a | 1.0E-02 | | b | 1.0E+00 | 5.8E-02 | 1.0E+00 | a,i | 2.0E+01 | e |
| DB (2,4-) | 8.0E-03 | | a | 8.0E-02 | | b | 1.0E+00 | 1.0E-01 | 1.0E+00 | a,h | 2.0E+02 | e |
| DDD | | | | | | | | | | | 4.4E+06 | e |
| DDE | | | | | | | | | | | 7.7E+05 | e |
| DDT | 5.0E-04 | | a | 5.0E-04 | | b | 1.0E+00 | 1.4E-01 | 1.0E+00 | h,i | 2.4E+05 | e |
| Dieldrin | 5.0E-05 | | a | 5.0E-05 | | b | 1.0E+00 | 1.0E-01 | 1.0E+00 | a,i | 7.4E+03 | i |
| Endosulfan | 6.0E-03 | | a | 6.0E-03 | | a | 1.0E+00 | 1.0E-01 | 1.0E+00 | a,i | 3.2E+03 | i |
| Endrin | 3.0E-04 | | a | 3.0E-04 | | b | 1.0E+00 | 1.0E-01 | 1.0E+00 | a,i | 6.7E+02 | i |
| Heptachlor | 5.0E-04 | | a | 5.0E-04 | | b | 1.0E+00 | 1.0E-01 | 1.0E+00 | a,i | 1.2E+04 | d |
| Heptachlor epoxide | 1.3E-05 | | a | 1.3E-05 | | b | 1.0E+00 | 1.0E-01 | 1.0E+00 | a,i | 2.2E+03 | i |
| Isophorone | 2.0E-01 | | a | 2.0E+00 | | b | 1.0E+00 | 1.0E-01 | 1.0E+00 | a,i | 2.5E+01 | o |
| MCPA | 5.0E-04 | | a | 5.0E-04 | | b | 1.0E+00 | 1.0E-01 | 1.0E+00 | h,o | | k |
| MCPP | 1.0E-03 | | a | 1.0E-02 | | b | 1.0E+00 | 1.0E-01 | 1.0E+00 | h,o | | k |
| Methoxychlor | 5.0E-03 | | a | 5.0E-03 | | b | 1.0E+00 | 1.0E-01 | 1.0E+00 | h,i | 1.0E+05 | o |
| T (2,4,5-) | 1.0E-02 | | a | 1.0E-01 | | b | 1.0E+00 | 1.0E-01 | 1.0E+00 | a,o | 2.0E+02 | o |
| TP (2,4,5) | 8.0E-03 | | a | 8.0E-03 | | b | 1.0E+00 | 1.0E-01 | 1.0E+00 | a,o | 2.6E+03 | o |
| METALS | | | | | | | | | | | | |
| Antimony | 4.0E-04 | | a | 4.0E-04 | | b | 1.0E+00 | 1.0E-02 | 1.0E+00 | h,i | 4.5E+01 | n |
| Arsenic | 3.0E-04 | | a | 3.0E-04 | | b | 1.0E+00 | 3.0E-02 | 1.0E+00 | c | 2.0E+02 | n |
| Barium | 7.0E-02 | | a | 7.0E-02 | | b | 1.0E+00 | 2.0E-02 | 1.0E+00 | h,i | 6.0E+01 | n |
| Beryllium | 5.0E-03 | | a | 5.0E-03 | | b | 1.0E+00 | 3.0E-02 | 1.0E+00 | h,i | 6.5E+02 | n |
| Cadmium | 1.0E-03 | | a,g | 1.0E-03 | | c,g | 1.0E+00 | 1.4E-01 | 1.0E+00 | c | 6.5E+00 | n |
| Chromium (total) | 1.0E+00 | | a | 1.0E+01 | | b | 1.0E+00 | 5.0E-02 | 1.0E+00 | h,i | 8.5E+02 | n |
| Chromium VI | 5.0E-03 | | a | 2.0E-02 | | b | 1.0E+00 | 5.0E-02 | 1.0E+00 | h,i | 8.5E+02 | n |
| Copper | 3.7E-02 | | b,j | 8.7E-02 | | b,j | 1.0E+00 | 2.0E-03 | 1.0E+00 | h,i | 3.5E+01 | n |
| Cyanide | 2.0E-02 | | a | 2.0E-02 | | b | 1.0E+00 | 3.0E-02 | 1.0E+00 | a,c | 5.0E+00 | d,v |
| Manganese | 1.4E-01 | | a,t | 1.4E-01 | | b,t | 1.0E+00 | 2.0E-02 | 1.0E+00 | h,i | 6.5E+01 | n |
| Mercury | 3.0E-04 | | b | 3.0E-04 | | b | 1.0E+00 | 7.0E-02 | 1.0E+00 | h,i | 1.0E+01 | n |
| Molybdenum | 5.0E-03 | | a | 5.0E-03 | | b | 1.0E+00 | 2.0E-03 | 1.0E+00 | h,w | 2.0E+01 | n |
| Nickel | 2.0E-02 | | a | 2.0E-02 | | b | 1.0E+00 | 1.0E-02 | 2.7E+00 | h,i | 1.5E+02 | n |
| Nitrate | 1.6E+00 | | a | 1.6E+00 | | b | 1.0E+00 | 1.0E-01 | 1.0E+00 | h | 1.0E-03 | d,p |
| Selenium | 5.0E-03 | | a | 5.0E-03 | | b | 1.0E+00 | 1.0E-03 | 1.0E+00 | h,i | 3.0E+02 | n |
| Silver | 5.0E-03 | | a | 5.0E-03 | | b | 1.0E+00 | 2.5E-02 | 1.0E+00 | c,h | 4.5E+01 | n |
| Thallium | 8.0E-05 | | a,u | 8.0E-04 | | b,u | 1.0E+00 | 1.0E-02 | 1.0E+00 | h,i | 1.5E+03 | n |
| Vanadium | 7.0E-03 | | b | 7.0E-03 | | b | 1.0E+00 | 4.0E-02 | 1.0E+00 | h,i | 1.0E+03 | n |
| Zinc | 3.0E-01 | | a | 3.0E-01 | | s | 1.0E+00 | 2.0E-03 | 1.3E+00 | c,h,i | 4.0E+01 | n |

