

**RISK-BASED STANDARDS FOR KANSAS
RSK MANUAL – 3rd VERSION**

MARCH 1, 2003



KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
DIVISION OF ENVIRONMENT
BUREAU OF ENVIRONMENTAL REMEDIATION

PREFACE:

The Risk-Based Standards for Kansas (RSK) Manual was developed to assist Kansas Department of Health and Environment (KDHE)/Bureau of Environmental Remediation project managers to fairly and consistently address contaminated sites in the State of Kansas. The manual is only applicable to contaminated properties or sites that are participating in an appropriate state program. KDHE project managers will work with responsible parties to ensure appropriate application of this guidance.

This document is not intended to be used for environmental audits, environmental assessments or other non-KDHE managed activities. Use of Tier 2 values established in the RSK Manual without KDHE oversight may constitute misapplication of the RSK Manual and may result in risk management decisions not supported by KDHE.

This March 1, 2003 RSK Manual supercedes the September 4, 2001 version. The September 4, 2001 version is obsolete and should not be used for future decisions related to the characterization or remediation of contaminated properties/sites. This March 1, 2003 version of the RSK Manual contains several updates to the existing text, tables, and appendices. Modifications to the text are mostly of an editorial nature, although text has been added to Section 6.0 to better describe the use of soil saturation values for total petroleum hydrocarbons (TPH). Also, an entirely new discussion on nitrate and ammonia contamination is presented in Section 7.0. All modifications to the appendices have been printed in bold font.

BACKGROUND: The Risk-based Standards for Kansas (RSK) Manual was originally developed in March of 1999 in collaboration with CH2M Hill, a private environmental contractor with expertise in risk assessments. Chemical-specific and media-specific risk-based cleanup goals were calculated using guidance and directives from the United States Environmental Protection Agency and various other technical resources. Prior to initial development of the RSK Manual, an Environmental Workgroup was established consisting of members of industry and the public to assist in determining appropriate risk-based cleanup levels. The risk-based cleanup levels determined by the Environmental Workgroup are incorporated into the RSK Manual. The RSK Manual assists the Kansas Department of Health and Environment (KDHE) to fairly and consistently address contaminated sites in the State of Kansas.

LIMITATIONS ON USE: The RSK Manual is only applicable to contaminated properties or sites that are participating in appropriate state cleanup programs. KDHE project managers will work with the public and industry to ensure appropriate application of this guidance. Tier 2 risk-based cleanup levels defined in the RSK Manual are applicable for a single contaminant, in a single medium, under standard and conservative default exposure assumptions. Tier 2 risk-based cleanup levels have several additional limitations. Specifically excluded from consideration are transfers of contaminants from soil to air, vapor intrusion of volatile contaminants from ground water to indoor air, cumulative risk from multiple contaminants or media, and risk to ecological receptors.

The RSK document should not be used for environmental audits, environmental assessments or other non-KDHE managed activities. Use of Tier 2 risk-based values established within the RSK Manual without KDHE oversight may constitute misapplication of the RSK manual and may result in risk management decisions not supported by KDHE. The RSK Manual is not intended for use by environmental consultants on contaminated sites in the State of Kansas that are not participating in a KDHE cleanup program.

Modifications to the March 1, 2003 RSK Manual

The last version of the RSK Manual was printed on March 1, 2003. Between printings, KDHE will continually modify the internet version of the RSK Manual. Modifications may include corrections to inaccurate data, development of Tier 2 values for additional contaminants, and incorporation of new chemical-specific characteristics. The information presented below describes modifications to the RSK Manual since March 1, 2003.

* June 16, 2003 - Corrections to the Tier 2 Values for bis(2-ethylhexyl)phthalate

In Appendix A of the RSK Manual, KDHE changed the Ground Water Pathway value for bis(2-ethylhexyl)phthalate to 0.006 mg/L, EPA's current MCL. Correspondingly, the Soil to Ground Water Pathway value changed to 18,000 mg/kg. These changes apply to both residential and non-residential scenarios. The soil pathway numbers remain the same.

* July 7, 2004 - Corrections to the Tier 2 Values for trihalomethanes (THMs)

In Appendix A of the RSK Manual, KDHE changed the Ground Water Pathway values for bromodichloromethane, bromoform, chloroform, and dibromochloromethane to 0.080 mg/L for each contaminant, EPA's current MCL. KDHE modified the Soil to Ground Water Pathway values for these contaminants to the following:

bromodichloromethane	1.21 mg/kg
bromoform	1.72 mg/kg
chloroform	0.96 mg/kg
dibromochloromethane	1.33 mg/kg

These changes apply to both residential and non-residential scenarios. The soil pathway numbers remain the same.

* September 28, 2004 - Correction to K_p and Tier 2 Values for di-n-octyl phthalate

In Appendix B of the RSK Manual, KDHE corrected the K_p (permeability coefficient) value for di-n-octyl phthalate, changing it to 4.168 cm/hr. To arrive at this new K_p value, KDHE used a $\log K_{ow}$ value of 8.06 (EPA Soil Screening Guidance, 1996), a molecular weight of 390.6 (Superfund Chemical Data Matrix), and the EPA equation displayed in footnote "m" of Appendix B.

(continued)

Using the recalculated K_p for di-n-octyl phthalate, KDHE modified the Ground Water Pathway values for this contaminant to the following:

	<u>Residential</u>	<u>Non-Residential</u>
Ground Water Pathway	0.010 mg/L	0.048 mg/L

The Soil to Ground Water Pathway values for di-n-octyl phthalate remain the same, as they are based upon soil saturation. The Soil Pathway values are unaffected by a change in K_p .

RISK-BASED STANDARDS FOR KANSAS

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RISK-BASED STANDARDS FOR KANSAS

1.0 INTRODUCTION

The Risk-Based Standards for Kansas (RSK) Manual is a guidance document which describes the process for establishing chemical-specific and site-specific cleanup goals for soil and ground water that are protective of human health and the environment. This document was created to establish a consistent and streamlined decision making process for addressing contaminated sites managed by the Kansas Department of Health and Environment (KDHE)/Bureau of Environmental Remediation (BER). The RSK Manual is meant to serve as a tool for evaluation of site conditions and the need for additional assessment or cleanup, when considered in conjunction with other site-specific conditions. The RSK Manual is a compilation of federal Safe Drinking Water Act Maximum Contaminant Levels (MCLs) for public drinking water supplies, risk-based cleanup goals for contaminants in soil and ground water for which federal standards have not been established, and supporting chemical, physical, and toxicological properties for the contaminants considered herein.

The procedures and methodologies contained in this document have been employed to be consistent with federal guidance and directives to assess potential human health risk posed by exposure to environmental contamination. Federal guidance and directives were established subsequent to the promulgation of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA). KDHE believes that proper employment of this manual will result in risk-based remediation that is consistent with federally promulgated standards, including the Safe Drinking Water Act, and is protective of human health as defined by the National Contingency Plan (NCP).

The document was developed through collaboration with CH2M Hill, a private environmental contractor with expertise in risk assessments. Chemical-specific and media-specific risk-based cleanup goals were calculated using guidance and directives from the United States Environmental Protection Agency (EPA) and other technical resources, which are referenced throughout this document and listed in Section 9, "REFERENCES." This document is the third edition of "Risk-Based Standards for Kansas," originally dated March 29, 1999, and supercedes all previous editions.

2.0 PUBLIC USE OF RSK

The primary benefit of this document is the predetermination of acceptable cleanup goals without requiring the performance of costly and time-consuming baseline risk assessments and/or contaminant fate and transport models. Use of the RSK Manual offers many other benefits to Kansas industry, Kansas residents, and KDHE, including:

BENEFITS OF THE RSK MANUAL:

- Streamlines the decision-making process;
- Promotes consistency;
- Ensures that remedial actions are protective of human health and the environment;
- Promotes flexibility by providing tabulated risk-based cleanup goals as well as the opportunity to develop site-specific cleanup goals;
- Considers land use; and,
- Provides the opportunity for the use of institutional controls and/or financial assurance to ensure that contamination remaining on site will not pose a future threat.

The document provides the public with a streamlined, cost-effective approach to determine whether some form of remedial action is warranted at a contaminated site. **Direct oversight and approval by KDHE in this determination is required.** The implementation or use of this document without the direct oversight and consent of KDHE does not constitute or convey the determination that no action is warranted at a contaminated site. Additional state, federal, and/or local laws or regulations may be applicable at certain sites. The user is responsible for compliance with these laws and regulations, and to obtain all applicable permits, approvals, authorizations, etc. The final selection of cleanup levels shall rest with the department. KDHE urges the public to consider the following when using the RSK document:

- Applicable or relevant and appropriate requirements may affect the selection or implementation of a cleanup approach for the site, i.e., zoning for land use designation, local public health laws and ordinances, ground water management districts, Resource Conservation and Recovery Act (RCRA), etc.;
- There may be additive effects posed by multiple contaminants and multiple pathways of exposure;
- Aesthetic or other criteria may drive the need for remediation independent of risk-based standards;
- KDHE's oversight and approval must be obtained to ensure that actions conducted at the site are consistent with and satisfy state laws, rules and regulations, guidance, and policies; and,
- The RSK Manual does not address the potential health risks associated with migration of contaminants from soil and ground water into indoor air.

3.0 OVERVIEW

The RSK Manual provides an overview of the rationale and process for determining soil and ground water cleanup levels for contaminated sites in Kansas. Detailed information on definitions, formulas, input parameters and the use of the three tiers are provided in the following sections. **This approach is not acceptable for all sites, so approval must be obtained from the state program responsible for regulating the site.**

- **TIER 1** – KDHE-approved methods to determine background concentrations;
- **TIER 2** – KDHE/BER Risk-Based Summary Table; or
- **TIER 3** – Site-specific technical analyses using KDHE-approved information, data, models, model input parameters or other methodologies to determine site-specific remedial actions or cleanup concentrations.

Human health risk is best described as the probability of suffering harm as a consequence of chronic, or long-term, exposure to contaminated media. Human health risk effects are generally classified into two separate categories. *Non-carcinogens* are contaminants that lack evidence of increasing the potential for developing cancer over a lifetime. *Carcinogens* are contaminants that have the potential to increase the potential for developing cancer over the lifetime of an exposed individual.

For *non-carcinogens* a threshold concentration is quantified for each contaminant based upon clinically-determined critical toxicological effects such as liver damage, kidney damage, central nervous system disorders, etc. The threshold concentration is referred to as the reference dose or RfD. The lower the RfD value for a contaminant, the more toxic it is relative to contaminants with higher RfDs. Exposure to a contaminant concentration below the RfD should not cause a critical toxicological effect; however, exposure to a contaminant concentration exceeding the RfD may cause a critical toxicological effect. Risk assessors calculate the ratio of a contaminant concentration to the RfD to determine the Hazard Index (HI). If the HI is less than or equal to 1, the contaminant concentration is considered acceptable. If the HI is greater than 1, the contaminant concentration is considered unacceptable and a response action may be required.

For *carcinogens*, the probability of increasing the potential for developing a cancer as a result of chronic exposure to contaminated media is quantified based upon clinical studies of exposed populations, including humans, where available, or test animals in the absence of documented human exposures. The contaminant-specific carcinogenic risk factor is referred to as the slope factor. Contrary to RfDs, the higher the slope factor value for a carcinogenic contaminant, the more toxic it is relative to carcinogenic contaminants with lower slope factors. Risk assessors quantify the probability of developing a cancer as a result of chronic exposure to carcinogenic contaminated media by multiplying the contaminant concentration by the contaminant slope factor. The resulting value is expressed in terms of one additional cancer incidence per population exposed; for example, one additional cancer incidence per ten thousand (1 in 10,000) exposed individuals, which may be expressed as 1×10^{-4} . EPA regulations state the 1×10^{-6} risk level shall be used as the point of departure for determining remediation goals for alternatives when applicable or relevant and appropriate requirements (ARARs) are not available or are not sufficiently protective because of the presence of multiple contaminants or multiple pathways of

exposure. Carcinogenic contaminants are also evaluated for their critical non-carcinogenic toxicological effect. The determining risk-based concentration is based upon the lower contaminant concentration of the carcinogenic risk or non-carcinogenic risk.

Soil cleanup goals are based upon one or more of the following considerations as defined in the various program policies and regulations. The primary goal of Bureau of Environmental Remediation programs is to insure that sites are remediated to the extent that the public are protected from unreasonable risks potentially caused by exposure to contaminated sites.

1. In the event naturally occurring¹ levels of an individual contaminant in soil exceed the cancer risk of 1×10^{-6} (1 in 1,000,000), or a hazard index value of 1.0, then the background level may be the cleanup level;
2. In the event that anthropogenic² levels of a contaminant in soil exceed the cancer risk of 1×10^{-6} (1 in 1,000,000), or a hazard index value of 1.0, then a 1×10^{-5} (1 in 100,000) cancer risk level, or a level corresponding to a hazard index value equal to 1.0 may be used as the cleanup levels;
3. A property-specific risk analysis performed in accordance with the department's scope of work shall be used to determine a property-specific cleanup level where the cancer risk exceeds 1×10^{-6} or the hazard index value exceeds 1.0. This site-specific cleanup level may not pose cumulative cancer risk of greater than 1×10^{-4} or a hazard index of greater than 1.0. Where carcinogenic contaminants drive the need for cleanup, the department will determine the appropriate level of cleanup within the 1×10^{-4} to 1×10^{-6} range based on site-specific considerations.
4. Property-specific cleanup levels shall be determined by the department for contaminants for which there is insufficient toxicological evidence to support a regulatory standard for risk-based cleanup levels or for nontoxic contaminants for which cleanup is required as a result of other undesirable characteristics of those contaminants. The levels shall be based on the following:
 - a) The ability of the impacted soil to support vegetation representative of non-impacted properties in the vicinity of the eligible property; and,
 - b) The potential of the contaminant to impact and degrade ground water, surface water, or both, through infiltration or runoff; and,
5. When there are multiple contaminants in the soil, the cleanup level of each contaminant shall not allow the cumulative risks posed by the contaminants to exceed a cancer risk of 1×10^{-4} (1 in 10,000), or a hazard index value of 1.0.

Ground water cleanup levels shall be based on the most beneficial use of the ground water considering present and proposed future uses. The most beneficial use of the ground water is for a potable water source, unless demonstrated otherwise by the voluntary party and approved by

¹ Naturally occurring chemicals or substances are defined as those chemicals or substances that are present in the environment at ambient concentrations unaffected by anthropogenic influences.

² Anthropogenic concentrations of chemicals or substances are defined as those chemicals or substances that are present in the environment as a result of human activity.

the department. The most beneficial use of ground water shall be determined by the department based upon available documentation, as well as documentation provided by the potentially responsible party. Ground water potentially or actually used as a potable water source shall require maximum protection in determining cleanup levels. The department shall approve cleanup levels that prevent additional degradation of the groundwater caused by contamination migration and that encourage remedial actions to restore contaminated groundwater to its most beneficial use. One or a combination of the following approaches to ground water cleanup shall be proposed and approved by the department:

1. In the event naturally occurring levels of an individual contaminant in ground water exceed the cancer risk of 1×10^{-6} (1 in 1,000,000), or a hazard index value of 1.0; then the background level may be the cleanup level;
2. In the event that anthropogenic levels of an individual contaminant in ground water exceed the cancer risk level of 1×10^{-6} (one 1 in 1,000,000), or a hazard index value of 1.0, then the maximum contaminant levels (MCLs) established by the federal government or a cancer risk level of 1×10^{-5} (1 in 100,000), or a level corresponding to a hazard index value equal to 1.0 shall be the cleanup level;
3. In the event that the chemical-specific maximum contaminant levels (MCLs) are not applicable or available, a property-specific risk analysis performed by the voluntary party in accordance with the department's scope of work shall be used to determine a property-specific cleanup level where the cancer risk exceeds 1×10^{-6} or the hazard index value exceeds 1.0. The site-specific cleanup level may not pose cumulative cancer risk of greater than 1×10^{-4} or a hazard index of greater than 1.0. Where carcinogenic contaminants drive the need for cleanup, the department will determine the appropriate level of cleanup within the 1×10^{-4} to 1×10^{-6} range based on site-specific considerations.
4. When the need for cleanup of a contaminant is predicated on characteristics of that contaminant other than toxicity, including the contribution of an undesirable taste or odor, or both, the site-specific cleanup level as determined by the department or secondary MCLs shall be used as cleanup levels for contaminants for which insufficient toxicological evidence has been gathered to support a regulatory standard. These levels shall be based on the aesthetic quality and usability of the ground water, surface water, or both, for the present and proposed future use;
5. When there are multiple contaminants in the ground water, the cleanup level of each contaminant shall be such that the cumulative risks posed by the contaminants shall not exceed a cancer risk level of 1×10^{-4} (1 in 10,000), or a hazard index value of 1.0; and,
6. Surface water cleanup levels shall meet the Kansas surface water quality standards, as defined in K.A.R. 28-16-28(b), et seq.

4.0 SITE CHARACTERIZATION

Elements of a basic site characterization generally include record searches to gather historical information. That information will be used to focus the collection of environmental data, which in turn will be used to identify source(s) of contamination, delineate the horizontal and vertical extent of contamination, and characterize the geology, including significant contaminant fate and transport mechanisms. The information and data collected during site characterization should be sufficient to develop a site-specific conceptual model and support the evaluation and selection of a remedial response, if appropriate. The conceptual model should identify all media impacted by contamination (soil, ground water, surface water, etc.), primary and secondary exposure pathways, and exposed or potentially exposed populations. Site characterization information and data combined with a site-specific conceptual model are used to develop site-specific remedial action objectives.

The KDHE/BER has developed various scopes of work which define the tasks necessary to satisfy the objectives of various stages of site characterization, data needs for potential Tier 3 technical analyses, and information necessary to evaluate potential remedial alternatives. These scopes of work and associated guidance are available from each of the individual programs. Essential elements of any environmental site characterization typically include:

- A review of historical records to identify, at a minimum, all chemicals used at the site, chemical storage and handling area, and chemical product and waste disposal methods;
- A visual inspection of the facility or property to identify observable evidence of chemical releases, such as stained soil, stressed vegetation, corroded flooring, etc.;
- The collection of samples for laboratory analysis from environmental media at locations that are likely to have been impacted by historical release(s) of the contaminants of concern;
- The characterization of the geology and hydrology of the property using intrusive technologies such as soil borings and monitoring wells and the performance of aquifer tests to evaluate the composition and stratigraphy of the subsurface and the intrinsic hydrologic properties of the aquifer(s) underlying the site;
- The evaluation of the background concentrations of the contaminants of concern in affected environmental media; and,
- The identification of threatened or impacted receptors including, but not limited to, residents, workers, private and public water supply wells, sensitive ecosystems, etc.

For site investigations where naturally occurring chemicals or substances are the contaminants of concern, background or ambient environmental quality will need to be characterized. Background environmental quality characterization is necessary in order to identify the contaminants of concern and their appropriate site-specific cleanup goals. Failure to adequately characterize background environmental quality conditions may result in unnecessary cleanups.

If pre-existing background environmental quality data is not available or not representative of the site, then the collection and analysis of background samples will be required to determine background environmental quality. A site-specific number of soil samples, approved by KDHE, collected from the same soil type in an area nearest the site unaffected by potential releases of naturally occurring contaminants of concern should be analyzed to characterize background soil concentrations. For ground water, data should be collected at a location(s) representing background ground water quality conditions. If naturally occurring chemicals, or substances, which are potential contaminants of concern, based upon their usage, treatment, storage, or disposal, are detected at concentrations in excess of background, remedial action may be warranted.

Information collected during the site characterization should be sufficient to classify current and likely future land uses for the site. Chemical-specific cleanup concentrations defined in this document are based upon land use and are separated into two general land use scenarios, residential³ and non-residential⁴. In general terms, all sites should be considered residential unless information provided within the site characterization proves otherwise and is approved by KDHE. Documentation of non-residential classification may include information from local zoning and planning department offices documenting the current and likely future land uses as non-residential. Non-residential sites located directly adjacent to residential properties shall be considered residential unless there are controls limiting access to the site such as security fencing. Land use shall be confirmed by KDHE by performing a site inspection.

After completing site characterization, including adequately assessing background environmental quality, chemical-specific goals can be determined for the site. The tiered approach outlined in the next section prescribes the process for determining cleanup goals for each site.

5.0 TIERED APPROACH

5.1 TIER 1

Tier 1 cleanup levels are determined for contaminants of concern that are naturally present in the environment. This class of contaminants includes metals such as lead, arsenic, cadmium, and chromium, among others, and inorganic pollutants such as nitrate and chloride, among others. In addition, certain substances that are endemically enriched in various environments, such as industrial tracts or agricultural lands as a result of their widespread employment by humans, may be evaluated as a Tier 1 contaminant. For sites with naturally-occurring contaminants, the

³ Residential land use means any property currently or proposed for use as a residence or dwelling, including a house, apartment, mobile home, nursing home or condominium; or public use area, including a school, educational center, day care center, playground, unrestricted outdoor recreational area or park.

⁴ Non-residential land use means any property that does not exclusively meet the definition of residential land use.

background concentration shall be the cleanup level in soil and ground water where the background cancer risk level exceeds 1×10^{-6} (1 in 1,000,000), or a hazard index value exceeds 1.0, or other criteria defined in Section 3.0.

Accordingly, background concentrations must be determined for substances that are naturally-occurring that are contaminants of concern at the site. If pre-existing data are not available or are not representative of the site, then determining background concentrations is a necessary element of site characterization. A site-specific number of soil samples collected from the same soil type in an area not affected by contamination from the site and not impacted from other releases should be analyzed to characterize background soil concentrations. For ground water, data should be collected from an upgradient location to determine background concentrations of naturally occurring contaminants of concern.

Ultimately, it will be necessary to gain approval from the KDHE/BER project manager for sampling strategies meant to characterize background environmental quality. Background environmental quality data may be presented to the KDHE/BER project manager from pre-existing referenced sources of information or a sampling and statistical analysis plan for the determination of background concentrations may be submitted for approval prior to implementation. The method of drilling, constructing, developing, and sampling wells will have a significant impact on the ground water geochemistry, especially for metals.

KDHE considers the speciation of metals and other inorganics in soils when determining risk-based standards. The general definition of speciation is the molecular structure or oxidation states of a compound. For the Tier 1 and Tier 2 approach, KDHE considers the most toxic form of a naturally occurring compound to assure protectiveness. As an example, this approach is factored in the Tier 2 cleanup concentrations for chromium and cyanide listed in Appendix A. In the Tier 2 approach, KDHE assumes 100 percent of the chromium detected is hexavalent chromium (Cr^{+6}), which is significantly more toxic compared to trivalent chromium (Cr^{+3}). For cyanide, copper cyanide is the most toxic form of the cyanides, including free cyanide. For a majority of the naturally occurring compounds listed in the Tier 2 table a general risk-based value is provided for those compounds since there is insufficient toxicological data available to determine risk-based standards for the various forms of these compounds. The user of RSK Manual may opt to perform a Tier 3 analyses based upon the actual speciation of a compound detected at the site or additional toxicological data available for that compound.

After completing the site characterization and assessment of background environmental quality, if contamination is equal to or less than KDHE-approved background concentrations for the contaminants of concern, KDHE may determine that no further action is required. However, if contamination exceeds KDHE-approved background concentration, the decision should be made to remediate the site to KDHE-approved background concentrations or proceed to Tier 2 or Tier 3, as appropriate.

5.2 TIER 2

After completing site characterization, including characterization of background environmental quality, if appropriate, and determining the appropriate land use, the user must compare each contaminant's maximum concentration detected in soil and ground water to each contaminant's

respective concentration in the Tier 2 Risk-Based Summary Table in Appendix A. If any contaminant of concern is detected in excess of its appropriate Tier 2 value(s), KDHE may determine that remedial action is warranted. Alternatively, a Tier 3 analyses as described in Section 5.3. may be performed. If KDHE's Tier 2 Risk-Based Summary Table does not list risk-based cleanup values for contaminants of concern detected at the property, KDHE will perform the appropriate Tier 2 calculations. Periodically, KDHE will update the Tier 2 Risk-Based Summary Table and Appendices B and C as needed.

The Tier 2 Risk-Based Summary Table has six separate concentrations for each listed contaminant. For soils, the Tier 2 Risk-Based Summary Table provides two separate human health risk-based concentrations for residential and non-residential land use settings and two separate concentrations which are protective of ground water for residential and non-residential land use settings. Chemical-specific human health risk-based concentrations represent the concentrations at which the contaminants pose the maximum acceptable human health risk as a result of carcinogenic (c) or non-carcinogenic (n) toxicity. In addition, the soil saturation concentration(s) has been calculated and, if the concentration is less than the contaminant's toxicity concentration or soil to ground water pathway concentration, the soil saturation concentration is the default cleanup value. The soil saturation concentration represents the maximum concentration that a contaminant may be present in soil, given the referenced geophysical setting and each contaminant's physical and chemical properties and suggests the presence of free phase product, which must be remedied in all cases. This approach is recommended in *Risk Assessment Guidance for Superfund: Volume 1 - Human Health Evaluation Manual (Part B, Development of Risk-based Preliminary Remediation Goals*, EPA/540/R-92/003, December 1991.

Tier 2 Risk-Based Summary Table ground water concentrations are derived with the assumption that the aquifer is a source of potable water. Contaminants leaching from soil to ground water may be significant. Soil contamination cleanups may frequently be determined by chemical specific soil to ground water pathway concentrations to protect ground water quality. The Tier 2 Risk-Based Summary Table provides chemical-specific human health risk-based values for residential and non-residential land use settings. It should be noted that for those contaminants for which a federal Safe Drinking Water Act maximum contaminant level (MCL) has been promulgated into law, the Tier 2 ground water value for both residential and non-residential land use settings is the chemical-specific MCL. In the event ground water is to be used as a source of drinking water the ground water cleanup concentration defaults to the residential land use concentration irrespective of land use.

For a few contaminants listed in the Tier 2 Risk-Based Summary Table, alternative methods were employed to determine chemical-specific concentrations that are protective of human health, environmentally safe, or preserve the aesthetic quality of drinking water supplies. Alternative methods include the use of the most toxic speciation of metals, the use of health advisory data in the absence of chemical-specific toxicological data, drinking water odor and taste, and the consideration of potential for explosive environments, etc. For these contaminants, the cleanup concentrations are generally more stringent than strictly human health risk-based concentrations.

5.2.1 EXPOSURE ASSESSMENT

The primary objectives of the exposure assessment are to identify potentially exposed receptors and the exposure pathways by which those receptors may be exposed to contaminants, and to measure or estimate the magnitude, duration, and frequency of exposure to environmental contamination for each receptor category. For the Tier 2 Risk-Based Summary Table, KDHE/BER divided receptors into two general categories, residents and non-residents, according to the appropriate land-use designation for each site. The significant differences between the two receptor classes include exposure frequency, exposure duration, and the consideration that children are potentially exposed at residential land-use settings and are more sensitive to environmental contaminants. The non-residential land-use setting is based upon industrial or commercial settings where adult workers are considered the potentially exposed receptor.

Human health risk-based contaminant concentrations for both residential and non-residential scenarios were calculated for soil and ground water. The soil exposure pathways evaluated in the human health risk-based calculations include incidental ingestion of soil, inhalation of airborne particulates (dusts), inhalation of chemicals volatilizing from the soil (volatile compounds only), and dermal contact with soil (organic compounds only). The reasoning for evaluating dermal contact for organics only is based upon chemical-specific absorption factors. For organics, the absorption factor is generally 1 to 30 percent; however, for non-organic contaminants, the absorption factor is generally less than 1 percent. Exposure pathways for ground water include ingestion, inhalation of chemicals volatilizing from the water (volatile compounds only), and dermal contact with water.

Default exposure factors were obtained primarily from *Risk Assessment Guidance for Superfund Supplemental Guidance Standard Default Exposure Factors* (OSWER Directive, 9285.6-03) dated March 25, 1991 and more recent information from EPA Office of Solid Waste and Emergency Response and EPA Office of Research and Development. Exposure factors used in the Tier 2 Risk-Based Summary Table are presented in Table 1 and Table 2 for ground water and soil, respectively.

For the residential land use scenario, child exposure parameters were used to evaluate non-carcinogenic risks in both soil and ground water, since child exposure parameters are more sensitive to this class of environmental contaminants. Adult exposure parameters were used to evaluate carcinogenic risks for residents because, as a result of the methodologies used to calculate risk, the exposure to adults is the most significant receptor category. Adult exposure parameters were used to evaluate both carcinogenic and non-carcinogenic risks for non-residents as they are the only receptors in a non-residential land-use setting.

Chemical-specific risk-based concentrations provided in the Tier 2 Risk-Based Summary Table combine current EPA toxicity values with "standard" exposure factors to estimate contaminant concentrations in environmental media (soil and water) that are protective of receptors, including sensitive groups (children or the elderly), over a lifetime. Chemical-specific human health risk-based concentrations were calculated for more than 150 potential contaminants, including metals, volatile organic compounds, semi-volatile organic compounds, pesticides, herbicides, and polychlorinated biphenyls (PCBs). These chemicals are listed in Appendix B with their respective chemical-specific parameters (including water solubility, Henry's Law constant, the water partition coefficient for inorganic constituents [K_d], diffusivity in air, and diffusivity in water).

5.2.2 TOXICITY ASSESSMENT

The primary objective of a toxicity assessment is to evaluate the inherent toxicity of contaminants, including each contaminant's potential carcinogenic risk and all other non-carcinogenic health risks. Toxicity assessments rely on scientific data available in literature on adverse effects in humans and non-human species to identify the critical toxicological effects.

For the purpose of developing the Tier 2 Risk-Based Summary Table, KDHE/BER used established contaminant-specific toxicity values developed and maintained by the EPA. EPA-approved toxicological data, known as reference doses (RfD) for non-carcinogens and slope factors (SF) for carcinogens, were obtained from the *Integrated Risk Information System* (IRIS) through June 2001, the *Health Effects Assessment Summary Table* (HEAST) through June 2001, EPA's National Center for Environmental Assessment (NCEA, formerly known as ECAO), or other appropriate EPA resources. The priority sequence among the referenced toxicological databases used from the most preferred to the least preferred is as follows: (1) IRIS, (2) HEAST, (3) NCEA, (4) withdrawn from IRIS or HEAST and under review, and (5) other EPA resources approved by KDHE. Contaminant toxicological data used in developing the Tier 2 Risk-Based Summary Table are provided in Appendix C.

Oral cancer slope factors ("SFo") and oral reference doses ("RfDo") were used for both oral and inhaled exposures for contaminants lacking inhalation values. Inhalation slope factors ("SF_i") and inhalation reference doses ("RfDi") were used for the inhalation and exposure pathways. Route-to-route extrapolations were used when there were no toxicity values available for a given route of exposure. In these cases, oral toxicological data was used for dermal slope factors and dermal reference doses.

5.2.3 RISK CHARACTERIZATION

The final step in developing risk-based cleanup concentrations that are protective of human health is the risk characterization phase. This process integrates exposure and toxicity information to quantify contaminant-specific risk-based concentrations that are protective of human health. The risk characterization process considers the two categories of potential adverse human health effects, carcinogenic and non-carcinogenic health effects through two separate land uses, residential and non-residential. Not all contaminants are classified as carcinogens, or potential cancer-causing contaminants; however, all contaminants, including carcinogens, are evaluated based upon their respective most critical adverse health effect, whether it is the contaminant's carcinogenic toxicity or its non-carcinogenic toxicity.

For non-carcinogens, toxicologists have determined that there is a threshold concentration below which there would be no adverse health effect to an exposed population. Toxicologists universally claim that exposure to any carcinogenic contaminant, or any carcinogenic situation, such as exposure to sunlight, cigarette smoke, etc., carries a risk of an adverse health effect, therefore human health risk is not characterized by the existence of a threshold concentration.

5.2.3.1 GROUND WATER

Tier 1 and Tier 2 evaluations assume that ground water from the impacted aquifer is potable in quantities capable of serving domestic needs. Accordingly, for those contaminants for which the federal Safe Drinking Water Act has promulgated primary maximum contaminant levels (MCLs), the Tier 1 and Tier 2 ground water cleanup concentrations are the MCLs. For all other contaminants addressed within this document, Equations 3-1 and 3-2 were used to calculate human health risk-based concentrations for ground water for both carcinogenic and non-carcinogenic contaminants. **If ground water is to be used for drinking water purposes at a non-residential site, the risk-based Tier 2 concentration defaults to the MCL or the residential land use concentration.** Exposure factors used in the equations are provided in Table 1. Contaminant chemical, physical, and toxicological data are provided in Appendices B and C.

5.2.3.2 SOILS

KDHE has identified three potential conditions which must be assessed collectively to determine the appropriate Tier 2 concentration for a contaminant in soil. The first condition is impact to human health via ingestion of contaminated soil, inhalation of volatile organic compounds and/or fugitive emission dusts, and dermal contact with contaminated soil. The second condition to be assessed is the contaminant concentration in soil which would be protective of ground water. The third condition is provided for in *Risk Assessment Guidance for Superfund: Volume 1 – Human Health Evaluation Manual (Part B, Development of Risk-based Preliminary Remediation Goals)*; which indicates that the soil saturation concentration for each contaminant be quantified to determine the concentration at which it could be reasonably assumed that free phase product is present. Under such a condition, KDHE would require remediation of the soils to mitigate the free phase contamination.

Equations used to calculate chemical-specific human health risk-based concentrations in soil for carcinogens and non-carcinogens are derived from referenced EPA guidance documents with the formulas presented in Equations 3-3 and 3-4, the exposure factors provided in Table 2, and contaminant chemical, physical, and toxicological data provided in Appendices B and C. For each of the two land uses, the Tier 2 Risk-Based Summary Table provides two separate soil concentration values. Under the “Soil Pathway” column, each chemical-specific concentration is based upon either the threat to human health or the soil saturation concentration, whichever is less. Each chemical-specific concentration is notated to inform the user as to which adverse health effect the Tier 2 Soil Pathway is based on. For carcinogenic risk, the notation is “c”. For non-carcinogenic risk, the notation is “n”. If the soil saturation concentration is used, the

notation is "s". The appropriate Tier 2 soil cleanup concentration will be the lesser of the calculated values for acceptable impact to human health, the soil saturation concentration, or potential threat to ground water.

The methodology used to determine soil cleanup levels incorporated the additive adverse human health effects associated with the inhalation of vapors from volatile organic chemical contaminated soil. EPA toxicity data indicate that risks posed from exposure to certain contaminants in soil via the inhalation pathway far outweigh the risks posed via ingestion; therefore, the human health risk-based concentrations have been calculated to address this pathway as well. For the purposes of this document, volatile organic chemicals (VOCs) are those chemicals having a Henry's Law constant greater than 1×10^{-5} atmospheres per cubic meter per mole (atm-m³/mol) and a molecular weight less than 200 grams/mole. These contaminants are evaluated for potential volatilization from soil or water to air using volatilization factors which are identified in Appendix B under the column "Volatilization Factor" (VF). To calculate inhalation exposure risk, each contaminant's volatilization factor must first be calculated. For volatilization from water to air the volatilization factor is assumed to be 0.5 liters per cubic meter (L/m³) based upon studies by Andelman 1990. The soil-to-air VF is used to define the relationship between the concentration of the contaminant in soil and the flux of the volatilized contaminant to air. The VF equation (Equation 5-1) represents a dispersion model that simulates the dispersion of contaminants in the atmosphere.

The soil saturation concentration corresponds to the contaminant concentration in soil at which the absorptive limits of the soil particles, the solubility limits of the soil pore water, and saturation of soil pore air have been reached. Above this concentration, the contaminant may be present as a pure liquid phase for contaminants that are liquid at ambient soil temperatures and pure solid phase for compounds that are solid at ambient soil temperatures.

A soil saturation concentration has been calculated using Equation 5-2 for all organic compounds. The soil saturation concentration represents chemical-physical limits of a soil matrix as defined by the parameters provided in Equation 5-2. Since these values represent the concentration at which soil pore air is saturated with a chemical, volatile emissions reach their maximum at the soil saturation value. If the chemical-specific soil saturation concentration is less than its corresponding human health risk-based concentration, the soil saturation concentration is used as the default soil concentration Tier 2 cleanup level.

5.2.3.3 SOIL TO GROUND WATER PROTECTION

The methodology for calculating soil concentrations protective to prevent the migration of soil contaminants to ground water was derived from the document titled, "*Soil Screening Guidance: Technical Background Document*", OSWER 9355.4-17A, EPA/540/R-95/128 May 1996. KDHE utilized the EPA methodology for two basic reasons. The "*Soil Screening Guidance*" document is EPA supported and extensively peer-reviewed, and the methodology presented therein is relatively simple.

Migration of a contaminant from soil to ground water can be envisioned as a two-stage process: (1) release of the contaminant in soil leachate and (2) transport of the contaminant soil leachate through the underlying soil to the aquifer and, potentially, to a receptor well. For the purposes of

this document, KDHE's Tier 2 Risk-Based Summary Table assumes the receptor well to be at the source area; therefore, fate and transport modeling is not an element of the Tier 2 Risk-Based Summary Table. KDHE has adopted EPA's screening dilution factor of 20 for calculating chemical-specific soil-to-ground water pathway concentrations.

Equation 5-3 is the soil-water partition equation used to calculate the concentration of a contaminant in soil above which a threat of the contaminant entering the ground water is a concern. Tier 2 soil-to-ground water pathway concentrations are back-calculated from acceptable ground water concentrations (MCLs or human health risk-based concentrations determined using equations 3-1 and 3-2. The acceptable ground water concentration is multiplied by the dilution factor of 20 to obtain a target leachate concentration.

Although simplified, the methodology described in this section is theoretically and operationally consistent with investigation and modeling efforts that are conducted to develop soil cleanup goals and cleanup levels for protection of ground water at Superfund sites. Simplifying assumptions for the migration to ground water pathway include:

- The source is infinite (i.e., steady-state concentrations will be maintained in ground water over the exposure period);
- Contaminants are uniformly distributed throughout the zone of contamination;
- Soil contamination extends from the surface to the ground water table (i.e., adsorption sites are filled in the unsaturated zone beneath the area of contamination);
- There is no chemical or biological degradation in the unsaturated zone;
- Equilibrium soil/water partitioning is instantaneous and linear in the contaminated soil;
- The receptor well is at the source area (i.e., there is no dilution from recharge down-gradient of the property and the well is screened within the plume);
- The aquifer is unconsolidated and unconfined (surficial);
- Aquifer properties are homogenous and isotropic;
- There is no attenuation (i.e., adsorption or degradation) of contaminants in the aquifer; and,
- The contaminant does not exist as free product in the soil at the property.

5.3 TIER 3

Tier 3 offers the user the opportunity to determine site-specific risk-based contaminant concentrations that are protective of human health and the environment. Tier 3 involves a substantial increase in effort relative to Tier 1 and Tier 2, including the collection of additional site-specific geophysical data, such as vertical profiling fraction organic carbon, bulk density, aquifer characterization, and/or performing more sophisticated contaminant fate and transport

models. If the user opts to perform a Tier 3 evaluation, it must be done with KDHE/BER oversight, including the submittal of appropriate work plans to perform any necessary additional work. KDHE will not authorize the performance of a Tier 3 analysis for contaminants of concern that are regulated by federal, state or local laws, such as federal Safe Drinking Water Act which mandates MCLs for drinking water aquifers.

Performing a Tier 3 analysis will require the collection of significantly more information than that required by either Tier 1 or Tier 2. Tier 3 risk-based concentrations (RBCs) will be based on KDHE-approved predicted and validated contaminant fate and transport estimates of the contaminants of concern potential to migrate away from source areas. Tier 3 analysis will allow monitoring points of compliance to be installed away from the source area in order to verify the ongoing effectiveness of facilitated natural attenuation and biodegradation; however, such monitoring points of compliance cannot extend beyond the property boundaries without department approval. A Tier 3 sampling and analysis plan may be required beyond that required by either the Tier 1 or Tier 2 analysis. Default assumption parameters that were employed by KDHE to calculate human health risk-based cleanup goals are included in Equations 5-1 and 5-2, and Table 3. Parameters for which site-specific data may be substituted to perform a Tier 3 analysis are denoted with an asterisk. The following is a list of additional data, which may be necessary to complete a Tier 3 analysis:

- Additional geological, geophysical or hydrological data, including items such as unsaturated zone physical and geological properties (vertical distribution profiling fraction organic carbon, bulk density, total porosity, air-filled porosity, water-filled porosity, etc.), thickness of unsaturated zone, thickness of the saturated aquifer, aquifer transmissivity, hydraulic conductivity, gradient, infiltration rate, and longitudinal, lateral, and vertical dispersivities;
- Documented property ownership boundaries, current and likely future land use designations, target receptors within the area, and implementability of potential institutional controls; and,
- Any additional data necessary to perform a sophisticated contaminant fate and transport model, i.e., contaminant mass limit models, contaminant degradation rates, fraction of vegetative cover, three-dimensional source area characterization, mean wind speed, infiltration rate, etc.

A common Tier 3 analysis could be the implementation of a sophisticated contaminant fate and transport model. Any model used for a Tier 3 analysis must be approved by the department project manager and must be a public domain model. In the event a proprietary model or any other model that KDHE does not possess is used in a Tier 3 analysis, the department may request a copy of the model for review and approval. The following are examples of measures that may be undertaken as part of a Tier 3 analysis:

- The use of property-specific numerical soil or ground water modeling to predict the effect of contaminant fate and transport mechanisms, including heterogeneous geological conditions;

- Characterization of property sources and exposure pathways by using property assessment data to identify relevant sources, transport mechanisms, impacted media, and exposure pathways;
- For pesticides, standard application rates have not been documented. Accordingly, the user may perform research to determine appropriate pesticide-specific standard application rates as a Tier 3 risk analysis activity.
- Identification of all potential receptors. Actual or potential receptors should be differentiated based on current and likely future land use, and upon the ability to place institutional controls at the property to eliminate potential exposure pathways;
- An evaluation of potential remedial actions that would reduce the human health or environmental risk to acceptable levels; and,
- Determination of site-specific cleanup goals based upon site-specific data, which may result in less stringent site-specific cleanup goals.

In the event a site-specific Tier 3 analysis determines that Tier 2 cleanup goals are not protective of human health or the environment, the more stringent Tier 3 cleanup goals will be the site-specific cleanup goals for the site.

6.0 TOTAL PETROLEUM HYDROCARBONS

Total petroleum hydrocarbons (TPH), for the purpose of this section of the RSK Manual includes all undifferentiated hydrocarbons including carbon range compounds C⁵ through C³⁵ containing various percentages of straight chain alkanes, branched chain alkanes, cycloalkanes, straight chain alkenes, branched chain alkenes, cycloalkenes, alkyl benzenes, naphtheno benzenes, alkyl naphthalenes and polynuclear aromatics. TPH cleanup concentrations in soil and ground water, as related to Tier 2 of this RSK Manual, shall be quantified by summing TPH using EPA SW-846 modified method 8015, also known as laboratory analytical methods OA1 for gasoline range organics (GRO) and OA2 for diesel range organics (DRO).

The use of Tier 2 values for TPH-GRO and TPH-DRO shall be used in conjunction with the values for individual constituents in order to determine site cleanup goals. These constituents include but are not limited to benzene, toluene, ethylbenzene, total xylenes (BTEX), methyl-tert-butyl-ether (MTBE), ethylene dibromide (EDB), and 1,2-dichloroethane (1,2-DCA) for TPH-GRO and chrysene, pyrene, benzo[a]pyrene, and anthracene for TPH-DRO. Please note that when a Tier 2 value is less than the method detection limit, the method detection limit becomes the Tier 2 value.

Considering that TPH detected at a site is commonly found as either GRO or DRO, KDHE has developed two separate Tier 2 risk-based concentrations based upon whether the TPH is entirely GRO or DRO. For pure GRO-type TPH, the Tier 2 cleanup concentrations are based upon the physical, chemical and toxicological properties of n-hexane. For pure DRO-type TPH, the Tier 2 cleanup concentrations are based upon the physical, chemical and toxicological properties of pyrene.

If the site has only one type of TPH (GRO or DRO), the risk-based cleanup concentrations are based upon their petroleum type as provided in Tier 2 of the RSK Manual. For sites where both types of TPH are detected, the sum of the ratios of each hydrocarbon type must be calculated as follows:

$$\frac{X}{\text{GRO Tier 2 Value}} + \frac{Y}{\text{DRO Tier 2 Value}} = N$$

Where:

X = Detected GRO Concentration

Y = Detected DRO Concentration

N = Sum

For instance, where GRO and DRO are detected at 22 mg/kg and 1,000 mg/kg respectively, the hazard index would be determined as $N = (22/220) + (1,000/2,000)$. Accordingly $N = 0.6$, which is less than 1.0, therefore this scenario would be acceptable. Any N value greater than 1.0 would be considered an excessive risk and may require corrective action as determined by the BER project manager.

Non-residential TPH standards should not be used in the following situations unless approved by the KDHE project manager:

- 1) sites where contamination is caused by a responsible party that does not own or control the property;
- 2) sites where a deed restriction can not be used to control future use of the property (i.e. assuring that the non-residential setting in the future); and
- 3) sites where contamination is located on the responsible party's property but is migrating or threatening to migrate to an adjacent property not under the ownership or control of the responsible party.

The current and future use of the property and the ownership of the property must be considered when determining the use of "Non-Residential" TPH Tier 2 levels. In most cases, the residential standards should be used as the target clean-up levels.

Independent of the TPH Tier 2 levels presented in Appendix A of this RSK Manual, all free product, including hydrocarbon saturated soil, must be addressed. KDHE has calculated soil saturation values for TPH GRO and TPH DRO of 3,300 mg/kg and 70,000 mg/kg, respectively, using the methodology described above in Section 5.2.3.2. These values are estimates, and site-specific soil saturation values can vary based upon the nature of the product released at each site. However, these soil saturation values provide a default when a site-specific soil saturation value has not been calculated.

KDHE considers any apparent product on the ground water surface to be a likely indicator of soil saturation, and therefore an indicator of the need to further evaluate the potential for free product and possible remediation at the site.

7.0 NITRATE AND AMMONIA

KDHE/BER has a policy, BER-RS-12 titled "Cleanup Levels for Nitrate," originally developed in 1991, which addresses soil and ground water contaminated by nitrate. Policy BER-RS-12 has been recently revised through discussions with agronomy experts at Kansas State University and those revisions are reflected in this version of the RSK Manual.

Soil Pathway:

- In areas where no vegetation is present (i.e., contamination in a gravel roadway, parking area, etc.) the following RSK standards apply:

Upper 8 inches of soil - 85 mg/kg total nitrate plus ammonia (N);

Below 8 inches in depth - 40 mg/kg nitrate plus ammonia (N).

- In areas where vegetation is present (i.e., cultivated and cropped agricultural ground, pasture, lawn, etc.) the following RSK standards apply:

Upper 24 inches of soil - 200 mg/kg total nitrate plus ammonia (N), or the maximum application rate recommended by Kansas State University for the particular crop;

Below 24 inches in depth - 40 mg/kg nitrate plus ammonia (N).

Ground Water Pathway:

The MCL for nitrate is 10 mg/l, measured as nitrogen; or 45 mg/l when measured as nitrate.

KDHE/BER will consider monitoring options for nitrate concentrations between 10 mg/l and 20 mg/l. This strategy for monitoring follows the agency's "Kansas Nitrate Strategy" document approved by USEPA in 1997.

KDHE/BER will also consider the following site-specific conditions when determining the appropriate response action for a site contaminated by nitrate and/or ammonia.

- 1) If it is not possible to excavate soil to reach a 40 mg/kg total nitrate plus ammonia (N) level then the responsible party must determine the vertical extent of total nitrate plus ammonia (N) contamination through vertical profiling approved by KDHE.

2) If ground water is 50 feet or less in depth then ground water monitoring wells may be requested by KDHE in the area of contamination and hydraulically down gradient to the nitrate concentration in ground water additional actions may be required:

a) If nitrate (N) in ground water is between the drinking water standard of 10mg/l and KDHE Bureau of Water's policy for public water supply wells of 20 mg/l, then the responsible party may be requested by KDHE to monitor the situation over a period of time. Note that where nitrate is detected at concentrations in excess of 10mg/l in actual private or public water supply wells, other requirements may apply as specified by the KDHE Bureau of Water "Kansas Nitrate Strategy."

b) If nitrate (N) in groundwater exceeds 20 mg/l then the responsible party may be required by KDHE to install a remedial system to hydraulically contain and/or remove the contamination.

c) If nitrate (N) in ground water is below the drinking water standard, or if the nitrate is shown to be from off-site sources, the monitoring points must be sampled in accordance with KDHE identified sites reclassification criteria to monitor ground water quality.

3) If ground water depth exceeds 50 feet, the need for installation of monitoring wells will be determined by KDHE on a case by case basis depending on ground water usage, soil type, and soil concentration of nitrate plus ammonia (N). Depending on nitrate concentrations in ground water, additional actions as described above may be required.

4) If vertical soil profiling indicates the presence of impervious bedrock (i.e. shale) isolating the nitrate/ammonia from ground water, up to 200 mg/kg nitrate plus ammonia (N) can be left in place (as determined by the KDHE project manager).

Excavation is commonly implemented as an appropriate response action to address soil contaminated with nitrate and/or ammonia. Nitrate and ammonia contaminated soil can be land applied on cultivated land at approved application rates. This approach requires the completion of the KDHE Land Application Work Plan and Agreement Form available from the KDHE project manager.

8.0 TABLES, FORMULAS, AND EQUATIONS

TABLE 1

GROUND WATER EXPOSURE FACTORS

ID	Description	Residents	Non-Residents
TR	Target cancer risk	1E-06, 1E-05, 1E-04	1E-06, 1E-05, 1E-04
THI	Target hazard index	1	1
BW	Body weight (kg)		
Bwa	Adult	70	70
BWc	Child (0-6 years)	15	NA
Irw	Daily water ingestion rate (L/day)		
Irwa	Adult	2	1
Irwc	Child	1	NA
INH	Inhalation rate (m3/day)		
INHa	Adult	20	20
INHc	Child	10	NA
VFW	Volatilization Factor (L/m3)	0.5	0.5
CF	Conversion Factor (L/cm3)	0.001	0.001
SA	Skin Surface Area (cm2)		
Saa	Adult	20,000	20,000
Sac	Child	7,000	NA
Kp	Permeability coefficient (cm/hr)	Chemical-specific	Chemical-specific
ET	Exposure Time (hours/day)	1	0.5
EF	Exposure Frequency (days/year)	350	250
ED	Exposure Duration (years)		
Edca	Cancer (adult)	30	25
Ednca	Noncancer (adult)	NA	25
Ednce	Noncancer (Child)	6	NA
AT	Averaging Time		
ATca	Cancer (adult)	70	70
Atnca	Noncancer (adult)	NA	25
Atnce	Noncancer (child)	6	NA
SF	Slope Factor (carcinogens)	Chemical-specific	Chemical-specific
RD	Reference Dose	Chemical-specific	Chemical-specific

Risk Assessment Guidance for Superfund Volume 1 Human Health Evaluation Manual (Part A) EPA, 1991 Human Health Evaluation Manual, Supplemental Guidance "Standard Default Exposure Factors".

Risk Assessment Guidance for Superfund, Part B: Development of Risk-based Preliminary Remediation Goals.

EQUATION 3-10

GROUND WATER / CARCINOGENS

$$\text{RBC (mg/L)} = \frac{\text{TR} \times \text{BW} \times \text{AT} \times 365 \text{ days / year}}{\text{EF} \times \text{ED} [(\text{IR}_w \times \text{SF}_o) + (\text{VF}_w \times \text{Inh} \times \text{SF}_i) + (\text{ET} \times \text{CF} \times \text{SA} \times \text{Kp} \times \text{SF}_o)]}$$

EQUATION 3-2

GROUND WATER / NON-CARCINOGENS

$$\text{RBC (mg/l)} = \frac{\text{THI} \times \text{BW} \times \text{AT} \times 365 \text{ days / year}}{\text{EF} \times \text{ED} \times [(\text{IR}_w \times 1/\text{RfD}_o) + (\text{VF}_w \times \text{Inh} \times 1/\text{RfD}_i) + (\text{ET} \times \text{CF} \times \text{SA} \times \text{Kp} \times 1/\text{RfD}_o)]}$$

TABLE 2

SOIL EXPOSURE FACTORS

ID	Description	Residents	Non-Residents
TR	Target cancer risk	1E-06, 1E-05, 1E-04	1E-06, 1E-05, 1E-04
THI	Target hazard index	1	1
BW	Body weight (kg)		
Bwa	Adult	70	70
BWc	Child (0-6 years)	15	NA
INGs	Soil ingestion rate (mg/day)		
INGsa	Adult	100	50
INGsc	Child	200	NA
INH	Soil inhalation rate (m3/day)		
INHa	Adult	20	20
INHc	Child	10	NA
VFs	Soil Volatilization Factor (m3/kg)	Chemical-specific	Chemical-specific
CF	Conversion Factor (kg/mg)	1E-06	1E-06
PEF	Particulate Emission Factor (m3/kg)	1.18E+09	1.18E+09
SA	Skin Surface Area (cm2/day)		
Saa	Adult	5000	5000
Sac	Child	1750	NA
ABS	Absorption Factor (fraction)	0.1	0.1
AF	Adherence Factor (mg/cm2)	0.2	0.2
EF	Exposure Frequency (days/year)	350	250
ED	Exposure Duration (years)		
Edca	Cancer (adult)	30	25
Ednca	Noncancer (adult)	NA	25
Edncc	Noncancer (child)	6	NA
AT	Averaging Time		
Atca	Cancer (adult)	70	70
Atnca	Noncancer (adult)	NA	25
Atncc	Noncancer (child)	6	NA
SF	Slope Factor (carcinogens)	Chemical-specific	Chemical-specific
RfD	Reference Dose	Chemical-specific	Chemical-specific

See references in Table 1

EQUATION 3-3

SOIL / CARCINOGENS

$$\text{RBC (mg/kg)} = \frac{\text{TR} \times \text{BW} \times \text{AT} \times 365 \text{ days / year}}{\text{EF} \times \text{ED} \left[(\text{ING}_s \times \text{CF} \times \text{SF}_o) + (\text{INH} \times \text{SF}_i \times \{1/\text{VF}_s + 1/\text{PEF}\}) + (\text{SF}_o \times \text{CF} \times \text{SA} \times \text{AF} \times \text{ABS}) \right]}$$

EQUATION 3-4

SOIL / NON-CARCINOGENS

$$\text{RBC (mg/kg)} = \frac{\text{THI} \times \text{BW} \times \text{AT} \times 365 \text{ days / year}}{\text{EF} \times \text{ED} \times \left[(\text{ING}_s \times \text{CF} \times 1/\text{RfD}_o) + (1/\text{RfD}_i \times \text{INH} \times \{1/\text{VF}_s + 1/\text{PEF}\}) + (1/\text{RfD}_o \times \text{CF} \times \text{SA} \times \text{AF} \times \text{ABS}) \right]}$$

EQUATION 5-1 VOLATILIZATION FACTOR EQUATION AND PARAMETERS

$$VF (m^3/kg) = \frac{Q}{C} * \frac{[(3.14)(D_A)(T)]^{1/2}}{2 * \rho_b * x D_A} * 10^{-4} (m^2 / cm^2)$$

$$\text{where } D_A = \frac{[(\theta_a^{10/3} D_i H' + \theta_w^{10/3} D_w) / n^2]}{\rho_b K_d + \theta_w + \theta_a H'}$$

Chemical-Specific Parameters	Default
VF = Volatilization factor (m ³ /kg)	--
D _A = Apparent diffusivity (cm ² /s)	--
Q/C = Inverse of the mean concentration at the center of square source (g/m ² -s per kg/m ³)	81.64
T = Exposure interval (seconds)	
Residential	9.5 E+08
Non-residential	7.9 E+08
ρ _b = Dry soil bulk density (g/cm ³)	1.5 *
θ _a = Air filled soil porosity (Lair/Lsoil)	0.28 *
N = Total soil porosity (Lpore/Lsoil)	0.43 *
θ _w = Water filled soil porosity (Lwater/Lsoil)	0.15 *
ρ _s = Soil particle density (g/cm ³)	2.65 *
D _i = Diffusivity in air (cm ² /s)	Chemical-specific
RG = Universal Gas Constant (atm-m ³ /mole-K)	0.000082
TEMP = Temperature (K)	293
H = Henry's Law constant (atm-m ³ /mol)	Chemical-specific
H' = Dimensionless Henry's Law constant	H/(RG x TEMP)
D _w = Diffusivity in water (cm ² /s)	Chemical-specific
K _d = Soil-water partition coefficient (cm ³ /g) = K _{oc} f _{oc}	Chemical-specific
K _{oc} = Soil organic carbon-water partition coefficient (cm ³ /g)	Chemical-specific
F _{oc} = Fraction organic carbon in soil (g/g)	0.01 *

* Asterisk notes the chemical-specific parameters that may be modified in a property-specific Tier 3 analyses.

EQUATION 5-2 SOIL SATURATION EQUATION AND PARAMETERS

$C_{sat} = \frac{S}{P_b} (K_d P_b + \theta_w + H' \theta_a)$	
Parameter Definition (units)	Default
Csat = Soil saturation concentration (mg/kg)	--
S = Solubility in water (mg/L-water)	chemical-specific
ρ_b = Dry soil bulk density (kg/L)	1.5 *
Kd = Soil-water partition coefficient (L/kg)	Koc × foc (chemical-specific)
Koc = Soil organic carbon/water partition coefficient (L/kg)	chemical-specific
foc = Fraction organic carbon in soil (g/g)	0.01 *
θ_w = Water-filled soil porosity (Lwater/Lsoil)	0.15 *
H' = Dimensionless Henry's law constant	Chemical-specific
θ_a = Air-filled soil porosity (Lair/Lsoil)	0.28 *
n = Total soil porosity (Lpore/Lsoil)	0.43 *
ρ_s = Soil particle density (kg/L)	2.65 *

* Asterisk notes the physical and chemical-specific parameters that may be modified in a property-specific Tier 3 analysis.

EQUATION 5-3 SOIL TO GROUND WATER MIGRATION PATHWAY EQUATION

$$C_t = C_w \left\langle (K_d) + \frac{\theta_w + \theta_a H'}{\rho_b} \right\rangle$$

TABLE 3 GROUND WATER PROTECTION PARAMETERS

Parameter Definition (units)	Default
Ct = Screening level in soil (mg/kg)	--
Cw = Target soil leachate concentration (mg/l)	(non-zero MCLG, MCL, or RBC) x 20 DAF
Koc = Soil organic carbon/water partition coefficient (l/kg)	Chemical-specific (see Appendix B)
foc = Fraction organic carbon in soil (g/g)	0.01 *
Kd = Soil-water partition coefficient (L/kg)	Chemical specific for inorganic contaminants; Koc x foc for organic contaminants
θw = Water-filled soil porosity (Lwater/Lsoil)	0.30 *
θa = Air-filled soil porosity (Lair/Lsoil)	0.13 *
n = Total soil porosity (Lpore/Lsoil)	0.43 *
ρb = Dry soil bulk density (kg/L)	1.5 *
ρs = Soil particle density (kg/L)	2.65 *
RG = Universal gas constant (atm-m ³ /mole-K)	0.000082
TEMP = Temperature (K)	293
H' = Dimensionless Henry's Law constant	H/(RG x TEMP)
H = Henry's Law constant (atm-m ³ /mol)	Chemical-specific (see Appendix B)

* Asterisk notes the physical and chemical-specific parameters that may be modified in a property-specific Tier 3 analysis.

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APPENDIX A
KDHE TIER 2 RISK-BASED SUMMARY TABLE

Chemical Name	CAS No.	RESIDENTIAL SCENARIOS				NON-RESIDENTIAL SCENARIOS		
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Acenaphthene	83-32-9	300 s	190	0.13 n	300 s	300 s	0.49 n	
Acetone	67-64-1	1700 n	1.1	0.26 n	6200 n	3.8	0.93 n	
Acetophenone	98-86-2	0.50 n	0.0002	0.00002 n	1.6 n	0.0006	0.00006 n	
Acrolein	107-02-8	1200 n	1.3	0.31 n	9800 n	8.6	2.0 n	
Acrylamide	79-06-1	1.9 c	0.0008	0.0002 c	4.2 c	0.003	0.0006 c	
Acrylonitrile	107-13-1	12 c	0.002	0.0005 c	25 c	0.004	0.001 c	
Alachlor (Lasso)	15972-60-8	110 c	0.08	0.002 m	240 c	0.08	0.002 m	
Aldicarb (Temik)	116-06-3	67 n	0.05	0.007 m	680 n	0.05	0.007 m	
Aldrin	309-00-2	0.50 c	24	5E-05 c	1.1 c	81	0.0002 c	
Anthracene	120-12-7	13 s	13 s	0.62 n	13 s	13 s	2.3 n	
Antimony and compounds	7440-36-0	31 n	N/A	0.006 m	820 n	N/A	0.006 m	
Arsenic	7440-38-2	11 c	5.84	0.01 m	38 c	5.84	0.01 m	
Atrazine	1912-24-9	38 c	0.26	0.003 m	86 c	0.26	0.003 m	
Barium	7440-39-3	5500 n	N/A	2.0 m	140000 n	N/A	2.0 m	
Benzene	71-43-2	9.8 n	0.08	0.005 m	17 c	0.08	0.005 m	
Benzydine	92-87-5	0.04 c	5.E-05	4E-06 c	0.08 c	0.0002	1E-05 c	
Benzo(a)anthracene	56-55-3	12 c	10	0.0001 c	26 c	35	0.0004 c	
Benzo(b)fluoranthene	205-99-2	12 c	19 s	9.E-05 c	19 s	19 s	0.0003 c	
Benzo(k)fluoranthene	207-08-9	10 s	10 s	0.001 c	10 s	10 s	0.003 c	
Benzo(a)pyrene	50-32-8	1.2 c	16 s	0.0002 m	2.6 c	16 s	0.0002 m	
Benzyl Chloride	100-44-7	6.4 c	0.02	0.0008 c	10 c	0.03	0.002 c	
Beryllium	7440-41-7	160 n	N/A	0.004 m	4100 n	N/A	0.004 m	
Bis(2-chloroethyl)ether	111-44-4	2.3 c	0.0009	0.0001 c	3.9 c	0.002	0.0002 c	
Bis(2-chloroisopropyl)ether	39638-32-9	47 c	0.25	0.003 c	82 c	0.49	0.007 c	
Bis(chloromethyl)ether	542-88-1	0.004 c	4.E-06	7.E-07 c	0.006 c	7.E-06	1.E-06 c	
Bis(2-ethylhexyl)phthalate	117-81-7	600 c	18000	0.006 m	1400 c	18000	0.006 m	
Bromacil	314-40-9	294 s	16.2	1.56 n	294 s	105	10.12 n	
Bromodichloromethane	75-27-4	14 c	1.21	0.08 m	23 c	1.21	0.08 m	

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Bromoform	75-25-2	1100 c	1.72	0.08 m	2400 c	1.72	0.08 m
Bromomethane	74-83-9	4.8 n	0.02	0.004 n	15 n	0.09	0.01 n
1,3-Butadiene	106-99-0	0.14 c	0.004	0.0001 c	0.21 c	0.007	0.0003 c
n-Butylbenzene	104-51-8	140 n	8	0.021	395 s	12	0.08 n
sec-Butylbenzene	135-98-8	110 n	8	0.02 n	380 n	9	0.08 n
Butyl Benzyl Phthalate	85-68-7	1500 s	1500 s	2.1 n	1500 s	1500 s	12 n
Cadmium	7440-43-9	39 n	N/A	0.005 m	1000 n	N/A	0.005 m
Captan	133-06-2	8.8 s	8.8 s	0.24 c	8.8 s	8.8 s	0.81 c
Carbaryl (Sevin)	63-25-2	230 s	69	1.5 n	230 s	230 s	9.7 n
Carbazole	86-74-8	250 s	16	0.02 c	250 s	54	0.08 c
Carbofuran (Furadan)	1563-66-2	150 s	0.47	0.04 m	150 s	0.47	0.04 m
Carbon Disulfide	75-15-0	460 n	0.14	0.009 n	950 s	0.45	0.03 n
Carbon Tetrachloride	56-23-5	2.5 n	0.20	0.005 m	7.0 c	0.20	0.005 m
Chlordane	57-74-9	24 c	48	0.002 m	55 c	48	0.002 m
Chlorobenzene	108-90-7	78 n	4.8	0.1 m	240 n	4.8	0.1 m
Chloroform	67-66-3	3.9 c	0.96	0.08 m	6.0 c	0.96	0.08 m
Chloromethane	74-87-3	86 c	0.11	0.02 c	140 c	0.22	0.04 c
Chlorpyrifos (Lorsban/Dursban)	2921-88-2	200 n	1100	0.04 n	1700 s	1700 s	0.21 n
Chromium (total)	18540-29-9	390 n	N/A	0.1 m	4000 c	N/A	0.1 m
Chrysene	218-01-9	6.4 s	6.4 s	0.01 c	6.4 s	6.4 s	0.04 c
Copper	7440-50-8	2900 n	N/A	1.3 m	76000 n	N/A	1.3 m
Cyanazine (Bladex)	21725-46-2	10 c	0.03	0.001 c	23 c	0.11	0.003 c
Cyanide (free)	57-12-5	1600 n	N/A	0.2 m	41000 n	N/A	0.2 m
Dacthal	1861-32-1	28 s	N/A	0.11 n	28 s	2.6	0.64 n
DDD	72-54-8	35 c	190	0.0009 c	79 c	620	0.003 c
DDE	72-55-9	25 c	650	0.0007 c	56 c	2200	0.002 c
DDT	50-29-3	25 c	250	0.0005 c	56 c	660 s	0.002 c
Diazinon	333-41-5	60 n	54000 s	0.01 n	610 n	54000 s	0.08 n

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Dibenzo(a,h)anthracene	53-70-3	1.2 c	3.1	4.E-06 c	2.6 c	11	1.E-05 c
Dibenzofuran	132-64-9	252 n	27	0.01 n	1351 s	86.5	0.032 n
1,4-Dibromobenzene	106-37-6	670 n	3700	0.13 n	6800 n	11000 s	0.76 n
Dibromochloromethane	124-48-1	100 c	1.33	0.08 m	230 c	1.33	0.08 m
1,2-Dichlorobenzene	95-50-1	990 s	77	0.6 m	990 s	77	0.6 m
1,4-Dichlorobenzene	106-46-7	57 c	9.5	0.075 m	92 c	9.5	0.075 m
Dichlorodifluoromethane	75-71-8	98 n	7.0	0.17 n	290 n	23	0.57 n
1,1-Dichloroethane	75-34-3	660 n	3.7	0.34 n	2100 s	13	1.3 n
1,2-Dichloroethane	107-06-2	4.7 c	0.04	0.005 m	7.3 c	0.04	0.005 m
1,1-Dichloroethene	75-35-4	0.90 c	0.12	0.007 m	1.4 c	0.12	0.007 m
1,2-Dichloroethene (cis)	156-59-2	57 n	0.80	0.07 m	180 n	0.80	0.07 m
1,2-Dichloroethene (trans)	156-60-5	94 n	1.5	0.1 m	290 n	1.5	0.1 m
2,4-Dichlorophenol	120-83-2	200 n	8.8	0.04 n	2000 n	54	0.25 n
2,4-Dichlorophenoxyacetic acid (2,4-D)	94-75-7	670 n	6.6	0.07 m	3100 s	6.6	0.07 m
1,2-Dichloropropane	78-87-5	6.0 c	0.06	0.005 m	9.3 c	0.06	0.005 m
1,3-Dichloropropene	542-75-6	1.6 c	0.01	0.001 c	2.5 c	0.03	0.002 c
Dichlorvos	62-73-7	29 c	0.03	0.003 c	66 c	0.09	0.01 c
Dieldrin	60-57-1	0.53 c	0.20	5.E-05 c	1.2 c	0.66	0.0002 c
Diethyl Phthalate	84-66-2	3200 s	740	12 n	3200 s	3200 s	78 n
2,4-Dimethylphenol	105-67-9	1300 n	13	0.28 n	14000 n	81	1.8 n
2,4-Dinitrophenol	51-28-5	130 n	0.33	0.03 n	1200 s	2.1	0.20 n
2,4-Dinitrotoluene	121-14-2	13 c	0.03	0.001 c	28 c	0.09	0.004 c
2,6-Dinitrotoluene	606-20-2	13 c	0.02	0.001 c	28 c	0.07	0.004 c
Di-n-octyl Phthalate	117-84-0	1300 n	17000 s	0.010 n	14000 n	17000 s	0.048 n
1,4-Dioxane	123-91-1	770 c	0.32	0.08 c	1700 c	1.1	0.26 c
Diuron	330-54-1	133 n	3.08	0.031 n	205 s	18.99	0.191 n
Endosulfan	115-29-7	11 s	11 s	0.09 n	11 s	11 s	0.59 n
Endrin	72-20-8	20 n	4.9	0.002 m	30 s	4.9	0.002 m

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EPTC (Ethyl-dithiopropylcarbamate, s-)	759-94-4	1700 n	97	0.33 n	5300 s	590	2.0 n
Ethylbenzene	100-41-4	650 s	55	0.7 m	650 s	55	0.7 m
Ethylene dibromide	106-93-4	0.09 c	0.0006	5.E-05 m	0.20 c	0.0006	5.E-05 m
Fluoranthene	206-44-0	220 s	220 s	0.18 n	220 s	220 s	0.89 n
Fluorene	86-73-7	270 s	200	0.07 n	270 s	270 s	0.28 n
Fonofos (Dyfonate)	944-22-9	130 n	9.6	0.02 n	250 s	57	0.15 n
Formaldehyde	50-00-0	10000 n	13	3.0 n	60000 s	84	20 n
Furan	110-00-9	3.2 n	0.02	0.003 n	9.9 n	0.08	0.009 n
Glyphosate (Roundup)	1071-83-6	6700 n	300	0.7 m	68000 n	300	0.7 m
Heptachlor	76-44-8	1.9 c	110	0.0004 m	4.2 c	110	0.0004 m
Heptachlor Epoxide	1024-57-3	0.87 n	3.3	0.0002 m	2.1 c	3.3	0.0002 m
Hexachlorobenzene	118-74-1	5.3 c	11	0.001 m	12 c	11	0.001 m
Hexachlorobutadiene	87-68-3	13 n	18	0.002 n	140 n	100	0.009 n
Hexachloroethane	67-72-1	67 n	4.3	0.01 n	680 n	26	0.07 n
n-Hexane	110-54-3	220 s	39	0.11 n	220 s	150	0.41 n
HMX	2691-41-0	0.67 s	0.67 s	0.78 n	0.67 s	0.67 s	5.1 n
Hydrazine	302-01-2	2.8 c	100000 s	0.0003 c	6.4 c	100000 s	0.001 c
Hydrazine Sulfate	10034-93-2	2.8 c	N/A	0.0003 c	6.4 c	N/A	0.001 c
Indeno(1,2,3-cd)pyrene	193-39-5	0.76 s	0.76 s	6.E-05 c	0.76 s	0.76 s	0.0002 c
Kepone	143-50-0	0.47 c	1.5	5.E-05 c	1.1 c	5.0	0.0002 c
Lead	7439-92-1	400	N/A	0.015 m	1000	N/A	0.015 m
Lindane	58-89-9	6.6 c	0.04	0.0002 m	15 c	0.04	0.0002 m
Malathion	121-75-5	330 s	15	0.31 n	330 s	97	2.0 n
Manganese	7439-96-5	3600 n	N/A	0.05 M	95000 n	N/A	0.05 M
Mercury	7439-97-6	2 n	N/A	0.002 m	20 n	N/A	0.002 m
Methoxychlor	72-43-5	44 s	44 s	0.04 m	44 s	44 s	0.04 m
Methylene Chloride	75-09-2	150 c	0.03	0.005 m	230 c	0.03	0.005 m
Methyl Ethyl Ketone (2-Butanone)	78-93-3	6400 n	3.6	0.82 n	21000 n	12	2.8 n

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Methyl Isobutyl Ketone	108-10-1	1000 n	0.41	0.07 n	3600 n	1.4	0.23 n
2-Methylphenol	95-48-7	3300 n	4.6	0.74 n	6500 s	29	4.7 n
3-Methylphenol	108-39-4	3300 n	8.1	0.74 n	6500 s	29	4.7 n
4-Methylphenol	106-44-5	330 n	1.0	0.08 n	3400 n	6.5	0.47 n
Methyl Tertbutyl Ether	1634-04-4	2400 n	0.09	0.020 h	15000 n	0.09	0.020 h
Metolachlor (Dual)	51218-45-2	390 s	41	2.3 n	390 s	260	15 n
Metribuzin (Sencor)	21087-64-9	740 s	5.6	0.39 n	740 s	36	2.5 n
Naphthalene	91-20-3	100 n	39	0.10 n	320 n	140	0.35 n
Nickel	7440-02-0	1600 n	N/A	0.10 m	41000 n	N/A	0.10 m
Nitrobenzene	98-95-3	21 n	0.02	0.001 n	110 n	0.09	0.005 n
Nitrofurazone	59-87-0	5.7 c	0.002	0.0006 c	13 c	0.008	0.002 c
Nitroguanidine	55-63-0	6700 n	190	1.6 n	12000 s	1200	10 n
2-Nitropropane	79-46-9	0.91 c	0.0005	9.E-05 c	2.0 c	0.002	0.0003 c
Oxamyl	23135-22-0	1700 n	1.2	0.2 m	17000 n	1.2	0.2 m
Paraquat	1910-42-5	300 n	210	0.07 n	3100 n	1400	0.45 n
Parathion	56-38-2	380 s	98	0.08 n	380 s	380 s	0.52 n
PCBs (Polychlorinated Biphenyl)	1336-36-3	4.3 c	53	0.0005 m	9.5 c	53	0.0005 m
Pendimethalin (Prowl)	40487-42-1	37 s	37 s	0.63 n	37 s	37 s	4.1 n
Pentachlorophenol	87-86-5	71 c	20	0.001 m	160 c	20	0.001 m
Permethrin (Ambush)	52645-53-1	2.4 s	2.4 s	0.002 n	2.4 s	2.4 s	0.01 n
Phenol	108-95-2	32000 s	88	9.0 n	32000 s	560	58 n
Phenylphenol	90-43-7	4400 c	1.4	0.35 c	9800 c	4.7	1.2 c
Phosphine	7803-51-2	20 n	0.02	0.005 n	37 s	0.12	0.03 n
Profluralin	26399-36-0	100 s	100 s	0.09 n	100 s	100 s	0.61 n
Propachlor (Ramrod)	1918-16-7	550 s	4.0	0.20 n	550 s	26	1.3 n
Propazine (Miloguard)	139-40-2	5.1 s	5.1 s	0.29 n	5.1 s	5.1 s	1.9 n
n-Propylbenzene	103-65-1	140 n	11	0.02 n	400 n	44	0.08 n
Pyrene	129-00-0	140 s	140 s	0.14 n	140 s	140 s	0.72 n

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Pyridine	110-86-1	33 n	0.01	0.003 n	150 n	0.05	0.009 n
RDX	121-82-4	44 s	0.13	0.008 c	44 s	0.43	0.03 c
Selenium	7782-49-2	390 n	N/A	0.05 m	10000 n	N/A	0.05 m
Silver	7440-22-4	390 n	N/A	0.1 M	10000 n	N/A	0.1 M
Simazine (Princap)	122-34-9	9.3 s	0.13	0.004 m	9.3 s	0.13	0.004 m
Styrene	100-42-5	2400 s	16	0.1 m	2400 s	16	0.1 m
2,4,5-T as Acid	93-76-5	670 n	53	0.15 n	4800 s	340	0.94 n
2,3,7,8-TCDD (Dioxin)	1746-01-6	6.E-05 c	0.02	3.E-08 m	0.0001 c	0.02	3.E-08 m
Terbacil (Sinbar)	5902-51-2	520 s	3.3	0.20 n	520 s	22	1.3 n
Terbufos (Counter)	13071-79-9	1.7 n	0.04	0.0003 n	17 n	0.23	0.002 n
1,1,1,2-Tetrachloroethane	630-20-6	29 c	0.17	0.005 c	45 c	0.33	0.01 c
1,1,2,2-Tetrachloroethane	79-34-5	7.1 c	0.02	0.0007 c	12 c	0.03	0.001 c
Tetrachloroethene (PCE)	127-18-4	79 c	0.18	0.005 m	140 c	0.18	0.005 m
2,3,4,6-Tetrachlorophenol	58-90-2	2000 n	1200	0.27 n	20000 n	6800	1.5 n
Tetryl	479-45-8	45 s	2.2	0.16	45 s	14	1.0 n
Toluene	108-88-3	930 n	40	1 m	1000 s	40	1 m
TPH GRO		220 n	39	0.500 n	450 n	150	0.500 n
TPH DRO		2000 n	3000	0.500 n	20000 n	15000	0.720 n
Toxaphene	8001-35-2	7.7 c	150	0.003 m	17 c	150	0.003 m
2,4,5-TP (Silvex)	93-72-1	530 n	55	0.05 m	5500 n	55	0.05 m
1,2,4-Trichlorobenzene	120-82-1	600 n	25	0.07 m	4900 n	25	0.07 m
1,1,1-Trichloroethane	71-55-6	880 n	5.5	0.2 m	1800 s	5.5	0.2 m
1,1,2-Trichloroethane	79-00-5	13 c	0.07	0.005 m	20 c	0.07	0.005 m
Trichloroethene (TCE) (see note below)	79-01-6	62 c	0.20	0.005 m	98 c	0.20	0.005 m
2,4,5-Trichlorophenol	95-95-4	6700 n	1600	1.2 n	68000 n	9200	6.7 n
2,4,6-Trichlorophenol	88-06-2	770 c	45	0.05 c	1700 c	150	0.17 c
2(2,4,5-Trichlorophenoxy)propionic acid	93-72-1	530 n	130	0.12 n	5500 n	800	0.73 n
1,2,3-Trichloropropane	96-18-4	0.17 c	0.0004	2.E-05 c	0.28 c	0.0007	4.E-05 c

The RSK document should not be used for environmental audits, environmental assessments or other non-KDHE managed activities. Use of Tier 2 risk-based values established within the RSK Manual without KDHE oversight may constitute misapplication of the RSK manual and may result in risk management decisions not supported by KDHE. Please read the narrative to ensure proper use of Appendix A for KDHE managed activities.

APPENDIX A
KDHE TIER 2 RISK-BASED SUMMARY TABLE

Chemical Name	CAS No.	RESIDENTIAL SCENARIOS			NON-RESIDENTIAL SCENARIOS		
		Soil Pathway (mg/kg)	Soil to Ground Water Protection Pathway	Ground Water Pathway (mg/L)	Soil Pathway (mg/kg)	Soil to Ground Water Protection Pathway	Ground Water Pathway (mg/L)
			(mg/kg)			(mg/kg)	
Triflualine (Treflan)	1582-09-8	500 n	1800	0.05 c	2500 c	6000	0.18 c
1,2,4-Trimethylbenzene	95-63-6	9.7 s	0.85	0.005 n	9.7 s	2.9	0.017 n
1,3,5-Trimethylbenzene	108-67-8	2.5 n	0.24	0.005 n	69.4 n	0.83	0.017 n
2,4,6-Trinitrotoluene	118-96-7	14 s	0.05	0.008 n	14 s	3.3	0.05 n
Vanadium	7440-62-2	550 n	N/A	0.11 n	14000 n	N/A	0.71 n
Vinyl Chloride	75-01-4	0.34 c	0.02	0.002 m	0.54 c	0.02	0.002 m
Xylene (mixed)	1330-20-7	700 s	700 s	10 m	700 s	700 s	10 m
Zinc	7440-66-6	23000 n	N/A	5 M	610000 n	N/A	5 M

The RSK document should not be used for environmental audits, environmental assessments or other non-KDHE managed activities. Use of Tier 2 risk-based values established within the RSK Manual without KDHE oversight may constitute misapplication of the RSK manual and may result in risk management decisions not supported by KDHE. Please read the narrative to ensure proper use of Appendix A for KDHE managed activities.