**TABLE 3 (Continued)**
**REFERENCE DOSES, RELATIVE ABSORPTION FACTORS, AND SORPTION COEFFICIENTS FOR NONCARCINOGENIC HEALTH-BASED LEVELS (HBLs)**
**(Sheet 4 of 4)**

NOTES:

Blank cells indicate data not available
RfDo – Oral Reference Dose
Koc – Organic sorption coefficient
Ref. cells with " / " interpret as oral / inhalation
RfDi – Inhalation Reference Dose
Kd – Inorganic sorption coefficient
RAF – Relative Absorption Factor

(a) Integrated Risk Information System (IRIS). (EPA 1993a)
(b) Health Effects Assessment Summary Tables (HEAST) -- Annual FY 1993. (EPA 1993b)
(c) Massachusetts Department of Environmental Protection. (MDEP 1992)
(d) Determining Soil Response Action Levels Based on Potential Contaminant Migration to Groundwater: A Compendium of Examples. (EPA 1989c)
(e) Superfund Public Health Evaluation Manual. (EPA 1986)
(f) Soil Transport and Fate Database Version 2.0. (EPA 1991d)
(g) Chronic and subchronic oral RfDo for cadmium in drinking water is 5E-4 mg/kg-d.
(h) Ryan, E. and others, 1987.
(i) Agency of Toxic Substances and Disease Registry (ATSDR) chemical-specific toxicological profile. (ATSDR 1989a-1989d, 1990a-1990f, 1991a-1991i, 1992a-1992f)
(j) Chronic oral RfD for copper was estimated by multiplying the current drinking water standard of 1.3 mg/L by an adult intake of 2 L/day and dividing by an adult body weight of 70 kg. Subchronic oral RfD for copper was estimated by multiplying the current drinking water standard of 1.3 mg/L by a child intake of 1 L/day and dividing by a child body weight of 15 kg.
(k) Koc for MCPA and MCPP are not available, use 0-2 ft. HBL as > 2 ft. HBLs.
(l) Toxicity value conservatively assumed to be that of naphthalene.
(m) Similar to benzene, a volatile organic compound.
(n) Baes III, C.F. and others. 1984.
(o) National Library of Medicine. (NLM 1993)
(p) Koc value obtained for nitrate is sodium nitrate.
(q) Toxicity information obtained from the Superfund Health Risk Technical Support Center (513)569-7300. (EPA 1993c)
(r) Route-to-route extrapolation, assuming equal rates of oral and inhalation absorption.
(s) HEAST, Supplement No. 1. (EPA 1993d)
(t) Chronic and subchronic oral RfDo for manganese in drinking water is 5E-3 mg/kg-d.
(u) Conservative RfD for thallium (I) carbonate, chloride, and sulfate was assumed.
(v) Koc value obtained for cyanide is sodium cyanide.
(w) Carson, B. and others, 1987.

TABLE 4
SLOPE FACTORS, RELATIVE ABSORPTION FACTORS, AND SORPTION COEFFICIENTS
FOR CARCINOGENIC HEALTH-BASED LEVELS (HBLc)
(Sheet 1 of 4)

| Analyte | Weight of Evidence | Oral SF kg-d/mg | Inhalation SF kg-d/mg | Ref. | Cal / EPA Oral SF (g) kg-d/mg | Cal / EPA Inh. SF (g) kg-d/mg | Carcinogenic RAF Soil Ingestion | Carcinogenic RAF Soil Dermal | Carcinogenic RAF Water Ingestion | Carcinogenic RAF Ref. | Org. Koc/ Inorg. Kd | Ref. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **VOLATILES** | | | | | | | | | | | | |
| Acetone | D | | | | | | | | | | 2.2E+00 | d |
| Benzene | A/A | 2.9E-02 | 2.9E-02 | a/b | 1.0E-01 | 1.0E-01 | 1.0E+00 | 8.0E-02 | 1.0E+00 | c | 8.3E+01 | d |
| Bromoform | B2/B2 | 7.9E-03 | 3.9E-03 | a/b | | | 1.0E+00 | 1.0E-01 | 1.0E+00 | m | 1.2E+02 | e |
| Carbon disulfide | | | | | | | | | | | 6.2E+01 | d |
| Carbon tetrachloride | B2/B2 | 1.3E-01 | 5.3E-02 | a/b | 1.5E-01 | 1.5E-01 | 1.0E+00 | 1.0E-01 | 1.0E+00 | c | 4.4E+02 | d |
| Chlorobenzene | D | | | a | | | | | | | 3.3E+02 | d |
| Chloroethane | | | | | | | | | | | 3.3E+01 | i |
| Chloroform | B2/B2 | 6.1E-03 | 8.1E-02 | a/a | 3.1E-02 | 1.9E-02 | 1.0E+00 | 1.0E-01 | 1.0E+00 | c | 4.4E+01 | d |
| Chloromethane | C/C | 1.3E-02 | 6.3E-03 | q/q | | | 1.0E+00 | 1.0E-01 | 1.0E+00 | a,m | 4.3E+00 | d |
| Dichloroethane (1,1-) | C/C | 9.1E-02 | 9.1E-02 | c/c | | | 1.0E+00 | 1.0E-01 | 1.0E+00 | c | 3.0E+01 | e |
| Dichloroethane (1,2-) | B2/B2 | 9.1E-02 | 9.1E-02 | a/b | 7.0E-02 | 7.0E-02 | 1.0E+00 | 1.0E-01 | 1.0E+00 | c | 1.4E+01 | d |
| Dichloroethene (1,1-) | C/C | 6.0E-01 | 1.8E-01 | a/a | | | 1.0E+00 | 1.0E-01 | 1.0E+00 | c | 6.5E+01 | d |
| Dichloroethene (1,2-) | D | | | a | | | | | | | 5.9E+01 | d |
| Dichloropropane (1,2-) | B2/B2 | 6.8E-02 | 6.8E-02 | b/r | 6.3E-02 | 6.3E-02 | 1.0E+00 | 1.0E-01 | 1.0E+00 | a,m | 5.1E+01 | d |
| Dichloropropene (1,3-) | B2/B2 | 1.8E-01 | 1.3E-01 | b/b | 1.8E-01 | 4.3E-02 | 1.0E+00 | 1.0E-01 | 1.0E+00 | a,m | 2.7E+01 | d |
| Ethyl benzene | D | | | a | | | | | | | 1.1E+03 | d |
| Methyl ethyl ketone | D | | | a | | | | | | | 3.9E+00 | d |
| Methyl isobutyl ketone | | | | | | | | | | | 2.1E+01 | d |
| Methylene chloride | B2/B2 | 7.5E-03 | 1.6E-03 | a/a | 1.4E-02 | 3.5E-03 | 1.0E+00 | 1.0E-01 | 1.0E+00 | m | 4.3E+00 | d |
| Styrene | | | | | | | | | | | 2.7E+02 | o |
| Tetrachloroethane (1,1,1,2-) | C/C | 2.6E-02 | 2.6E-02 | a/b | | | 1.0E+00 | 1.0E-01 | 1.0E+00 | m | 2.4E+02 | d |
| Tetrachloroethane (1,1,2,2-) | C/C | 2.0E-01 | 2.0E-01 | a/b | | | 1.0E+00 | 1.0E-01 | 1.0E+00 | c | 1.2E+02 | e |
| Tetrachloroethene | B2/B2 | 5.2E-02 | 2.0E-03 | p/p | | | 1.0E+00 | 1.0E-01 | 1.0E+00 | c | 3.6E+02 | d |
| Toluene | D | | | a | | | | | | | 2.5E+02 | d |
| Trichloroethane (1,1,1-) | D | | | a | | | | | | | 1.5E+02 | d |
| Trichloroethane (1,1,2-) | C/C | 5.7E-02 | 5.7E-02 | a/a | | | 1.0E+00 | 1.0E-01 | 1.0E+00 | m | 5.6E+01 | d |
| Trichloroethene | B2/B2 | 1.1E-02 | 6.0E-03 | p/p | | | 1.0E+00 | 1.0E-01 | 1.0E+00 | c | 1.3E+02 | d |
| Trichlorofluoromethane | | | | | | | | | | | 1.6E+02 | e |
| Trichloro-1,2,2-trifluoroethane (1,1,2-) | | | | | | | | | | | 1.9E+02 | o |
| Vinyl acetate | | | | | | | | | | | 1.9E+01 | o |
| Vinyl chloride | A/A | 1.9E+00 | 3.0E-01 | b/b | 2.7E-01 | 2.7E-01 | 1.0E+00 | 3.0E-04 | 1.0E+00 | i | 8.2E+00 | d |
| Xylenes | D | | | a | | | | | | | 2.7E+02 | d |
| **SEMIVOLATILES** | | | | | | | | | | | | |
| Acenaphthene | | | | | | | | | | | 4.6E+03 | d |
| Acenaphthylene | D | | | a | | | | | | | 2.5E+03 | d |
| Anthracene | D | | | a | | | | | | | 1.4E+04 | e |
| Benzo(a)anthracene | B2 | 7.3E-01 | | a,k* | 1.2E+00 | | 1.0E+00 | 2.0E-01 | 1.0E+00 | c | 1.4E+06 | d |
| Benzo(a)pyrene | B2 | 7.3E+00 | | a | 1.2E+01 | | 1.0E+00 | 2.0E-01 | 1.0E+00 | c | 5.5E+06 | d |
| Benzo(b)fluoranthene | B2 | 7.3E-01 | | a,k* | 1.2E+00 | | 1.0E+00 | 2.0E-01 | 1.0E+00 | c | 5.5E+05 | d |

TABLE 4 (Continued)
SLOPE FACTORS, RELATIVE ABSORPTION FACTORS, AND SORPTION COEFFICIENTS
FOR CARCINOGENIC HEALTH-BASED LEVELS (HBLc)
(Sheet 2 of 4)