Notes

- n - non-carcinogenic risk, HI = 1
- c - carcinogenic risk, risk = 1×10^{-5}
- s - soil saturation
- m - primary maximum contaminant level (MCL)

- M - secondary maximum contaminant level (MCL)
- h - health advisory
- N/A - insufficient data to calculate value

At the time of the printing of this document, EPA was reevaluating the toxicity of TCE. Upon completion of EPA's evaluation, the soil pathway value for TCE will change accordingly.

**APPENDIX B
CONTAMINANT-SPECIFIC PARAMETERS**

Chemical Name	Solubility (mg/L)	Log Kow	Log Koc	Kd for inorganics or Koc * foc for organics	HLC	Diffusivity in Air	Diffusivity in Water	Kp	Volatilization Factor Residential	Volatilization Factor Industrial
Acenaphthene	4.24 a	3.92 a	3.85 a	71	1.55E-04 a	0.04 a	7.69E-06	0.150 m	3.3E+05	3.0E+05
Acenaphthylene	16.1 b	3.55 b	3.49 d	31	1.13E-04 b			0.074 m		
Acetone	1.00E+06 a	-0.24 a	-0.24 a	0.01	3.88E-05 a	0.12 a	1.14E-05	0.0012 m	1.5E+04	1.3E+04
Acetophenone	6.10E+03	1.58	1.55	0.36	1.10E-05		8.70E-06	0.0047		
Acrolein	2.13E+05 b	-0.01 b	1.33 c	0.21	1.22E-04 b	0.11 c	1.22E-05	0.00074 l		
Acrylamide	6.40E+05 b	-0.96 b	-0.94 d	0.0011	1.00E-09 b			0.00024 l		
Acrylonitrile	7.4.E+04 b	0.25 b	-0.07 c	0.01	1.03E-04 b	0.11 c	1.34E-05	0.0014 l	1.6E+05	1.5E+05
Alachlor (Lasso)	242			1.9	2.07E-08 g			0.014 m		
Aldicarb (Temik)	6030 b	1.11 b	1.09 d	0.12	1.44E-09 b			0.00084 m		
Aldrin	0.18 a	6.50 a	6.39 a	24535	1.70E-04 a	0.01 a	4.86E-06	0.0016 l		
Anthracene	0.04 a	4.55 a	4.47 a	297	6.50E-05 a	0.03 a	7.74E-06	0.23 m	1.2E+06	1.1E+06
Antimony and compounds				45				0.0010 l		
Arsenic				29				0.0010 l		
Atrazine	70 b	2.65 b	2.61 d	4.0	4.53E-03 b			0.0083 m		
Barium				41				0.0010 l		
Benzene	1750 a	2.13 a	1.77 a	0.58	5.55E-03 a	0.09 a	9.80E-06	0.021 l	3.8E+03	3.5E+03
Benzidine	500 b	1.66 b	1.63 d	0.43	3.88E-11 b			0.0013 l		
Benzo(a)anthracene	0.01 a	5.70 a	5.60 a	4012	3.35E-06 a	0.05 a	9.00E-06	0.81 l		
Benzo(b)fluoranthene	0.0015 a	6.20 a	6.09 a	12442	1.11E-04 a	0.02 a	5.56E-06	1.2 l		
Benzo(k)fluoranthene	0.0008 a	6.20 a	6.09 a	12442	8.29E-07 a	0.02 a	5.56E-06	1.1 m		
Benzo(a)pyrene	0.0016 a	6.11 a	6.01 a	10149	1.13E-06 a	0.04 a	9.00E-06	1.2 l		
Benzyl Chloride	525 b	2.30 b	1.70 c	0.50	4.15E-04 b	0.07 c	7.80E-06	0.014 l	1.5E+04	1.3E+04
Beryllium				790				0.0010 l		
Bis(2-chloroethyl)ether	1.7.E+04 a	1.21 a	1.19 a	0.15	1.80E-05 a	0.07 a	7.53E-06	0.0021 l	4.5E+04	4.1E+04
Bis(2-chloroisopropyl)ether	1310 b	2.58 b	1.79 c	0.61	1.13E-04 b	0.06 c	6.40E-06	0.010 m	3.1E+04	2.9E+04
Bis(chloromethyl)ether	3.8E+04 b	1.04 b	0.08 c	0.01	1.18E-04 c	0.09 c	9.40E-06	0.00038 m	1.0E+04	9.4E+03
Bis(2-ethylhexyl)phthalate	0.34 a	7.30 a	7.18 a	150031	1.02E-07 a	0.04 a	3.66E-06	0.033 m		
Bromacil	700 g	1.88 g	1.51 g	0.32	1.48E-10 g			0.001 m		
Bromodichloromethane	6740 a	2.10 a	1.74 a	0.55	1.60E-03 a	0.03 a	1.06E-05	0.0058 l	1.2E+04	1.1E+04
Bromoform	3100 a	2.35 a	1.94 a	0.87	5.35E-04 a	0.01 a	1.03E-05	0.0026 l		
Bromomethane	1.5.E+04 b	1.19 b	0.95 c	0.09	6.24E-03 b	0.07 c	1.20E-05	0.0035 l	2.3E+03	2.1E+03
1,3-Butadiene	735 b.	1.99 b	2.08 c	1.20	7.36E-02 b	0.10 c	1.10E-05	0.023 l	1.6E+03	1.5E+03
n-Butylbenzene	14 b	4.01 b	3.45 c	28	1.30E-02 b	0.075 c	7.80E-06			
sec-Butylbenzene	17 b	3.94 b	3.34 c	22	1.90E-02 b	0.075 c	7.80E-06			
Butyl Benzyl Phthalate	2.7 a	4.84 a	4.76 a	573	1.26E-06 a	0.02 a	4.83E-06	0.073 m		

**APPENDIX B
CONTAMINANT-SPECIFIC PARAMETERS**

Chemical Name	Solubility (mg/L)	Log Kow	Log Koc	Kd for inorganics or Koc * foc for organics	HLC	Diffusivity in Air	Diffusivity in Water	Kp	Volatilization Factor Residential	Volatilization Factor Industrial
Cadmium				75				0.0010		
Captan	3.3 b	2.45 b	2.41 d	2.6	7.19E-06 b			0.0013		
Carbaryl (Sevin)	104 b	2.36 b	2.32 d	2.1	3.46E-09 b			0.0053		
Carbazole	7.5 a	3.59 a	3.53 a	34	1.53E-08 a	0.04 a	7.03E-06	0.080		
Carbofuran (Furadan)	320 b	1.61 b	1.58 d	0.38	9.20E-05 b			0.0038		
Carbon Disulfide	1190 a	2.00 a	1.66 a	0.46	3.03E-02 a	0.10 a	1.00E-05	0.024	1.6E+03	1.4E+03
Carbon Tetrachloride	793 a	2.73 a	2.24 a	1.74	3.04E-02 a	0.08 a	8.80E-06	0.022	2.9E+03	2.7E+03
Chlordane	0.06 a	6.32 a	5.08 a	1211	4.86E-05 a	0.01 a	4.37E-06	0.052		
Chlorobenzene	472 a	2.86 a	2.34 a	2.2	3.70E-03 a	0.07 a	8.70E-06	0.041	9.2E+03	8.4E+03
Chloroform	7920 a	1.92 a	1.60 a	0.40	3.67E-03 a	0.10 a	1.00E-05	0.0089	3.7E+03	3.4E+03
Chloromethane	5330 b	0.91 b	1.54 c	0.35	8.82E-03 b	0.11 c	6.50E-06	0.0042	7.3E+03	6.7E+03
Chlorpyrifos (Lorsban/Dursban)	1.12 b	5.26 b	5.17 d	1482	2.87E-05 f			0.046		
Chromium (trivalent)				2.E+06				0.0010		
Chromium (hexavalent)				19						
Chrysene	0.0016 a	5.70 a	5.60 a	4012	9.46E-05 a	0.02 a	6.21E-06	0.81		
Copper								0.0010		
Cyanazine (Bladex)	171 b	2.20 b	2.16 d	1.5	1.00E-10 b			0.0024		
Cyanide (free)				9.9				0.0010		
Dacthal	0.50			56	2.16E-06 g			0.059		
DDD	0.09 a	6.10 a	6.00 a	9922	4.00E-06 a	0.02 a	4.76E-06	0.28		
DDE	0.12 a	6.76 a	6.65 a	44194	2.10E-05 a	0.01 a	5.87E-06	0.24		
DDT	0.03 a	6.53 a	6.42 a	26259	8.10E-06 a	0.01 a	4.95E-06	0.43		
Diazinon	40 b	3.35 b	3.29 d	20				0.013		
Dibenzo(a,h)anthracene	0.0025 a	6.69 a	6.58 a	37718	1.47E-08 a	0.02 a	5.18E-06	2.7		
Dibenzofuran	10.0 b	4.20 b	4.13 d	135	1.26E-05 b	0.06 q	1.00E-05	0.173	7.8E+05	7.1E+05
1,4-Dibromobenzene	3.45	3.75	3.05 e	11	4.00E+02 j			0.034		
Dibromochloromethane	2600 b	2.17 b	1.80 e	0.63	7.83E-04 b			0.0035		
1,2-Dichlorobenzene	156 a	3.43 a	2.79 a	6.2	1.90E-03 a	0.07 a	7.90E-06	0.061	2.2E+04	2.0E+04
1,4-Dichlorobenzene	74.0 a	3.42 a	2.79 a	6.1	2.43E-03 a	0.07 a	7.90E-06	0.062	1.9E+04	1.8E+04
Dichlorodifluoromethane	280 b	2.16 b	1.76 c	0.58	3.43E-01 b	0.08 c	1.05E-05	0.012	1.1E+03	1.0E+03
1,1-Dichloroethane	5060 a	1.79 a	1.50 a	0.31	5.62E-03 a	0.07 a	1.05E-05	0.0089	3.3E+03	3.0E+03
1,2-Dichloroethane	8520 a	1.47 a	1.24 a	0.17	9.79E-04 a	0.10 a	9.90E-06	0.0053	5.2E+03	4.8E+03
1,1-Dichloroethene	2250 a	2.13 a	1.77 a	0.58	2.61E-02 a	0.09 a	1.04E-05	0.016	1.9E+03	1.8E+03
1,2-Dichloroethene (cis)	3500 a	1.86 a	1.55 a	0.36	4.08E-03 a	0.07 a	1.13E-05	0.010	4.0E+03	3.7E+03
1,2-Dichloroethene (trans)	6300 a	2.07 a	1.72 a	0.52	9.38E-03 a	0.07 a	1.19E-05	0.014	3.2E+03	2.9E+03

**APPENDIX B
CONTAMINANT-SPECIFIC PARAMETERS**

Chemical Name	Solubility (mg/L)	Log Kow	Log Koc	Kd for Inorganics or Koc * foc for organics	HLC	Diffusivity in Air	Diffusivity in Water	Kp	Volatilization Factor Residential	Volatilization Factor Industrial
2,4-Dichlorophenol	4500 a	3.08 a	3.03 d	11	3.16E-06 a	0.03 a	8.77E-06	0.023 l		
2,4-Dichlorophenoxyacetic acid (2,4-D)	677 b	2.70 b	2.65 d	4.5	1.02E-08 b			0.0084 m		
1,2-Dichloropropane	2800 a	1.97 a	1.64 a	0.43	2.80E-03 a	0.08 a	8.73E-06	0.010 l	5.0E+03	4.6E+03
1,3-Dichloropropene	2800 a	2.00 a	1.66 a	0.46	1.77E-02 a	0.06 a	1.00E-05	0.0055 l	2.5E+03	2.3E+03
Dichlorvos	1.0.E+04 b	1.43 b	1.41 d	0.25	1.54E-03 b			0.0010 l		
Dieldrin	0.20 a	5.37 a	4.33 a	214	1.51E-05 a	0.01 a	4.74E-06	0.016 l		
Diethyl Phthalate	1080 a	2.50 a	2.46 a	2.87	4.50E-07 a	0.03 a	6.35E-06	0.0048 l		
2,4-Dimethylphenol	7870 a	2.36 a	2.32 a	2.09	2.00E-06 a	0.06 a	8.69E-06	0.015 l		
2,4-Dinitrophenol	2790 a	1.55 a	1.52 d	0.33	4.43E-07 a	0.03 a	9.06E-06	0.0018 l		
2,4-Dinitrotoluene	270 a	2.01 a	1.98 a	0.95	9.26E-08 a	0.20 a	7.06E-06	0.0038 l		
2,6-Dinitrotoluene	180 a	1.87 a	1.84 a	0.69	7.47E-07 a	0.03 a	7.26E-06	0.0025 l		
Di-n-octyl Phthalate	0.02 a	8.06 a	7.92 a	8.4.E+05	6.68E-05 a	0.02 a	3.58E-06	4.168 m		
1,4-Dioxane	1.00E+06 b	-0.39 b	-0.23 e	0.01	4.80E-06 b			0.00036 l		
Diuron	42 g	2.80 g	2.68 g	4.77	5.03E-10 g			0.007 m		
Endosulfan	0.51 a	4.10 a	3.33 a	21	1.12E-05 a	0.01 a	4.55E-06	0.0033 m		
Endrin	0.25 a	5.06 a	4.09 a	122	7.52E-06 a	0.01 a	4.74E-06	0.016 l		
EPTC (Ethyl-dithiopropylcarbamate, s-	370 b	3.21 b	3.16 d	14	1.07E-04 b			0.025 m		
Eradicane	344			2.0						
Ethylbenzene	169 a	3.14 a	2.56 a	3.7	7.88E-03 a	0.08 a	7.80E-06	0.074 l	8.0E+03	7.3E+03
Ethylene dibromide	4180 b	1.96 b	1.45 c	0.28	7.43E-04 b	0.07 c	8.06E-06	0.0034 l	8.4E+03	7.6E+03
Fluoranthene	0.21 a	5.12 a	5.03 a	1080	1.61E-05 a	0.03 a	6.35E-06	0.36 l		
Fluorene	2.0 a	4.21 a	4.14 a	138	6.36E-05 a	0.04 a	7.88E-06	0.36 m	7.6E+05	7.0E+05
Fonofos (Dyfonate)	13 g			19	6.48E-06 g			0.038 m		
Formaldehyde	5.50E+05 b	-0.05 b	-0.05 d	0.01	3.36E-07 b			0.0022 l		
Furan	1.0.E+04 b	1.34 b	1.08 c	0.12	5.40E-03 b	0.10 c	1.22E-05	0.0065 m	2.1E+03	2.0E+03
Glyphosate (Roundup)	1.3.E+04 g			21	1.38E-12 g			0.00018 m		
Heptachlor	0.18 a	6.26 a	6.15 a	14251	1.48E+00 b	0.01 a	5.69E-06	0.011 l	9.2E+04	
Heptachlor Epoxide	0.20 a	5.00 a	4.92 a	823	9.50E-06 a	0.01 a	4.23E-06	0.055 m		
Hexachlorobenzene	6.2 a	5.89 a	4.74 a	553	1.32E-03 a	0.05 a	5.91E-06	0.21 l		
Hexachlorobutadiene	3.2 a	4.81 a	4.73 a	535	8.15E-03 a	0.06 a	6.16E-06	0.12 l		
Hexachloroethane	50 a	4.00 a	3.25 a	18	3.89E-03 a	0.00 a	6.80E-06	0.042 l		
n-Hexane	12 b	4.00 b	2.95 c	8.9	1.43E-02 b	0.20 c	7.77E-06	0.33 m	5.6E+03	5.1E+03
HMX	5 n	0.26 n	0.54 n	0.035	2.60E-15 n			0.000046 m		
Hydrazine	1.00E+06 b	-2.07 b	-2.03 d	0.00009	4.61E-04 l			0.000041 l		
Hydrazine sulfate								0.000041 l		

**APPENDIX B
CONTAMINANT-SPECIFIC PARAMETERS**

Chemical Name	Solubility (mg/L)	Log Kow	Log Koc	Kd for inorganics or Koc * foc for organics	HLC	Diffusivity in Air	Diffusivity in Water	Kp	Volatilization Factor Residential	Volatilization Factor Industrial
Indeno(1,2,3-cd)pyrene	0.000022 a	6.65 a	6.54 a	34453	1.60E-06 a	0.02 a	5.66E-06	1.9 l		
Kepone	7.6 b	5.30 b	5.21 d	1622	2.50E-08 b			0.0030 m		
Lead								0.0010 l		
Lindane	6.8 a	3.73 a	3.03 a	11	1.40E-05 a	0.01 a	7.34E-06	0.014 l		
Malathion	143 b	2.86 b	2.34 e	2.2	4.89E-09 b			0.0009 m		
Manganese								0.0010 l		
Mercury				52	1.14E-02 b	0.03 a	6.30E-06	0.0010 l		
Methoxychlor	0.05 a	5.08 a	4.99 a	986	1.58E-05 a	0.02 a	4.46E-06	0.043 m		
Methylene Chloride	13000 a	1.25 a	1.07 a	0.12	2.19E-03 a	0.10 a	1.17E-05	0.0045 l	3.2E+03	3.0E+03
Methyl Ethyl Ketone	2.23E+05 b	0.28 b	0.65 c	0.05	5.59E-05 b	0.09 c	9.80E-06	0.0011 l	1.7E+04	1.5E+04
Methyl Isobutyl Ketone	1.90E+04 b	1.19 b	2.11 c	1.3	1.38E-04 b	0.08 c	7.80E-06	0.0033 m	3.7E+04	3.3E+04
2-Methylphenol (o-Creosol)	3.10E+04 b	2.06 b	1.04 c	0.11	1.10E-06					
3-Methylphenol (m-Creosol)	2.50E+04 b	2.06 b	1.54 c	0.35	1.50E-06					
4-Methylphenol (p-Creosol)	2.15E+04 b	2.06 b	1.69 c	0.49	1.00E-06					
Methyl Tertbutyl Ether	5.00E+04 n	1.24 n	1.04 n	0.11	5.85E-04 n	0.08 o		0.0026 m	6.7E+03	6.1E+03
Metolachlor (Dual)	488 g			0.70	2.41E-08 g			0.0059 m		
Metribuzin (Sencor)	1200 b	1.70 b		0.52	8.78E-02 b			0.0015 m		
Naphthalene	31 a	3.36 a	3.30 a	20	4.83E-04 a	0.06 a	7.50E-06	0.069 l	8.4E+04	7.6E+04
Nickel				65				0.0010 l		
Nitrobenzene	2090 a	1.84 a	1.81 a	0.64	2.40E-05 a	0.08 a	8.60E-06	0.0070 m	6.3E+04	5.8E+04
Nitrofurazone								0.00017 m		
Nitroguanidine	1950.00 p	1.62 p	2.77 k	5.9	2.71E-07 p			0.00011 p		
2-Nitropropane	2.E+04 b	0.87 b	0.86 d	0.07	1.23E-04 b			0.0010 l		
Oxamyl	3.E+05 g			0.09	3.85E-13 g			0.00019 m		
Paraquat	1.E+06 h			155	1.00E-09 k			0.0053 D		
Parathion (ethyl)	6.5 b	3.83 b	3.77 d	58	5.65E-07 b			0.017 l		
PCBs (Polychlorinated Biphenyl)	0.07 b	6.04 b	5.49 a	3090	2.60E-03 b			0.0050 D		
Pendimethalin (Prowl)	0.28 g			134	1.21E-05 g			0.000037 m		
Pentachlorophenol	1950 a	5.09 a	5.00 d	1009	2.44E-08 a	0.06 a	6.10E-06	0.65 l		
Permethrin (Ambush)	0.01 g			393	1.87E-06 g			45 m		
Phenanthrene	1.15 b	4.55 b	4.47 d	297	2.33E-05 b			0.23 l		
Phenol	8.E+04 a	1.48 a	1.46 a	0.29	3.97E-07 a	0.08 a	9.10E-06	0.0055 l		
Phenylphenol								0.027 m		
Phosphine	370 b	b						0.0012 m		
Profuralin	0.10 g			1000	2.88E-04 g			0.000015 m		

**APPENDIX B
CONTAMINANT-SPECIFIC PARAMETERS**

Chemical Name	Solubility (mg/L)	Log Kow	Log Koc	Kd for inorganics or Koc * foc for organics	HLC	Diffusivity in Air	Diffusivity in Water	Kp	Volatilization Factor Residential	Volatilization Factor Industrial
Propachlor (Ramros)	613 g			0.80	1.05E-07 g			0.0034 m		
Propazine (Miloguard)	3.0 g			1.6	1.28E-08 g			0.0091 m		
n-Propylbenzene	14.0	4.01	3.45	28	1.30E-02	0.075	7.80E-06			
Pyrene	0.14 a	5.11 a	5.02 a	1055	1.10E-05 a	0.03 a	7.24E-06	0.33 m		
Pyridine	1.00E+06 b	0.67 b	0.66 d	0.05	8.88E-06 b	0.09 o		0.0018 m	4.2E+04	3.9E+04
RDX	6.10E+01 n	0.87 n	1.80 n	0.63	1.20E-05 n			0.0018 m		
Selenium				5.0				0.0010 l		
Silver				8.3				0.0010 l		
Simazine (Princap)	6.2 g			1.4	9.67E-10 g			0.0040 m		
Styrene	310 a	2.94 a	2.89 a	7.8	2.75E-03 a	0.07 a	8.00E-06	0.055 l	2.0E+04	1.8E+04
2,4,5-Trichlorophenoxyacetic acid	268 b	3.31 b	3.25 d	18	8.68E-09 b			0.0088 m		
2,3,7,8-TCDD (Dioxin)	7.9E-06 b	6.53 b	6.42 d	26259	7.92E-05 b			1.4 l		
Terbacil (Sinbar)	710 g			0.63	1.88E-10 g			0.0020 m		
Terbufos (Counter)	4.5 g			6.5	2.67E-05 g			0.050 m		
1,1,1,2-Tetrachloroethane	1100 b	2.63 b	2.16 e	1.45	2.42E-03 b	0.07 c	7.90E-06	0.028 m	9.5E+03	8.7E+03
1,1,2,2-Tetrachloroethane	2970 a	2.39 a	1.97 a	0.94	3.45E-04 a	0.07 a	7.90E-06	0.0090 l	2.0E+04	1.9E+04
Tetrachloroethene (PCE)	200 a	2.67 a	2.19 a	1.56	1.84E-02 a	0.07 a	8.20E-06	0.048 l	3.7E+03	3.3E+03
2,3,4,6-Tetrachlorophenol	100 b	4.44 b	4.36 d	232	4.39E-06 b			0.11 m		
Tetryl	80 p	1.65 p	1.69 p	0.49	2.69E-11 p			0.0005 p		
Toluene	526 a	2.75 a	2.26 a	1.80	6.64E-03 a	0.09 a	8.60E-06	0.045 l	5.8E+03	5.3E+03
TPH GRO	12 b	4.00 b	2.95 c	8.90	1.43E-02 b	0.20 c	7.77E-06	0.330 m	5.6E+03	5.1E+03
TPH DRO	0.14 a	5.11 a	5.02 a	1055	1.10E-05 a	0.03 a	7.24E-06	0.330 m		
Toxaphene	0.74 a	5.50 a	5.41 a	2551	6.00E-06 a	0.01 a	4.34E-06	0.015 l		
2,4,5-TP (Silvex)	140 b	3.80 b	3.74 d	54	7.83E-11 b			0.011 l		
1,2,4-Trichlorobenzene	300 a	4.01 a	3.25 a	18	1.42E-03 a	0.03 a	8.23E-06	0.10 l	6.5E+04	5.9E+04
1,1,1-Trichloroethane	1330 a	2.48 a	2.04 a	1.10	1.72E-02 a	0.08 a	8.80E-06	0.017 l	3.1E+03	2.9E+03
1,1,2-Trichloroethane	4420 a	2.05 a	1.70 a	0.50	9.13E-04 a	0.08 a	8.80E-06	0.0084 l	9.2E+03	8.4E+03
Trichloroethene (TCE)	1100 a	2.71 a	2.22 a	1.68	1.03E-02 a	0.08 a	9.10E-06	0.016 l	4.7E+03	4.3E+03
2,4,5-Trichlorophenol	1200 a	3.90 a	3.83 d	68	4.33E-06 a	0.03 a	7.03E-06	0.052 m		
2,4,6-Trichlorophenol	800 a	3.70 a	3.64 d	43	7.79E-06 a	0.03 a	6.25E-06	0.050 l		
2(2,4,5-Trichlorophenoxy)propionic ac	140 b	3.80 b	3.74 d	54	7.83E-11 b			0.011 l		
1,2,3-Trichloropropane	1750 b	2.25 b	1.86 e	0.72	4.09E-04 b	0.07 c	7.90E-06	0.010 m	1.7E+04	1.5E+04
Trifluralin (Treflan)	8.1 b	5.32 b	5.23 d	1698	2.64E-05 b			0.11 m		
1,2,4-Trimethylbenzene	0.26	3.63	3.57	37	5.70E-03	0.075	7.10E-06			
1,3,5-Trimethylbenzene	50 c	3.42	2.91	8.2	7.70E-03	0.075	7.10E-06			

**APPENDIX B
CONTAMINANT-SPECIFIC PARAMETERS**

Chemical Name	Solubility (mg/L)	Log Kow	Log Koc	Kd for inorganics or Koc * f _{oc} for organics	HLC	Diffusivity in Air	Diffusivity in Water	Kp	Volatilization Factor Residential	Volatilization Factor Industrial
2,4,6-Trinitrotoluene	120 _n	1.60 _n	0.20 _n	0.016	4.90E-09 _n			0.0011 _m		
Vanadium				1000				0.0010 _l		
Vinyl Chloride	2760 _a	1.50 _a	1.27 _a	0.18	2.70E-02 _a	0.11 _a	1.23E-06	0.0073 _l	1.3E+03	1.2E+03
Xylene (mixed)	175 _c	3.17 _c	2.59 _e	3.9	5.71E-03 _c	0.08 _c	8.40E-06	0.080 _l	9.4E+03	8.6E+03
Zinc				62				0.0010 _l		

Footnotes

a=EPA's Soil Screening Guidance (May 1996)

b = Superfund Chemical Data Matrix <http://www.epa.gov/superfund/oerr/products/scdm/scdm.htm>

c= from EPA Region IX PRG list, 1996

d = calculated using nonionizing organic compound equation #70 from EPA's Soil Screening Guidance (May 1996)

e = calculated using equation for VOCs, chlorinated benzenes, and certain chlorinated pesticides [equation #71 from EPA's Soil Screening Guidance (May 1996)]

f = Table A-1 Water Solubility, Vapor Pressure, Henry's Law Constant, Koc, and Kow Dat: <http://www3.bae.ncsu.edu/info1/courses/bae573/models/gleams/www-docs/tabp2.txt>

g = ARS Pesticide Properties <http://www.arsusda.gov/rsm/ppdb3>

h = Table P-2 Characteristics of Pesticides sorted by Common Name

i = calculated using equation #68 from EPA's Soil Screening Guidance: Technical Background Document (May 1996): $HLC = (VP)(M)/(S)$

j = Schwarzenbch et al., 1993 Properties of Some Organic Compounds <http://www.uc.edu/www/geology/org-cont/refer/propert.html>

k = HSDB Hazardous Substance Data Ban . Online search for specified chemicals. 1994

l = USEPA, Dermal Exposure Assessment Principles & Applications, EPA/600/8-9/0118, January 1992

m = Calculated Kp using equation from EPA's Dermal Exposure Assessment 1/92: $\log Kp = -2.72 + 0.71 \log kow - 0.0061 MW$

n = Agency for Toxic Substances and Disease Registry

o = EPA March93 451/R-93/001. Air/Superfund National Technical Guidance Study Series, Model for Estimating Air Emission Rates from Superfund Remedial Action

p = U.S. Army Biomedical Research & Development Laboratory; Technical Report 8901

q = EPA Region 9 PRG Tables, 2002

Notes:

Chemical/Physical Parameters not found for Eradicane, Hydrazine sulfate, nitrofurazone, phenylphenol, and phosphine

Solubility: the ability or tendency of one substance to blend uniformly with another

Kow: octanol-water partition coefficient

Koc: organic carbon normalized soil-water partition coefficient for organic compounds

Kd: soil-water partition coefficient for inorganic constituents

HLC: Henry's Law constant (atm-m³/mol)

H': Henry's Law constant (unitless)

APPENDIX C CONTAMINANT TOXICITY DATA

Chemical Name	Weight of Evidence CLASS	SFo (kg-day/mg)	SFi (kg-day/mg)	SFd (kg-day/mg)	RfDo (mg/kg-day)	RfDi (mg/kg-day)	RfDd (mg/kg-day)
Acenaphthene	NA				6.00E-02 i	6.00E-02 r	6.00E-02 r
Acenaphthylene	D						
Acetone	D				1.00E-01 i	1.00E-01 r	1.00E-01 r
Acetophenone					1.00E-01 i	5.71E-06 i	
Acrolein	C				2.00E-02 h	5.71E-06 c	2.00E-02 r
Acrylamide	B2	4.55E+00 i	4.55E+00 c	4.55E+00 r	2.00E-04 i	2.00E-04 r	2.00E-04 r
Acrylonitrile	B1	5.40E-01 i	2.38E-01 c	5.40E-01 r	1.00E-03 h	5.71E-04 c	1.00E-03 r
Alachlor (Lasso)	B2	8.05E-02 h	8.00E-02 r	8.05E-02 r	1.00E-02 i	1.00E-02 r	1.00E-02 r
Aldicarb (Temik)	D				1.00E-03 i	1.00E-03 r	1.00E-03 r
Aldrin	B2	1.70E+01 i	1.72E+01 r	1.70E+01 r	3.00E-05 i	3.00E-05 r	3.00E-05 r
Anthracene	D				3.00E-01 i	3.00E-01 r	3.00E-01 r
Antimony and compounds	D				4.00E-04 i		
Arsenic	A	1.50E+00 i	1.51E+01 c	1.50E+00 r	3.00E-04 i		
Atrazine	C	2.22E-01 h	2.22E-01 r	2.22E-01 r	3.50E-02 h	3.50E-02 r	3.50E-02 r
Barium	D				7.00E-02 i	1.43E-04 h	
Benzene	A	2.90E-02 i	2.90E-02 c	2.90E-02 r	3.00E-03 n	1.71E-03 n	3.00E-03 r
Benidine	A	2.30E+02 i	2.30E+02 r	2.30E+02 r	3.00E-03 i	3.00E-03 r	3.00E-03 r
Benzo(a)anthracene	B2	7.30E-01 n	3.10E-01 n	7.30E-01 r			
Benzo(b)fluoranthene	B2	7.30E-01 n	3.10E-01 n	7.30E-01 r			
Benzo(k)fluoranthene	B2	7.30E-02 n	3.10E-02 n	7.30E-02 r			
Benzo(a)pyrene	B2	7.30E+00 n	3.10E+00 n	7.30E+00 r			
Benzyl Chloride	B2	1.70E-01 i	1.70E-01 r	1.70E-01 r			
Beryllium	B1		8.40E+00 c		2.00E-03 i	5.71E-06 i	2.00E-03 r
Bis(2-chloroethyl)ether	B2	1.10E+00 i	1.16E+00 c	1.10E+00 r			
Bis(2-chloroisopropyl)ether	C	7.00E-02 h	3.50E-02 c	7.00E-02 r	4.00E-02 i	4.00E-02 r	4.00E-02 r
Bis(chloromethyl)ether	A	2.20E+02 i	2.17E+02 c	2.20E+02 r			
Bis(2-ethylhexyl)phthalate	B2	1.40E-02 i	1.40E-02 r	1.40E-02 r	2.00E-02 i	2.20E-02 r	2.20E-02 r
Bromacil	C				1.00E-01 e	1.00E-01 r	1.00E-01 r
Bromodichloromethane	B2	6.20E-02 i	6.20E-02 r	6.20E-02 r	2.00E-02 i	2.00E-02 r	2.00E-02 r
Bromoform	B2	7.90E-03 i	3.85E-03 c	7.90E-03 r	2.00E-02 i	2.00E-02 r	2.00E-02 r
Bromomethane	D				1.40E-03 i	1.43E-03 c	1.40E-03 r
n-Butylbenzene					1.00E-02 n	1.00E-02 n	1.00E-02 n
sec-Butylbenzene					1.00E-02 n	1.00E-02 n	1.00E-02 n
1,3-Butadiene	B2	9.80E-01 r	9.80E-01 c	9.80E-01 r			
Butyl Benzyl Phthalate	C				2.00E-01 i	2.00E-01 r	2.00E-01 r

APPENDIX C
CONTAMINANT TOXICITY DATA

Chemical Name	Weight of Evidence CLASS	SFo (kg-day/mg)	SFi (kg-day/mg)	SFd (kg-day/mg)	RfDo (mg/kg-day)	RfDi (mg/kg-day)	RfDd (mg/kg-day)
Cadmium	B1 (inhalation)		6.30E+00 c		5.00E-04 i		
Captan	B2	3.50E-03 h	3.50E-03 r	3.50E-03 r	1.30E-01 i	1.30E-01 r	1.30E-01 r
Carbaryl (Sevin)					1.00E-01 i	1.00E-01 r	1.00E-01 r
Carbazole	B2	2.00E-02 h	2.00E-02 r	2.00E-02 r			
Carbofuran (Furadan)					5.00E-03 i	5.00E-03 r	5.00E-03 r
Carbon Disulfide	NA				1.00E-01 i	2.00E-01 i	1.00E-01 r
Carbon Tetrachloride	B2	1.30E-01 i	5.25E-02 c	1.30E-01 r	7.00E-04 i	5.71E-04 n	7.00E-04 r
Chlordane	B2	3.50E-01 i	3.50E-01 c	3.50E-01 r	5.00E-04 i	2.29E-05 r	5.00E-04 r
Chlorobenzene	D				2.00E-02 i	5.71E-03 h	2.00E-02 r
Chloroform	B2	6.10E-03 i	8.05E-02 c	6.10E-03 r	1.00E-02 i	1.00E-02 r	1.00E-02 r
Chloromethane	C	1.30E-02 h	6.30E-03 c	1.30E-02 r			
Chlorpyrifos (Lorsban/Dursban)	D				3.00E-03 i	3.00E-03 r	3.00E-03 r
Chromium (trivalent)	D				1.00E+00 i		
Chromium (hexavalent)	A		4.20E+01 c		5.00E-03 i		
Chrysene	B2	7.30E-03 n	3.10E-03 n	7.30E-03 r			
Copper	D				3.71E-02 h		
Cyanazine (Bladex)	C	8.40E-01 h	8.40E-01 r	8.40E-01 r	2.00E-03 h	2.00E-03 r	2.00E-03 r
Cyanide (free)	D				2.00E-02 i		
Dacthal					1.00E-02 i	1.00E-02 r	1.00E-02 r
DDD	B2	2.40E-01 i	2.40E-01 r	2.40E-01 r			
DDE	B2	3.40E-01 i	3.40E-01 r	3.40E-01 r			
DDT	B2	3.40E-01 i	3.40E-01 c	3.40E-01 r	5.00E-04 i	5.00E-04 r	5.00E-04 r
Diazinon					9.00E-04 h	9.00E-04 r	9.00E-04 r
Dibenzo(a,h)anthracene	B2	7.30E+00 n	3.10E+00 n	7.30E+00 r			
Dibenzofuran					4.00E-03 n	4.00E-03 n	4.00E-03 n
1,4-Dibromobenzene					1.00E-02 i	1.00E-02 r	1.00E-02 r
Dibromochloromethane	C	8.40E-02 i	8.40E-02 r	8.40E-02 r	2.00E-02 i	2.00E-02 r	2.00E-02 r
1,2-Dichlorobenzene	D				9.00E-02 i	5.71E-02 c	9.00E-02 r
1,4-Dichlorobenzene	C	2.40E-02 h	2.40E-02 r	2.40E-02 r	2.00E-01 n	2.29E-01 c	2.29E-01 r
Dichlorodifluoromethane	D				2.00E-01 i	5.71E-02 h	2.00E-01 r
1,1-Dichloroethane	C				1.00E-01 h	1.43E-01 c	1.00E-01 r
1,2-Dichloroethane	B2	9.10E-02 i	9.10E-02 c	9.10E-02 r			
1,1-Dichloroethene	C	6.00E-01 i	1.75E-01 l	6.00E-01 r	9.00E-03 i	9.00E-03 r	9.00E-03 r
1,2-Dichloroethene (cis)	D				1.00E-02 h	1.00E-02 r	1.00E-02 r
1,2-Dichloroethene (trans)	D				2.00E-02 i	2.00E-02 r	2.00E-02 r

APPENDIX C CONTAMINANT TOXICITY DATA

Chemical Name	Weight of Evidence CLASS	SFo (kg-day/mg)	SFi (kg-day/mg)	SFd (kg-day/mg)	RfDo (mg/kg-day)	RfDi (mg/kg-day)	RfDd (mg/kg-day)
2,4-Dichlorophenol					3.00E-03 i	3.00E-03 r	3.00E-03 r
2,4-Dichlorophenoxyacetic acid (2,4-D)	D				1.00E-02 i	1.00E-02 r	1.00E-02 r
1,2-Dichloropropane	B2	6.80E-02 h	6.80E-02 r	6.80E-02 r	1.10E-03 r	1.10E-03 i	1.10E-03 r
1,3-Dichloropropene	B2	1.80E-01 h	1.30E-01 c	1.80E-01 r	3.00E-04 i	5.71E-03 c	3.00E-04 r
Dichlorvos	B2	2.90E-01 i	2.90E-01 r	2.90E-01 r	5.00E-04 i	1.43E-04 c	5.00E-04 r
Dieldrin	B2	1.60E+01 i	1.61E+01 c	1.60E+01 r	5.00E-05 i	5.00E-05 r	5.00E-05 r
Diethyl Phthalate	D				8.00E-01 i	8.00E-01 r	8.00E-01 r
2,4-Dimethylphenol					2.00E-02 i	2.00E-02 r	2.00E-02 r
2,4-Dinitrophenol					2.00E-03 i	2.00E-03 r	2.00E-03 r
2,4-Dinitrotoluene	B2	6.80E-01 i	6.80E-01 r	6.80E-01 r	2.00E-03 i	2.00E-03 r	2.00E-03 r
2,6-Dinitrotoluene	B2	6.80E-01 i	6.80E-01 r	6.80E-01 r	1.00E-03 h	1.00E-03 r	1.00E-03 r
Di-n-octyl Phthalate	NA				2.00E-02 h	2.00E-02 r	2.00E-02 r
1,4-Dioxane	B2	1.10E-02 i	1.10E-02 r	1.10E-02 r			
Diuron					2.00E-03 i2	2.00E-03 r	2.00E-03 r
Endosulfan					6.00E-03 i	6.00E-03 r	6.00E-03 r
Endrin	D				3.00E-04 i	3.00E-04 r	3.00E-04 r
EPTC (Ethyl-dithiopropylcarbamate, s-)					2.50E-02 i	2.50E-02 r	2.50E-02 r
Eradicane							
Ethylbenzene	D				1.00E-01 i	2.90E-01 c	1.00E-01 r
Ethylene dibromide	B2	8.50E+01 i	7.70E-01 c	8.50E+01 r	5.70E-05 r	5.70E-05 h	5.70E-05 r
Fluoranthene	D				4.00E-02 i	4.00E-02 r	4.00E-02 r
Fluorene	D				4.00E-02 i	4.00E-02 r	4.00E-02 r
Fonofos (Dyfonate)					2.00E-03 i	2.00E-03 r	2.00E-03 r
Formaldehyde	B1 (inhalation)		4.55E-02 c		1.50E-01 i		1.50E-01 r
Furan					1.00E-03 i	1.00E-03 r	1.00E-03 r
Glyphosate (Roundup)	D				1.00E-01 i	1.00E-01 r	1.00E-01 r
Heptachlor	B2	4.50E+00 i	4.55E+00 c	4.50E+00 r	5.00E-04 i	5.00E-04 r	5.00E-04 r
Heptachlor Epoxide	B2	9.10E+00 i	9.10E+00 c	9.10E+00 r	1.30E-05 i	1.30E-05 r	1.30E-05 r
Hexachlorobenzene	B2	1.60E+00 i	1.61E+00 c	1.60E+00 r	8.00E-04 i	8.00E-04 r	8.00E-04 r
Hexachlorobutadiene	C	7.80E-02 i	7.70E-02 c	7.80E-02 r	2.00E-04 h	2.00E-04 r	2.00E-04 r
Hexachloroethane	C	1.40E-02 i	1.40E-02 c	1.40E-02 r	1.00E-03 i	1.00E-03 r	1.00E-03 r
n-Hexane					6.00E-02 h	5.71E-02 c	6.00E-02 r
HMX					5.00E-02 i	5.00E-02 i	5.00E-02 r
Hydrazine	B2	3.00E+00 i	1.72E+01 c	3.00E+00 r			
Hydrazine sulfate	B2	3.00E+00 i	1.72E+01 c	3.00E+00 r			