| Analyte | Weight of Evidence | Oral SF kg-d/mg | Inhalation SF kg-d/mg | Ref. | Cal / EPA Oral SF (g) kg-d/mg | Cal / EPA Inh. SF (g) kg-d/mg | Carcinogenic RAF | | | | Org. Koc/ Inorg. Kd | Ref. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Soil Ingestion | Soil Dermal | Water Ingestion | Ref. | | |
| Benzo(ghi)perylene | D | | | a | | | | | | | 1.6E+06 | e |
| Benzo(k)fluoranthene | B2 | 7.3E-02 | | a,k* | 1.2E-01 | | 1.0E+00 | 2.0E-01 | 1.0E+00 | c | 5.5E+05 | e |
| Benzoic acid | D | | | a | | | | | | | 4.6E+01 | o |
| Bis(2-ethylhexyl)phthalate | B2 | 1.4E-02 | | a | | | 1.0E+00 | 2.0E-02 | 1.0E+00 | c | 2.0E+09 | d |
| Butylbenzylphthalate | C | | | a | | | | | | | 1.7E+02 | p |
| Chloronaphthalene (2-) | | | | | | | | | | | 9.4E+02 | d |
| Chlorophenol (2-) | | | | | | | | | | | 7.3E+01 | d |
| Chrysene | B2 | 7.3E-03 | | a,k* | 1.2E-02 | | 1.0E+00 | 2.0E-01 | 1.0E+00 | c | 2.0E+05 | d |
| Di-n-butylphthalate | D | | | a | | | | | | | 1.7E+05 | e |
| Di-n-octylphthalate | | | | | | | | | | | 1.9E+04 | o |
| Dibenzo(a,h)anthracene | B2 | 7.3E+00 | | a,k* | 1.2E+01 | | 1.0E+00 | 9.0E-02 | 1.0E+00 | c | 3.3E+06 | d |
| Dichlorobenzene (1,2-) | D | | | a | | | | | | | 1.7E+03 | d |
| Dichlorobenzene (1,4-) | B2 | 2.4E-02 | | b | 4.0E-02 | | 1.0E+00 | 1.0E-01 | 1.0E+00 | h | 1.7E+03 | d |
| Dichlorobenzidine (3,3'-) | B2 | 4.5E-01 | | a | 1.2E+00 | | 1.0E+00 | 1.0E-01 | 1.0E+00 | a,h | 1.6E+03 | e |
| Diethylphthalate | D | | | a | | | | | | | 1.4E+02 | e |
| Dimethylphenol (2,4-) | | | | | | | | | | | 9.6E+01 | d |
| Dimethylphthalate | D | | | a | | | | | | | 1.6E+02 | o |
| Dinitrophenol (2,4-) | | | | | | | | | | | 1.7E+01 | e |
| Dinitrotoluene (2,4-) | | | | | 3.1E-01 | | | | | | 4.5E+01 | d |
| Fluoranthene | D | | | a | | | | | | | 3.8E+04 | d |
| Fluorene | D | | | a | | | | | | | 7.3E+03 | e |
| Hydrazine | B2 | 3.0E+00 | | a | | | 1.0E+00 | 1.0E-01 | 1.0E+00 | h | 1.0E-01 | e |
| Indeno(1,2,3-cd)pyrene | B2 | 7.3E-01 | | a,k* | 1.2E+00 | | 1.0E+00 | 2.0E-01 | 1.0E+00 | c | 1.6E+06 | d |
| Methylnaphthalene (2-) | | | | | | | | | | | 3.0E+03 | f |
| Methylphenol (2-) | C | | | a | | | | | | | 2.2E+01 | o |
| Napthalene | D | | | a | | | | | | | 9.4E+02 | d |
| Nitroaniline (2-) | | | | | | | | | | | 4.4E+01 | o |
| Nitrosodiphenylamine (n-) | B2 | 4.9E-03 | | a | 9.0E-03 | | 1.0E+00 | 1.0E-01 | 1.0E+00 | h | 1.2E+03 | o |
| Nitrosodipropylamine (n-) | B2 | 7.0E+00 | | a | 7.0E+00 | | 1.0E+00 | 1.0E-01 | 1.0E+00 | h | 1.3E+02 | i |
| Pentachlorophenol | B2 | 1.2E-01 | | a | 1.8E-02 | | 1.0E+00 | 1.0E-01 | 1.0E+00 | h | 5.3E+05 | d |
| Phenanthrene | D | | | a | | | | | | | 1.4E+04 | e |
| Phenol | C | | | a | | | | | | | 6.0E+00 | d |
| Pyrene | D | | | a | | | | | | | 3.8E+04 | e |
| Trichlorobenzene (1,2,4-) | D | | | a | | | | | | | 9.2E+03 | d |
| Trichlorophenol (2,4,5-) | | | | | | | | | | | 8.9E+01 | e |
| PESTICIDES/PCBs | | | | | | | | | | | | |
| Aldrin | B2 | 1.7E+01 | | a | 1.7E+01 | | 1.0E+00 | 1.0E-01 | 1.0E+00 | h,i | 4.9E+04 | i |
| Aroclor-1260 | B2 | 7.7E+00 | | a | | | 8.5E-01 | 6.7E-02 | 1.0E+00 | c | 3.0E+04 | d |
| BHC (alpha-) | B2 | 6.3E+00 | | a | | | 1.0E+00 | 1.0E-01 | 1.0E+00 | a,i | 3.8E+03 | e |
| BHC (beta-) | C | 1.8E+00 | | a | | | 1.0E+00 | 1.0E-01 | 1.0E+00 | a,i | 3.8E+03 | e |

TABLE 4 (Continued)
SLOPE FACTORS, RELATIVE ABSORPTION FACTORS, AND SORPTION COEFFICIENTS
FOR CARCINOGENIC HEALTH-BASED LEVELS (HBLc)
(Sheet 3 of 4)