**APPENDIX C
CONTAMINANT TOXICITY DATA**

Chemical Name	Weight of Evidence CLASS	SFo (kg-day/mg)	SFi (kg-day/mg)	SFd (kg-day/mg)	RfDo (mg/kg-day)	RfDi (mg/kg-day)	RfDd (mg/kg-day)
Indeno(1,2,3-cd)pyrene	B2	7.30E-01 n	3.10E-01 n	7.30E-01 r			
Kepone		1.80E+01 n	1.80E+01 r	1.80E+01 r			
Lead	B2						
Lindane	B2 - C	1.30E+00 h	1.30E+00 r	1.30E+00 r	3.00E-04 l	3.00E-04 r	3.00E-04 r
Malathion					2.00E-02 i	2.00E-02 r	2.00E-02 r
Manganese	D				4.67E-02 i	1.40E-05 c	4.67E-02 r
Mercury	D				3.00E-04 h	8.57E-05 c	3.00E-04 r
Methoxychlor	D				5.00E-03 i	5.00E-03 r	5.00E-03 r
Methylene Chloride	B2	7.50E-03 i	1.65E-03 c	7.50E-03 r	6.00E-02 i	8.57E-01 c	6.00E-02 r
Methyl Ethyl Ketone	D				6.00E-01 i	2.86E-01 c	6.00E-01 r
Methyl Isobutyl Ketone					8.00E-02 h	2.29E-02 c	8.00E-02 r
2-Methylphenol					5.00E-02 i	5.00E-02 i	5.00E-02 l
3-Methylphenol					5.00E-02 i	5.00E-02 i	5.00E-02 i
4-Methylphenol					5.00E-03 h	5.00E-03 h	5.00E-03 h
Methyl Tertbutyl Ether					5.00E-02 n	8.57E-01 c	5.00E-02 r
Metolachlor (Dual)	C				1.50E-01 i	1.50E-01 r	1.50E-01 r
Metribuzin (Sencor)	D				2.50E-02 i	2.50E-02 r	2.50E-02 r
Naphthalene	D				2.00E-02 i	8.57E-04 i	2.00E-02 r
Nickel	D				2.00E-02 i		
Nitrobenzene	D				5.00E-04 i	5.71E-04 c	5.00E-04 r
Nitrofurazone	B2	1.50E+00 h	9.40E+00 h	1.50E+00 r			
Nitroguanidine					1.00E-01 i	1.00E-01 r	1.00E-01 r
2-Nitropropane	B2	9.40E+00 r	9.40E+00 c	9.40E+00 r	5.71E-03 r	5.71E-03 c	5.71E-03 r
Oxamyl					2.50E-02 i	2.50E-02 r	2.50E-02 r
Paraquat	C				4.50E-03 i	4.50E-03 r	4.50E-03 r
Parathion	C				6.00E-03 h	6.00E-03 r	6.00E-03 r
PCBs (Polychlorinated Biphenyl)	B2	2.00E+00 i	2.00E+00 r	2.00E+00 r			
Pendimethalin (Prowl)					4.00E-02 i	4.00E-02 r	4.00E-02 r
Pentachlorophenol	B2	1.20E-01 i	1.20E-01 r	1.20E-01 r	3.00E-02 i	3.00E-02 r	3.00E-02 r
Permethrin (Ambush)					5.00E-02 i	5.00E-02 r	5.00E-02 r
Phenanthrene	D						
Phenol	D				6.00E-01 l	6.00E-01 r	6.00E-01 r
Phenylphenol	C	1.94E-03 h	1.90E-03 r	1.94E-03 r			
Phosphine					3.00E-04 i	8.57E-05 c	3.00E-04 r
Profluralin					6.00E-03 h	6.00E-03 r	6.00E-03 r

**APPENDIX C
CONTAMINANT TOXICITY DATA**

Chemical Name	Weight of Evidence CLASS	SFo (kg-day/mg)	SFi (kg-day/mg)	SFd (kg-day/mg)	RfDo (mg/kg-day)	RfDi (mg/kg-day)	RfDd (mg/kg-day)
Propachlor (Ramros)	D				1.30E-02 i	1.30E-02 r	1.30E-02 r
Propazine (Miloguard)					2.00E-02 i	2.00E-02 r	2.00E-02 r
n-Propylbenzene					1.00E-02 n	1.00E-02 n	1.00E-02 n
Pyrene	D				3.00E-02 i	3.00E-02 r	3.00E-02 r
Pyridine					1.00E-03 i	1.00E-03 r	1.00E-03 r
RDX		1.10E-01 i	1.10E-01 i	1.10E-01 r	3.00E-03 i	3.00E-03 i	3.00E-03 r
Selenium	D				5.00E-03 i		
Silver	D				5.00E-03 i		
Simazine (Princap)	C	1.20E-01 h	1.20E-01 r	1.20E-01 r	5.00E-03 i	5.00E-03 r	5.00E-03 r
Styrene	C				2.00E-01 i	2.90E-01 c	2.00E-01 r
2,4,5-T as Acid	D				1.00E-02 i	1.00E-02 r	1.00E-02 r
2,3,7,8-TCDD (Dioxin)	B2	1.50E+05 h	1.50E+05 h	1.50E+05 r			
Terbacil (Sinbar)					1.30E-02 i	1.30E-02 r	1.30E-02 r
Terbufos (Counter)					2.50E-05 h	2.50E-05 r	2.50E-05 r
1,1,1,2-Tetrachloroethane	C	2.60E-02 i	2.59E-02 c	2.60E-02 r	3.00E-02 i	3.00E-02 r	3.00E-02 r
1,1,2,2-Tetrachloroethane	C	2.00E-01 i	2.03E-01 c	2.00E-01 r			
Tetrachloroethene (PCE)	C-B2	5.20E-02 n	2.03E-03 n	5.20E-02 r	1.00E-02 i	1.14E-01 n	1.00E-02 r
2,3,4,6-Tetrachlorophenol					3.00E-02 i	3.00E-02 r	3.00E-02 r
Tetryl					1.00E-02 h	1.00E-02 r	1.00E-02 r
Toluene	D				2.00E-01 i	1.10E-01 c	2.00E-01 r
TPH GRO					6.00E-02 h	5.71E-02 c	6.00E-02 r
TPH DRO					3.00E-02 i	3.00E-02 r	3.00E-02 r
Toxaphene	B2	1.10E+00 i	1.12E+00 c	1.10E+00 r			
2,4,5-TP (Silvex)	D				8.00E-03 i	8.00E-03 r	8.00E-03 r
1,2,4-Trichlorobenzene	D				1.00E-02 i	5.70E-02 c	1.00E-02 r
1,1,1-Trichloroethane	D				3.50E-02 n	2.86E-01 n	3.50E-02 r
1,1,2-Trichloroethane	C	5.70E-02 i	5.60E-02 c	5.70E-02 r	4.00E-03 i	4.00E-03 r	4.00E-03 r
Trichloroethene (TCE) (see note below)	B2	1.10E-02 n	6.00E-03 n	1.10E-02 r			
2,4,5-Trichlorophenol					1.00E-01 i	1.00E-01 r	1.00E-01 r
2,4,6-Trichlorophenol	B2	1.10E-02 i	1.09E-02 c	1.10E-02 r			
2(2,4,5-Trichlorophenoxy)propionic acid	D				8.00E-03 i	8.00E-03 r	8.00E-03 r
1,2,3-Trichloropropane	B2	7.00E+00 h	7.00E+00 r	7.00E+00 r	6.00E-03 i	6.00E-03 r	6.00E-03 r
Triflualine (Treflan)	C	7.70E-03 i	7.70E-03 r	7.70E-03 r	7.50E-03 i	7.50E-03 r	7.50E-03 r
1,2,4-Trimethylbenzene					5.00E-02 i	1.70E-03 i	5.00E-02 r
1,3,5-Trimethylbenzene					5.00E-02 i	1.70E-03 i	5.00E-02 r

APPENDIX C CONTAMINANT TOXICITY DATA

Chemical Name	Weight of Evidence CLASS	SFo (kg-day/mg)	SFi (kg-day/mg)	SFd (kg-day/mg)	RfDo (mg/kg-day)	RfDi (mg/kg-day)	RfDd (mg/kg-day)
2,4,6-Trinitrotoluene		3.00E-02 i	3.00E-02 i	3.00E-02 r	5.00E-04 i	5.00E-04 i	5.00E-04 r
Vanadium					7.00E-03 h		
Vinyl Chloride	A	1.90E+00 h	3.00E-01 c	1.90E+00 r			
Xylene (mixed)	D				2.00E+00 i		2.00E+00 r
Zinc	D				3.00E-01 i		
SFo = oral slope factor							
SFi = inhalation slope factor							
SFd = dermal slope factor							
RfDo = oral reference dose							
RfDi = inhalation reference dose							
RfDd = dermal reference dose							
i = Integrated Risk Information System (IRIS), EPA, 1997							
i2 = Integrated Risk Information System (IRIS), EPA, 2002							
h = Health Effects Assessment Summary Tables (HEAST), EPA, 1997							
n = National Center for Environmental Assessment (NCEA, formerly ECAO)							
r = Route to Route Extrapolation							
c = Calculated from Inhalation RfC or Unit Risk							
e = other EPA resources as approved by KDHE							
Weight of Evidence Groups: A is Human Carcinogen; B is Probable Human Carcinogen (B1-limited evidence of carcinogenicity in humans, B2 sufficient evidence of carcinogenicity in animals with inadequate or lack of evidence in humans); C is Possible Human Carcinogen;							
D is Not Classifiable as to Human Carcinogenicity.							
Toxicity values are not available for acenaphthylene, eradicane, or phenanthrene							
At the time of the printing of this document, EPA was reevaluating the toxicity of TCE. Upon completion of EPA's evaluation, the reference doses and slope factors of TCE will change accordingly.							



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What's New in 2004

October 20, 2004

The Region 9 Preliminary Remediation Goals (PRG) Table has been updated. It is available at: <http://www.epa.gov/region09/waste/sfund/prg/index.html>

Most people will want to print out a copy of this "What's New" file to serve as a cover letter to the PRG Table. For those of you who are new to the PRG Table or want additional background information, we recommend that you read the recently revised [PRG Users Guide](#) (PDF, 30 pp., 346 KB, [About PDF](#)).

With this update to the [PRG Table](#) (PDF, 15 pp., 81 KB, [About PDF](#)), we announce a new hierarchy of human health toxicity values that replaces earlier guidance. This is important because human health toxicity values known as cancer slope factors (SF) or non-cancer reference doses (RfDs) form the basis of the PRG values listed in the table.

As noted in OSWER Directive 9285.7-53 (dated December 5, 2003), the updated EPA hierarchy is as follows:

- Tier 1 - EPA's Integrated IRIS,
- Tier 2 - EPA's Provisional Peer Reviewed Toxicity Values (PPRTVs)
- Tier 3 - Includes additional EPA sources (e.g., historic HEAST and NCEA provisional values) and non-EPA sources of toxicity information (e.g., California EPA toxicity values).

Updates for individual chemicals have been highlighted in bold in the Table. Changes are typically due to revisions to toxicity values but could also reflect a change in CAS number or physical chemical data. For your convenience, chemicals that have been revised or added are also listed here: acetone; acrolein; acrylonitrile (California State value); allyl chloride; aminodinitrotoluene; arsenic (California State value); benzene; 1,1-biphenyl; bromate; 1,3-butadiene (both EPA and California State); chloroform; chloromethane (methyl chloride); cyclohexane; dibenzofuran; 1,2-dibromochloropropane (DBCP); 1,2 dibromoethane (EDB); 1,2-dichlorobenzene; 1,3-dichlorobenzene; 1,3-dichloropropane; diisopropyl ether; 3,3'-dimethylbenzidine; 4,6-dinitro-o-cresol; epichlorohydrin (California State value); ethylbenzene; ethylene diamine; formic acid; n-hexane; p-hydroquinone; lead; malononitrile; methyl ethyl ketone (2-butanone); methyl isobutyl ketone; methyl tertbutyl ether (MTBE); 2-nitroaniline; 3-nitroaniline; 4-nitroaniline; n-nitrosodimethylamine; n-nitrosodiphenylamine; m-nitrotoluene; o-nitrotoluene; p-nitrotoluene; phenol; o-phenylenediamine; naphthalene (California State value); 1,1'-sulfonylbis (4-chlorobenzene); tetrachloroethylene (PCE); tributyl phosphate; 1,2,4-trichlorobenzene; trichloroethylene (California State value); 1,1,2-trichloropropane; 1,2,3-trichloropropene; triphenylphosphine oxide; tris(2-chloroethyl) phosphate; tris(2-ethylhexyl) phosphate; and xylenes.

You may notice there are two rows for trichloroethylene (TCE), one reflecting the California EPA value (1990) and the other reflecting the more recent, but draft NCEA value (EPA 2001). Region 9 has shown both on this Table, rather than choosing one over the other, to give Table users as much information as possible in the absence of a final EPA toxicity value. It is anticipated that there may be interim guidance provided in the future on how best to address TCE at contaminated sites so please stay tuned.

The Table provides a convenient source of human health toxicity values and other risk assessment information used by EPA and other agencies. However, it is always best to check the original sources

to verify that the numbers and information are correct because the use of the Region 9 PRG Table ultimately becomes the responsibility of the user.

If you find an error please contact Stan Smucker via e-mail at smucker.stan@epa.gov.

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**USERS' GUIDE AND BACKGROUND TECHNICAL DOCUMENT
FOR
USEPA REGION 9'S PRELIMINARY REMEDIATION GOALS (PRG) TABLE**

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DISCLAIMER

Preliminary remediation goals (PRGs) focus on common exposure pathways and may not consider all exposure pathways encountered at CERCLA / RCRA sites (Exhibit 1-1). PRGs do not consider impact to groundwater or address ecological concerns. The PRG Table is specifically not intended as a (1) stand-alone decision-making tool, (2) as a substitute for EPA guidance for preparing baseline risk assessments, (3) a rule to determine if a waste is hazardous under RCRA, or (4) set of final cleanup or action levels to be applied at contaminated sites.

The guidance set out in this document is not final Agency action. It is not intended, nor can it be relied upon to create any rights enforceable by any party in litigation with the United States. EPA officials may decide to follow the guidance provided herein, or act at variance with the guidance, based on an analysis of specific circumstances. The Agency also reserves the right to change this guidance at any time without public notice.

1.0 INTRODUCTION

Region 9 Preliminary Remediation Goals (PRGs) are risk-based tools for evaluating and cleaning up contaminated sites. They are being used to streamline and standardize all stages of the risk decision-making process.

The Region 9 PRG Table combines current human health toxicity values with standard exposure factors to estimate contaminant concentrations in environmental media (soil, air, and water) that are considered by the Agency to be health protective of human exposures (including sensitive groups), over a lifetime. Chemical concentrations above these levels would not automatically designate a site as "dirty" or trigger a response action. However, exceeding a PRG suggests that further evaluation of the potential risks that may be posed by site contaminants is appropriate. Further evaluation may include additional sampling, consideration of ambient levels in the environment, or a reassessment of the assumptions contained in these screening-level estimates (e.g. appropriateness of route-to-route extrapolations, appropriateness of using chronic toxicity values to evaluate childhood exposures, appropriateness of generic exposure factors for a specific site etc.).

The risk-based concentrations presented in the Table may be used as screening goals or initial cleanup goals if applicable. Generally a screening goal is intended to provide health protection without knowledge of the specific exposure conditions at a site. PRGs may also be used as initial cleanup goals when the exposure assumptions based on site-specific data match up with the default exposure assumptions in the PRG Table. When considering PRGs as cleanup goals, it is EPA's preference to assume maximum beneficial use of a property (that is, residential use) unless a non-residential number (for example, industrial soil PRG) can be justified.

Before applying PRGs at a particular site, the Table user should consider whether the exposure pathways and exposure scenarios at the site are fully accounted for in the PRG calculations. Region 9 PRG concentrations are based on direct contact pathways for which generally accepted methods, models, and assumptions have been developed (i.e. ingestion, dermal contact, and inhalation) for specific land-use conditions and do not consider impact to groundwater or ecological receptors (see Developing a Conceptual Site Model below).

**EXHIBIT 1-1
TYPICAL EXPOSURE PATHWAYS BY MEDIUM
FOR RESIDENTIAL AND INDUSTRIAL LAND USES^a**

EXPOSURE PATHWAYS, ASSUMING:		
MEDIUM	RESIDENTIAL LAND USE	INDUSTRIAL LAND USE
Ground Water	<i>Ingestion from drinking</i>	Ingestion from drinking
	<i>Inhalation of volatiles</i>	Inhalation of volatiles
	Dermal absorption from bathing	Dermal absorption
Surface Water	<i>Ingestion from drinking</i>	Ingestion from drinking
	<i>Inhalation of volatiles</i>	Inhalation of volatiles
	Dermal absorption from bathing	Dermal absorption
	Ingestion during swimming	
	Ingestion of contaminated fish	
Soil	<i>Ingestion</i>	<i>Ingestion</i>
	<i>Inhalation of particulates</i>	<i>Inhalation of particulates</i>
	<i>Inhalation of volatiles</i>	<i>Inhalation of volatiles</i>
	Exposure to indoor air from soil gas	Exposure to indoor air from soil gas
	Exposure to ground water contaminated by soil leachate	Exposure to ground water contaminated by soil leachate
	Ingestion via plant, meat, or dairy products	Inhalation of particulates from trucks and heavy equipment
	<i>Dermal absorption</i>	<i>Dermal absorption</i>

Footnote:

^aExposure pathways considered in the PRG calculations are indicated in boldface italics.

2.0 READING THE PRG TABLE

2.1 General Considerations

With the exceptions described below, PRGs are chemical concentrations that correspond to fixed levels of risk (i.e. either a one-in-one million [10^{-6}] cancer risk or a noncarcinogenic hazard quotient of 1) in soil, air, and water. In most cases, where a substance causes both cancer and noncancer (systemic) effects, the 10^{-6} cancer risk will result in a more stringent criteria and consequently this value is presented in the printed copy of the Table. PRG concentrations that equate to a 10^{-6} cancer risk are indicated by "ca". PRG concentrations that equate to a hazard quotient of 1 for noncarcinogenic concerns are indicated by "nc".

If the risk-based concentrations are to be used for site screening, it is recommended that both cancer and noncancer-based PRGs be used. Both carcinogenic and noncarcinogenic values may be obtained at the Region 9 PRG homepage at:

<http://www.epa.gov/region09/waste/sfund/prg/>

It has come to my attention that some users have been multiplying the cancer PRG concentrations by 10 or 100 to set "action levels" for triggering remediation or to set less stringent cleanup levels for a specific site after considering non-risk-based factors such as ambient levels, detection limits, or technological feasibility. This risk management practice recognizes that there may be a range of values that may be "acceptable" for carcinogenic risk (EPA's risk management range is one-in-a-million [10^{-6}] to one-in-ten thousand [10^{-4}]). However, this practice could lead one to overlook serious noncancer health threats and it is strongly recommended that the user consult with a toxicologist or regional risk assessor before doing this. For carcinogens, I have indicated by asterisk ("ca*") in the PRG Table where the noncancer PRGs would be exceeded if the cancer value that is displayed is multiplied by 100. Two stars ("ca**") indicate that the noncancer values would be exceeded if the cancer PRG were multiplied by 10. There is no range of "acceptable" noncarcinogenic "risk" so that under no circumstances should noncancer PRGs be multiplied by 10 or 100, when setting final cleanup criteria. In the rare case where noncancer PRGs are more stringent than cancer PRGs set at one-in-one-million risk, a similar approach has been applied (e.g. "nc**").

In general, PRG concentrations in the printed Table are risk-based but for soil there are two important exceptions: (1) for several volatile chemicals, PRGs are based on the soil saturation equation ("sat") and (2) for relatively less toxic inorganic and semivolatile contaminants, a non-risk based "ceiling limit" concentration is given as 10^{+5} mg/kg ("max"). At the Region 9 PRG website, the risk-based calculations for these same chemicals are also available in the "InterCalc Tables" if the user wants to view the risk-based concentrations prior to the application of "sat" or "max". For more information on why the "sat" value and not a risk-based value is presented for several volatile chemicals in the PRG Table, please see the discussion in Section 4.6.

With respect to applying a "ceiling limit" for chemicals other than volatiles, it is recognized that

this is not a universally accepted approach. Some within the agency argue that all values should be risk-based to allow for scaling (for example, if the risk-based PRG is set at a hazard quotient = 1.0, and the user would like to set the hazard quotient to 0.1 to take into account multiple chemicals, then this is as simple as multiplying the risk-based PRG by 1/10th). If scaling is necessary, PRG users can do this simply by referring to the "InterCalc Tables" at our website where risk-based soil concentrations are presented for all chemicals (see soil calculations, "combined" pathways column).

In spite of the fact that applying a ceiling limit is not a universally accepted approach, we have opted to continue applying a "max" soil concentration to the PRG Table for the following reasons:

- Risk-based PRGs for some chemicals in soil exceed unity (>1,000,000 mg/kg) which is not possible.
- The ceiling limit of 10^{+5} mg/kg is equivalent to a chemical representing 10% by weight of the soil sample. At this contaminant concentration (and higher), the assumptions for soil contact may be violated (for example, soil adherence and windborne dispersion assumptions) due to the presence of the foreign substance itself.
- PRGs currently do not address short-term exposures (e.g. pica children and construction workers). Although extremely high soil PRGs are likely to represent relatively non-toxic chemicals, such high values may not be justified if in fact more toxicological data were available for evaluating short-term and/or acute exposures.

In addition to Region 9 PRG values, the PRG Table also includes California EPA PRGs ("CAL-Modified PRGs") for specific chemicals where CAL-EPA screening values may deviate significantly from the federal values (see Section 2.4) and EPA OSWER soil screening levels (SSLs) for protection of groundwater (see Section 2.5).

2.2 Toxicity Values

Hierarchy of Toxicity Values

There is a new hierarchy of human health toxicity values that replaces earlier guidance. This is important because human toxicity values known as cancer slope factors (SF) or non-cancer reference doses (RfDs) form the basis of the PRG values listed in the table. As noted in OSWER Directive 9285.7-53 (dated December 5, 2003), the updated EPA hierarchy is as follows: Tier 1 - EPA's Integrated IRIS, Tier 2 - EPA's Provisional Peer Reviewed Toxicity Values (PPRTVs), and Tier 3 - Other Toxicity Values. Tier 3 includes additional EPA sources (e.g. historic HEAST and NCEA provisional values) and non-EPA sources of toxicity information (e.g. California EPA toxicity values).

The PRG Table lists Tier 1 toxicity values from IRIS as "i" and Tier 2 toxicity values known as PPRTVs as "p". Tier 3 toxicity values were obtained from various sources including California EPA databases "c", historic HEAST tables "h" and NCEA provisional values "n".

Inhalation Conversion Factors

As of January 1991, IRIS and NCEA databases no longer present RfDs or SFs for the inhalation route. These criteria have been replaced with reference concentrations (RfC) for noncarcinogenic effects and unit risk factors (URF) for carcinogenic effects. However, for purposes of estimating risk and calculating risk-based concentrations, inhalation reference doses (RfDi) and inhalation slope factors (SF_i) are preferred. This is not a problem for most chemicals because the inhalation toxicity criteria are easily converted. To calculate an RfDi from an RfC, the following equation and assumptions may be used for most chemicals:

$$\text{RfDi} \frac{\text{mg}}{(\text{kg} \cdot \text{day})} = \text{RfC} (\text{mg} / \text{m}^3) \times \frac{20\text{m}^3}{\text{day}} \times \frac{1}{70\text{kg}}$$

Likewise, to calculate an SF_i from an inhalation URF, the following equation and assumptions may be used:

$$\text{SF}_i \frac{(\text{kg} \cdot \text{day})}{(\text{mg})} = \text{URF} (\text{m}^3 / \text{ug}) \times \frac{\text{day}}{20\text{m}^3} \times 70\text{kg} \times \frac{10^3 \text{ug}}{\text{mg}}$$

Route-to-Route Methods

Route-to-route extrapolations ("r") were frequently used when there were no toxicity values available for a given route of exposure. Oral cancer slope factors ("SF_o") and reference doses ("RfD_o") were used for both oral and inhaled exposures for organic compounds lacking inhalation values. Inhalation slope factors ("SF_i") and inhalation reference doses ("RfD_i") were used for both inhaled and oral exposures for organic compounds lacking oral values. Route extrapolations were not performed for inorganics due to portal of entry effects and known differences in absorption efficiency for the two routes of exposure.

An additional route extrapolation is the use of oral toxicity values for evaluating dermal exposures. In general, dermal toxicity values are not listed in EPA databases and consequently must be estimated from oral toxicity information. However, a scientifically defensible data base often does not exist for making an adjustment to the oral slope factor/RfD so that the oral toxicity value is often applied without adjustment to estimate a dermal toxicity value. For more information please refer to recent Agency guidance (USEPA 2004) entitled *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment)* available on the web at:
<http://www.epa.gov/superfund/programs/risk/ragse/index.htm>

Please note that whenever route-extrapolated values are used to calculate risk-based PRGs, additional uncertainties are introduced in the calculation.

2.3 PRGs Derived with Special Considerations

Most of the Region 9 PRGs are readily derived by referring to Equations 4-1 thru 4-8 contained in this "User's Guide/Technical Background Document" to the Region 9 PRGs. However, there are some chemicals for which the standard equations do not apply and/or adjustments to the toxicity values are recommended. These special case chemicals are discussed below.

Cadmium The PRGs for Cadmium are based on the oral RfD for water which is slightly more conservative (by a factor of 2) than the RfD for food. Because the PRGs are considered screening values, we elected to use the more conservative RfD for cadmium. However, reasonable arguments could be made for applying an RfD for food (instead of the oral RfD for water) for some media such as soils.

The water RfD for cadmium assumes a 5% oral absorption factor. The assumption of an oral absorption efficiency of 5% for Cadmium leads to an estimated dermal RfD of 2.5E-05. The PRG calculations incorporate these adjustments per recent guidance (USEPA 2004).

Chromium 6 For Chromium 6 (Cr6), IRIS shows an air unit risk of 1.2E-2 per (ug/cu.m) or expressed as an inhalation cancer slope factor (adjusting for inhalation/body weight) of 42 (mg/kg-day)⁻¹. However, the supporting documentation in the IRIS file states that these toxicity values are based on an assumed 1:6 ratio of Cr6:Cr3. Because of this assumption, we in Region 9 prefer to present PRGs based on these cancer toxicity values as "total chromium" numbers.

In the PRG Table, we also include a Cr6 specific value (assuming 100% Cr6) that is derived by multiplying the "total chromium" value by 7, yielding a cancer potency factor of 290 (mg/kg-day)⁻¹. This is considered to be an overly conservative assumption by some within the Agency. However, this calculation is also consistent with the State of California's interpretation of the Mancuso study that forms the basis of Cr6's toxicity values.

If you are working on a project outside of California (and outside of Region 9), you may want to contact the appropriate regulatory officials to determine what their position is on this issue. As mentioned, Region 9 also includes PRGs for "total chromium" which is based on the same ratio (1:6 ratio Cr6:Cr3) that forms the basis of the cancer slope factor of 42 (mg/kg-day)⁻¹ presented in IRIS.

Dioxin Dioxins, furans, and some polychlorinated biphenyls are members of the same family and exhibit similar toxicological properties. Before using the dioxin PRG at an individual site, these dioxin-related compounds must be summed together. However, they differ in the degree of toxicity so that a toxicity equivalence factor (TEF) must first be applied to adjust the measured concentrations to a toxicity equivalent concentration. EPA Region 9 has adopted the 1997 World Health Organization (WHO) TEFs. For more on this, please refer to the following article (in Environmental Health Perspectives, Vol. 6, No. 12, Dec. 1998) online at: <http://ehp.niehs.nih.gov/members/1998/106p775-792vandenberg/vandenberg-full.html>

Lead Residential PRGs for Lead (Region 9 EPA and California EPA) are derived based on pharmacokinetic models. Both EPA's Integrated Exposure Uptake Biokinetic (IEUBK) Model and California's LeadSpread model are designed to predict the probable blood lead concentrations for children between six months and seven years of age who have been exposed to lead through various sources (air, water, soil, dust, diet and *in utero* contributions from the mother). Run in the reverse, these models also allow the user to calculate lead PRGs that are considered "acceptable" by EPA or the State of California.

EPA uses a second Adult Lead Model to estimate PRGs for an industrial setting. This PRG is intended to protect a fetus that may be carried by a pregnant female worker. It is assumed that a cleanup goal that is protective of a fetus will also afford protection for male or female adult workers. The model equations were developed to calculate cleanup goals such that there would be no more than a 5% probability that fetuses exposed to lead would exceed a blood lead (PbB) of 10 $\mu\text{g/dL}$. An updated screening level for soil lead at commercial/industrial (i.e., non-residential) sites of 800 ppm is based on a recent analysis of the combined phases of NHANES III that chooses a cleanup goal protective of all subpopulations.

For more information on EPA's lead models and other lead-related topics, please go to:

<http://www.epa.gov/oerrpage/superfund/programs/lead/>

For more information on California's LeadSpread Model and Cal-Modified PRGs for lead, please go to:

<http://www.dtsc.ca.gov/ScienceTechnology/ledspred.html>

Manganese The IRIS RfD (0.14 mg/kg-day) includes manganese from all sources, including diet. The author of the IRIS assessment for manganese recommends that the dietary contribution from the normal U.S. diet (an upper limit of 5 mg/day) be subtracted when evaluating non-food (e.g. drinking water or soil) exposures to manganese, leading to a RfD of 0.071 mg/kg-day for non-food items. The explanatory text in IRIS further recommends using a modifying factor of 3 when calculating risks associated with non-food sources due to a number of uncertainties that are discussed in the IRIS file for manganese, leading to a RfD of 0.024 mg/kg-day. This modified RfD is applied in the derivation of the Region 9 PRGs for soil and water. For more information regarding the Manganese RfD, you may want to contact Dr. Bob Benson at (303) 312-7070.

Nitrates/Nitrites Tap water PRGs for Nitrates/Nitrites are based on the MCL as there is no available RfD for these compounds. For more information, please see IRIS at:

<http://www.epa.gov/iriswebp/iris/index.html>

Thallium IRIS has many values for the different salts of thallium. However, our analytical data packages typically report "thallium". Therefore, as a practical matter it makes more sense to report a PRG for plain thallium. We have done this by making the adjustment contained in the IRIS file for thallium sulfate based on the molecular weight of the thallium in the thallium salt. The adjusted oral RfD for plain thallium is 6.6 E-05 mg/kg-day which we use to calculate a thallium PRG.

Vinyl Chloride In EPA's recent reassessment of vinyl chloride toxicity, IRIS presents two cancer slope factors for vinyl chloride (VC): one that is intended to be applied towards evaluating adult risks and a second more protective slope factor that takes into account the unique susceptibility of developing infants and young children. For residential PRGs, the Region 9 PRG Table applies the more conservative cancer potency factor that addresses exposures to both children and adults whereas for the industrial soils PRG, the adult only cancer slope factor is applied.

Because of the age-dependent vulnerability associated with vinyl chloride exposures, and due to the method that is applied in deriving the cancer slope factor for VC, an assumption of a 70 year exposure over the lifetime is assumed, consistent with the way that the toxicity value for VC was derived. Therefore, instead of the usual exposure assumption of 6 years as a child and 24 years as an adult that is assumed for carcinogenic substances, we have revised the exposure assumption for VC to 6 years as a child and 64 years as adult. Since most of the cancer risk is associated with the first 30 years of exposure to VC, there is actually little difference between a 30 year exposure assumption (typically assumed for Superfund risk assessments) and the 70 year exposure assumption that is assumed in calculating the PRG for VC.

2.4 Cal-Modified PRGs

When EPA Region 9 first came out with a Draft of the PRG Table in 1992, there was concern expressed by California EPA's Department of Toxic Substances and Control (DTSC) that for some chemicals, the risk-based concentrations that are calculated using Cal-EPA toxicity values are "significantly" more protective than the risk-based concentrations that are calculated using EPA toxicity values. Because the risk-based PRGs are order-of-magnitude estimates at best, it was agreed by both Agencies that a difference of approximately 4 or greater would be regarded as a significant difference. For chemicals with California and EPA values that differ by a factor of 4 or more, both the EPA PRGs and the "Cal-Modified PRGs" are listed in the Table.

Please note that in the State of California, Cal-Modified PRGs should be used as screening levels for contaminated sites if they are more stringent than the Federal numbers.

2.5 Soil Screening Levels

Generic, soil screening levels (SSLs) for the protection of groundwater have been included in the PRG Table for 100 of the most common contaminants at Superfund sites. Generic SSLs are derived using default values in standardized equations presented in EPA OSWER's *Soil Screening Guidance* series, available on the web at <http://www.epa.gov/superfund/resources/soil/index.htm>.

The SSLs were developed using a default dilution-attenuation factor (DAF) of 20 to account for natural processes that reduce contaminant concentrations in the subsurface. Also included are generic SSLs that assume no dilution or attenuation between the source and the receptor well (i.e., a DAF of 1). These values can be used at sites where little or no dilution or attenuation of soil leachate concentrations is expected at a site (e.g., sites with shallow water tables, fractured media, karst topography, or source size greater than 30 acres).

In general, if an SSL is not exceeded for the migration to groundwater pathway, the user may eliminate this pathway from further investigation.

It should be noted that in the State of California, the California Regional Water Quality Control Board has derived "California SSLs" for a number of pathways including migration to groundwater. These are not included in the Region 9 PRG Table, but may be accessed at the following website:

<http://www.swrcb.ca.gov/rwqcb2/rbsl.htm>

Or, for more information on the "California SSLs", please contact Dr Roger Brewer at: (510) 622-2374.

2.6 Miscellaneous

Volatile organic compounds (VOCs) are indicated by "y" in the VOC column of the Table and in general, are defined as those chemicals having a Henry's Law constant greater than 10^{-5} (atm-m³/mol) and a molecular weight less than 200 g/mole). Three borderline chemicals (dibromochloromethane, 1,2-dibromochloropropane, and pyrene) which do not strictly meet these criteria of volatility have also been included based upon discussions with other state and federal agencies and after a consideration of vapor pressure characteristics etc. Volatile organic chemicals are evaluated for potential volatilization from soil/water to air using volatilization factors (see Section 4.4).

Chemical-specific dermal absorption values for contaminants in soil and dust are presented for arsenic, cadmium, chlordane, 2,4-D, DDT, lindane, TCDD, PAHs, PCBs, and pentachlorophenols as recommended in the *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim Guidance* (USEPA 2004). Otherwise, default skin absorption fractions are assumed to be 0.10 for nonvolatile organics. Please note that previous defaults of 0.01 and 0.10 for inorganics and VOCs respectively, have been withdrawn per new guidance.

3.0 USE OF PRGS AT SITES

The decision to use PRGs at a site will be driven by the potential benefits of having generic risk-based concentrations in the absence of site-specific risk assessments. The original intended use of PRGs was to provide initial cleanup goals for individual chemicals given specific medium and land-use combinations (see RAGS Part B, 1991), however risk-based concentrations have several applications. They can also be used for:

- Setting health-based detection limits for chemicals of potential concern
- Screening sites to determine whether further evaluation is appropriate
- Calculating cumulative risks associated with multiple contaminants

A few basic procedures are recommended for using PRGs properly. These are briefly described below. Potential problems with the use of PRGs are also identified.

3.1 Conceptual Site Model

The primary condition for use of PRGs is that exposure pathways of concern and conditions at the site match those taken into account by the PRG framework. Thus, it is always necessary to develop a conceptual site model (CSM) to identify likely contaminant source areas, exposure pathways, and potential receptors. This information can be used to determine the applicability of PRGs at the site and the need for additional information. For those pathways not covered by PRGs, a risk assessment specific to these additional pathways may be necessary. Nonetheless, the PRG lookup values will still be useful in such situations for focusing further investigative efforts on the exposure pathways not addressed.

To develop a site-specific CSM, perform an extensive records search and compile existing data (e.g. available site sampling data, historical records, aerial photographs, and hydrogeologic information). Once this information is obtained, CSM worksheets such as those provided in ASTM's *Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites* (1995) can be used to tailor the generic worksheet model to a site-specific CSM. The final CSM diagram represents linkages among contaminant sources, release mechanisms, exposure pathways and routes and receptors. It summarizes our understanding of the contamination problem.

As a final check, the CSM should answer the following questions:

- Are there potential ecological concerns?
- Is there potential for land use other than those covered by the PRGs (that is, residential and industrial)?
- Are there other likely human exposure pathways that were not considered in development of the PRGs (e.g. impact to groundwater, local fish consumption, raising beef, dairy, or other livestock)?
- Are there unusual site conditions (e.g. large areas of contamination, high fugitive dust levels, potential for indoor air contamination)?

If any of these four conditions exist, the PRG may need to be adjusted to reflect this new information. Suggested websites for the evaluation of pathways not currently addressed by Region 9 PRG's are presented in Exhibit 3-1.

EXHIBIT 3-1
SUGGESTED WEBSITES FOR EVALUATING EXPOSURE
PATHWAYS NOT CURRENTLY ADDRESSED BY REGION 9 PRGs

EXPOSURE PATHWAY	WEBSITE
Migration of contaminants to an underlying potable aquifer	EPA Soil Screening Guidance: http://www.epa.gov/superfund/resources/soil/index.htm California Water Board Guidance: http://www.swrcb.ca.gov/rwqcb2/rbsl.htm
Ingestion via plant uptake	EPA Soil Screening Guidance: http://www.epa.gov/superfund/resources/soil/index.htm EPA Fertilizer Risk Assessment: http://www.epa.gov/epaoswer/hazwaste/recycle/fertiliz/risk/
Ingestion via meat, dairy products, human milk	EPA Protocol for Combustion Facilities: http://www.epa.gov/epaoswer/hazwaste/combust/riskvol.htm#volume1 California "Hot Spots" Risk Guidelines: http://www.oehha.ca.gov/air/hot_spots/HRSguide.html
Inhalation of volatiles that have migrated into basements or other enclosed spaces.	EPA's draft Subsurface Vapor Intrusion Guidance: http://www.epa.gov/correctiveaction/eis/vapor.htm EPA's Version of Johnson & Ettinger Model: http://www.epa.gov/oerrpage/superfund/programs/risk/airmodel/johnson_ettinger.htm
Ecological pathways	EPA Ecological Soil Screening Guidance: http://www.epa.gov/superfund/programs/risk/ecorisk/ecossl.htm NOAA Sediment Screening Table: http://response.restoration.noaa.gov/cpr/sediment/squirt/squirt.html

3.2 Background Levels Evaluation

A necessary step in determining the applicability of Region 9 risk-based PRGs is the consideration of background contaminant concentrations. There is new EPA guidance on determining background at sites. *Guidance for Characterizing Background Chemicals in Soil at Superfund Sites* (USEPA 2001b) is available on the web at:
<http://www.epa.gov/superfund/programs/risk/background.pdf>.

EPA may be concerned with two types of background at sites: naturally occurring and

anthropogenic. Natural background is usually limited to metals whereas anthropogenic (i.e. human-made) "background" includes both organic and inorganic contaminants. Before embarking on an extensive sampling and analysis program to determine local background concentrations in the area, one should first compile existing data on the subject. Far too often there is pertinent information in the literature that gets ignored, resulting in needless expenditures of time and money.

Generally EPA does not clean up below natural background. In some cases, the predictive risk-based models generate PRG concentrations that lie within or even below typical background concentrations for the same element or compound. If natural background concentrations are higher than the risk-based PRG concentrations, then background concentrations should also be considered in determining whether further evaluation and/or remediation is necessary at a particular site. Exhibit 3-2 presents summary statistics for selected elements in soils that have background levels that may exceed risk-based PRGs.

Where anthropogenic "background" levels exceed PRGs and EPA has determined that a response action is necessary and feasible, EPA's goal will be to develop a comprehensive response to the widespread contamination. This will often require coordination with different authorities that have jurisdiction over the sources of contamination in the area.

**EXHIBIT 3-2
BACKGROUND CONCENTRATIONS OF SELECTED ELEMENTS IN SOILS**

TRACE ELEMENT	U.S. STUDY DATA ¹			CALIFORNIA DATA ²		
	Range	GeoMean	ArMean	Range	GeoMean	ArMean
Arsenic	<1-97	5.2 mg/kg	7.2 mg/kg	0.59-11	2.75 mg/kg	3.54 mg/kg
Beryllium	<1-15	0.63 "	0.92 "	0.10-2.7	1.14 "	1.28 "
Cadmium	<1-10	--	<1	0.05-1.7	0.26	0.36
Chromium	1-2000	37	54	23-1579	76.25	122.08
Nickel	<5-700	13	19	9.0-509	35.75	56.60

¹Shacklette and Hansford, "Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States", USGS Professional Paper 1270, 1984.

²Bradford et. al, "Background Concentrations of Trace and Major Elements in California Soils", Kearney Foundation Special Report, UC-Riverside and CAL-EPA DTSC, March 1996.

3.3 Screening Sites with Multiple Pollutants

A suggested stepwise approach for PRG-screening of sites with multiple pollutants is as follows:

- Perform an extensive records search and compile existing data.

- Identify site contaminants in the PRG Table. Record the PRG concentrations for various media and note whether PRG is based on cancer risk (indicated by "ca") or noncancer hazard (indicated by "nc"). Segregate cancer PRGs from non-cancer PRGs and exclude (but don't eliminate) non-risk based PRGs ("sat" or "max").
- For cancer risk estimates, take the site-specific concentration (maximum or 95 UCL) and divide by the PRG concentrations that are designated for cancer evaluation ("ca"). Multiply this ratio by 10^{-6} to estimate chemical-specific risk for a reasonable maximum exposure (RME). For multiple pollutants, simply add the risk for each chemical:

$$Risk = \left[\left(\frac{conc_x}{PRG_x} \right) + \left(\frac{conc_y}{PRG_y} \right) + \left(\frac{conc_z}{PRG_z} \right) \right] \times 10^{-6}$$

- For non-cancer hazard estimates. Divide the concentration term by its respective non-cancer PRG designated as "nc" and sum the ratios for multiple contaminants. The cumulative ratio represents a non-carcinogenic hazard index (HI). A hazard index of 1 or less is generally considered "safe". A ratio greater than 1 suggests further evaluation. [Note that carcinogens may also have an associated non-cancer PRG that is not listed in the PRG Table. To obtain these values, the user should view or download the InterCalc Tables at the PRG website and display the appropriate sections.]

$$Hazard\ Index = \left[\left(\frac{conc_x}{PRG_x} \right) + \left(\frac{conc_y}{PRG_y} \right) + \left(\frac{conc_z}{PRG_z} \right) \right]$$

For more information on screening site risks, the reader should contact EPA Region 9's Technical Support Section.

3.4 Potential Problems

As with any risk-based tool, the potential exists for misapplication. In most cases the root cause will be a lack of understanding of the intended use of Region 9 PRGs. In order to prevent misuse of PRGs, the following should be avoided:

- Applying PRGs to a site without adequately developing a conceptual site model that identifies relevant exposure pathways and exposure scenarios,
- Not considering background concentrations when choosing PRGs as cleanup goals,
- Use of PRGs as cleanup levels without the nine-criteria analysis specified in the National Contingency Plan (or, comparable analysis for programs outside of Superfund),
- Use of PRGs as cleanup levels without verifying numbers with a toxicologist or regional risk assessor,

- Use of antiquated PRG Tables that have been superseded by more recent publications,
- Not considering the effects of additivity when screening multiple chemicals, and
- Adjusting PRGs upward by factors of 10 or 100 without consulting a toxicologist or regional risk assessor.

4.0 TECHNICAL SUPPORT DOCUMENTATION

Region 9 PRGs consider human exposure hazards to chemicals from contact with contaminated soils, air, and water. The emphasis of the PRG equations and technical discussion are aimed at developing screening criteria for soils, since this is an area where few standards exist. For air and water, additional reference concentrations or standards are available for many chemicals (e.g. MCLs, non-zero MCLGs, AWQC, and NAAQS) and consequently the discussion of these media are brief.

4.1 Ambient Air and the Vapor Intrusion Pathway

The ambient air PRG is applicable to both indoor and outdoors and is based on a residential exposure scenario using standard Superfund exposure factors (see Exhibit 4-1 below).

The air PRG may also be used as a health-protective indoor air target for determining soil gas and groundwater screening levels for the evaluation of the subsurface vapor intrusion pathway. The “vapor intrusion pathway” refers to the migration of volatile chemicals from the subsurface into overlying buildings. Volatile chemicals in buried wastes and/or contaminated groundwater can emit vapors that may migrate through subsurface soils and into indoor air spaces of overlying buildings in ways similar to that of radon gas seeping into homes.

To derive a soil gas and/or groundwater screening level that targets the air PRG, it is necessary to divide the air PRG by an appropriate attenuation factor. The attenuation factor represents the factor by which subsurface vapor concentrations migrating into indoor air spaces are reduced due to diffusive, advective, and/or other attenuating mechanisms. The attenuation factor can be empirically determined and/or calculated using an appropriate vapor intrusion model such as the Johnson and Ettinger model available at:

http://www.epa.gov/oerrpage/superfund/programs/risk/airmodel/johnson_ettinger.htm . Once the appropriate attenuation factor is determined, the following equation can be used to derive a screening level that would be protective of indoor air assuming residential land use.

For Soil Gas, the relationship is as follows:

$$C_{\text{soil-gas}} [\text{ug}/\text{m}^3] = \text{Air PRG} [\text{ug}/\text{m}^3] / \text{AF}$$

where

$C_{\text{soil-gas}}$ = soil gas screening level

AF = attenuation factor (ratio of indoor air concentration to soil gas concentration)

For Groundwater, the relationship is as follows:

$$C_{gw}[\text{ug/L}] = \text{Air PRG} [\text{ug/m}^3] \times 10^{-3} \text{ m}^3/\text{L} \times 1/H \times 1/AF$$

where

C_{gw} = groundwater screening level

H = dimensionless Henry's Law Constant at 25C [(mg/L - vapor)/(mg/L - water)]

AF = attenuation factor (ratio of indoor air concentration to soil gas concentration)

For more information on EPA's current understanding of this emerging exposure pathway, please refer to EPA's recent draft guidance *Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance)* (USEPA 2002) available on the web at:

<http://www.epa.gov/correctiveaction/eis/vapor.htm>

4.2 Soils - Direct Ingestion

Calculation of risk-based PRGs for direct ingestion of soil is based on methods presented in RAGS HHEM, Part B (USEPA 1991a) and *Soil Screening Guidance* (USEPA 1996a,b, USEPA 2001a). Briefly, these methods backcalculate a soil concentration level from a target risk (for carcinogens) or hazard quotient (for noncarcinogens).

Residential Soil PRGs

A number of studies have shown that inadvertent ingestion of soil is common among children 6 years old and younger (Calabrese et al. 1989, Davis et al. 1990, Van Wijnen et al. 1990). To take into account the higher soil intake rate for children, two different approaches are used to estimate PRGs, depending on whether the adverse health effect is cancer or some effect other than cancer.

For carcinogens, the method for calculating PRGs uses an age-adjusted soil ingestion factor that takes into account the difference in daily soil ingestion rates, body weights, and exposure duration for children from 1 to 6 years old and others from 7 to 31 years old. This health-protective approach is chosen to take into account the higher daily rates of soil ingestion in children as well as the longer duration of exposure that is anticipated for a long-term resident. For more on this method, see USEPA RAGs Part B (1991a).

For noncarcinogenic concerns, the more protective method of calculating a soil PRG is to evaluate childhood exposures separately from adult exposures. In other words, an age-adjustment factor is not applied as was done for carcinogens. This approach is considered conservative because it combines the higher 6-year exposure for children with chronic toxicity criteria. In their analysis of the method, the Science Advisory Board (SAB) indicated that, for most chemicals, the approach may be overly protective. However, they noted that there are specific instances when the chronic RfD may be based on endpoints of toxicity that are specific to children (e.g. fluoride and nitrates) or when the dose-response is steep (i.e., the dosage difference between the no-observed-adverse-effects level [NOAEL] and an adverse effects level is small). Thus, for the purposes of screening, EPA Region 9 has adopted this approach for calculating soil PRGs for noncarcinogenic health concerns.

Industrial Soil PRGs

In the *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites* (Supplemental SSL Guidance, EPA 2001a), two different soil ingestion rates are assumed for non-construction workers: 100 mg/day is assumed for outdoor workers whereas 50 mg/day is assumed for indoor workers. The default value of 100 mg/day for outdoor workers is also recommended by EPA's Technical Review Workgroup for Lead (TRW), and it reflects increased exposures to soils for outdoor workers relative to their indoor counterparts. For more on this, please see the Supplemental SSL Guidance available at the following website:

<http://www.epa.gov/superfund/resources/soil/index.htm>

Because the Region 9 PRGs are generic and intended for screening sites early in the investigation process (often before site-specific information is available), we have chosen to use the 100 mg/day soil ingestion (i.e. outdoor worker) assumption to calculate industrial soil PRGs. The appropriateness of this assumption for a particular site may be evaluated when additional information becomes available regarding site conditions or site development.

4.3 Soils - Dermal Contact

Dermal Contact Assumptions

Exposure factors for dermal contact with soil are based on recommendations in *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim Guidance* (USEPA 2004). Recommended RME (reasonable maximum exposure) defaults for adult workers' skin surface areas (3300 cm²/day) and soil adherence factors (0.2 mg/cm²) now differ from the defaults recommended for adult residents (5700 cm²/day, 0.07 mg/cm²) as noted in Exhibit 4-1. This is due to differences in the range of activities experienced by workers versus residents.

Dermal Absorption

Chemical-specific skin absorption values recommended by the Superfund Dermal Workgroup were applied when available. Chemical-specific values are included for the following chemicals: arsenic, cadmium, chlordane, 2,4-D, DDT, lindane, TCDD, PAHs, PCBs, and pentachlorophenols.

The *Supplemental Guidance for Dermal Risk Assessment* (USEPA 2004) recommends a default dermal absorption factor for semivolatile organic compounds of 10% as a screening method for the majority of SVOCs without dermal absorption factors. Default dermal absorption values for other chemicals (VOCs and inorganics) are not recommended in this new guidance. Therefore, the assumption of 1% for inorganics and 10% for volatiles is no longer included in the PRG Table. This change has minimal impact on the final risk-based calculations because human exposure to VOCs and inorganics in soils is generally driven by other pathways of exposure.

4.4 Soils - Vapor and Particulate Inhalation

Agency toxicity criteria indicate that risks from exposure to some chemicals via inhalation far outweigh the risk via ingestion; therefore soil PRGs have been designed to address this pathway

as well. The models used to calculate PRGs for inhalation of volatiles/particulates are based on updates to risk assessment methods presented in RAGS Part B (USEPA 1991a) and are identical to the *Soil Screening Guidance: User's Guide and Technical Background Document* (USEPA 1996a,b).

It should be noted that the soil-to-air pathway that is evaluated in the PRGs calculations is based on inhalation exposures that result from the volatilization or particulate emissions of chemicals from soil to outdoor air. **The soil PRG calculations do not evaluate potential for volatile contaminants in soil to migrate indoors. For more on the subsurface vapor intrusion pathway please see Section 4.1.**

To address the soil-to-outdoor air pathways, the PRG calculations incorporate volatilization factors (VF_s) for volatile contaminants and particulate emission factors (PEF) for nonvolatile contaminants. These factors relate soil contaminant concentrations to air contaminant concentrations that may be inhaled on-site. The VF_s and PEF equations can be broken into two separate models: an emission model to estimate emissions of the contaminant from the soil and a dispersion model to simulate the dispersion of the contaminant in the atmosphere.

The box model in RAGS Part B has been replaced with a dispersion term (Q/C) derived from a modeling exercise using meteorological data from 29 locations across the United States because the box model may not be applicable to a broad range of site types and meteorology and does not utilize state-of-the-art techniques developed for regulatory dispersion modeling. The dispersion model for both volatiles and particulates is the AREA-ST, an updated version of the Office of Air Quality Planning and Standards, Industrial Source Complex Model, ISC2. However, different Q/C terms are used in the VF_s and PEF equations. Los Angeles was selected as the 90th percentile data set for volatiles and Minneapolis was selected as the 90th percentile data set for fugitive dusts (USEPA 1996 a,b). A default source size of 0.5 acres was chosen for the PRG calculations. This is consistent with the default exposure area over which Region 9 typically averages contaminant concentrations in soils. If unusual site conditions exist such that the area source is substantially larger than the default source size assumed here, an alternative Q/C could be applied (see USEPA 1996a,b).

Volatilization Factor for Soils

Volatile chemicals, defined as those chemicals having a Henry's Law constant greater than 10^{-5} (atm-m³/mol) and a molecular weight less than 200 g/mole, were screened for inhalation exposures using a volatilization factor for soils (VF_s). Please note that VF_s 's and other physical-chemical data for VOCs are contained in the InterCalc Tables at the EPA Region 9 PRG website.

The emission terms used in the VF_s are chemical-specific and were calculated from physical-chemical information obtained from several sources. The priority of these sources were as follows: *Soil Screening Guidance* (USEPA 1996a,b), *Superfund Chemical Data Matrix* (USEPA 1996c), *Fate and Exposure Data* (Howard 1991), *Subsurface Contamination Reference Guide* (EPA 1990a), and *Superfund Exposure Assessment Manual* (SEAM, EPA 1988). When there was a choice between a measured or a modeled value (e.g. Koc), our default was to use modeled values. In those cases where Diffusivity Coefficients (Di) were not provided in existing literature, Di 's were calculated using Fuller's Method described in SEAM. A surrogate term was required for some chemicals that lacked physico-chemical information. In these cases, a proxy chemical of similar structure was used that may over- or under-estimate the PRG for soils.

Equation 4-9 forms the basis for deriving generic soil PRGs for the inhalation pathway. The following parameters in the standardized equation can be replaced with specific site data to develop a simple site-specific PRG

- Source area
- Average soil moisture content
- Average fraction organic carbon content
- Dry soil bulk density

The basic principle of the VF_s model (Henry's law) is applicable only if the soil contaminant concentration is at or below soil saturation "sat". Above the soil saturation limit, the model cannot predict an accurate VF-based PRG. How these particular cases are handled, depends on whether the contaminant is liquid or solid at ambient soil temperatures (see Section 4.6).

Particulate Emission Factor for Soils

Inhalation of chemicals adsorbed to respirable particles (PM_{10}) were assessed using a default PEF equal to $1.316 \times 10^9 \text{ m}^3/\text{kg}$ that relates the contaminant concentration in soil with the concentration of respirable particles in the air due to fugitive dust emissions from contaminated soils. The generic PEF was derived using default values in Equation 4-11, which corresponds to a receptor point concentration of approximately $0.76 \text{ ug}/\text{m}^3$. The relationship is derived by Cowherd (1985) for a rapid assessment procedure applicable to a typical hazardous waste site where the surface contamination provides a relatively continuous and constant potential for emission over an extended period of time (e.g. years). This represents an annual average emission rate based on wind erosion that should be compared with chronic health criteria; it is not appropriate for evaluating the potential for more acute exposures.

The impact of the PEF on the resultant PRG concentration (that combines soil exposure pathways for ingestion, skin contact, and inhalation) can be assessed by accessing the Region 9 PRG website and viewing the pathway-specific soil concentrations listed in the InterCalc Tables. Equation 4-11 forms the basis for deriving a generic PEF for the inhalation pathway. For more details regarding specific parameters used in the PEF model, the reader is referred to *Soil Screening Guidance: Technical Background Document* (USEPA 1996a).

Note: the generic PEF evaluates windborne emissions and does not consider dust emissions from traffic or other forms of mechanical disturbance that could lead to greater emissions than assumed here.

4.5 Soils - Migration to Groundwater

The methodology for calculating SSLs for the migration to groundwater was developed to identify chemical concentrations in soil that have the potential to contaminate groundwater. Migration of contaminants from soil to groundwater can be envisioned as a two-stage process: (1) release of contaminant in soil leachate and (2) transport of the contaminant through the underlying soil and aquifer to a receptor well. The SSL methodology considers both of these fate and transport mechanisms.

SSLs are backcalculated from acceptable ground water concentrations (i.e. nonzero MCLGs, MCLs, or risk-based PRGs). First, the acceptable groundwater concentration is multiplied by a

dilution factor to obtain a target leachate concentration. For example, if the dilution factor is 10 and the acceptable ground water concentration is 0.05 mg/L, the target soil leachate concentration would be 0.5 mg/L. The partition equation (presented in the *Soil Screening Guidance* document) is then used to calculate the total soil concentration (i.e. SSL) corresponding to this soil leachate concentration.

The SSL methodology was designed for use during the early stages of a site evaluation when information about subsurface conditions may be limited. Because of this constraint, the methodology is based on conservative, simplifying assumptions about the release and transport of contaminants in the subsurface. For more on SSLs, and how to calculate site-specific SSLs versus generic SSLs presented in the PRG Table, the reader is referred to the *Soil Screening Guidance* document (USEPA 1996a,b).

4.6 Soil Saturation Limit

The soil saturation concentration “sat” corresponds to the contaminant concentration in soil at which the absorptive limits of the soil particles, the solubility limits of the soil pore water, and saturation of soil pore air have been reached. Above this concentration, the soil contaminant may be present in free phase, i.e., nonaqueous phase liquids (NAPLs) for contaminants that are liquid at ambient soil temperatures and pure solid phases for compounds that are solid at ambient soil temperatures.

Equation 4-10 is used to calculate “sat” for each volatile contaminant. As an update to RAGS HHEM, Part B (USEPA 1991a), this equation takes into account the amount of contaminant that is in the vapor phase in soil in addition to the amount dissolved in the soil’s pore water and sorbed to soil particles.

Chemical-specific “sat” concentrations must be compared with each VF-based PRG because a basic principle of the PRG volatilization model is not applicable when free-phase contaminants are present. How these cases are handled depends on whether the contaminant is liquid or solid at ambient temperatures. Liquid contaminant that have a VF-based PRG that exceeds the “sat” concentration are set equal to “sat” whereas for solids (e.g., PAHs), soil screening decisions are based on the appropriate PRGs for other pathways of concern at the site (e.g., ingestion).

4.7 Tap Water - Ingestion and Inhalation

Calculation of PRGs for ingestion and inhalation of contaminants in domestic water is based on the methodology presented in RAGS HHEM, Part B (USEPA 1991a). Ingestion of drinking water is an appropriate pathway for all chemicals. For the purposes of this guidance, however, inhalation of volatile chemicals from water is considered routinely only for chemicals with a Henry’s Law constant of 1×10^{-5} atm-m³/mole or greater and with a molecular weight of less than 200 g/mole.

For volatile chemicals, an upperbound volatilization constant (VF_w) is used that is based on all uses of household water (e.g. showering, laundering, and dish washing). Certain assumptions were made. For example, it is assumed that the volume of water used in a residence for a family of four is 720 L/day, the volume of the dwelling is 150,000 L and the air exchange rate is 0.25 air changes/hour (Andelman in RAGS Part B). Furthermore, it is assumed that the average transfer efficiency weighted by water use is 50 percent (i.e. half of the concentration of each

chemical in water will be transferred into air by all water uses). Note: the range of transfer efficiencies extends from 30% for toilets to 90% for dishwashers.

4.8 Default Exposure Factors

Default exposure factors were obtained primarily from RAGS Supplemental Guidance Standard Default *Exposure Factors* (OSWER Directive, 9285.6-03) dated March 25, 1991 and more recent information from U.S. EPA's Office of Solid Waste and Emergency Response, U.S. EPA's Office of Research and Development, and California EPA's Department of Toxic Substances Control (see Exhibit 4-1).

Because contact rates may be different for children and adults, carcinogenic risks during the first 30 years of life were calculated using age-adjusted factors ("adj"). Use of age-adjusted factors are especially important for soil ingestion exposures, which are higher during childhood and decrease with age. However, for purposes of combining exposures across pathways, additional age-adjusted factors are used for inhalation and dermal exposures. These factors approximate the integrated exposure from birth until age 30 combining contact rates, body weights, and exposure durations for two age groups - small children and adults. Age-adjusted factors were obtained from RAGS PART B or developed by analogy (see derivations next page).

For soils only, noncarcinogenic contaminants are evaluated in children separately from adults. No age-adjustment factor is used in this case. The focus on children is considered protective of the higher daily intake rates of soil by children and their lower body weight. For maintaining consistency when evaluating soils, dermal and inhalation exposures are also based on childhood contact rates.

- (1) ingestion([mg-yr]/[kg-d]):

$$IFS_{adj} = \frac{ED_c \times IRS_c}{BW_c} + \frac{(ED_r - ED_c) \times IRS_a}{BW_a}$$

- (2) skin contact([mg-yr]/[kg-d]):

$$SFS_{adj} = \frac{ED_c \times AF \times SA_c}{BW_c} + \frac{(ED_r - ED_c) \times AF \times SA_a}{BW_a}$$

- (3) inhalation ([m³-yr]/[kg-d]):

$$InhF_{adj} = \frac{ED_c \times IRA_c}{BW_c} + \frac{(ED_r - ED_c) \times IRA_a}{BW_a}$$

EXHIBIT 4-1 STANDARD DEFAULT FACTORS

<u>Symbol</u>	<u>Definition (units)</u>	<u>Default</u>	<u>Reference</u>
CSFo	Cancer slope factor oral (mg/kg-d)-1	--	IRIS, PPRTV, HEAST, NCEA, or California
CSFi	Cancer slope factor inhaled (mg/kg-d)-1	--	IRIS, PPRTV, HEAST, NCEA, or California
RfDo	Reference dose oral (mg/kg-d)	--	IRIS, PPRTV, HEAST, NCEA, or California
RfDi	Reference dose inhaled (mg/kg-d)	--	IRIS, PPRTV, HEAST, NCEA, or California
TR	Target cancer risk	10 ⁻⁶	--
THQ	Target hazard quotient	1	--
BWa	Body weight, adult (kg)	70	RAGS (Part A), EPA 1989 (EPA/540/1-89/002)
BWc	Body weight, child (kg)	15	Exposure Factors, EPA 1991 (OSWER No. 9285.6-03)
ATc	Averaging time - carcinogens (days)	25550	RAGS(Part A), EPA 1989 (EPA/540/1-89/002)
ATn	Averaging time - noncarcinogens (days)	ED*365	
SAa	Exposed surface area for soil/dust (cm ² /day)		Dermal Assessment, EPA 2004 (EPA/540/R-99/005)
	– adult resident	5700	
	– adult worker	3300	
SAc	Exposed surface area, child in soil (cm ² /day)	2800	Dermal Assessment, EPA 2004 (EPA/540/R-99/005)
AFa	Adherence factor, soils (mg/cm ²)		Dermal Assessment, EPA 2004 (EPA/540/R-99/005)
	– adult resident	0.07	
	– adult worker	0.2	
AFc	Adherence factor, child (mg/cm ²)	0.2	Dermal Assessment, EPA 2004 (EPA/540/R-99/005)
ABS	Skin absorption defaults (unitless):		
	– semi-volatile organics	0.1	Dermal Assessment, EPA 2004 (EPA/540/R-99/005)
	– volatile organics	--	Dermal Assessment, EPA 2004 (EPA/540/R-99/005)
	– inorganics	--	Dermal Assessment, EPA 2004 (EPA/540/R-99/005)
IRAA	Inhalation rate - adult (m ³ /day)	20	Exposure Factors, EPA 1991 (OSWER No. 9285.6-03)
IRAc	Inhalation rate - child (m ³ /day)	10	Exposure Factors, EPA 1997 (EPA/600/P-95/002Fa)
IRWva	Drinking water ingestion - adult (L/day)	2	RAGS(Part A), EPA 1989 (EPA/540/1-89/002)
IRWc	Drinking water ingestion - child (L/day)	1	PEA, Cal-EPA (DTSC, 1994)
IRSa	Soil ingestion - adult (mg/day)	100	Exposure Factors, EPA 1991 (OSWER No. 9285.6-03)
IRSc	Soil ingestion - child (mg/day)	200	Exposure Factors, EPA 1991 (OSWER No. 9285.6-03)
IRSo	Soil ingestion - occupational (mg/day)	100	Soil Screening Guidance (EPA 2001a)
EFr	Exposure frequency - residential (d/y)	350	Exposure Factors, EPA 1991 (OSWER No. 9285.6-03)
EFO	Exposure frequency - occupational (d/y)	250	Exposure Factors, EPA 1991 (OSWER No. 9285.6-03)
EDr	Exposure duration - residential (years)	30 ^a	Exposure Factors, EPA 1991 (OSWER No. 9285.6-03)
EDc	Exposure duration - child (years)	6	Exposure Factors, EPA 1991 (OSWER No. 9285.6-03)
EDo	Exposure duration - occupational (years)	25	Exposure Factors, EPA 1991 (OSWER No. 9285.6-03)
	Age-adjusted factors for carcinogens:		
IFSadj	Ingestion factor, soils ([mg-yr]/[kg-d])	114	RAGS(Part B), EPA 1991 (OSWER No. 9285.7-01B)
SFSadj	Dermal factor, soils ([mg-yr]/[kg-d])	361	By analogy to RAGS (Part B)
InhFadj	Inhalation factor, air ([m ³ -yr]/[kg-d])	11	By analogy to RAGS (Part B)
IFWadj	Ingestion factor, water ([L-yr]/[kg-d])	1.1	By analogy to RAGS (Part B)
VFw	Volatilization factor for water (L/m ³)	0.5	RAGS(Part B), EPA 1991 (OSWER No. 9285.7-01B)
PEF	Particulate emission factor (m ³ /kg)	See below	Soil Screening Guidance (EPA 1996a,b)
VFsoil	Volatilization factor for soil (m ³ /kg)	See below	Soil Screening Guidance (EPA 1996a,b)
sat	Soil saturation concentration (mg/kg)	See below	Soil Screening Guidance (EPA 1996a,b)

Footnote:

^aExposure duration for lifetime residents is assumed to be 30 years total. For carcinogens, exposures are combined for children (6 years) and adults (24 years).

4.9 Standardized Equations

The equations used to calculate the PRGs for carcinogenic and noncarcinogenic contaminants are presented in Equations 4-1 through 4-8. The PRG equations update RAGS Part B equations. The methodology backcalculates a soil, air, or water concentration level from a target risk (for carcinogens) or hazard quotient (for noncarcinogens). For completeness, the soil equations combine risks from ingestion, skin contact, and inhalation simultaneously. **Note: the InterCalc Tables available at the EPA Region 9 PRG website also includes pathway-specific concentrations, should the user decide against combining specific exposure pathways; or, the user wants to identify the relative contribution of each pathway to exposure.**

To calculate PRGs for volatile chemicals in soil, a chemical-specific volatilization factor is calculated per Equation 4-9. Because of its reliance on Henry's law, the VF_s model is applicable only when the contaminant concentration in soil is at or below saturation (i.e. there is no free-phase contaminant present). Soil saturation ("sat") corresponds to the contaminant concentration in soil at which the adsorptive limits of the soil particles and the solubility limits of the available soil moisture have been reached. Above this point, pure liquid-phase contaminant is expected in the soil. If the PRG calculated using VF_s was greater than the calculated sat, the PRG was set equal to sat, in accordance with *Soil Screening Guidance* (USEPA 1996 a,b). The equation for deriving sat is presented in Equation 4-10.

PRG EQUATIONS

Soil Equations: For soils, equations were based on three exposure routes (ingestion, skin contact, and inhalation).

Equation 4-1: Combined Exposures to Carcinogenic Contaminants in Residential Soil

$$C(\text{mg/kg}) = \frac{TR \times AT_c}{EF_r \left[\left(\frac{IFS_{adj} \times CSF_o}{10^6 \text{mg/kg}} \right) + \left(\frac{SFS_{adj} \times ABS \times CSF_o}{10^6 \text{mg/kg}} \right) + \left(\frac{InhF_{adj} \times CSF_i}{VF_s^a} \right) \right]}$$

Equation 4-2: Combined Exposures to Noncarcinogenic Contaminants in Residential Soil

$$C(\text{mg/kg}) = \frac{THQ \times BW_c \times AT_n}{EF_r \times ED_c \left[\left(\frac{1}{RfD_o} \times \frac{IRS_c}{10^6 \text{mg/kg}} \right) + \left(\frac{1}{RfD_o} \times \frac{SA_c \times AF \times ABS}{10^6 \text{mg/kg}} \right) + \left(\frac{1}{RfD_i} \times \frac{IRA_c}{VF_s^a} \right) \right]}$$

Equation 4-3: Combined Exposures to Carcinogenic Contaminants in Industrial Soil

$$C(\text{mg/kg}) = \frac{TR \times BW_a \times AT_c}{EF_o \times ED_o \left[\left(\frac{IRS_o \times CSF_o}{10^6 \text{mg/kg}} \right) + \left(\frac{SA_a \times AF \times ABS \times CSF_o}{10^6 \text{mg/kg}} \right) + \left(\frac{IRA_a \times CSF_i}{VF_s^a} \right) \right]}$$

Footnote:

^aUse VF_s for volatile chemicals (defined as having a Henry's Law Constant [atm-m³/mol] greater than 10⁻⁵ and a molecular weight less than 200 grams/mol) or PEF for non-volatile chemicals.

Equation 4-4: Combined Exposures to Noncarcinogenic Contaminants in Industrial Soil

$$C(\text{mg/kg}) = \frac{THQ \times BW_a \times AT_n}{EF_o \times ED_o \left[\left(\frac{1}{RfD_o} \times \frac{IRS_o}{10^6 \text{mg/kg}} \right) + \left(\frac{1}{RfD_o} \times \frac{SA_a \times AF \times ABS}{10^6 \text{mg/kg}} \right) + \left(\frac{1}{RfD_i} \times \frac{IRA_a}{VF_s^a} \right) \right]}$$

Tap Water Equations:

Equation 4-5: Ingestion and Inhalation Exposures to Carcinogenic Contaminants in Water

$$C(\text{ug/L}) = \frac{TR \times AT_c \times 1000 \text{ug/mg}}{EF_r \left[(IFW_{adj} \times CSF_o) + (VF_w \times InhF_{adj} \times CSF_i) \right]}$$

Equation 4-6: Ingestion and Inhalation Exposures to Noncarcinogenic Contaminants in Water

$$C(\text{ug/L}) = \frac{THQ \times BW_a \times AT_n \times 1000 \text{ug/mg}}{EF_r \times ED_r \left[\left(\frac{IRW_a}{RfD_o} \right) + \left(\frac{VF_w \times IRA_a}{RfD_i} \right) \right]}$$

Air Equations:

Equation 4-7: Inhalation Exposures to Carcinogenic Contaminants in Air

$$C(\text{ug/m}^3) = \frac{TR \times AT_c \times 1000 \text{ug/mg}}{EF_r \times InhF_{adj} \times CSF_i}$$

Equation 4-8: Inhalation Exposures to Noncarcinogenic Contaminants in Air

$$C(\text{ug/m}^3) = \frac{THQ \times RfD_i \times BW_a \times AT_n \times 1000 \text{ug/mg}}{EF_r \times ED_r \times IRA_a}$$

Footnote:

^aUse VF_s for volatile chemicals (defined as having a Henry's Law Constant [atm-m³/mol] greater than 10⁻⁵ and a molecular weight less than 200 grams/mol) or PEF for non-volatile chemicals.

SOIL-TO-AIR VOLATILIZATION FACTOR (VF_s)

Equation 4-9: Derivation of the Volatilization Factor

$$VF_s \text{ (m}^3/\text{kg)} = (Q/C) \times \frac{(3.14 \times D_A \times T)^{1/2}}{(2 \times \rho_b \times D_A)} \times 10^{-4} \text{ (m}^2/\text{cm}^2)$$

where:

$$D_A = \frac{[(\Theta_a^{10/3} D_i H' + \Theta_w^{10/3} D_w) / n^2]}{\rho_b K_d + \Theta_w + \Theta_a H'}$$

<u>Parameter</u>	<u>Definition (units)</u>	<u>Default</u>
VF _s	Volatilization factor (m ³ /kg)	--
D _A	Apparent diffusivity (cm ² /s)	--
Q/C	Inverse of the mean conc. at the center of a 0.5-acre square source (g ^{M2} -s per kg/m ³)	68.81
T	Exposure interval (s)	9.5 x 10 ⁸
ρ _b	Dry soil bulk density (g/cm ³)	1.5
Θ _a	Air filled soil porosity (L _{air} /L _{soil})	0.28 or n-Θ _w
n	Total soil porosity (L _{pore} /L _{soil})	0.43 or 1 - (ρ _b /ρ _s)
Θ _w	Water-filled soil porosity (L _{water} /L _{soil})	0.15
ρ _s	Soil particle density (g/cm ³)	2.65
D _i	Diffusivity in air (cm ² /s)	Chemical-specific
H	Henry's Law constant (atm-m ³ /mol)	Chemical-specific
H'	Dimensionless Henry's Law constant	Calculated from H by multiplying by 41 (USEPA 1991a)
D _w	Diffusivity in water (cm ² /s)	Chemical-specific
K _d	Soil-water partition coefficient (cm ³ /g) = K _{oc} f _{oc}	Chemical-specific
K _{oc}	Soil organic carbon-water partition coefficient (cm ³ /g)	Chemical-specific
f _{oc}	Fraction organic carbon in soil (g/g)	0.006 (0.6%)

SOIL SATURATION CONCENTRATION (sat)

Equation 4-10: Derivation of the Soil Saturation Limit

$$\text{sat} = \frac{S}{\rho_b} (K_d \rho_b + \theta_w + H' \theta_a)$$

<u>Parameter</u>	<u>Definition (units)</u>	<u>Default</u>
sat	Soil saturation concentration (mg/kg)	--
S	Solubility in water (mg/L-water)	Chemical-specific
ρ_b	Dry soil bulk density (kg/L)	1.5
n	Total soil porosity ($L_{\text{pore}}/L_{\text{soil}}$)	0.43 or $1 - (\rho_b/\rho_s)$
ρ_s	Soil particle density (kg/L)	2.65
K_d	Soil-water partition coefficient (L/kg)	$K_{oc} \times f_{oc}$ (chemical-specific)
k_{oc}	Soil organic carbon/water partition coefficient (L/kg)	Chemical-specific
f_{oc}	Fraction organic carbon content of soil (g/g)	0.006 or site-specific
θ_w	Water-filled soil porosity ($L_{\text{water}}/L_{\text{soil}}$)	0.15
θ_a	Air filled soil porosity ($L_{\text{air}}/L_{\text{soil}}$)	0.28 or $n - \theta_w$
w	Average soil moisture content ($\text{kg}_{\text{water}}/\text{kg}_{\text{soil}}$ or $L_{\text{water}}/\text{kg}_{\text{soil}}$)	0.1
H	Henry's Law constant ($\text{atm} \cdot \text{m}^3/\text{mol}$)	Chemical-specific
H'	Dimensionless Henry's Law constant	$H \times 41$, where 41 is a units conversion factor

SOIL-TO-AIR PARTICULATE EMISSION FACTOR (PEF)

Equation 4-11: Derivation of the Particulate Emission Factor

$$PEF (m^3/kg) = Q/C \times \frac{3600s/h}{0.036 \times (1-V) \times (U_m/U_t)^3 \times F(x)}$$

<u>Parameter</u>	<u>Definition (units)</u>	<u>Default</u>
PEF	Particulate emission factor (m ³ /kg)	1.316 x 10 ⁹
Q/C	Inverse of the mean concentration at the center of a 0.5-acre-square source (g ^{/M²-s} per kg/m ³)	90.80
V	Fraction of vegetative cover (unitless)	0.5
U _m	Mean annual windspeed (m/s)	4.69
U _t	Equivalent threshold value of windspeed at 7 m (m/s)	11.32
F(x)	Function dependent on U _m /U _t derived using Cowherd (1985) (unitless)	0.194

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Key : SFO_o=Cancer Slope Factor oral, inhalation RfDo_o=Reference Dose oral, inhalation i=IRIS p=PPRTV c=California EPA n=NCEA h=HEAST x=Withdrawn r=Route-extrapolation ca=Cancer PRG nc= Noncancer PRG ca* (where: nc PRG < 100X ca PRG)
 ca** (where nc PRG < 10X ca PRG) +++=Non-Standard Method Applied (See User's Guide) sat=Soil Saturation (See User's Guide) max=Ceiling limit (See User's Guide) DAF=Dilution Attenuation Factor (See User's Guide) CAS=Chemical Abstract Services