| Analyte | Weight of Evidence | Oral SF kg-d/mg | Inhalation SF kg-d/mg | Ref. | Cal / EPA Oral SF (g) kg-d/mg | Cal / EPA Inh. SF (g) kg-d/mg | Carcinogenic RAF | | | | Org. Koc/ Inorg. Kd | Ref. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Soil Ingestion | Soil Dermal | Water Ingestion | Ref. | | |
| BHC (gamma-) Lindane | B2-C | 1.3E+00 | | b | 1.1E+00 | | 1.0E+00 | 1.0E-01 | 1.0E+00 | a,i | 1.1E+03 | e |
| Chlordane | B2 | 1.3E+00 | | a | 1.2E+00 | | 1.0E+00 | 1.3E-01 | 1.0E+00 | a,i | 1.4E+05 | d |
| D (2,4-) | | | | | | | | | | | 2.0E+01 | e |
| DB (2,4-) | | | | | | | | | | | 2.0E+02 | e |
| DDD | B2 | 2.4E-01 | | a | 2.4E-01 | | 1.0E+00 | 1.4E-01 | 1.0E+00 | h,i | 4.4E+06 | e |
| DDE | B2 | 3.4E-01 | | a | 3.4E-01 | | 1.0E+00 | 1.4E-01 | 1.0E+00 | h,i | 7.7E+05 | e |
| DDT | B2 | 3.4E-01 | | a | 3.4E-01 | | 1.0E+00 | 1.4E-01 | 1.0E+00 | h,i | 2.4E+05 | e |
| Dieldrin | B2 | 1.6E+01 | | a | 1.6E+01 | | 1.0E+00 | 1.0E-01 | 1.0E+00 | a,i | 7.4E+03 | i |
| Endosulfan | | | | | | | | | | | 3.2E+03 | i |
| Endrin | D | | | a | | | | | | | 6.7E+02 | i |
| Heptachlor | B2 | 4.5E+00 | | a | 5.7E+00 | | 1.0E+00 | 1.0E-01 | 1.0E+00 | a,i | 1.2E+04 | d |
| Heptachlor epoxide | B2 | 9.1E+00 | | a | 1.3E+01 | | 1.0E+00 | 1.0E-01 | 1.0E+00 | a,i | 2.2E+03 | i |
| Isophorone | C | 9.5E-04 | | a | | | 1.0E+00 | 1.0E-01 | 1.0E+00 | a,i | 2.5E+01 | o |
| MCPA | | | | | | | | | | | | j |
| MCPP | | | | | | | | | | | | j |
| Methoxychlor | D | | | a | | | | | | | 1.0E+05 | o |
| T (2,4,5-) | | | | | | | | | | | 2.0E+02 | o |
| TP (2,4,5) | D | | | a | | | | | | | 2.6E+03 | o |
| METALS | | | | | | | | | | | | |
| Antimony | | | | | | | | | | | 4.5E+01 | n |
| Arsenic | A | 1.8E+00 | | c | | | 1.0E+00 | 3.0E-02 | 1.0E+00 | c | 2.0E+02 | n |
| Barium | | | | | | | | | | | 6.0E+01 | n |
| Beryllium | B2 | 4.3E+00 | | a | 7.0E+00 | | 1.0E+00 | 3.0E-02 | 1.0E+00 | h,i | 6.5E+02 | n |
| Cadmium | B1 | | | a | | | | | | | 6.5E+00 | n |
| Chromium (total) | | | | | | | | | | | 8.5E+02 | n |
| Chromium VI | | | | | | | | | | | 8.5E+02 | n |
| Copper | D | | | a | | | | | | | 3.5E+01 | n |
| Cyanide | D | | | a | | | | | | | 5.0E+00 | d,s |
| Manganese | | | | | | | | | | | 6.5E+01 | n |
| Mercury | D | | | a | | | | | | | 1.0E+01 | n |
| Molybdenum | | | | | | | | | | | 2.0E+01 | n |
| Nickel | | | | | | | | | | | 1.5E+02 | n |
| Nitrate | | | | | | | | | | | 1.0E-03 | d,l |
| Selenium | D | | | a | | | | | | | 3.0E+02 | n |
| Silver | D | | | a | | | | | | | 4.5E+01 | n |
| Thallium | D | | | a | | | | | | | 1.5E+03 | n |
| Vanadium | | | | | | | | | | | 1.0E+03 | n |
| Zinc | D | | | a | | | | | | | 4.0E+01 | n |

**TABLE 4 (Continued)**
**SLOPE FACTORS, RELATIVE ABSORPTION FACTORS, AND SORPTION COEFFICIENTS FOR CARCINOGENIC HEALTH-BASED LEVELS (HBLc)**
**(Sheet 4 of 4)**

| NOTES: | Blank cells indicate data not available | Cells with " / " interpret as oral/inhalation | Kd – Inorganic sorption coefficient |
|---|---|---|---|
| | SF – Slope Factor | RAF – Relative Absorption Factor | Koc – Organic sorption coefficient |

Weight of Evidence – U.S. EPA classification system: A = Human carcinogen; B2 = Probable human carcinogen, sufficient evidence in animals and inadequate or no evidence in humans; C = Possible human carcinogen; D = Not classifiable as to human carcinogenicity.

(a) Integrated Risk Information System (IRIS). (EPA 1993a)
(b) Health Effects Assessment Summary Tables (HEAST)--FY Annual 1993. (EPA 1993d)
(c) Massachusetts Department of Environmental Protection (MDEP). (MDEP 1992)
(d) Determining Soil Response Action Levels Based on Potential Contaminant Migration to Groundwater: A Compendium of Examples. (EPA 1989c)
(e) Superfund Public Health Evaluation Manual. (EPA 1986)
(f) Soil Transport and Fate Database Version 2.0. (EPA 1991d).
(g) California Environmental Protection Agency (Cal/EPA). (Cal/EPA 1992)
(h) Ryan, E. and others. 1987.
(i) Agency of Toxic Substance and Diesease Registry (ATSDR) chemical-specific toxicological profile. (ATSDR 1989a-1989d, 1990a-1990f, 1991a-1991i, 1992a-1992f)
(j) Koc for MCPA and MCPP are not available, use 0-2 ft. HBLs as > 2 ft. HBLs.
(k) Similar to benzo(a)pyrene. k* means values based on toxicity equivalence factor. (EPA 1993e)
(l) Koc obtained for nitrate is sodium nitrate.
(m) Similar to benzene, a volatile organic compound.
(n) Baes III, C.F. and others. 1984.
(o) National Library of Medicine. (NLM 1993)
(p) Toxicity information obtained from the Superfund Health Risk Technical Support Center (513) 569-7300. (EPA 1993c)
(q) HEAST, Supplement No. 1. (EPA 1993d)
(r) Route-to-route extrapolation, assuming equal rates of oral and inhalation absorption.
(s) Koc obtained for cyanide is sodium cyanide.

## TABLE 5
## EQUATIONS AND PARAMETERS FOR HBLn
## RESIDENTIAL SCENARIO - ADULT AND CHILDREN RECEPTORS

***For Volatile Contaminants of Potential Concern (COPC) in Groundwater:***

$$HBL_{w/n} = \frac{THI \times BW_n \times AT_n}{EF \times ED \times [((RAF_w \times IR_w)/RfD_o) + ((IR_i \times K)/RfD_i)]}$$

***For Semivolatile/Metal COPCs in Groundwater:***

$$HBL_{w/n} = \frac{THI \times BW_n \times AT_n \times RfD_o}{EF \times ED \times RAF_w \times IR_w}$$

| where | | Adults | Children (0-6) |
|---|---|---|---|
| HBLw/n= | Noncarcinogenic health-based level for water (mg/L) | — | — |
| THI = | Target hazard index (unitless) | 1 | 1 |
| $BW_n$ = | Body weight (kg), noncarcinogenic effects | 70 | 15 |
| $AT_n$ = | Averaging time (d), noncarcinogenic effects | 8,760 | 2,190 |
| EF = | Exposure frequency (d/yr) | 350 | 350 |
| ED = | Exposure duration (yr) | 24 | 6 |
| $RfD_o$ = | Oral reference dose (mg/kg-d) | Table 3 | Table 3 |
| $RfD_i$ = | Inhalation reference dose (mg/kg-d) | Table 3 | Table 3 |
| $IR_w$ = | Daily water ingestion rate (L/d) | 2 | 1 |
| $IR_i$ = | Daily indoor air inhalation rate ($m^3$/d) | 15 | 15 |
| $RAF_w$ = | RAF for water ingestion (unitless) | Table 3 | Table 3 |
| K = | Volatilization factor (L/$m^3$) | 0.5 | 0.5 |

**TABLE 5 (Continued)**
**EQUATIONS AND PARAMETERS FOR HBLn**
**RESIDENTIAL SCENARIO - ADULT AND CHILDREN RECEPTORS**

***For Contaminants of Potential Concern in Surface Soil:***

$$HBL_n = \frac{THI \times BW_n \times AT_n \times RfD_o}{EF \times ED \times CF \times [(RAF_o \times IR_s) + (RAF_d \times SA \times AF)]}$$

| where | | | Adults | Children (0-6) |
|---|---|---|---|---|
| $HBL_n$ | = | Noncarcinogenic health-based level for soil (mg/kg) | — | — |
| THI | = | Target hazard index (unitless) | 1 | 1 |
| $BW_n$ | = | Body weight (kg), noncarcinogenic effects | 70 | 15 |
| $AT_n$ | = | Averaging time (d), noncarcinogenic effects | 8,760 | 2,190 |
| EF | = | Exposure frequency (d/yr) | 350 | 350 |
| ED | = | Exposure duration (yr) | 24 | 6 |
| CF | = | Conversion factor (kg/mg) | $10^{-6}$ | $10^{-6}$ |
| $RfD_o$ | = | Oral reference dose (mg/kg-d) | Table 3 | Table 3 |
| $IR_s$ | = | Daily soil ingestion rate (mg/d) | 100 | 200 |
| $RAF_o$ | = | Relative absorption factor for soil ingestion (unitless) | Table 3 | Table 3 |
| $RAF_d$ | = | RAF for soil dermal contact (unitless) | Table 3 | Table 3 |
| SA | = | Contact surface area ($cm^2$/d) | 3,850 | 2,720 |
| AF | = | Soil-to-skin adherence factor (mg/$cm^2$) | 1 | 1 |

***For COPCs in Subsurface Soil:***

*ESTIMATION OF CONCENTRATION OF LEACHATE, $C_p$ (CRWQCB, 1989):*

$$C_p = HBL_{w/n} \times 100$$

*ESTIMATION OF HEALTH-BASED LEVELS FOR SUBSURFACE SOIL (EPA, 1989a):*

*Organics:* $HBL_n = K_{oc} \times F_{oc} \times C_p$
*Inorganics:* $HBL_n = K_d \times C_p$

| where | | | Adults | Children (0-6) |
|---|---|---|---|---|
| $HBL_n$ | = | Noncarcinogenic health-based level for soil (mg/kg) | — | — |
| $HBL_{w/n}$ | = | Noncarcinogenic health-based level for water (mg/L) | — | — |
| $C_p$ | = | Concentration of infiltrating leachate (mg/L) | — | — |
| $K_d$ | = | Soil : water equilibrium partition coefficient (L/kg) | Table 3 | Table 3 |
| $K_{oc}$ | = | Organic carbon water partition coefficient (L/kg) | Table 3 | Table 3 |
| $F_{oc}$ | = | Fraction of organic carbon in the soil (%) | 2 | 2 |

## TABLE 6
## EQUATIONS AND PARAMETERS FOR HBLc
## RESIDENTIAL SCENARIO - ADULT AND CHILDREN RECEPTORS

***For Volatile Contaminants of Potential Concern (COPC) in Groundwater:***

$$HBL_{w/c} = TR \times [(\frac{BW_c \times AT_c}{EF \times ED \times [(SF_o \times RAF_w \times IR_w) + (SF_i \times IR_i \times K)]})_{adult} + (\frac{BW_c \times AT_c}{EF \times ED \times [(SF_o \times RAF_w \times IR_w) + (SF_i \times IR_i \times K)]})_{child}]$$