TOXICITY VALUES				V O C	skin abs. soils	CAS No.	CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs)				SOIL SCREENING LEVELS					
SFO _o 1/(mg/kg-d)	RfDo _o (mg/kg-d)	SFi 1/(mg/kg-d)	RfDi (mg/kg-d)					Residential Soil (mg/kg)	Industrial Soil (mg/kg)	Ambient Air (ug/m ³)	Tap Water (ug/l)	"Direct Contact Exposure Pathways"		"Migration to Ground Water"			
												DAF 20 (mg/kg)	DAF 1 (mg/kg)				
8.7E-03	i 4.0E-03	i 8.7E-03	r 4.0E-03	r	0.1	30560-19-1	Acephate	5.6E+01	ca**	2.0E+02	ca*	7.7E-01	ca*	7.7E+00	ca*		
		7.7E-03	i 2.6E-03	i	y	75-07-0	Acetaldehyde	1.1E+01	ca**	2.3E+01	ca**	8.7E-01	ca*	1.7E+00	ca		
	2.0E-02	i	2.0E-02	r	0.1	34256-82-1	Acetochlor	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
	9.0E-01	i	9.0E-01	r	y	67-64-1	Acetone	1.4E+04	nc	5.4E+04	nc	3.3E+03	nc	5.5E+03	nc	1.6E+01	8.0E-01
	8.0E-04	h	8.0E-04	r	0.1	75-86-5	Acetone cyanohydrin	4.9E+01	nc	4.9E+02	nc	2.9E+00	nc	2.9E+01	nc		
	1.7E-02	r	1.7E-02	i	y	75-05-8	Acetonitrile	4.2E+02	nc	1.8E+03	nc	6.2E+01	nc	1.0E+02	nc		
	5.0E-04	i	5.7E-06	i	y	107-02-8	Acrolein	1.0E-01	nc	3.4E-01	nc	2.1E-02	nc	4.2E-02	nc		
4.5E+00	i 2.0E-04	i 4.5E+00	i 2.0E-04	r	0.1	79-06-1	Acrylamide	1.1E-01	ca	3.8E-01	ca	1.5E-03	ca	1.5E-02	ca		
	5.0E-01	i	2.8E-04	i	0.1	79-10-7	Acrylic acid	2.9E+04	nc	1.0E+05	max	1.0E+00	nc	1.8E+04	nc		
5.4E-01	i 1.0E-03	h 2.4E-01	i 5.7E-04	i	y	107-13-1	Acrylonitrile	2.1E-01	ca*	4.9E-01	ca*	2.8E-02	ca*	3.9E-02	ca*		
1.0E+00	r	1.0E+00	c		y		"CAL-Modified PRG"	5.5E-02	ca	1.2E-01	ca	6.7E-03	ca	1.1E-02	ca		
8.1E-02	h 1.0E-02	i 8.0E-02	r 1.0E-02	r	0.1	15972-60-8	Alachlor	6.0E+00	ca	2.1E+01	ca	8.4E-02	ca	8.4E-01	ca		
	1.5E-01	i	1.5E-01	r	0.1	1596-84-5	Alar	9.2E+03	nc	9.2E+04	nc	5.5E+02	nc	5.5E+03	nc		
	1.0E-03	i	1.0E-03	r	0.1	116-06-3	Aldicarb	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc		
	1.0E-03	i	1.0E-03	r	0.1	1646-88-4	Aldicarb sulfone	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc		
1.7E+01	i 3.0E-05	i 1.7E+01	i 3.0E-05	r	0.1	309-00-2	Aldrin	2.9E-02	ca*	1.0E-01	ca	3.9E-04	ca	4.0E-03	ca	5.0E-01	2.0E-02
	2.5E-01	i	2.5E-01	r	0.1	74223-64-6	Allyl	1.5E+04	nc	1.0E+05	max	9.1E+02	nc	9.1E+03	nc		
	5.0E-03	i	5.0E-03	r	0.1	107-18-6	Allyl alcohol	3.1E+02	nc	3.1E+03	nc	1.8E+01	nc	1.8E+02	nc		
	2.9E-04	r	2.9E-04	i	0.1	107-05-1	Allyl chloride	1.7E+01	nc	1.8E+02	nc	1.0E+00	nc	1.0E+01	nc		
	1.0E+00	p	1.4E-03	p		7429-90-5	Aluminum	7.6E+04	nc	1.0E+05	max	5.1E+00	nc	3.6E+04	nc		
	4.0E-04	i				20859-73-8	Aluminum phosphide	3.1E+01	nc	4.1E+02	nc		1.5E+01	nc			
	3.0E-04	i	3.0E-04	r	0.1	67485-29-4	Amdro	1.8E+01	nc	1.8E+02	nc	1.1E+00	nc	1.1E+01	nc		
	9.0E-03	i	9.0E-03	r	0.1	834-12-8	Ametryn	5.5E+02	nc	5.5E+03	nc	3.3E+01	nc	3.3E+02	nc		
	2.0E-04	n	2.0E-04	r	0.1	1321-12-6	Aminodinitrotoluene	1.2E+01	nc	1.2E+02	nc	7.3E-01	nc	7.3E+00	nc		
	7.0E-02	h	7.0E-02	r	0.1	591-27-5	m-Aminophenol	4.3E+03	nc	4.3E+04	nc	2.6E+02	nc	2.6E+03	nc		
	2.0E-05	h	2.0E-05	r	0.1	504-24-5	4-Aminopyridine	1.2E+00	nc	1.2E+01	nc	7.3E-02	nc	7.3E-01	nc		
	2.5E-03	i	2.5E-03	r	0.1	33089-61-1	Amitraz	1.5E+02	nc	1.5E+03	nc	9.1E+00	nc	9.1E+01	nc		
			2.9E-02	i		7664-41-7	Ammonia					1.0E+02	nc				
	2.0E-01	i			0.1	7773-06-0	Ammonium sulfamate	1.2E+04	nc	1.0E+05	max		7.3E+03	nc			
5.7E-03	i 7.0E-03	p 5.7E-03	r 2.9E-04	i	0.1	62-53-3	Aniline	8.5E+01	ca**	3.0E+02	ca*	1.0E+00	nc	1.2E+01	ca*		
	4.0E-04	i				7440-38-0	Antimony and compounds	3.1E+01	nc	4.1E+02	nc		1.5E+01	nc	5.0E+00	3.0E-01	
	1.3E-02	i	1.3E-02	r	0.1	74115-24-5	Apollo	7.9E+02	nc	8.0E+03	nc	4.7E+01	nc	4.7E+02	nc		
2.5E-02	i 5.0E-02	h 2.5E-02	i 5.0E-02	r	0.1	140-57-8	Aramite	1.9E+01	ca	6.9E+01	ca	2.7E-01	ca	2.7E+00	ca		
1.5E+00	i 3.0E-04	i 1.5E+01	i		0.03	7440-38-2	Arsenic	3.9E-01	ca*	1.6E+00	ca	4.5E-04	ca	4.5E-02	ca	2.9E+01	1.0E+00
9.5E+00	c	1.2E+01	c		0.03		"CAL-Modified PRG"	6.2E-02	ca	2.5E-01	ca	5.6E-04	ca	7.1E-03	ca		
			1.4E-05	i		7784-42-1	Arsine (see arsenic for cancer endpoint)					5.2E-02	nc				
	9.0E-03	i	9.0E-03	r	0.1	76578-14-8	Assure	5.5E+02	nc	5.5E+03	nc	3.3E+01	nc	3.3E+02	nc		
	5.0E-02	i	5.0E-02	r	0.1	3337-71-1	Asulam	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc		
2.2E-01	h 3.5E-02	i 2.2E-01	r 3.5E-02	r	0.1	1912-24-9	Atrazine	2.2E+00	ca	7.8E+00	ca	3.1E-02	ca	3.0E-01	ca		
	4.0E-04	i	4.0E-04	r	0.1	71751-41-2	Avermectin B1	2.4E+01	nc	2.5E+02	nc	1.5E+00	nc	1.5E+01	nc		
1.1E-01	i	1.1E-01	i		0.1	103-33-3	Azobenzene	4.4E+00	ca	1.6E+01	ca	6.2E-02	ca	6.1E-01	ca		
	7.0E-02	i	1.4E-04	h		7440-39-3	Barium and compounds	5.4E+03	nc	6.7E+04	nc	5.2E-01	nc	2.6E+03	nc	1.6E+03	8.2E+01

Key : SFo,i=Cancer Slope Factor oral, inhalation RfDo,i=Reference Dose oral, inhalation i=IRIS p=PPRTV c=California EPA n=NCEA h=HEAST x=Withdrawn r=Route-extrapolation ca=Cancer PRG nc=Noncancer PRG ca* (where: nc PRG < 100X ca PRG)
 ca** (where nc PRG < 10X ca PRG) +++=Non-Standard Method Applied (See User's Guide) sat=Soil Saturation (See User's Guide) max=Ceiling limit (See User's Guide) DAF=Dilution Attenuation Factor (See User's Guide) CAS=Chemical Abstract Services

TOXICITY VALUES						CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs)					SOIL SCREENING LEVELS								
SFo	RfDo	SFi	RfDi	V _{skin}	CAS No.		Residential Soil (mg/kg)	Industrial Soil (mg/kg)	"Direct Contact Exposure Pathways"		"Migration to Ground Water"									
1/(mg/kg-d)	(mg/kg-d)	1/(mg/kg-d)	(mg/kg-d)	O C				Ambient Air (ug/m ³)	Tap Water (ug/l)	DAF 20 (mg/kg)	DAF 1 (mg/kg)									
	4.0E-03	i	4.0E-03	r	0.1	114-28-1	Baygon	2.4E+02	nc	2.5E+03	nc	1.5E+01	nc	1.5E+02	nc					
	3.0E-02	i	3.0E-02	r	0.1	43121-43-3	Bayleton	1.8E+03	nc	1.8E+04	nc	1.1E+02	nc	1.1E+03	nc					
	2.5E-02	i	2.5E-02	r	0.1	68359-37-5	Baythroid	1.5E+03	nc	1.5E+04	nc	9.1E+01	nc	9.1E+02	nc					
	3.0E-01	i	3.0E-01	r	0.1	1861-40-1	Benefin	1.8E+04	nc	1.0E+05	max	1.1E+03	nc	1.1E+04	nc					
	5.0E-02	i	5.0E-02	r	0.1	17804-35-2	Benomyl	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc					
	3.0E-02	i	3.0E-02	r	0.1	25057-89-0	Bentazon	1.8E+03	nc	1.8E+04	nc	1.1E+02	nc	1.1E+03	nc					
	1.0E-01	i	1.0E-01	r	0.1	100-52-7	Benzaldehyde	6.1E+03	nc	6.2E+04	nc	3.7E+02	nc	3.6E+03	nc					
5.5E-02	4.0E-03	i	2.7E-02	i	8.6E-03	i	y	71-43-2	Benzene	6.4E-01	ca*	1.4E+00	ca*	2.5E-01	ca	3.5E-01	ca	3.0E-02	2.0E-03	
2.3E+02	3.0E-03	i	2.3E+02	i	3.0E-03	r	0.1	92-87-5	Benzydine	2.1E-03	ca	7.5E-03	ca	2.9E-05	ca	2.9E-04	ca			
	4.0E+00	i	4.0E+00	r	0.1	65-85-0	Benzoic acid	1.0E+05	max	1.0E+05	max	1.5E+04	nc	1.5E+05	nc	4.0E+02	2.0E+01			
1.3E+01		i	1.3E+01	r	0.1	98-07-7	Benzo-trichloride	3.7E-02	ca	1.3E-01	ca	5.2E-04	ca	5.2E-03	ca					
	3.0E-01	h	3.0E-01	r	0.1	100-51-6	Benzyl alcohol	1.8E+04	nc	1.0E+05	max	1.1E+03	nc	1.1E+04	nc					
1.7E-01	2.9E-03	r	1.7E-01	r	2.9E-03	n	y	100-44-7	Benzyl chloride	8.9E-01	ca*	2.2E+00	ca	4.0E-02	ca	6.6E-02	ca			
	2.0E-03	i	8.4E+00	i	5.7E-06	i		7440-41-7	Beryllium and compounds	1.5E+02	nc	1.9E+03	ca**	8.0E-04	ca*	7.3E+01	nc	6.3E+01	3.0E+00	
	1.0E-04	i	1.0E-04	r	0.1	141-86-2	Bidrin	6.1E+00	nc	6.2E+01	nc	3.7E-01	nc	3.6E+00	nc					
	1.5E-02	i	1.5E-02	r	0.1	62657-04-3	Biphenthrin (Talstar)	9.2E+02	nc	9.2E+03	nc	5.5E+01	nc	5.5E+02	nc					
	5.0E-02	i	5.0E-02	r	y	92-52-4	1,1-Biphenyl	3.0E+03	nc	2.3E+04	nc	1.8E+02	nc	3.0E+02	nc					
1.1E+00		i	1.1E+00	i		y	111-44-4	Bis(2-chloroethyl)ether	2.2E-01	ca	5.8E-01	ca	6.1E-03	ca	1.0E-02	ca	4.0E-04	2.0E-05		
7.0E-02	x	4.0E-02	i	3.5E-02	x	4.0E-02	r	y	108-60-1	Bis(2-chloroisopropyl)ether	2.9E+00	ca	7.4E+00	ca	1.9E-01	ca	2.7E-01	ca		
2.2E+02		i	2.2E+02	i		y	542-88-1	Bis(chloromethyl)ether	1.9E-04	ca	4.3E-04	ca	3.1E-05	ca	5.2E-05	ca				
7.0E-02	x	4.0E-02	i	3.5E-02	x	4.0E-02	r	y	108-60-1	Bis(2-chloro-1-methylethyl)ether	2.9E+00	ca	7.4E+00	ca	1.9E-01	ca	2.7E-01	ca		
1.4E-02	i	2.0E-02	i	1.4E-02	r	2.0E-02	r	0.1	117-81-7	Bis(2-ethylhexyl)phthalate (DEHP)	3.5E+01	ca*	1.2E+02	ca	4.8E-01	ca	4.8E+00	ca		
	5.0E-02	i	5.0E-02	r	0.1	80-05-7	Bisphenol A	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc					
	2.00E-01	i	5.7E-03	h		7440-42-8	Boron	1.6E+04	nc	1.0E+05	max	2.1E+01	nc	7.3E+03	nc					
			2.0E-04	h		7637-07-2	Boron trifluoride					7.3E-01	nc							
7.0E-01	i	4.0E-03	i	7.0E-01	r	4.0E-03	r	0.1	15541-45-4	Bromate	6.9E-01	ca	2.5E+00	ca	9.6E-03	ca	9.6E-02	ca		
	2.0E-02	p	2.9E-03	p	y	108-86-1	Bromobenzene	2.8E+01	nc	9.2E+01	nc	1.0E+01	nc	2.0E+01	nc					
6.2E-02	i	2.0E-02	i	6.2E-02	r	2.0E-02	r	y	75-27-4	Bromodichloromethane	8.2E-01	ca	1.8E+00	ca	1.1E-01	ca	1.8E-01	ca	6.0E-01	3.0E-02
7.9E-03	i	2.0E-02	i	3.9E-03	i	2.0E-02	r	0.1	75-25-2	Bromoform (tribromomethane)	6.2E+01	ca*	2.2E+02	ca*	1.7E+00	ca*	8.5E+00	ca*	8.0E-01	4.0E-02
	1.4E-03	i	1.4E-03	i	y	74-83-9	Bromomethane (Methyl bromide)	3.9E+00	nc	1.3E+01	nc	5.2E+00	nc	8.7E+00	nc	2.0E-01	1.0E-02			
	5.0E-03	h	5.0E-03	r	0.1	2104-96-3	Bromophos	3.1E+02	nc	3.1E+03	nc	1.8E+01	nc	1.8E+02	nc					
	2.0E-02	i	2.0E-02	r	0.1	1689-84-5	Bromoxynil	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc					
	2.0E-02	i	2.0E-02	r	0.1	1689-99-2	Bromoxynil octanoate	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc					
1.1E-01	r	5.7E-04	r	1.1E-01	i	5.7E-04	i	y	106-99-0	1,3-Butadiene	5.8E-02	ca*	1.2E-01	ca*	6.1E-02	ca*	1.0E-01	ca*		
6.0E-01	r	5.7E-03	r	6.0E-01	c	5.7E-03	c	y	106-99-0	"CAL-Modified PRG"	1.1E-02	ca	2.3E-02	ca	1.1E-02	ca	1.9E-02	ca		
	1.0E-01	i	2.6E-03	n	0.1	71-36-3	1-Butanol	6.1E+03	nc	6.1E+04	nc	9.5E+00	nc	3.6E+03	nc	1.7E+01	9.0E-01			
	5.0E-02	i	5.0E-02	r	0.1	2008-41-5	Butylate	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc					
	4.0E-02	n	4.0E-02	r	y	104-51-8	n-Butylbenzene	2.4E+02	sat	2.4E+02	sat	1.5E+02	nc	2.4E+02	nc					
	4.0E-02	n	4.0E-02	r	y	135-9-88	sec-Butylbenzene	2.2E+02	sat	2.2E+02	sat	1.5E+02	nc	2.4E+02	nc					
	4.0E-02	n	4.0E-02	r	y	98-06-6	tert-Butylbenzene	3.9E+02	sat	3.9E+02	sat	1.5E+02	nc	2.4E+02	nc					
	2.0E-01	i	2.0E-01	r	0.1	85-88-7	Butyl benzyl phthalate	1.2E+04	nc	1.0E+05	max	7.3E+02	nc	7.3E+03	nc	9.3E+02	8.1E+02			
	1.0E+00	i	1.0E+00	r	0.1	85-70-1	Butylphthalyl butylglycolate	6.1E+04	nc	1.0E+05	max	3.7E+03	nc	3.6E+04	nc					

Key : SFO=Cancer Slope Factor oral, inhalation RfDo=Reference Dose oral, inhalation i=IRIS p=PPRTV c=California EPA n=NCEA h=HEAST x=Withdrawn r=Route-extrapolation ca=Cancer PRG nc= Noncancer PRG ca* (where: nc PRG < 100X ca PRG) ca** (where nc PRG < 10X ca PRG) +++=Non-Standard Method Applied (See User's Guide) sat=Soil Saturation (See User's Guide) max=Ceiling limit (See User's Guide) DAF=Dilution Attenuation Factor (See User's Guide) CAS=Chemical Abstract Services

TOXICITY VALUES					CAS No.	CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs)				SOIL SCREENING LEVELS						
SFO 1/(mg/kg-d)	RfDo (mg/kg-d)	SFi 1/(mg/kg-d)	RfDi (mg/kg-d)	V O C skin abs. soils			Residential Soil (mg/kg)	"Direct Contact Exposure Pathways" Industrial Soil (mg/kg)	Ambient Air (ug/m ³)	Tap Water (ug/l)	DAF 20 (mg/kg)	DAF 1 (mg/kg)					
	5.0E-04	i 6.3E+00	i		0.001	7440-43-9	Cadmium and compounds	3.7E+01	nc	4.5E+02	nc	1.1E-03	ca	1.8E+01	nc	8.0E+00	4.0E-01
	5.0E-01	i	5.0E-01	r	0.1	105-60-2	Caprolactam	3.1E+04	nc	1.0E+05	max	1.8E+03	nc	1.8E+04	nc		
8.6E-03	h 2.0E-03	i 8.6E-03	r 2.0E-03	r	0.1	2425-06-1	Captafol	5.7E+01	ca**	2.0E+02	ca**	7.8E-01	ca**	7.8E+00	ca**		
3.5E-03	h 1.3E-01	i 3.5E-03	r 1.3E-01	r	0.1	133-06-2	Captan	1.4E+02	ca*	4.9E+02	ca	1.9E+00	ca	1.9E+01	ca		
	1.0E-01	i	1.1E-01	r	0.1	63-25-2	Carbaryl	6.1E+03	nc	6.2E+04	nc	4.0E+02	nc	3.6E+03	nc		
2.0E-02	h	2.0E-02	r		0.1	86-74-8	Carbazole	2.4E+01	ca	8.6E+01	ca	3.4E-01	ca	3.4E+00	ca	6.0E-01	3.0E-02
	5.0E-03	i	5.0E-03	r	0.1	1563-86-2	Carbofuran	3.1E+02	nc	3.1E+03	nc	1.8E+01	nc	1.8E+02	nc		
	1.0E-01	i	2.0E-01	i	y	75-15-0	Carbon disulfide	3.6E+02	nc	7.2E+02	sat	7.3E+02	nc	1.0E+03	nc	3.2E+01	2.0E+00
1.3E-01	i 7.0E-04	i 5.3E-02	i 7.0E-04	r	y	56-23-5	Carbon tetrachloride	2.5E-01	ca**	5.5E-01	ca*	1.3E-01	ca*	1.7E-01	ca*	7.0E-02	3.0E-03
	1.0E-02	i	1.0E-02	r	0.1	55285-14-8	Carbosulfan	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc		
	1.0E-01	i	1.0E-01	r	0.1	5234-68-4	Carboxin	6.1E+03	nc	6.2E+04	nc	3.7E+02	nc	3.6E+03	nc		
	1.5E-02	i	1.5E-02	r	0.1	133-90-4	Chloramben	9.2E+02	nc	9.2E+03	nc	5.5E+01	nc	5.5E+02	nc		
4.0E-01	h	4.0E-01	r		0.1	118-75-2	Chloranil	1.2E+00	ca	4.3E+00	ca	1.7E-02	ca	1.7E-01	ca		
3.5E-01	i 5.0E-04	i 3.5E-01	i 2.0E-04	i	0.04	12789-03-6	Chlordane (technical)	1.6E+00	ca*	6.5E+00	ca*	1.9E-02	ca*	1.9E-01	ca*	1.0E+01	5.0E-01
	2.0E-02	i	2.0E-02	r	0.1	90982-32-4	Chlorimuron-ethyl	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
	1.0E-01	i	5.7E-05	n		7782-50-5	Chlorine					2.1E-01	nc				
	3.0E-02	i	5.7E-05	i		10049-04-4	Chlorine dioxide					2.1E-01	nc				
	2.0E-03	h	2.0E-03	r	0.1	79-11-8	Chloroacetic acid	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc		
	8.6E-06	r	8.6E-06	i	y	532-27-4	2-Chloroacetophenone	3.3E-02	nc	1.1E-01	nc	3.1E-02	nc	5.2E-02	nc		
	4.0E-03	i	4.0E-03	r	0.1	106-47-8	4-Chloroaniline	2.4E+02	nc	2.5E+03	nc	1.5E+01	nc	1.5E+02	nc	7.0E-01	3.0E-02
	2.0E-02	i	1.7E-02	n	y	103-90-7	Chlorobenzene	1.5E+02	nc	5.3E+02	nc	6.2E+01	nc	1.1E+02	nc	1.0E+00	7.0E-02
2.7E-01	h 2.0E-02	i 2.7E-01	h 2.0E-02	r	0.1	510-15-6	Chlorobenzilate	1.8E+00	ca	6.4E+00	ca	2.5E-02	ca	2.5E-01	ca		
	2.0E-01	h	2.0E-01	r	0.1	74-11-3	p-Chlorobenzoic acid	1.2E+04	nc	1.0E+05	max	7.3E+02	nc	7.3E+03	nc		
	2.0E-02	h	2.0E-02	r	0.1	98-56-6	4-Chlorobenzotrifluoride	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
	2.0E-02	h	2.0E-03	h	y	126-99-8	2-Chloro-1,3-butadiene	3.6E+00	nc	1.2E+01	nc	7.3E+00	nc	1.4E+01	nc		
	4.0E-01	h	4.0E-01	r	y	109-69-3	1-Chlorobutane	4.8E+02	sat	4.8E+02	sat	1.5E+03	nc	2.4E+03	nc		
	1.4E+01	r	1.4E+01	i	y	75-68-3	1-Chloro-1,1-difluoroethane (HCFC-142b)	3.4E+02	sat	3.4E+02	sat	5.2E+04	nc	8.7E+04	nc		
	1.4E+01	r	1.4E+01	i	y	75-45-6	Chlorodifluoromethane	3.4E+02	sat	3.4E+02	sat	5.1E+04	nc	8.5E+04	nc		
2.9E-03	n 4.0E-01	n 2.9E-03	r 2.9E+00	i	y	75-00-3	Chloroethane	3.0E+00	ca	6.5E+00	ca	2.3E+00	ca	4.6E+00	ca		
	1.0E-02	i 8.1E-02	i 1.4E-02	n	y	67-66-3	Chloroform	2.2E-01	ca	4.7E-01	ca	8.3E-02	ca	1.7E-01	ca	6.0E-01	3.0E-02
3.1E-02	c	1.9E-02	c		y		"CAL-Modified PRG"	9.4E-01	ca	2.0E+00	ca	3.5E-01	ca	5.3E-01	ca		
	2.6E-02	r	2.6E-02	i	y	74-87-3	Chloromethane (methyl chloride)	4.7E+01	nc	1.6E+02	nc	9.5E+01	nc	1.6E+02	nc		
5.8E-01	h	5.8E-01	r		0.1	95-69-2	4-Chloro-2-methylaniline	8.4E-01	ca	3.0E+00	ca	1.2E-02	ca	1.2E-01	ca		
4.6E-01	h	4.6E-01	r		0.1	3165-93-3	4-Chloro-2-methylaniline hydrochloride	1.1E+00	ca	3.7E+00	ca	1.5E-02	ca	1.5E-01	ca		
	8.0E-02	i	8.0E-02	r	y	91-58-7	beta-Chloronaphthalene	4.9E+03	nc	2.3E+04	nc	2.9E+02	nc	4.9E+02	nc		
9.7E-03	p 1.0E-03	p 9.7E-03	r 2.0E-05	p	y	88-73-3	o-Chloronitrobenzene	1.4E+00	nc**	4.5E+00	nc**	7.3E-02	nc**	1.5E-01	nc**		
6.7E-03	p 1.0E-03	p 6.7E-03	r 1.7E-04	p	y	100-00-5	p-Chloronitrobenzene	1.0E+01	nc**	3.7E+01	nc**	6.2E-01	nc**	1.2E+00	nc**		
	5.0E-03	i	5.0E-03	r	y	95-57-8	2-Chlorophenol	6.3E+01	nc	2.4E+02	nc	1.8E+01	nc	3.0E+01	nc	4.0E+00	2.0E-01
	2.9E-02	r	2.9E-02	h	y	75-29-8	2-Chloropropane	1.7E+02	nc	5.9E+02	nc	1.0E+02	nc	1.7E+02	nc		
1.1E-02	h 1.5E-02	i 1.1E-02	r 1.5E-02	r	0.1	1897-45-6	Chlorothalonil	4.4E+01	ca*	1.6E+02	ca*	6.1E-01	ca*	6.1E+00	ca*		
	2.0E-02	i	2.0E-02	r	y	95-49-8	o-Chlorotoluene	1.6E+02	nc	5.6E+02	nc	7.3E+01	nc	1.2E+02	nc		
	2.0E-01	i	2.0E-01	r	0.1	101-21-3	Chlorpropham	1.2E+04	nc	1.0E+05	max	7.3E+02	nc	7.3E+03	nc		

Key: SFO_i=Cancer Slope Factor oral, inhalation RfDo_i=Reference Dose oral, inhalation i=IRIS p=PPRTV c=California EPA n=NCEA h=HEAST x=Withdrawn r=Route-extrapolation ca=Cancer PRG nc=Noncancer PRG ca* (where: nc PRG < 100X ca PRG)
 ca** (where nc PRG < 10X ca PRG) +++=Non-Standard Method Applied (See User's Guide) sat=Soil Saturation (See User's Guide) max=Ceiling limit (See User's Guide) DAF=Dilution Attenuation Factor (See User's Guide) CAS=Chemical Abstract Services

TOXICITY VALUES				CONTAMINANT			PRELIMINARY REMEDIATION GOALS (PRGs)				SOIL SCREENING LEVELS								
SFO	RfDo	SFi	RfDi	V	skin	CAS No.	"Direct Contact Exposure Pathways"				"Migration to Ground Water"								
1/(mg/kg-d)	(mg/kg-d)	1/(mg/kg-d)	(mg/kg-d)	O	abs		Residential	Industrial	Ambient Air	Tap Water	DAF 20	DAF 1							
				C	soils		Soil (mg/kg)	Soil (mg/kg)	(ug/m ³)	(ug/l)	(mg/kg)	(mg/kg)							
	3.0E-03	i	3.0E-03	r	0.1	2921-88-2	Chlorpyrifos	1.8E+02	nc	1.8E+03	nc	1.1E+01	nc	1.1E+02	nc				
	1.0E-02	h	1.0E-02	r	0.1	5598-13-0	Chlorpyrifos-methyl	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc				
	5.0E-02	i	5.0E-02	r	0.1	64902-72-3	Chlorsulfuron	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc				
	8.0E-04	h	8.0E-04	r	0.1	60238-56-4	Chlorthiophos	4.9E+01	nc	4.9E+02	nc	2.9E+00	nc	2.9E+01	nc				
	4.2E+01	i					Total Chromium (1:6 ratio Cr VI:Cr III)+++	2.1E+02	ca	4.5E+02	ca	1.6E-04	ca		3.8E+01 2.0E+00				
	1.5E+00	i				16065-83-1	Chromium III	1.0E+05	max	1.0E+05	max			5.5E+04	nc				
	3.0E-03	i	2.8E+02	i	2.2E-06	i	18540-29-9	Chromium VI+++	3.0E+01	ca**	6.4E+01	ca	2.3E-05	ca	1.1E+02	nc			
	2.0E-02	p	9.8E+00	p	5.7E-06	p	7440-48-4	Cobalt	9.0E+02	ca**	1.9E+03	ca*	6.9E-04	ca*	7.3E+02	nc			
	2.2E+00	i				8007-45-2	Coke Oven Emissions							3.1E-03	ca				
	4.0E-02	h				7440-50-8	Copper and compounds	3.1E+03	nc	4.1E+04	nc			1.5E+03	nc				
1.9E+00	h	1.9E+00	r		y	123-73-9	Crotonaldehyde	5.3E-03	ca	1.1E-02	ca	3.5E-03	ca	5.9E-03	ca				
	1.0E-01	i	1.1E-01	i	y	98-82-8	Cumene (isopropylbenzene)	5.7E+02	nc	2.0E+03	nc	4.0E+02	nc	6.6E+02	nc				
8.4E-01	h	2.0E-03	h	8.4E-01	r	2.0E-03	r	0.1	21725-46-2	Cyanazine	5.8E-01	ca	2.1E+00	ca	8.0E-03	ca	8.0E-02	ca	
	2.0E-02	i				57-12-5	Cyanide (free)	1.2E+03	nc	1.2E+04	nc			7.3E+02	nc				
	2.0E-02	i	8.6E-04	i	y	74-90-8	Cyanide (hydrogen)	1.1E+01	nc	3.5E+01	nc	3.1E+00	nc	6.2E+00	nc				
	4.0E-02	i	4.0E-02	r	y	460-19-5	Cyanogen	1.3E+02	nc	4.3E+02	nc	1.5E+02	nc	2.4E+02	nc				
	9.0E-02	i	9.0E-02	r	y	506-68-3	Cyanogen bromide	2.9E+02	nc	9.7E+02	nc	3.3E+02	nc	5.5E+02	nc				
	5.0E-02	i	5.0E-02	r	y	506-77-4	Cyanogen chloride	1.6E+02	nc	5.4E+02	nc	1.8E+02	nc	3.0E+02	nc				
	1.7E+00	r	1.7E+00	i	y	110-82-7	Cyclohexane	1.4E+02	sat	1.4E+02	sat	6.2E+03	nc	1.0E+04	nc				
	5.0E+00	i	5.0E+00	r	0.1	108-84-1	Cyclohexanone	1.0E+05	max	1.0E+05	max	1.8E+04	nc	1.8E+05	nc				
	2.0E-01	i	2.0E-01	r	0.1	108-91-8	Cyclohexylamine	1.2E+04	nc	1.0E+05	max	7.3E+02	nc	7.3E+03	nc				
	5.0E-03	i	5.0E-03	r	0.1	88085-85-8	Cyhalothrin/Karate	3.1E+02	nc	3.1E+03	nc	1.8E+01	nc	1.8E+02	nc				
	1.0E-02	i	1.0E-02	r	0.1	52315-07-8	Cypermethrin	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc				
	7.5E-03	i	7.5E-03	r	0.1	68215-27-8	Cyromazine	4.6E+02	nc	4.6E+03	nc	2.7E+01	nc	2.7E+02	nc				
	1.0E-02	i	1.0E-02	r	0.1	1861-32-1	Dacthal	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc				
	3.0E-02	i	3.0E-02	r	0.1	75-99-0	Dalapon	1.8E+03	nc	1.8E+04	nc	1.1E+02	nc	1.1E+03	nc				
	2.5E-02	i	2.5E-02	r	0.1	39515-41-8	Danitol	1.5E+03	nc	1.5E+04	nc	9.1E+01	nc	9.1E+02	nc				
2.4E-01	i	2.4E-01	r		0.03	72-54-8	DDD	2.4E+00	ca	1.0E+01	ca	2.8E-02	ca	2.8E-01	ca	1.6E+01 8.0E-01			
3.4E-01	i	3.4E-01	r		0.03	72-55-9	DDE	1.7E+00	ca	7.0E+00	ca	2.0E-02	ca	2.0E-01	ca	5.4E+01 3.0E+00			
3.4E-01	i	5.0E-04	i	3.4E-01	i	5.0E-04	r	0.03	50-29-3	DDT	1.7E+00	ca*	7.0E+00	ca*	2.0E-02	ca*	2.0E-01	ca*	3.2E+01 2.0E+00
	1.0E-02	i	1.0E-02	r	0.1	1163-19-5	Decabromodiphenyl ether	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc				
	4.0E-05	i	4.0E-05	r	0.1	8085-48-3	Demeton	2.4E+00	nc	2.5E+01	nc	1.5E-01	nc	1.5E+00	nc				
6.1E-02	h	6.1E-02	r		0.1	2303-16-4	Diallate	8.0E+00	ca	2.8E+01	ca	1.1E-01	ca	1.1E+00	ca				
	9.0E-04	h	9.0E-04	r	0.1	333-41-5	Diazinon	5.5E+01	nc	5.5E+02	nc	3.3E+00	nc	3.3E+01	nc				
	2.0E-03	n	2.0E-03	r	y	132-64-9	Dibenzofuran	1.5E+02	nc	1.6E+03	nc	7.3E+00	nc	1.2E+01	nc				
	1.0E-02	i	1.0E-02	r	0.1	106-37-6	1,4-Dibromobenzene	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc				
8.4E-02	i	2.0E-02	i	8.4E-02	r	2.0E-02	r	y	124-48-1	Dibromochloromethane	1.1E+00	ca	2.6E+00	ca	8.0E-02	ca	1.3E-01	ca	4.0E-01 2.0E-02
1.4E+00	h	5.7E-05	r	2.4E+03	x	5.7E-05	i	y	96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	4.6E-01	ca**	2.0E+00	ca**	2.1E-01	nc	4.8E-02	ca**	
7.0E+00	c	7.0E+00	c		y	96-12-8	"CAL-Modified PRG"	3.0E-02	ca	7.6E-02	ca	9.6E-04	ca	1.6E-03	ca				
2.0E+00	i	9.0E-03	i	2.0E+00	i	2.6E-03	i	y	106-93-4	1,2-Dibromoethane (EDB)	3.2E-02	ca	7.3E-02	ca	3.4E-03	ca	5.6E-03	ca	
	1.0E-01	i	1.0E-01	r	0.1	84-74-2	Dibutyl phthalate	6.1E+03	nc	6.2E+04	nc	3.7E+02	nc	3.6E+03	nc				
	3.0E-02	i	3.0E-02	r	0.1	1918-00-9	Dicamba	1.8E+03	nc	1.8E+04	nc	1.1E+02	nc	1.1E+03	nc				

Key : SFo,i=Cancer Slope Factor oral, inhalation RfDo,i=Reference Dose oral, inhalation i=IRIS p=PPRTV c=California EPA n=NCEA h=HEAST x=Withdrawn r=Route-extrapolation ca=Cancer PRG nc=Noncancer PRG ca* (where: nc PRG < 100X ca PRG) ca** (where nc PRG < 10X ca PRG) +++=Non-Standard Method Applied (See User's Guide) sat=Soil Saturation (See User's Guide) max=Ceiling limit (See User's Guide) DAF=Dilution Attenuation Factor (See User's Guide) CAS=Chemical Abstract Services