***For Semivolatile/Metal COPCs in Groundwater:***

$$HBL_{w/c} = TR \times [(\frac{BW_c \times AT_c}{EF \times ED \times SF_o \times RAF_w \times IR_w})_{adult} + (\frac{BW_c \times AT_c}{EF \times ED \times SF_o \times RAF_w \times IR_w})_{child}]$$

where

| | | | Adults | Children (0-6) |
|---|---|---|---|---|
| $HBL_{w/c}$ | = | Carcinogenic health-based level for water (mg/L) | --- | --- |
| TR | = | Target excess lifetime cancer risk (unitless) | $10^{-4}$ | $10^{-4}$ |
| $BW_c$ | = | Body weight (kg), carcinogenic effects | 70 | 15 |
| $AT_c$ | = | Averaging time (d), carcinogenic effects | 25,550 | 25,550 |
| EF | = | Exposure frequency (d/yr) | 350 | 350 |
| ED | = | Exposure duration (yr) | 24 | 6 |
| $SF_o$ | = | Oral slope factor (kg-d/mg) | Table 4 | Table 4 |
| $SF_i$ | = | Inhalation slope factor (kg-d/mg) | Table 4 | Table 4 |
| $IR_w$ | = | Daily water ingestion rate (L/d) | 2 | 1 |
| $IR_i$ | = | Daily indoor air inhalation rate ($m^3$/d) | 15 | 15 |
| $RAF_w$ | = | RAF for water ingestion (unitless) | Table 4 | Table 4 |
| K | = | Volatilization factor (L/$m^3$) | 0.5 | 0.5 |

**TABLE 6 (Continued)**
**EQUATIONS AND PARAMETERS FOR HBLc**
**RESIDENTIAL SCENARIO - ADULT AND CHILDREN RECEPTORS**

***For COPCs in Surface Soil:***

$$HBL_c = TR \times \left[ \left( \frac{BW_c \times AT_c}{EF \times ED \times CF \times SF_o \times [(RAF_o \times IR_s) + (RAF_d \times SA \times AF)]} \right)_{adult} + \left( \frac{BW_c \times AT_c}{EF \times ED \times CF \times SF_o \times [(RAF_o \times IR_s) + (RAF_d \times SA \times AF)]} \right)_{child} \right]$$

where

| | | | Adults | Children (0-6) |
|---|---|---|---|---|
| $HBL_c$ | = | Carcinogenic health-based level for soil (mg/kg) | --- | --- |
| TR | = | Target excess lifetime cancer risk (unitless) | $10^{-4}$ | $10^{-4}$ |
| $BW_c$ | = | Body weight (kg), carcinogenic effects | 70 | 15 |
| $AT_c$ | = | Averaging time (d), carcinogenic effects | 25,550 | 25,550 |
| EF | = | Exposure frequency (d/yr) | 350 | 350 |
| ED | = | Exposure duration (yr) | 24 | 6 |
| CF | = | Conversion factor (kg/mg) | $10^{-6}$ | $10^{-6}$ |
| $SF_o$ | = | Oral slope factor (kg-d/mg) | Table 4 | Table 4 |
| $IR_s$ | = | Daily soil ingestion rate (mg/d) | 100 | 200 |
| $RAF_o$ | = | Relative absorption factor for soil ingestion (unitless) | Table 4 | Table 4 |
| $RAF_d$ | = | RAF for soil dermal contact (unitless) | Table 4 | Table 4 |
| SA | = | Contact surface area ($cm^2$/d) | 3,850 | 2,720 |
| AF | = | Soil-to-skin adherence factor (mg/$cm^2$) | 1 | 1 |

**TABLE 6 (Continued)**
**EQUATIONS AND PARAMETERS FOR HBLc**
**RESIDENTIAL SCENARIO - ADULT AND CHILDREN RECEPTORS**

***For COPCs in Subsurface Soil:***

*ESTIMATION OF CONCENTRATION OF LEACHATE, $C_p$ (CRWQCB, 1989):*

$$C_p = HBL_{w/c} \times 100$$

*ESTIMATION OF HEALTH-BASED LEVELS FOR SUBSURFACE SOIL (EPA, 1989a):*

$$\textit{Organics:} \quad HBL_c = K_{oc} \times F_{oc} \times C_p$$
$$\textit{Inorganics:} \quad HBL_c = K_d \times C_p$$

where

| | | | Adults | Children (0-6) |
|---|---|---|---|---|
| $C_p$ | = | Concentration of infiltrating leachate (mg/L) | --- | --- |
| $K_d$ | = | Soil : water equilibrium partition coefficient (L/kg) | Table 4 | Table 4 |
| $K_{oc}$ | = | Organic carbon water partition coefficient (L/kg) | Table 4 | Table 4 |
| $F_{oc}$ | = | Fraction of organic carbon in the soil (%) | 2 | 2 |

## TABLE 7
## EQUATIONS AND PARAMETERS FOR HBLn
## INDUSTRIAL/COMMERCIAL SCENARIO - ADULT WORKERS

***For Contaminants of Potential Concern (COPC) in Groundwater:***

$$HBL_{w/n} = \frac{THI \times BW_n \times AT_n \times RfD_o}{EF \times ED \times RAF_w \times IR_w}$$

where

| | | | Workers |
|---|---|---|---|
| $HBL_{w/n}$ | = | Noncarcinogenic health-based level (Water) (mg/L) | — |
| THI | = | Target hazard index (unitless) | 1 |
| $BW_n$ | = | Body weight (kg), noncarcinogenic effects | 70 |
| $AT_n$ | = | Averaging time (d), noncarcinogenic effects | 9,125 |
| EF | = | Exposure frequency (d/yr) | 250 |
| ED | = | Exposure duration (yr) | 25 |
| $RfD_o$ | = | Oral reference dose (mg/kg-d) | Table 3 |
| $RAF_w$ | = | Relative absorption factor for water ingestion (unitless) | Table 3 |
| $IR_w$ | = | Daily water ingestion rate (L/d) | 1 |

***For COPCs in Surface Soil:***

$$HBL_n = \frac{THI \times BW_n \times AT_n \times RfD_o}{EF \times ED \times CF \times [(RAF_o \times IR_s) + (RAF_d \times SA \times AF)]}$$

where

| | | | Workers |
|---|---|---|---|
| $HBL_n$ | = | Noncarcinogenic health-based level (Soil) (mg/kg) | — |
| THI | = | Target hazard index (unitless) | 1 |
| $BW_n$ | = | Body weight (kg), noncarcinogenic effects | 70 |
| $AT_n$ | = | Averaging time (d), noncarcinogenic effects | 9,125 |
| EF | = | Exposure frequency (d/yr) | 250 |
| ED | = | Exposure duration (yr) | 25 |
| CF | = | Conversion factor (kg/mg) | $10^{-6}$ |
| $RfD_o$ | = | Oral reference dose (mg/kg-d) | Table 3 |
| $RAF_o$ | = | Relative absorption factor for soil ingestion (unitless) | Table 3 |
| $RAF_d$ | = | Relative absorption factor for dermal contact (unitless) | Table 3 |
| $IR_s$ | = | Daily soil ingestion rate (mg/d) | 50 |
| SA | = | Contact surface area ($cm^2$/d) | 3,850 |
| AF | = | Soil-to-skin adherence factor ($mg/cm^2$) | 1 |

**TABLE 7 (Continued)**
**EQUATIONS AND PARAMETERS FOR HBLn**
**INDUSTRIAL/COMMERCIAL SCENARIO - ADULT WORKERS**

***For COPCs in Subsurface Soil:***

*ESTIMATION OF CONCENTRATION OF LEACHATE, $C_p$ (CRWQCB, 1989):*

$$C_p = HBL_{w/n} \times 100$$

*ESTIMATION OF HEALTH-BASED LEVELS FOR SUBSURFACE SOIL (EPA, 1989a):*

*Organics:* $HBL_n = K_{oc} \times F_{oc} \times C_p$

*Inorganics:* $HBL_n = K_d \times C_p$

where

| | | | Workers |
|---|---|---|---|
| $HBL_n$ | = | Noncarcinogenic health-based level (Soil) (mg/kg) | --- |
| $C_p$ | = | Concentration of infiltrating leachate (mg/L) | --- |
| $K_d$ | = | Soil : water equilibrium partition coefficient (L/kg) | Table 3 |
| $K_{oc}$ | = | Organic carbon water partition coefficient (L/kg) | Table 3 |
| $F_{oc}$ | = | Fraction of organic carbon in the soil (%) | 2 |

## TABLE 8
## EQUATIONS AND PARAMETERS FOR HBLc
## INDUSTRIAL/COMMERCIAL SCENARIO - ADULT WORKERS

***For Contaminants of Potential Concern (COPC) in Groundwater:***

$$HBL_{w/c} = \frac{TR \times BW_c \times AT_c}{EF \times ED \times SF_o \times RAF_w \times IR_w}$$

where

| | | | Workers |
|---|---|---|---|
| $HBL_{w/c}$ | = | Carcinogenic health-based level (Water) (mg/L) | — |
| TR | = | Target excess lifetime cancer risk (unitless) | $10^{-4}$ |
| $BW_c$ | = | Body weight (kg), carcinogenic effects | 70 |
| $AT_c$ | = | Averaging time (d), carcinogenic effects | 25,550 |
| EF | = | Exposure frequency (d/yr) | 250 |
| ED | = | Exposure duration (yr) | 25 |
| $SF_o$ | = | Oral slope factor $(mg/kg\text{-}d)^{-1}$ | Table 4 |
| $RAF_w$ | = | Relative absorption factor for water ingestion (unitless) | Table 4 |
| $IR_w$ | = | Daily water ingestion rate (L/d) | 1 |

***For COPCs in Surface Soil:***

$$HBL_c = \frac{TR \times BW_c \times AT_c}{EF \times ED \times CF \times SF_o[(RAF_o \times IR_s) + (RAF_d \times SA \times AF)]}$$

where

| | | | Workers |
|---|---|---|---|
| $HBL_c$ | = | Carcinogenic health-based level (Soil) (mg/kg) | — |
| TR | = | Target excess lifetime cancer risk (unitless) | $10^{-4}$ |
| $BW_c$ | = | Body weight (kg), carcinogenic effects | 70 |
| $AT_c$ | = | Averaging time (d), carcinogenic effects | 25,550 |
| EF | = | Exposure frequency (d/yr) | 250 |
| ED | = | Exposure duration (yr) | 25 |
| CF | = | Conversion factor (kg/mg) | $10^{-6}$ |
| $SF_o$ | = | Oral slope factor $(mg/kg\text{-}d)^{-1}$ | Table 4 |
| $RAF_o$ | = | Relative absorption factor for soil ingestion (unitless) | Table 4 |
| $RAF_d$ | = | Relative absorption factor for dermal contact (unitless) | Table 4 |
| $IR_s$ | = | Daily soil ingestion rate (mg/d) | 50 |
| SA | = | Contact surface area ($cm^2/d$) | 3,850 |
| AF | = | Soil-to-skin adherence factor ($mg/cm^2$) | 1 |

**TABLE 8 (Continued)**
**EQUATIONS AND PARAMETERS FOR HBLc**
**INDUSTRIAL/COMMERCIAL SCENARIO - ADULT WORKERS**

***For COPCs in Subsurface Soil:***

*ESTIMATION OF CONCENTRATION OF LEACHATE, $C_p$ (CRWQCB, 1989):*

$$C_p = HBL_{w/c} \times 100$$

*ESTIMATION OF HEALTH-BASED LEVELS FOR SUBSURFACE SOIL (EPA, 1989a):*

*Organics:* $HBL_c = K_{oc} \times F_{oc} \times C_p$

*Inorganics:* $HBL_c = K_d \times C_p$

where

| | | | Workers |
|---|---|---|---|
| $HBL_c$ | = | Carcinogenic health-based level (Soil) (mg/kg) | --- |
| $HBL_{w/c}$ | = | Carcinogenic health-based level (Water) (mg/L) | --- |
| $C_p$ | = | Concentration of infiltrating leachate (mg/L) | --- |
| $K_d$ | = | Soil : water equilibrium partition coefficient (L/kg) | Table 4 |
| $K_{oc}$ | = | Organic carbon water partition coefficient (L/kg) | Table 4 |
| $F_{oc}$ | = | Fraction of organic carbon in the soil (%) | 2 |