TOXICITY VALUES						CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs)				SOIL SCREENING LEVELS				
SFo 1/(mg/kg-d)	RfDo (mg/kg-d)	SFi 1/(mg/kg-d)	RfDi (mg/kg-d)	V O skin C abs. C soils	CAS No.		Residential Soil (mg/kg)	Industrial Soil (mg/kg)	Ambient Air (ug/m ³)	Tap Water (ug/l)	DAF 20 (mg/kg)	DAF 1 (mg/kg)			
9.0E-02	i		5.7E-02	h y	95-50-1	1,2-Dichlorobenzene	6.0E+02 sat	6.0E+02 sat	2.1E+02 nc	3.7E+02 nc	1.7E+01	9.0E-01			
3.0E-02	n		3.0E-02	r y	541-73-1	1,3-Dichlorobenzene	5.3E+02 nc	6.0E+02 sat	1.1E+02 nc	1.8E+02 nc					
2.4E-02	h	3.0E-02	n 2.2E-02	n 2.3E-01	i y	106-46-7	1,4-Dichlorobenzene	3.4E+00 ca	7.9E+00 ca	3.1E-01 ca	5.0E-01 ca	2.0E+00	1.0E-01		
4.5E-01	i	4.5E-01	r	0.1	91-94-1	3,3-Dichlorobenzidine	1.1E+00 ca	3.8E+00 ca	1.5E-02 ca	1.5E-01 ca	7.0E-03	3.0E-04			
		3.0E-02	n		3.0E-02	r	0.1	90-98-2	4,4'-Dichlorobenzophenone	1.8E+03 nc	1.8E+04 nc	1.1E+02 nc	1.1E+03 nc		
9.3E+00	r	9.3E+00	h	y	784-41-0	1,4-Dichloro-2-butene	7.9E-03 ca	1.8E-02 ca	7.2E-04 ca	1.2E-03 ca					
		2.0E-01	i		5.7E-02	h y	75-71-8	Dichlorodifluoromethane	9.4E+01 nc	3.1E+02 nc	2.1E+02 nc	3.9E+02 nc			
		1.0E-01	h		1.4E-01	h y	75-34-3	1,1-Dichloroethane	5.1E+02 nc	1.7E+03 nc	5.2E+02 nc	8.1E+02 nc	2.3E+01	1.0E+00	
5.7E-03	c	5.7E-03	c	y		"CAL-Modified PRG"	2.8E+00 ca	6.0E+00 ca	1.2E+00 ca	2.0E+00 ca					
9.1E-02	i	2.0E-02	n 9.1E-02	i 1.4E-03	n y	107-06-2	1,2-Dichloroethane (EDC)	2.8E-01 ca*	6.0E-01 ca*	7.4E-02 ca*	1.2E-01 ca*	2.0E-02	1.0E-03		
		5.0E-02	i		5.7E-02	i y	75-35-4	1,1-Dichloroethylene	1.2E+02 nc	4.1E+02 nc	2.1E+02 nc	3.4E+02 nc	6.0E-02	3.0E-03	
		1.0E-02	p		1.0E-02	r y	156-59-2	1,2-Dichloroethylene (cis)	4.3E+01 nc	1.5E+02 nc	3.7E+01 nc	6.1E+01 nc	4.0E-01	2.0E-02	
		2.0E-02	i		2.0E-02	r y	156-60-5	1,2-Dichloroethylene (trans)	6.9E+01 nc	2.3E+02 nc	7.3E+01 nc	1.2E+02 nc	7.0E-01	3.0E-02	
		3.0E-03	i		3.0E-03	r	0.1	120-83-2	2,4-Dichlorophenol	1.8E+02 nc	1.8E+03 nc	1.1E+01 nc	1.1E+02 nc	1.0E+00	5.0E-02
		8.0E-03	i		8.0E-03	r	0.1	84-82-6	4-(2,4-Dichlorophenoxy)butyric Acid (2,4-DB)	4.9E+02 nc	4.9E+03 nc	2.9E+01 nc	2.9E+02 nc		
6.8E-02	h	1.1E-03	r 6.8E-02	r 1.1E-03	i y	78-87-5	2,4-Dichlorophenoxyacetic Acid (2,4-D)	6.9E+02 nc	7.7E+03 nc	3.7E+01 nc	3.6E+02 nc				
		2.0E-02	p		2.0E-02	r y	142-28-9	1,2-Dichloropropane	3.4E-01 ca*	7.4E-01 ca*	9.9E-02 ca*	1.6E-01 ca*	3.0E-02	1.0E-03	
								1,3-Dichloropropane	1.0E+02 nc	3.6E+02 nc	7.3E+01 nc	1.2E+02 nc			
1.0E-01	i	3.0E-02	i 1.4E-02	i 5.7E-03	i y	542-75-6	1,3-Dichloropropene	7.8E-01 ca	1.8E+00 ca	4.8E-01 ca	4.0E-01 ca	4.0E-03	2.0E-04		
		3.0E-03	i		3.0E-03	r	0.1	616-23-9	2,3-Dichloropropanol	1.8E+02 nc	1.8E+03 nc	1.1E+01 nc	1.1E+02 nc		
2.9E-01	i	5.0E-04	i 2.9E-01	r 1.4E-04	i	62-73-7	Dichlorvos	1.7E+00 ca*	5.9E+00 ca*	2.3E-02 ca*	2.3E-01 ca*				
4.4E-01	x	4.4E-01	r	0.1	115-32-2	Dicofol	1.1E+00 ca	3.9E+00 ca	1.5E-02 ca	1.5E-01 ca					
		3.0E-02	h		5.7E-05	x y	77-73-6	Dicyclopentadiene	5.4E-01 nc	1.8E+00 nc	2.1E-01 nc	4.2E-01 nc			
1.6E+01	i	5.0E-05	i 1.6E+01	i 5.0E-05	r	60-57-1	Dieldrin	3.0E-02 ca	1.1E-01 ca	4.2E-04 ca	4.2E-03 ca	4.0E-03	2.0E-04		
		1.0E-02	p		5.7E-03	p	0.1	112-34-5	Diethylene glycol, monobutyl ether	6.1E+02 nc	6.2E+03 nc	2.1E+01 nc	3.6E+02 nc		
		6.0E-02	p		8.6E-04	p	0.1	111-90-0	Diethylene glycol, monoethyl ether	3.7E+03 nc	3.7E+04 nc	3.1E+00 nc	2.2E+03 nc		
		4.0E-04	p		4.0E-04	r	0.1	617-84-5	Diethylformamide	2.4E+01 nc	2.5E+02 nc	1.5E+00 nc	1.5E+01 nc		
1.2E-03	i	6.0E-01	i 1.2E-03	r 6.0E-01	r	0.1	103-23-1	Di(2-ethylhexyl)adipate	4.1E+02 ca	1.4E+03 ca	5.6E+00 ca	5.6E+01 ca			
		8.0E-01	i		8.0E-01	r	0.1	84-86-2	Diethyl phthalate	4.9E+04 nc	1.0E+05 max	2.9E+03 nc	2.9E+04 nc		
4.7E+03	h	4.7E+03	r	0.1	56-53-1	Diethylstilbestrol	1.0E-04 ca	3.7E-04 ca	1.4E-06 ca	1.4E-05 ca					
		8.0E-02	i		8.0E-02	r	0.1	43222-48-6	Difenzoquat (Avenge)	4.9E+03 nc	4.9E+04 nc	2.9E+02 nc	2.9E+03 nc		
		2.0E-02	i		2.0E-02	r	0.1	35367-38-5	Diflubenzuron	1.2E+03 nc	1.2E+04 nc	7.3E+01 nc	7.3E+02 nc		
		1.1E+01	r		1.1E+01	i y	75-37-6	1,1-Difluoroethane			4.2E+04 nc	6.9E+04 nc			
		2.0E-02	n		2.0E-02	r	0.1	28553-12-0	Diisononyl phthalate	1.2E+03 nc	1.2E+04 nc	7.3E+01 nc	7.3E+02 nc		
					1.1E-01	p	108-20-3	Diisopropyl ether			4.0E+02 nc				
		8.0E-02	i		8.0E-02	r	0.1	1445-75-6	Diisopropyl methylphosphonate	4.9E+03 nc	4.9E+04 nc	2.9E+02 nc	2.9E+03 nc		
		2.0E-02	i		2.0E-02	r	0.1	55290-64-7	Dimethipin	1.2E+03 nc	1.2E+04 nc	7.3E+01 nc	7.3E+02 nc		
		2.0E-04	i		2.0E-04	r	0.1	60-51-5	Dimethoate	1.2E+01 nc	1.2E+02 nc	7.3E-01 nc	7.3E+00 nc		
1.4E-02	h	1.4E-02	r	0.1	119-90-4	3,3'-Dimethoxybenzidine	3.5E+01 ca	1.2E+02 ca	4.8E-01 ca	4.8E+00 ca					
		5.7E-06	r		5.7E-06	x y	124-40-3	Dimethylamine	6.7E-02 nc	2.5E-01 nc	2.1E-02 nc	3.5E-02 nc			
		2.0E-03	i		2.0E-03	r	0.1	121-69-7	N-N-Dimethylaniline	1.2E+02 nc	1.2E+03 nc	7.3E+00 nc	7.3E+01 nc		
7.5E-01	h	7.5E-01	r	0.1	95-68-1	2,4-Dimethylaniline	6.5E-01 ca	2.3E+00 ca	9.0E-03 ca	9.0E-02 ca					

Key : SFO_i=Cancer Slope Factor oral, inhalation RfDo_i=Reference Dose oral, inhalation i=IRIS p=PPRTV c=California EPA n=NCEA h=HEAST x=Withdrawn r=Route-extrapolation ca=Cancer PRG nc= Noncancer PRG ca* (where: nc PRG < 100X ca PRG)
 ca** (where nc PRG < 10X ca PRG) +++=Non-Standard Method Applied (See User's Guide) sat=Soil Saturation (See User's Guide) max=Ceiling limit (See User's Guide) DAF=Dilution Attenuation Factor (See User's Guide) CAS=Chemical Abstract Services

TOXICITY VALUES				CONTAMINANT		PRELIMINARY REMEDIATION GOALS (PRGs)					SOIL SCREENING LEVELS			
SFO	RfDo	SFi	RfDi	V	CAS No.	Residential Soil (mg/kg)	"Direct Contact Exposure Pathways"				"Migration to Ground Water"			
1/(mg/kg-d)	(mg/kg-d)	1/(mg/kg-d)	(mg/kg-d)	O C	soils		Industrial Soil (mg/kg)	Ambient Air (ug/m ³)	Tap Water (ug/l)	DAF 20 (mg/kg)	DAF 1 (mg/kg)			
5.8E-01	h	5.8E-01	r	0.1	21436-96-4	2,4-Dimethylaniline hydrochloride	8.4E-01	ca	3.0E+00	ca	1.2E-02	ca	1.2E-01	ca
2.3E+00	p	2.3E+00	r	0.1	119-93-7	3,3'-Dimethylbenzidine	2.1E-01	ca	7.5E-01	ca	2.9E-03	ca	2.9E-02	ca
1.0E-01	h	8.6E-03	i	0.1	88-12-2	N,N-Dimethylformamide	6.1E+03	nc	6.2E+04	nc	3.1E+01	nc	3.6E+03	nc
1.0E-03	n	1.0E-03	r	0.1	122-09-8	Dimethylphenethylamine	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc
2.0E-02	i	2.0E-02	r	0.1	105-67-9	2,4-Dimethylphenol	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc
6.0E-04	i	6.0E-04	r	0.1	578-26-1	2,6-Dimethylphenol	3.7E+01	nc	3.7E+02	nc	2.2E+00	nc	2.2E+01	nc
1.0E-03	i	1.0E-03	r	0.1	95-65-8	3,4-Dimethylphenol	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc
1.0E+01	h	1.0E+01	r	0.1	131-11-3	Dimethyl phthalate	1.0E+05	max	1.0E+05	max	3.7E+04	nc	3.6E+05	nc
1.0E-01	i	1.0E-01	r	0.1	120-61-6	Dimethyl terephthalate	6.1E+03	nc	6.2E+04	nc	3.7E+02	nc	3.6E+03	nc
1.0E-04	p	1.0E-04	r	0.1	534-52-1	4,6-Dinitro-o-cresol	6.1E+00	nc	6.2E+01	nc	3.7E-01	nc	3.6E+00	nc
2.0E-03	i	2.0E-03	r	0.1	131-89-5	4,6-Dinitro-o-cyclohexyl phenol	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc
1.0E-04	p	1.0E-04	r	0.1	528-29-0	1,2-Dinitrobenzene	6.1E+00	nc	6.2E+01	nc	3.7E-01	nc	3.6E+00	nc
1.0E-04	i	1.0E-04	r	0.1	99-65-0	1,3-Dinitrobenzene	6.1E+00	nc	6.2E+01	nc	3.7E-01	nc	3.6E+00	nc
1.0E-04	p	1.0E-04	r	0.1	100-25-4	1,4-Dinitrobenzene	6.1E+00	nc	6.2E+01	nc	3.7E-01	nc	3.6E+00	nc
2.0E-03	i	2.0E-03	r	0.1	51-28-5	2,4-Dinitrophenol	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc
6.8E-01	i	6.8E-01	r	0.1	25321-14-6	Dinitrotoluene mixture	7.2E+01	ca	2.5E+00	ca	9.9E-03	ca	9.9E-02	ca
2.0E-03	i	2.0E-03	r	0.1	121-14-2	2,4-Dinitrotoluene (also see Dinitrotoluene mixture)	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc
1.0E-03	h	1.0E-03	r	0.1	606-20-2	2,6-Dinitrotoluene (also see Dinitrotoluene mixture)	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc
1.0E-03	i	1.0E-03	r	0.1	88-85-7	Dinoseb	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc
4.0E-02	p	4.0E-02	r	0.1	117-84-0	di-n-Octyl phthalate	2.4E+03	nc	2.5E+04	nc	1.5E+02	nc	1.5E+03	nc
1.1E-02	i	1.1E-02	r	0.1	123-91-1	1,4-Dioxane	4.4E+01	ca	1.6E+02	ca	6.1E-01	ca	6.1E+00	ca
1.5E+05	h	1.5E+05	h	0.03	1746-01-6	Dioxin (2,3,7,8-TCDD)+++	3.9E-06	ca	1.6E-05	ca	4.5E-08	ca	4.5E-07	ca
3.0E-02	i	3.0E-02	r	0.1	957-51-7	Diphenamid	1.8E+03	nc	1.8E+04	nc	1.1E+02	nc	1.1E+03	nc
2.5E-02	i	2.5E-02	r	0.1	122-39-4	Diphenylamine	1.5E+03	nc	1.5E+04	nc	9.1E+01	nc	9.1E+02	nc
3.0E-04	p	3.0E-04	r	0.1	74-31-7	N,N-Diphenyl-1,4 benzenediamine (DPPD)	1.8E+01	nc	1.8E+02	nc	1.1E+00	nc	1.1E+01	nc
8.0E-01	i	8.0E-01	i	0.1	122-86-7	1,2-Diphenylhydrazine	6.1E-01	ca	2.2E+00	ca	8.4E-03	ca	8.4E-02	ca
3.0E-03	p	3.0E-03	r	0.1	127-83-9	Diphenyl sulfone	1.8E+02	nc	1.8E+03	nc	1.1E+01	nc	1.1E+02	nc
2.2E-03	i	2.2E-03	r	0.1	85-00-7	Diquat	1.3E+02	nc	1.4E+03	nc	8.0E+00	nc	8.0E+01	nc
8.6E+00	h	8.6E+00	r	0.1	1837-37-7	Direct black 38	5.7E-02	ca	2.0E-01	ca	7.8E-04	ca	7.8E-03	ca
8.1E+00	h	8.1E+00	r	0.1	2602-46-2	Direct blue 6	6.0E-02	ca	2.1E-01	ca	8.3E-04	ca	8.3E-03	ca
9.3E+00	h	9.3E+00	r	0.1	16071-86-6	Direct brown 95	5.2E-02	ca	1.9E-01	ca	7.2E-04	ca	7.2E-03	ca
4.0E-05	i	4.0E-05	r	0.1	288-04-4	Disulfoton	2.4E+00	nc	2.5E+01	nc	1.5E-01	nc	1.5E+00	nc
1.0E-02	i	1.0E-02	r	0.1	505-29-3	1,4-Dithiane	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc
2.0E-03	i	2.0E-03	r	0.1	330-54-1	Diuron	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc
4.0E-03	i	4.0E-03	r	0.1	2439-10-3	Dodine	2.4E+02	nc	2.5E+03	nc	1.5E+01	nc	1.5E+02	nc
1.0E-01	n				7429-91-6	Dysprosium	7.8E+03	nc	1.0E+05	max			3.6E+03	nc
6.0E-03	i	6.0E-03	r	0.1	115-29-7	Endosulfan	3.7E+02	nc	3.7E+03	nc	2.2E+01	nc	2.2E+02	nc
2.0E-02	i	2.0E-02	r	0.1	145-73-3	Endothall	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc
3.0E-04	i	3.0E-04	r	0.1	72-20-8	Endrin	1.8E+01	nc	1.8E+02	nc	1.1E+00	nc	1.1E+01	nc
9.9E-03	i	2.0E-03	h	2.9E-04	106-89-8	Epichlorohydrin	7.6E+00	nc	2.6E+01	nc	1.0E+00	nc	2.0E+00	nc

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ca** (where nc PRG < 10X ca PRG) +++=Non-Standard Method Applied (See User's Guide) sat=Soil Saturation (See User's Guide) max=Ceiling limit (See User's Guide) DAF=Dilution Attenuation Factor (See User's Guide) CAS=Chemical Abstract Services

TOXICITY VALUES						CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs)				SOIL SCREENING LEVELS				
SFo	RfDo	SFi	RfDi	V	CAS No.		Residential Soil (mg/kg)	"Direct Contact Exposure Pathways"			DAF 20 (mg/kg)	DAF 1 (mg/kg)			
1/(mg/kg-d)	(mg/kg-d)	1/(mg/kg-d)	(mg/kg-d)	O C			Industrial Soil (mg/kg)	Ambient Air (ug/m^3)	Tap Water (ug/l)						
8.00E-02	r	8.00E-02	c	y		"CAL-Modified PRG"	1.3E+00	nc	2.9E+00	nc	8.4E-02	nc	1.4E-01	nc	
5.7E-03	r		5.7E-03	i	0.1	108-88-7	3.5E+02	nc	3.5E+03	nc	2.1E+01	nc	2.1E+02	nc	
2.5E-02	i		2.5E-02	r	0.1	759-94-4	1.5E+03	nc	1.5E+04	nc	9.1E+01	nc	9.1E+02	nc	
5.0E-03	i		5.0E-03	r	0.1	18672-87-0	3.1E+02	nc	3.1E+03	nc	1.8E+01	nc	1.8E+02	nc	
5.0E-04	i		5.0E-04	r	0.1	563-12-2	3.1E+01	nc	3.1E+02	nc	1.8E+00	nc	1.8E+01	nc	
4.0E-01	h		5.7E-02	i	0.1	110-80-5	2.4E+04	nc	1.0E+05	max	2.1E+02	nc	1.5E+04	nc	
3.0E-01	h		3.0E-01	r	0.1	111-15-9	1.8E+04	nc	1.0E+05	max	1.1E+03	nc	1.1E+04	nc	
9.0E-01	i		9.0E-01	r	y	141-78-6	1.9E+04	nc	3.7E+04	sat	3.3E+03	nc	5.5E+03	nc	
4.8E-02	h	4.8E-02	r	y		140-88-5	2.1E-01	ca	4.5E-01	ca	1.4E-01	ca	2.3E-01	ca	
1.0E-01	i		2.9E-01	i	y	100-41-4	4.0E+02	sat	4.0E+02	sat	1.1E+03	nc	1.3E+03	nc	
2.9E-03	n	4.0E-01	h	2.9E-03	r	2.9E+00	75-00-3	3.0E+00	ca	6.5E+00	ca	2.3E+00	ca	4.6E+00	ca
3.0E-01	h		3.0E-01	r	0.1	109-78-4	1.8E+04	nc	1.0E+05	max	1.1E+03	nc	1.1E+04	nc	
9.0E-02	p		9.0E-02	r	0.1	107-15-3	5.5E+03	nc	5.5E+04	nc	3.3E+02	nc	3.3E+03	nc	
2.0E+00	i		2.0E+00	r	0.1	107-21-1	1.0E+05	max	1.0E+05	max	7.3E+03	nc	7.3E+04	nc	
5.0E-01	i		3.7E+00	i	0.1	111-76-2	3.1E+04	nc	1.0E+05	max	1.4E+04	nc	1.8E+04	nc	
1.0E+00	h	3.5E-01	h	y		75-21-8	1.4E-01	ca	3.4E-01	ca	1.9E-02	ca	2.4E-02	ca	
1.1E-01	h	8.0E-05	i	1.1E-01	r	8.0E-05	86-45-7	4.4E+00	ca**	1.6E+01	ca**	6.1E-02	ca**	6.1E-01	ca**
2.0E-01	i		2.0E-01	r	y	60-29-7	1.8E+03	sat	1.8E+03	sat	7.3E+02	nc	1.2E+03	nc	
9.0E-02	h		9.0E-02	r	y	97-83-2	1.4E+02	sat	1.4E+02	sat	3.3E+02	nc	5.5E+02	nc	
1.0E-05	i		1.0E-05	r	0.1	2104-64-5	6.1E-01	nc	6.2E+00	nc	3.7E-02	nc	3.6E-01	nc	
3.0E+00	i		3.0E+00	r	0.1	84-72-0	1.0E+05	max	1.0E+05	max	1.1E+04	nc	1.1E+05	nc	
8.0E-03	i		8.0E-03	r	0.1	101209-48-0	4.9E+02	nc	4.9E+03	nc	2.9E+01	nc	2.9E+02	nc	
2.5E-04	i		2.5E-04	r	0.1	22224-92-6	1.5E+01	nc	1.5E+02	nc	9.1E-01	nc	9.1E+00	nc	
1.3E-02	i		1.3E-02	r	0.1	2164-17-2	7.9E+02	nc	8.0E+03	nc	4.7E+01	nc	4.7E+02	nc	
6.0E-02	i				0.1	18984-49-5	3.7E+03	nc	3.7E+04	nc		2.2E+03	nc		
8.0E-02	i		8.0E-02	r	0.1	59756-60-4	4.9E+03	nc	4.9E+04	nc	2.9E+02	nc	2.9E+03	nc	
2.0E-02	i		2.0E-02	r	0.1	56425-91-3	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc	
6.0E-02	i		6.0E-02	r	0.1	66332-96-5	3.7E+03	nc	3.7E+04	nc	2.2E+02	nc	2.2E+03	nc	
1.0E-02	i		1.0E-02	r	0.1	69409-94-5	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc	
3.5E-03	i	1.0E-01	i	3.5E-03	r	1.0E-01	133-07-3	1.4E+02	ca*	4.9E+02	ca	1.9E+00	ca	1.9E+01	ca
1.9E-01	i	1.9E-01	r		0.1	72178-02-0	2.6E+00	ca	9.1E+00	ca	3.5E-02	ca	3.5E-01	ca	
2.0E-03	i		2.0E-03	r	0.1	944-22-9	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc	
1.5E-01	i	4.8E-02	i		0.1	50-00-0	9.2E+03	nc	1.0E+05	nc	1.5E-01	ca	5.5E+03	nc	
2.0E+00	h		8.6E-04	p	0.1	64-18-6	1.0E+05	max	1.0E+05	max	3.1E+00	nc	7.3E+04	nc	
3.0E+00	i		3.0E+00	r	0.1	39148-24-8	1.0E+05	max	1.0E+05	max	1.1E+04	nc	1.1E+05	nc	
3.0E+01	i		8.6E+00	h	y	78-13-1	5.6E+03	sat	5.6E+03	sat	3.1E+04	nc	5.9E+04	nc	
1.0E-03	i		1.0E-03	r	y	110-00-9	2.5E+00	nc	8.5E+00	nc	3.7E+00	nc	6.1E+00	nc	
3.8E+00	h	3.8E+00	r		0.1	67-45-8	1.3E-01	ca	4.5E-01	ca	1.8E-03	ca	1.8E-02	ca	
3.0E-03	i		1.4E-02	h	0.1	98-01-1	1.8E+02	nc	1.8E+03	nc	5.2E+01	nc	1.1E+02	nc	
5.0E+01	h	5.0E+01	r		0.1	531-82-8	9.7E-03	ca	3.4E-02	ca	1.3E-04	ca	1.3E-03	ca	
3.0E-02	i	3.0E-02	r		0.1	60568-05-0	1.6E+01	ca	5.7E+01	ca	2.2E-01	ca	2.2E+00	ca	
4.0E-04	i		4.0E-04	r	0.1	77182-82-2	2.4E+01	nc	2.5E+02	nc	1.5E+00	nc	1.5E+01	nc	

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TOXICITY VALUES						CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs)				SOIL SCREENING LEVELS									
Sfo	RfDo	Sfi	RfDi	V	CAS No.		"Direct Contact Exposure Pathways"				"Migration to Ground Water"									
1/(mg/kg-d)	(mg/kg-d)	1/(mg/kg-d)	(mg/kg-d)	O C		Residential Soil (mg/kg)	Industrial Soil (mg/kg)	Ambient Air (ug/m ³)	Tap Water (ug/l)	DAF 20 (mg/kg)	DAF 1 (mg/kg)									
	4.0E-04	i	2.9E-04	h	0.1	765-34-4	Glycidaldehyde	2.4E+01	nc	2.5E+02	nc	1.0E+00	nc	1.5E+01	nc					
	1.0E-01	i	1.0E-01	r	0.1	1071-83-6	Glyphosate	6.1E+03	nc	6.2E+04	nc	3.7E+02	nc	3.6E+03	nc					
	5.0E-05	i	5.0E-05	r	0.1	69806-40-2	Haloxypop-methyl	3.1E+00	nc	3.1E+01	nc	1.8E-01	nc	1.8E+00	nc					
	1.3E-02	i	1.3E-02	r	0.1	79277-27-3	Harmony	7.9E+02	nc	8.0E+03	nc	4.7E+01	nc	4.7E+02	nc					
4.5E+00	i	5.0E-04	i	4.6E+00	i	5.0E-04	r	0.1	76-44-8	Heptachlor	1.1E-01	ca	3.8E-01	ca	1.5E-03	ca	1.5E-02	ca	2.3E+01	1.0E+00
9.1E+00	i	1.3E-05	i	9.1E+00	i	1.3E-05	r	0.1	1024-57-3	Heptachlor epoxide	5.3E-02	ca*	1.9E-01	ca*	7.4E-04	ca*	7.4E-03	ca*	7.0E-01	3.0E-02
	2.0E-03	i	2.0E-03	r	0.1	87-82-1	Hexabromobenzene	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc					
1.6E+00	i	8.0E-04	i	1.6E+00	i	8.0E-04	r	0.1	118-74-1	Hexachlorobenzene	3.0E-01	ca	1.1E+00	ca	4.2E-03	ca	4.2E-02	ca	2.0E+00	1.0E-01
7.8E-02	i	3.0E-04	n	7.8E-02	i	3.0E-04	r	0.1	87-69-3	Hexachlorobutadiene	6.2E+00	ca**	2.2E+01	ca**	8.6E-02	ca*	8.6E-01	ca*	2.0E+00	1.0E-01
6.3E+00	i	5.0E-04	n	6.3E+00	i	5.0E-04	r	0.04	319-84-8	HCH (alpha)	9.0E-02	ca	3.6E-01	ca	1.1E-03	ca	1.1E-02	ca	5.0E-04	3.0E-05
1.8E+00	i	2.0E-04	n	1.8E+00	i	2.0E-04	r	0.04	319-85-7	HCH (beta)	3.2E-01	ca	1.3E+00	ca	3.7E-03	ca	3.7E-02	ca	3.0E-03	1.0E-04
1.3E+00	h	3.0E-04	i	1.3E+00	r	3.0E-04	r	0.04	58-89-9	HCH (gamma) Lindane	4.4E-01	ca*	1.7E+00	ca	5.2E-03	ca	5.2E-02	ca	9.0E-03	5.0E-04
1.8E+00	i	1.8E+00	i			0.04	608-73-1	HCH-technical	3.2E-01	ca	1.3E+00	ca	3.8E-03	ca	3.7E-02	ca	3.0E-03	1.0E-04		
	8.0E-03	i	5.7E-05	i	0.1	77-47-4	Hexachlorocyclopentadiene	3.7E+02	nc	3.7E+03	nc	2.1E-01	nc	2.2E+02	nc	4.0E+02	2.0E+01			
1.4E-02	i	1.0E-03	i	1.4E-02	i	1.0E-03	r	0.1	67-72-1	Hexachloroethane	3.5E+01	ca**	1.2E+02	ca**	4.8E-01	ca**	4.8E+00	ca**	5.0E-01	2.0E-02
	3.0E-04	i	3.0E-04	r	0.1	70-30-4	Hexachlorophene	1.8E+01	nc	1.8E+02	nc	1.1E+00	nc	1.1E+01	nc					
1.1E-01	i	3.0E-03	i	1.1E-01	r	3.0E-03	r	0.1	121-82-4	Hexahydro-1,3,5-trinitro-1,3,5-triazine	4.4E+00	ca*	1.6E+01	ca	6.1E-02	ca	6.1E-01	ca		
	2.9E-06	r	2.9E-06	i	0.1	822-06-0	1,6-Hexamethylene diisocyanate	1.7E-01	nc	1.8E+00	nc	1.0E-02	nc	1.0E-01	nc					
	1.1E+01	p	5.7E-02	i	y	110-54-3	n-Hexane	1.1E+02	sat	1.1E+02	sat	2.1E+02	nc	4.2E+02	nc					
	3.3E-02	i	3.3E-02	r	0.1	51235-04-2	Hexazinone	2.0E+03	nc	2.0E+04	nc	1.2E+02	nc	1.2E+03	nc					
	5.0E-02	i	5.0E-02	r	0.1	2691-41-0	HMX	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc					
3.0E+00	i	1.7E+01	i			0.1	302-01-2	Hydrazine, hydrazine sulfate	1.6E-01	ca	5.7E-01	ca	3.9E-04	ca	2.2E-02	ca				
3.0E+00	n	1.7E+01	n			0.1	60-34-4	Hydrazine, monomethyl	1.6E-01	ca	5.7E-01	ca	4.0E-04	ca	2.2E-02	ca				
3.0E+00	n	1.7E+01	n			0.1	57-14-7	Hydrazine, dimethyl	1.6E-01	ca	5.7E-01	ca	4.0E-04	ca	2.2E-02	ca				
			5.7E-03	i			7647-01-0	Hydrogen chloride					2.1E+01	nc						
	2.0E-02	i	8.6E-04	i	y		74-90-8	Hydrogen cyanide	1.1E+01	nc	3.5E+01	nc	3.1E+00	nc	6.2E+00	nc				
	3.0E-03	i	2.9E-04	i			7783-08-4	Hydrogen sulfide					1.0E+00	nc	1.1E+02	nc				
5.6E-02	p	4.0E-02	p	5.6E-02	r	4.0E-02	r	0.1	123-31-9	p-Hydroquinone	8.7E+00	ca	3.1E+01	ca	1.2E-01	ca	1.2E+00	ca		
	1.3E-02	i	1.3E-02	r	0.1	35594-44-0	Imazalil	7.9E+02	nc	8.0E+03	nc	4.7E+01	nc	4.7E+02	nc					
	2.5E-01	i	2.5E-01	r	0.1	81335-37-7	Imazaquin	1.5E+04	nc	1.0E+05	max	9.1E+02	nc	9.1E+03	nc					
	4.0E-02	i	4.0E-02	r	0.1	36734-19-7	Iprodione	2.4E+03	nc	2.5E+04	nc	1.5E+02	nc	1.5E+03	nc					
	3.0E-01	n					7439-89-8	Iron	2.3E+04	nc	1.0E+05	max		1.1E+04	nc					
	3.0E-01	i	3.0E-01	r	y		78-83-1	Isobutanol	1.3E+04	nc	4.0E+04	sat	1.1E+03	nc	1.8E+03	nc				
9.5E-04	i	2.0E-01	i	9.5E-04	r	2.0E-01	r	0.1	78-59-1	Isophorone	5.1E+02	ca*	5.1E+02	ca*	7.1E+00	ca	7.1E+01	ca	5.0E-01	3.0E-02
	1.5E-02	i	1.5E-02	r	0.1	33820-53-0	Isopropalin	9.2E+02	nc	9.2E+03	nc	5.5E+01	nc	5.5E+02	nc					
	1.0E-01	i	1.1E-01	r	0.1	1832-54-8	Isopropyl methyl phosphonic acid	6.1E+03	nc	6.2E+04	nc	4.0E+02	nc	3.6E+03	nc					
	5.0E-02	i	5.0E-02	r	0.1	82558-50-7	Isoxaben	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc					
8.0E+00	p	2.0E-04	p	8.0E+00	r	2.0E-04	r	0.1	143-50-0	Kepone	6.1E-02	ca	2.2E-01	ca	8.4E-04	ca	8.4E-03	ca		
	2.0E-03	i	2.0E-03	r	0.1	77501-63-4	Lactofen	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc					
							7439-82-1	Lead+++	4.0E+02	nc	8.0E+02	nc								
								"CAL-Modified PRG"+++	1.5E+02	nc										
	1.0E-07	i				0.1	78-00-2	Lead (tetraethyl)	6.1E-03	nc	6.2E-02	nc		3.6E-03	nc					

Key: Sfo, i=Cancer Slope Factor oral, inhalation RfDo, i=Reference Dose oral, inhalation i=IRIS p=PPRTV c=California EPA n=NCEA h=HEAST x=Withdrawn r=Route-extrapolation ca=Cancer PRG nc=Noncancer PRG ca* (where: nc PRG < 100X ca PRG) ca** (where nc PRG < 10X ca PRG) ***=Non-Standard Method Applied (See User's Guide) sat=Soil Saturation (See User's Guide) max=Ceiling limit (See User's Guide) DAF=Dilution Attenuation Factor (See User's Guide) CAS=Chemical Abstract Services

TOXICITY VALUES					V O C	skin abs. soils	CAS No.	CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs)				SOIL SCREENING LEVELS					
Sfo 1/(mg/kg-d)	RfDo (mg/kg-d)	SFi 1/(mg/kg-d)	RfDi (mg/kg-d)	Residential Soil (mg/kg)					Industrial Soil (mg/kg)	Ambient Air (ug/m ³)	Tap Water (ug/l)	"Direct Contact Exposure Pathways"		"Migration to Ground Water"				
												DAF 20 (mg/kg)	DAF 1 (mg/kg)					
	2.0E-03	i	2.0E-03	r	0.1	330-55-2	Linuron	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc			
	2.0E-02	x				7439-93-2	Lithium	1.6E+03	nc	2.0E+04	nc			7.3E+02	nc			
	2.0E-01	i	2.0E-01	r	0.1	83055-99-6	Londax	1.2E+04	nc	1.0E+05	max	7.3E+02	nc	7.3E+03	nc			
	2.0E-02	i	2.0E-02	r	0.1	121-75-5	Malathion	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc			
	1.0E-01	i	1.0E-01	r	0.1	108-31-8	Maleic anhydride	6.1E+03	nc	6.2E+04	nc	3.7E+02	nc	3.6E+03	nc			
	5.0E-01	i	5.0E-01	r	y	123-33-1	Maleic hydrazide	1.7E+03	nc	2.4E+03	sat	1.8E+03	nc	3.0E+03	nc			
	1.0E-04	p	1.0E-04	r	0.1	109-77-3	Malononitrile	6.1E+00	nc	6.2E+01	nc	3.7E-01	nc	3.6E+00	nc			
	3.0E-02	h	3.0E-02	r	0.1	8018-01-7	Mancozeb	1.8E+03	nc	1.8E+04	nc	1.1E+02	nc	1.1E+03	nc			
6.0E-02	5.0E-03	i	6.0E-02	r	0.1	12427-38-2	Maneb	8.1E+00	ca*	2.9E+01	ca	1.1E-01	ca	1.1E+00	ca			
	2.4E-02	i	1.4E-05	i		7439-96-5	Manganese and compounds+++	1.8E+03	nc	1.9E+04	nc	5.1E-02	nc	8.8E+02	nc			
	9.0E-05	h	9.0E-05	r	0.1	950-10-7	Mepfosfolan	5.5E+00	nc	5.5E+01	nc	3.3E-01	nc	3.3E+00	nc			
	3.0E-02	i	3.0E-02	r	0.1	24307-26-4	Mepiquat chloride	1.8E+03	nc	1.8E+04	nc	1.1E+02	nc	1.1E+03	nc			
2.9E-02	1.0E-01	n	2.9E-02	r	1.0E-01	149-30-4	2-Mercaptobenzothiazole	1.7E+01	ca	5.9E+01	ca	2.3E-01	ca	2.3E+00	ca			
	3.0E-04	i				7487-84-7	Mercury and compounds	2.3E+01	nc	3.1E+02	nc			1.1E+01	nc			
			8.6E-05	i		7439-97-6	Mercury (elemental)					3.1E-01	nc					
	1.0E-04	i			0.1	22967-92-6	Mercury (methyl)	6.1E+00	nc	6.2E+01	nc			3.6E+00	nc			
	3.0E-05	i	3.0E-05	r	0.1	150-50-5	Merphos	1.8E+00	nc	1.8E+01	nc	1.1E-01	nc	1.1E+00	nc			
	3.0E-05	i	3.0E-05	r	0.1	78-48-8	Merphos oxide	1.8E+00	nc	1.8E+01	nc	1.1E-01	nc	1.1E+00	nc			
	6.0E-02	i	6.0E-02	r	0.1	57837-19-1	Metalaxyl	3.7E+03	nc	3.7E+04	nc	2.2E+02	nc	2.2E+03	nc			
	1.0E-04	i	2.0E-04	h	y	126-98-7	Methacrylonitrile	2.1E+00	nc	8.4E+00	nc	7.3E-01	nc	1.0E+00	nc			
	5.0E-05	i	5.0E-05	r	0.1	10285-92-6	Methamidophos	3.1E+00	nc	3.1E+01	nc	1.8E-01	nc	1.8E+00	nc			
	5.0E-01	i	5.0E-01	r	0.1	67-56-1	Methanol	3.1E+04	nc	1.0E+05	max	1.8E+03	nc	1.8E+04	nc			
	1.0E-03	i	1.0E-03	r	0.1	950-37-8	Methidathion	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc			
	2.5E-02	i	2.5E-02	r	y	16752-77-5	Methomyl	4.4E+01	nc	1.5E+02	nc	9.1E+01	nc	1.5E+02	nc			
	5.0E-03	i	5.0E-03	r	0.1	72-43-5	Methoxychlor	3.1E+02	nc	3.1E+03	nc	1.8E+01	nc	1.8E+02	nc	1.6E+02 8.0E+00		
	1.0E-03	h	5.7E-03	i	0.1	109-86-4	2-Methoxyethanol	6.1E+01	nc	6.2E+02	nc	2.1E+01	nc	3.6E+01	nc			
	2.0E-03	h	2.0E-03	r	0.1	110-49-6	2-Methoxyethanol acetate	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc			
4.6E-02	h	4.6E-02	r		0.1	99-59-2	2-Methoxy-5-nitroaniline	1.1E+01	ca	3.7E+01	ca	1.5E-01	ca	1.5E+00	ca			
	1.0E+00	h	1.0E+00	r	y	79-20-9	Methyl acetate	2.2E+04	nc	9.2E+04	nc	3.7E+03	nc	6.1E+03	nc			
	3.0E-02	h	3.0E-02	r	y	96-33-3	Methyl acrylate	7.0E+01	nc	2.3E+02	nc	1.1E+02	nc	1.8E+02	nc			
2.4E-01	h	2.4E-01	r		0.1	95-53-4	2-Methylaniline (o-toluidine)	2.0E+00	ca	7.2E+00	ca	2.8E-02	ca	2.8E-01	ca			
1.8E-01	h	1.8E-01	r		0.1	636-21-5	2-Methylaniline hydrochloride	2.7E+00	ca	9.6E+00	ca	3.7E-02	ca	3.7E-01	ca			
	5.0E-04	i	5.0E-04	r	0.1	94-74-6	2-Methyl-4-chlorophenoxyacetic acid	3.1E+01	nc	3.1E+02	nc	1.8E+00	nc	1.8E+01	nc			
	1.0E-02	i	1.0E-02	r	0.1	94-81-5	4-(2-Methyl-4-chlorophenoxy) butyric acid	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc			
	1.0E-03	i	1.0E-03	r	0.1	93-85-2	2-(2-Methyl-4-chlorophenoxy) propionic acid	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc			
	1.0E-03	i	1.0E-03	r	0.1	16484-77-8	2-(2-Methyl-1,4-chlorophenoxy) propionic acid	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc			
	8.6E-01	r	8.6E-01	h	y	108-87-2	Methylcyclohexane	2.6E+03	nc	8.7E+03	nc	3.1E+03	nc	5.2E+03	nc			
2.5E-01	h	2.5E-01	r		0.1	101-77-9	4,4'-Methylenebisbenzeneamine	1.9E+00	ca	6.9E+00	ca	2.7E-02	ca	2.7E-01	ca			
1.3E-01	h	7.0E-04	h	1.3E-01	h	7.0E-04	4,4'-Methylene bis(2-chloroaniline)	3.7E+00	ca*	1.3E+01	ca*	5.2E-02	ca*	5.2E-01	ca*			
4.6E-02	i	4.6E-02	r		0.1	101-61-1	4,4'-Methylene bis(N,N'-dimethyl)aniline	1.1E+01	ca	3.7E+01	ca	1.5E-01	ca	1.5E+00	ca			
	1.0E-02	h	1.0E-02	r	y	74-85-3	Methylene bromide	6.7E+01	nc	2.3E+02	nc	3.7E+01	nc	6.1E+01	nc			
7.5E-03	i	6.0E-02	i	1.6E-03	i	8.6E-01	h	y	75-09-2	7.5E+00	ca	2.1E+01	ca	4.1E+00	ca	4.3E+00	ca	2.0E-02 1.0E-03

Key : SFO=Cancer Slope Factor oral, inhalation RfDo,i=Reference Dose oral, inhalation i=IRIS p=PPRTV c=California EPA n=NCEA h=HEAST x=Withdrawn r=Route-extrapolation ca=Cancer PRG nc= Noncancer PRG ca* (where: nc PRG < 100X ca PRG)
 ca** (where nc PRG < 10X ca PRG) +++=Non-Standard Method Applied (See User's Guide) sat=Soil Saturation (See User's Guide) max=Ceiling limit (See User's Guide) DAF=Dilution Attenuation Factor (See User's Guide) CAS=Chemical Abstract Services

TOXICITY VALUES						CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs)				SOIL SCREENING LEVELS								
SFO 1/(mg/kg-d)	RfDo (mg/kg-d)	SFi 1/(mg/kg-d)	RfDi (mg/kg-d)	V O C	skin abs. soils		CAS No.	Residential Soil (mg/kg)	"Direct Contact Exposure Pathways" Industrial Soil (mg/kg)		Ambient Air (ug/m^3)	Tap Water (ug/l)	DAF 20 (mg/kg)	DAF 1 (mg/kg)					
	1.7E-04	r	1.7E-04	i	0.1	101-68-8	4,4'-Methylene diphenyl diisocyanate	1.0E+01	nc	1.0E+02	nc	6.2E-01	nc	6.2E+00	nc				
	6.0E-01	i	1.4E+00	i	y	78-93-3	Methyl ethyl ketone (2-Butanone)	2.2E+04	nc	1.1E+05	nc	5.1E+03	nc	7.0E+03	nc				
	8.0E-02	h	8.6E-01	i	y	108-10-1	Methyl isobutyl ketone	5.3E+03	nc	4.7E+04	nc	3.1E+03	nc	2.0E+03	nc				
	5.7E-04	r	5.7E-04	n	0.1	74-93-1	Methyl Mercaptan	3.5E+01	nc	3.5E+02	nc	2.1E+00	nc	2.1E+01	nc				
	1.4E+00	i	2.0E-01	i	y	80-62-6	Methyl methacrylate	2.2E+03	nc	2.7E+03	sat	7.3E+02	nc	1.4E+03	nc				
3.3E-02		h	3.3E-02	r		99-55-8	2-Methyl-5-nitroaniline	1.5E+01	ca	5.2E+01	ca	2.0E-01	ca	2.0E+00	ca				
	2.5E-04	i	2.5E-04	r	0.1	298-00-0	Methyl parathion	1.5E+01	nc	1.5E+02	nc	9.1E-01	nc	9.1E+00	nc				
	5.0E-02	i	5.0E-02	r	0.1	95-48-7	2-Methylphenol	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc				
	5.0E-02	i	5.0E-02	r	0.1	108-39-4	3-Methylphenol	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc				
	5.0E-03	h	5.0E-03	r	0.1	106-44-5	4-Methylphenol	3.1E+02	nc	3.1E+03	nc	1.8E+01	nc	1.8E+02	nc				
	2.0E-02	p	2.0E-02	r	0.1	893-13-5	Methyl phosphonic acid	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc				
	6.0E-03	h	1.1E-02	h	y	25013-15-4	Methyl styrene (mixture)	1.3E+02	nc	5.4E+02	nc	4.2E+01	nc	6.0E+01	nc				
	7.0E-02	h	7.0E-02	r	y	98-83-9	Methyl styrene (alpha)	6.8E+02	sat	6.8E+02	sat	2.6E+02	nc	4.3E+02	nc				
1.8E-03	c	8.6E-01	r	9.1E-04	c	8.6E-01	i	y	1634-04-4	Methyl tertbutyl ether (MTBE)	3.2E+01	ca	7.0E+01	ca	7.4E+00	ca	1.1E+01	ca	
	1.5E-01	i	1.5E-01	r	0.1	51218-45-2	Metolaclo (Dual)	9.2E+03	nc	9.2E+04	nc	5.5E+02	nc	5.5E+03	nc				
	2.5E-02	i	2.5E-02	r	0.1	21087-64-9	Metribuzin	1.5E+03	nc	1.5E+04	nc	9.1E+01	nc	9.1E+02	nc				
1.8E+00	x	2.0E-04	i	1.8E+00	r	2.0E-04	r	0.1	2385-85-5	Mirex	2.7E-01	ca*	9.6E-01	ca	3.7E-03	ca	3.7E-02	ca	
	2.0E-03	i	2.0E-03	r	0.1	2212-67-1	Molinate	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc				
	5.0E-03	i				7439-98-7	Molybdenum	3.9E+02	nc	5.1E+03	nc			1.8E+02	nc				
	1.0E-01	i	1.0E-01	r	0.1	10599-90-3	Monochloramine	6.1E+03	nc	6.2E+04	nc	3.7E+02	nc	3.6E+03	nc				
	2.0E-03	i	2.0E-03	r	0.1	300-76-5	Naled	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc				
	1.0E-01	i	1.0E-01	r	0.1	15299-99-7	Napropamide	6.1E+03	nc	6.2E+04	nc	3.7E+02	nc	3.6E+03	nc				
	2.0E-02	i				7440-02-0	Nickel (soluble salts)	1.6E+03	nc	2.0E+04	nc			7.3E+02	nc				
	8.4E-01	i					Nickel refinery dust					8.0E-03	ca						
	1.7E+00	i				12035-72-2	Nickel subsulfide			1.1E+04	ca	4.0E-03	ca						
						14797-55-8	Nitrate+++							1.0E+04	nc				
						14797-65-0	Nitrite+++							1.0E+03	nc				
	3.0E-03	p	3.0E-05	p	0.1	88-74-4	2-Nitroaniline	1.8E+02	nc	1.8E+03	nc	1.1E-01	nc	1.1E+02	nc				
2.1E-02	p	3.0E-04	p	2.1E-02	r	3.0E-04	p	0.1	99-09-2	3-Nitroaniline	1.8E+01	nc	8.2E+01	ca**	3.2E-01	ca**	3.2E+00	ca**	
2.1E-02	p	3.0E-03	p	2.1E-02	r	1.0E-03	p	0.1	100-01-6	4-Nitroaniline	2.3E+01	ca**	8.2E+01	ca*	3.2E-01	ca*	3.2E+00	ca*	
	5.0E-04	i	5.7E-04	h	y	98-95-3	Nitrobenzene	2.0E+01	nc	1.0E+02	nc	2.1E+00	nc	3.4E+00	nc				
1.5E+00	h	1.5E+00	r		0.1	67-20-9	Nitrofurantoin	4.3E+03	nc	4.3E+04	nc	2.6E+02	nc	2.6E+03	nc				
	1.4E-02	n	1.4E-02	r		0.1	55-63-0	Nitrofurazone	3.2E-01	ca	1.1E+00	ca	4.5E-03	ca	4.5E-02	ca			
	1.0E-01	i	1.0E-01	r	0.1	556-88-7	Nitroglycerin	3.5E+01	ca	1.2E+02	ca	4.8E-01	ca	4.8E+00	ca				
9.4E+00	r	5.7E-03	r	9.4E+00	h	5.7E-03	i	y	79-46-9	Nitroguanidine	6.1E+03	nc	6.2E+04	nc	3.7E+02	nc	3.6E+03	nc	
	5.4E+00	i	5.6E+00	i		924-16-3	2-Nitropropane					7.2E-04	ca	1.2E-03	ca				
2.8E+00	i	2.8E+00	r		0.1	1116-54-7	N-Nitrosodi-n-butylamine	2.4E-02	ca	5.8E-02	ca	1.2E-03	ca	2.0E-03	ca				
1.5E+02	i	1.5E+02	i		0.1	55-18-5	N-Nitrosodiethanolamine	1.7E-01	ca	6.2E-01	ca	2.4E-03	ca	2.4E-02	ca				
	5.1E+01	i	8.0E-06	p	4.9E+01	i	8.0E-06	r	0.1	62-75-9	N-Nitrosodiethylamine	3.2E-03	ca	1.1E-02	ca	4.5E-05	ca	4.5E-04	ca
4.9E-03	i	2.0E-02	p	4.9E-03	r	2.0E-02	r	0.1	86-30-6	N-Nitrosodimethylamine	9.5E-03	ca*	3.4E-02	ca	1.4E-04	ca	1.3E-03	ca	
7.0E+00	i	7.0E+00	r		0.1	621-64-7	N-Nitrosodiphenylamine	9.9E+01	ca*	3.5E+02	ca*	1.4E+00	ca*	1.4E+01	ca*				
							N-Nitroso di-n-propylamine	6.9E-02	ca	2.5E-01	ca	9.6E-04	ca	9.6E-03	ca				

Key : SFO_i=Cancer Slope Factor oral, inhalation RfDo_i=Reference Dose oral, inhalation i=IRIS p=PPRTV c=California EPA n=NCEA h=HEAST x=Withdrawn r=Route-extrapolation ca=Cancer PRG nc= Noncancer PRG ca* (where: nc PRG < 100X ca PRG)
 ca** (where nc PRG < 10X ca PRG) +++=Non-Standard Method Applied (See User's Guide) sat=Soil Saturation (See User's Guide) max=Ceiling limit (See User's Guide) DAF=Dilution Attenuation Factor (See User's Guide) CAS=Chemical Abstract Services

TOXICITY VALUES				CONTAMINANT		PRELIMINARY REMEDIATION GOALS (PRGs)				SOIL SCREENING LEVELS							
SFO _i	RfDo _i	SFi	RfDi	V	CAS No.	Residential	"Direct Contact Exposure Pathways"			"Migration to Ground Water"							
1/(mg/kg-d)	(mg/kg-d)	1/(mg/kg-d)	(mg/kg-d)	skin O soils		Soil (mg/kg)	Industrial	Ambient Air	Tap Water	DAF 20	DAF 1						
							Soil (mg/kg)	(ug/m ³)	(ug/l)	(mg/kg)	(mg/kg)						
2.2E+01	i	2.2E+01	r	0.1	10595-85-6	N-Nitroso-N-methylethylamine	2.2E-02	ca	7.8E-02	ca	3.1E-04	ca	3.1E-03	ca			
2.1E+00	i	2.1E+00	i	0.1	930-55-2	N-Nitrosopyrrolidine	2.3E-01	ca	8.2E-01	ca	3.1E-03	ca	3.2E-02	ca			
		2.0E-02	p	2.0E-02	r y	m-Nitrotoluene	7.3E+02	nc	1.0E+03	sat	7.3E+01	nc	1.2E+02	nc			
2.3E-01	p	1.0E-02	h	2.3E-01	r	1.0E-02	r y	88-72-2	o-Nitrotoluene	8.8E-01	ca	2.2E+00	ca	2.9E-02	ca	4.9E-02	ca
1.7E-02	p	1.0E-02	p	1.7E-02	r	1.0E-02	r y	99-99-0	p-Nitrotoluene	1.2E+01	ca*	3.0E+01	ca*	4.0E-01	ca*	6.6E-01	ca*
		4.0E-02	i	4.0E-02	r	0.1	27314-13-2	Norflurazon	2.4E+03	nc	2.5E+04	nc	1.5E+02	nc	1.5E+03	nc	
		7.0E-04	i	7.0E-04	r	0.1	85508-19-9	NuStar	4.3E+01	nc	4.3E+02	nc	2.6E+00	nc	2.6E+01	nc	
		3.0E-03	i	3.0E-03	r	0.1	32536-52-0	Octabromodiphenyl ether	1.8E+02	nc	1.8E+03	nc	1.1E+01	nc	1.1E+02	nc	
		2.0E-03	h	2.0E-03	r	0.1	152-16-9	Octamethylpyrophosphoramide	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc	
		5.0E-02	i	5.0E-02	r	0.1	19044-88-3	Oryzalin	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc	
		5.0E-03	i	5.0E-03	r	0.1	19666-30-9	Oxadiazon	3.1E+02	nc	3.1E+03	nc	1.8E+01	nc	1.8E+02	nc	
		2.5E-02	i	2.5E-02	r	0.1	23135-22-0	Oxamyl	1.5E+03	nc	1.5E+04	nc	9.1E+01	nc	9.1E+02	nc	
		3.0E-03	i	3.0E-03	r	0.1	42874-03-3	Oxyfluorfen	1.8E+02	nc	1.8E+03	nc	1.1E+01	nc	1.1E+02	nc	
		1.3E-02	i	1.3E-02	r	0.1	76738-62-0	Paclobutrazol	7.9E+02	nc	8.0E+03	nc	4.7E+01	nc	4.7E+02	nc	
		4.5E-03	i	4.5E-03	r	0.1	4685-14-7	Paraquat	2.7E+02	nc	2.8E+03	nc	1.6E+01	nc	1.6E+02	nc	
		6.0E-03	h	6.0E-03	r	0.1	56-38-2	Parathion	3.7E+02	nc	3.7E+03	nc	2.2E+01	nc	2.2E+02	nc	
		5.0E-02	h	5.0E-02	r	0.1	1114-71-2	Pebulate	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc	
		4.0E-02	i	4.0E-02	r	0.1	40487-42-1	Pendimethalin	2.4E+03	nc	2.5E+04	nc	1.5E+02	nc	1.5E+03	nc	
2.3E-02	h	2.3E-02	r	0.1	87-84-3	Pentabromo-6-chloro cyclohexane	2.1E+01	ca	7.5E+01	ca	2.9E-01	ca	2.9E+00	ca			
		2.0E-03	i	2.0E-03	r	0.1	32534-81-9	Pentabromodiphenyl ether	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc	
		8.0E-04	i	8.0E-04	r	0.1	808-93-5	Pentachlorobenzene	4.9E+01	nc	4.9E+02	nc	2.9E+00	nc	2.9E+01	nc	
2.6E-01	h	3.0E-03	i	2.6E-01	r	0.1	82-68-8	Pentachloronitrobenzene	1.9E+00	ca*	6.6E+00	ca	2.6E-02	ca	2.6E-01	ca	
1.2E-01	i	3.0E-02	i	1.2E-01	r	0.25	87-86-5	Pentachlorophenol	3.0E+00	ca	9.0E+00	ca	5.6E-02	ca	5.6E-01	ca	3.0E-02 1.0E-03
		1.0E-04	n			7601-90-3	Perchlorate	7.8E+00	ca/nc	1.0E+02	ca/nc		3.6E+00	ca/nc			
		5.0E-02	i	5.0E-02	r	0.1	52845-53-1	Permethrin	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc	
		2.5E-01	i	2.5E-01	r	0.1	13684-63-4	Phenmedipham	1.5E+04	nc	1.0E+05	max	9.1E+02	nc	9.1E+03	nc	
		3.0E-01	i	3.0E-01	r	0.1	108-95-2	Phenol	1.8E+04	nc	1.0E+05	max	1.1E+03	nc	1.1E+04	nc	1.0E+02 5.0E+00
		2.0E-03	n	2.0E-03	r	0.1	92-84-2	Phenothiazine	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc	
		6.0E-03	i	6.0E-03	r	0.1	108-45-2	m-Phenylenediamine	3.7E+02	nc	3.7E+03	nc	2.2E+01	nc	2.2E+02	nc	
4.7E-02	h	4.7E-02	r	0.1	95-54-5	o-Phenylenediamine	1.0E+01	ca	3.7E+01	ca	1.4E-01	ca	1.4E+00	ca			
		1.9E-01	h	1.9E-01	r	0.1	106-50-3	p-Phenylenediamine	1.2E+04	nc	1.0E+05	max	6.9E+02	nc	6.9E+03	nc	
		8.0E-05	i	8.0E-05	r	0.1	62-38-4	Phenylmercuric acetate	4.9E+00	nc	4.9E+01	nc	2.9E-01	nc	2.9E+00	nc	
1.9E-03	h	1.9E-03	r	0.1	90-43-7	2-Phenylphenol	2.5E+02	ca	8.9E+02	ca	3.5E+00	ca	3.5E+01	ca			
		2.0E-04	h	2.0E-04	r	0.1	298-02-2	Phorate	1.2E+01	nc	1.2E+02	nc	7.3E-01	nc	7.3E+00	nc	
		2.0E-02	i	2.0E-02	r	0.1	732-11-6	Phosmet	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc	
		3.0E-04	i	8.6E-05	i	0.1	7803-51-2	Phosphine	1.8E+01	nc	1.8E+02	nc	3.1E-01	nc	1.1E+01	nc	
				2.9E-03	i	7684-38-2	Phosphoric acid				1.0E+01	nc					
		2.0E-05	i			7723-14-0	Phosphorus (white)	1.6E+00	nc	2.0E+01	nc		7.3E-01	nc			
		1.0E+00	h	1.0E+00	r	0.1	100-21-0	p-Phthalic acid	6.1E+04	nc	1.0E+05	max	3.7E+03	nc	3.6E+04	nc	
		2.0E+00	i	3.4E-02	h	0.1	85-44-9	Phthalic anhydride	1.0E+05	max	1.0E+05	max	1.2E+02	nc	7.3E+04	nc	
		7.0E-02	i	7.0E-02	r	0.1	1918-02-1	Picloram	4.3E+03	nc	4.3E+04	nc	2.6E+02	nc	2.6E+03	nc	
		1.0E-02	i	1.0E-02	r	0.1	29232-93-7	Pirimiphos-methyl	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc	

Key : SFo,i=Cancer Slope Factor oral, inhalation RfDi,i=Reference Dose oral, inhalation i=IRIS p=PPRTV c=California EPA n=NCEA h=HEAST x=Withdrawn r=Route-extrapolation ca=Cancer PRG nc=Noncancer PRG ca* (where: nc PRG < 100X ca PRG) ca** (where nc PRG < 10X ca PRG) +++=Non-Standard Method Applied (See User's Guide) sat=Soil Saturation (See User's Guide) max=Ceiling limit (See User's Guide) DAF=Dilution Attenuation Factor (See User's Guide) CAS=Chemical Abstract Services

TOXICITY VALUES					CAS No.	CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs)				SOIL SCREENING LEVELS			
SFo 1/(mg/kg-d)	RfDi (mg/kg-d)	SFi 1/(mg/kg-d)	RfDi (mg/kg-d)	V O C			Residential Soil (mg/kg)	Industrial Soil (mg/kg)	Ambient Air (ug/m ³)	Tap Water (ug/l)	"Migration to Ground Water" DAF 20 (mg/kg) DAF 1 (mg/kg)			
8.9E+00	h 7.0E-06	h 8.9E+00	r 7.0E-06	r	0.1	Polybrominated biphenyls	5.5E-02	ca**	1.9E-01	ca*	7.6E-04	ca*	7.6E-03	ca*
						Polychlorinated biphenyls (PCBs, see IRIS)								
7.0E-02	i 7.0E-05	i 7.0E-02	i 7.0E-05	r	0.14	12674-11-2 PCBs (unspecified mixture, low risk, e.g. Aroclor 1016)	3.9E+00	nc	2.1E+01	ca**	9.6E-02	ca**	9.6E-01	ca**
2.0E+00	i 2.0E-05	i 2.0E+00	i 2.0E-05	r	0.14	11097-69-1 PCBs (unspecified mixture, high risk, e.g. Aroclor 1254)	2.2E-01	ca**	7.4E-01	ca*	3.4E-03	ca*	3.4E-02	ca*
4.5E+00	n	4.5E+00	r		0.1	61788-33-8 Polychlorinated terphenyls	1.1E-01	ca	3.8E-01	ca	1.5E-03	ca	1.5E-02	ca
						Polynuclear aromatic hydrocarbons (PAHs)								
	6.0E-02	i	6.0E-02	r	y	83-32-9 Acenaphthene	3.7E+03	nc	2.9E+04	nc	2.2E+02	nc	3.7E+02	nc
	3.0E-01	i	3.0E-01	r	y	120-12-7 Anthracene	2.2E+04	nc	1.0E+05	max	1.1E+03	nc	1.8E+03	nc
7.3E-01	n	7.3E-01	r		0.13	56-55-3 Benz[a]anthracene	6.2E-01	ca	2.1E+00	ca	9.2E-03	ca	9.2E-02	ca
7.3E-01	n	7.3E-01	r		0.13	205-99-2 Benzo[b]fluoranthene	6.2E-01	ca	2.1E+00	ca	9.2E-03	ca	9.2E-02	ca
7.3E-02	n	7.3E-02	r		0.13	207-08-9 Benzo[k]fluoranthene	6.2E+00	ca	2.1E+01	ca	9.2E-02	ca	9.2E-01	ca
1.2E+00	c	3.9E-01	c		0.13	207-08-9 "CAL-Modified PRG"	3.8E-01	ca	1.3E+00	ca	1.7E-02	ca	5.6E-02	ca
7.3E+00	i	7.3E+00	r		0.13	50-32-8 Benzo[a]pyrene	6.2E-02	ca	2.1E-01	ca	9.2E-04	ca	9.2E-03	ca
7.3E-03	n	7.3E-03	r		0.13	218-01-9 Chrysene	6.2E+01	ca	2.1E+02	ca	9.2E-01	ca	9.2E+00	ca
1.2E-01	c	3.9E-02	c		0.13	"CAL-Modified PRG"	3.8E+00	ca	1.3E+01	ca	1.7E-01	ca	5.6E-01	ca
7.3E+00	n	7.3E+00	r		0.13	53-70-3 Dibenz[ah]anthracene	6.2E-02	ca	2.1E-01	ca	9.2E-04	ca	9.2E-03	ca
	4.0E-02	i	4.0E-02	r	0.13	206-44-0 Fluoranthene	2.3E+03	nc	2.2E+04	nc	1.5E+02	nc	1.5E+03	nc
	4.0E-02	i	4.0E-02	r	y	86-73-7 Fluorene	2.7E+03	nc	2.6E+04	nc	1.5E+02	nc	2.4E+02	nc
7.3E-01	n	7.3E-01	r		0.13	193-39-5 Indeno[1,2,3-cd]pyrene	6.2E-01	ca	2.1E+00	ca	9.2E-03	ca	9.2E-02	ca
	2.0E-02	i	8.6E-04	i	y	91-20-3 Naphthalene	5.6E+01	nc	1.9E+02	nc	3.1E+00	nc	6.2E+00	nc
1.2E-01	r	1.2E-01	c			"CAL-Modified PRG"	1.7E+00	ca	4.2E+00	ca	5.6E-02	ca	9.3E-02	ca
	3.0E-02	i	3.0E-02	r	y	129-00-0 Pyrene	2.3E+03	nc	2.9E+04	nc	1.1E+02	nc	1.8E+02	nc
1.5E-01	i 9.0E-03	i 1.5E-01	r 9.0E-03	r	0.1	67747-09-5 Prochloraz	3.2E+00	ca	1.1E+01	ca	4.5E-02	ca	4.5E-01	ca
	6.0E-03	h	6.0E-03	r	0.1	26398-36-0 Profluralin	3.7E+02	nc	3.7E+03	nc	2.2E+01	nc	2.2E+02	nc
	1.5E-02	i	1.5E-02	r	0.1	1610-18-0 Prometon	9.2E+02	nc	9.2E+03	nc	5.5E+01	nc	5.5E+02	nc
	4.0E-03	i	4.0E-03	r	0.1	7287-19-6 Prometryn	2.4E+02	nc	2.5E+03	nc	1.5E+01	nc	1.5E+02	nc
	7.5E-02	i	7.5E-02	r	0.1	23950-58-5 Pronamide	4.6E+03	nc	4.6E+04	nc	2.7E+02	nc	2.7E+03	nc
	1.3E-02	i	1.3E-02	r	0.1	1916-16-7 Propachlor	7.9E+02	nc	8.0E+03	nc	4.7E+01	nc	4.7E+02	nc
	5.0E-03	i	5.0E-03	r	0.1	709-98-8 Propanil	3.1E+02	nc	3.1E+03	nc	1.8E+01	nc	1.8E+02	nc
	2.0E-02	i	2.0E-02	r	0.1	2312-35-8 Propargite	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc
	2.0E-03	i	2.0E-03	r	0.1	107-19-7 Propargyl alcohol	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc
	2.0E-02	i	2.0E-02	r	0.1	139-40-2 Propazine	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc
	2.0E-02	i	2.0E-02	r	0.1	122-42-9 Propham	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc
	1.3E-02	i	1.3E-02	r	0.1	60207-80-1 Propiconazole	7.9E+02	nc	8.0E+03	nc	4.7E+01	nc	4.7E+02	nc
						98-82-8 Isopropylbenzene (see Cumene)								
	4.0E-02	n	4.0E-02	r	y	103-65-1 n-Propylbenzene	2.4E+02	sat	2.4E+02	sat	1.5E+02	nc	2.4E+02	nc
	5.0E-01	p	8.6E-04	p	0.1	57-55-6 Propylene glycol	3.0E+04	nc	1.0E+05	max	3.1E+00	nc	1.8E+04	nc
	7.0E-01	h	7.0E-01	r	0.1	52125-53-8 Propylene glycol, monoethyl ether	4.3E+04	nc	1.0E+05	max	2.6E+03	nc	2.6E+04	nc
	7.0E-01	h	5.7E-01	i	0.1	107-98-2 Propylene glycol, monomethyl ether	4.3E+04	nc	1.0E+05	max	2.1E+03	nc	2.6E+04	nc
2.4E-01	i 6.6E-03	r 1.3E-02	i 8.6E-03	i	y	75-56-9 Propylene oxide	1.9E+00	ca*	6.6E+00	ca*	5.2E-01	ca*	2.2E-01	ca
	2.5E-01	i	2.5E-01	r	0.1	81335-77-5 Pursuit	1.5E+04	nc	1.0E+05	max	9.1E+02	nc	9.1E+03	nc
	2.5E-02	i	2.5E-02	r	0.1	51830-58-1 Pydrin	1.5E+03	nc	1.5E+04	nc	9.1E+01	nc	9.1E+02	nc

Key : SFo,i=Cancer Slope Factor oral, inhalation RfDo,i=Reference Dose oral, inhalation i=IRIS p=PPRTV c=California EPA n=NCEA h=HEAST x=Withdrawn r=Route-extrapolation ca=Cancer PRG nc=Noncancer PRG ca* (where: nc PRG < 100X ca PRG) ca** (where nc PRG < 10X ca PRG) +++=Non-Standard Method Applied (See User's Guide) sat=Soil Saturation (See User's Guide) max=Ceiling limit (See User's Guide) DAF=Dilution Attenuation Factor (See User's Guide) CAS=Chemical Abstract Services

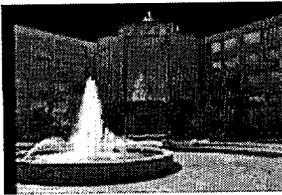
TOXICITY VALUES					V O C	skn abs soils	CAS No.	CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs)				SOIL SCREENING LEVELS					
SFo 1/(mg/kg-d)	RfDo (mg/kg-d)	SFi 1/(mg/kg-d)	RfDi (mg/kg-d)	Residential Soil (mg/kg)					Industrial Soil (mg/kg)	Ambient Air (ug/m ³)	Tap Water (ug/l)	DAF 20 (mg/kg)	DAF 1 (mg/kg)					
	1.0E-03	i		1.0E-03	r	0.1	110-86-1	Pyridine	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc		
	5.0E-04	i		5.0E-04	r	0.1	13593-03-8	Quinalphos	3.1E+01	nc	3.1E+02	nc	1.8E+00	nc	1.8E+01	nc		
3.0E+00		i	3.0E+00	r		0.1	91-22-5	Quinoline	1.6E-01	ca	5.7E-01	ca	2.2E-03	ca	2.2E-02	ca		
1.1E-01	3.0E-03	i	1.1E-01	r	3.0E-03	r	0.1	121-82-4	RDX (Cyclonite)	4.4E+00	ca*	1.6E+01	ca	6.1E-02	ca	6.1E-01	ca	
	3.0E-02	i		3.0E-02	r	0.1	10453-86-8	Resmethrin	1.8E+03	nc	1.8E+04	nc	1.1E+02	nc	1.1E+03	nc		
	5.0E-02	h		5.0E-02	r	0.1	299-84-3	Ronnel	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc		
	4.0E-03	i		4.0E-03	r	0.1	83-79-4	Rotenone	2.4E+02	nc	2.5E+03	nc	1.5E+01	nc	1.5E+02	nc		
	2.5E-02	i		2.5E-02	r	0.1	78587-05-0	Savey	1.5E+03	nc	1.5E+04	nc	9.1E+01	nc	9.1E+02	nc		
	5.0E-03	i				0.1	7783-00-8	Selenious Acid	3.1E+02	nc	3.1E+03	nc			1.8E+02	nc		
	5.0E-03	i					7782-49-2	Selenium	3.9E+02	nc	5.1E+03	nc			1.8E+02	nc	5.0E+00 3.0E-01	
	5.0E-03	h				0.1	630-10-4	Selenourea	3.1E+02	nc	3.1E+03	nc			1.8E+02	nc		
	9.0E-02	i		9.0E-02	r	0.1	74051-80-2	Sethoxydim	5.5E+03	nc	5.5E+04	nc	3.3E+02	nc	3.3E+03	nc		
	5.0E-03	i					7440-22-4	Silver and compounds	3.9E+02	nc	5.1E+03	nc			1.8E+02	nc	3.4E+01 2.0E+00	
1.2E-01	5.0E-03	i	1.2E-01	r	5.0E-03	r	0.1	122-34-9	Simazine	4.1E+00	ca*	1.4E+01	ca	5.6E-02	ca	5.6E-01	ca	
	4.0E-03	i					26628-22-8	Sodium azide										
2.7E-01	3.0E-02	i	2.7E-01	r	3.0E-02	r	0.1	148-18-5	Sodium diethyldithiocarbamate	1.8E+00	ca	6.4E+00	ca	2.5E-02	ca	2.5E-01	ca	
	2.0E-05	i		2.0E-05	r	0.1	62-74-8	Sodium fluoroacetate	1.2E+00	nc	1.2E+01	nc	7.3E-02	nc	7.3E-01	nc		
	1.0E-03	h		1.0E-03	r	0.1	13718-26-8	Sodium metavanadate	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc		
	6.0E-01	i					7440-24-6	Strontium, stable	4.7E+04	nc	1.0E+05	max			2.2E+04	nc		
	3.0E-04	i		3.0E-04	r	0.1	57-24-9	Strychnine	1.8E+01	nc	1.8E+02	nc	1.1E+00	nc	1.1E+01	nc		
	2.0E-01	i		2.9E-01	i	y	100-42-5	Styrene	1.7E+03	sat	1.7E+03	sat	1.1E+03	nc	1.6E+03	nc	4.0E+00 2.0E-01	
	5.0E-03	p		5.0E-03	r		80-07-9	1,1'-Sulfonylbis (4-chlorobenzene)	3.9E+02	nc	5.1E+03	nc	1.8E+01	nc	1.8E+02	nc		
	2.5E-02	i		2.5E-02	r	0.1	88571-99-0	Sythane	1.5E+03	nc	1.5E+04	nc	9.1E+01	nc	9.1E+02	nc		
1.5E+05		h	1.5E+05	h		0.03	1746-01-6	2,3,7,8-TCDD (dioxin)	3.9E-06	ca	1.6E-05	ca	4.5E-08	ca	4.5E-07	ca		
	7.0E-02	i		7.0E-02	r	0.1	34014-18-1	Tebuthiuron	4.3E+03	nc	4.3E+04	nc	2.6E+02	nc	2.6E+03	nc		
	2.0E-02	h		2.0E-02	r	0.1	3383-96-8	Temphos	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
	1.3E-02	i		1.3E-02	r	0.1	5902-51-2	Terbacil	7.9E+02	nc	8.0E+03	nc	4.7E+01	nc	4.7E+02	nc		
	2.5E-05	h		2.5E-05	r	0.1	13071-79-9	Terbufos	1.5E+00	nc	1.5E+01	nc	9.1E-02	nc	9.1E-01	nc		
	1.0E-03	i		1.0E-03	r	0.1	886-50-0	Terbutryn	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc		
	3.0E-04	i		3.0E-04	r	0.1	95-94-3	1,2,4,5-Tetrachlorobenzene	1.8E+01	nc	1.8E+02	nc	1.1E+00	nc	1.1E+01	nc		
2.6E-02	3.0E-02	i	2.6E-02	i	3.0E-02	r	y	630-20-6	1,1,1,2-Tetrachloroethane	3.2E+00	ca	7.3E+00	ca	2.6E-01	ca	4.3E-01	ca	
2.0E-01	6.0E-02	p	2.0E-01	i	6.0E-02	r	y	79-34-5	1,1,2,2-Tetrachloroethane	4.1E-01	ca	9.3E-01	ca	3.3E-02	ca	5.5E-02	ca	3.0E-03 2.0E-04
5.4E-01	1.0E-02	i	2.1E-02	c	1.0E-02	c	y	127-18-4	Tetrachloroethylene (PCE)	4.8E-01	ca*	1.3E+00	ca	3.2E-01	ca	1.0E-01	ca	6.0E-02 3.0E-03
	3.0E-02	i		3.0E-02	r	0.1	58-90-2	2,3,4,6-Tetrachlorophenol	1.8E+03	nc	1.8E+04	nc	1.1E+02	nc	1.1E+03	nc		
2.0E+01		h	2.0E+01	r		0.1	5216-25-1	p,a,a,a-Tetrachlorotoluene	2.4E-02	ca	8.6E-02	ca	3.4E-04	ca	3.4E-03	ca		
2.4E-02	3.0E-02	i	2.4E-02	r	3.0E-02	r	0.1	961-11-5	Tetrachlorovinphos	2.0E+01	ca*	7.2E+01	ca	2.8E-01	ca	2.8E+00	ca	
	5.0E-04	i		5.0E-04	r	0.1	3689-24-5	Tetraethyldithiopyrophosphate	3.1E+01	nc	3.1E+02	nc	1.8E+00	nc	1.8E+01	nc		
7.6E-03	2.1E-01	n	6.8E-03	n	8.6E-02	n	y	109-99-9	Tetrahydrofuran	9.4E+00	ca	2.1E+01	ca	9.9E-01	ca	1.6E+00	ca	
	6.6E-05	i					7440-28-0	Thallium and compounds+++	5.2E+00	nc	6.7E+01	nc			2.4E+00	nc		
	1.0E-02	i		1.0E-02	r	0.1	28249-77-6	Thiobencarb	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc		
	5.0E-02	n		5.0E-02	r	0.1	N/A	Thiocyanate	3.1E+03	nc	1.0E+05	max	1.8E+02	nc	1.8E+03	nc		
	3.0E-04	h		3.0E-04	r	0.1	39196-18-4	Thiofanox	1.8E+01	nc	1.8E+02	nc	1.1E+00	nc	1.1E+01	nc		

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 ca** (where nc PRG < 10X ca PRG) +++=Non-Standard Method Applied (See User's Guide) sat=Soil Saturation (See User's Guide) max=Ceiling limit (See User's Guide) DAF=Dilution Attenuation Factor (See User's Guide) CAS=Chemical Abstract Services

TOXICITY VALUES					CONTAMINANT		PRELIMINARY REMEDIATION GOALS (PRGs)				SOIL SCREENING LEVELS						
SFo	RfDo	SFi	RfDi	V	CAS No.	"Direct Contact Exposure Pathways"				"Migration to Ground Water"							
1/(mg/kg-d)	(mg/kg-d)	1/(mg/kg-d)	(mg/kg-d)	O		Residential	Industrial	Ambient Air	Tap Water	DAF 20	DAF 1						
				C		Soil (mg/kg)	Soil (mg/kg)	(ug/m ³)	(ug/l)	(mg/kg)	(mg/kg)						
	8.0E-02	i	8.0E-02	r	0.1	23564-05-8	Thiophanate-methyl	4.9E+03	nc	4.9E+04	nc	2.9E+02	nc	2.9E+03	nc		
	5.0E-03	i	5.0E-03	r	0.1	137-26-8	Thiram	3.1E+02	nc	3.1E+03	nc	1.8E+01	nc	1.8E+02	nc		
	6.0E-01	h				7440-31-5	Tin (inorganic, also see tributyltin oxide)	4.7E+04	nc	1.0E+05	max			2.2E+04	nc		
	4.0E+00	n	8.6E-03	n		7440-32-8	Titanium	1.0E+05	max	1.0E+05	max	3.1E+01	nc	1.5E+05	nc		
	2.0E-01	i	1.1E-01	i	y	108-88-3	Toluene	5.2E+02	sat	5.2E+02	sat	4.0E+02	nc	7.2E+02	nc	1.2E+01	
3.2E+00	h	3.2E+00	r		0.1	95-80-7	Toluene-2,4-diamine	1.5E-01	ca	5.4E-01	ca	2.1E-03	ca	2.1E-02	ca		
	6.0E-01	h	6.0E-01	r	0.1	95-70-5	Toluene-2,5-diamine	3.7E+04	nc	1.0E+05	max	2.2E+03	nc	2.2E+04	nc		
	2.0E-01	h	2.0E-01	r	0.1	823-40-5	Toluene-2,6-diamine	1.2E+04	nc	1.0E+05	max	7.3E+02	nc	7.3E+03	nc		
1.9E-01	i	1.9E-01	r		0.1	106-49-0	p-Toluidine	2.6E+00	ca	9.1E+00	ca	3.5E-02	ca	3.5E-01	ca		
1.1E+00	i	1.1E+00	i		0.1	8001-35-2	Toxaphene	4.4E-01	ca	1.6E+00	ca	6.0E-03	ca	6.1E-02	ca	3.1E+01	
	7.5E-03	i	7.5E-03	r	0.1	66841-25-6	Tralomehrin	4.6E+02	nc	4.6E+03	nc	2.7E+01	nc	2.7E+02	nc		
	1.3E-02	i	1.3E-02	r	0.1	2303-17-5	Triallate	7.9E+02	nc	8.0E+03	nc	4.7E+01	nc	4.7E+02	nc		
	1.0E-02	i	1.0E-02	r	0.1	82097-50-5	Triasulfuron	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc		
	5.0E-03	i	5.0E-03	r	0.1	615-54-3	1,2,4-Tribromobenzene	3.1E+02	nc	3.1E+03	nc	1.8E+01	nc	1.8E+02	nc		
9.2E-03	p	2.0E-01	p	9.2E-03	r	2.0E-01	r	0.1	126-73-8	Tributyl phosphate	5.3E+01	ca	1.9E+02	ca	7.3E-01	ca	7.3E+00
	3.0E-04	i			0.1	56-35-9	Tributyltin oxide (TBTO)	1.8E+01	nc	1.8E+02	nc			1.1E+01	nc		
3.4E-02	h	3.4E-02	r		0.1	634-93-5	2,4,6-Trichloroaniline	1.4E+01	ca	5.1E+01	ca	2.0E-01	ca	2.0E+00	ca		
2.9E-02	h	2.9E-02	r		0.1	33863-50-2	2,4,6-Trichloroaniline hydrochloride	1.7E+01	ca	5.9E+01	ca	2.3E-01	ca	2.3E+00	ca		
	1.0E-02	i	1.0E-03	p	y	120-82-1	1,2,4-Trichlorobenzene	6.2E+01	nc	2.2E+02	nc	3.7E+00	nc	7.2E+00	nc	5.0E+00	
	2.8E-01	n	6.3E-01	p	y	71-55-6	1,1,1-Trichloroethane	1.2E+03	sat	1.2E+03	sat	2.3E+03	nc	3.2E+03	nc	2.0E+00	
5.7E-02	i	4.0E-03	i	5.6E-02	i	4.0E-03	r	y	79-00-5	1,1,2-Trichloroethane	7.3E-01	ca*	1.6E+00	ca*	1.2E-01	ca	2.0E-01
4.0E-01	n	3.0E-04	n	4.0E-01	n	1.0E-02	n	y	79-01-6	Trichloroethylene (TCE)	5.3E-02	ca	1.1E-01	ca	1.7E-02	ca	2.8E-02
1.3E-02	c	7.0E-03	c	1.7E-01	c	y	79-01-6	"CAL-Modified PRG"	2.9E+00	ca	6.5E+00	ca	9.6E-01	ca	1.4E+00	ca	6.0E-02
	3.0E-01	i	2.0E-01	h	y	75-69-4	Trichlorofluoromethane	3.9E+02	nc	2.0E+03	sat	7.3E+02	nc	1.3E+03	nc	3.0E-03	
1.1E-02	i	1.0E-04	n	1.1E-02	i	1.0E-04	r	0.1	95-95-4	2,4,5-Trichlorophenol	6.1E+03	nc	6.2E+04	nc	3.7E+02	nc	3.6E+03
7.0E-02	c	7.0E-02	c		0.1	88-06-2	2,4,6-Trichlorophenol	6.1E+00	nc**	6.2E+01	nc**	3.7E-01	nc**	3.6E+00	nc**	2.7E+02	
	1.0E-02	i	1.0E-02	r	0.1	93-76-5	"CAL-Modified PRG"	6.9E+00	ca	2.5E+01	ca	9.6E-02	ca	9.6E-01	ca	1.4E+01	
	1.0E-02	i	1.0E-02	r	0.1	93-76-5	2,4,5-Trichlorophenoxyacetic Acid	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc	2.0E-01	
	8.0E-03	i	8.0E-03	r	0.1	93-72-1	2-(2,4,5-Trichlorophenoxy) propionic acid	4.9E+02	nc	4.9E+03	nc	2.9E+01	nc	2.9E+02	nc	1.0E-01	
	5.0E-03	i	5.0E-03	r	y	598-77-6	1,1,2-Trichloropropane	7.1E+01	nc	2.7E+02	nc	1.8E+01	nc	3.0E+01	nc	9.0E-04	
2.0E+00	n	6.0E-03	i	2.0E+00	r	1.4E-03	n	y	96-18-4	1,2,3-Trichloropropane	3.4E-02	ca	7.6E-02	ca	3.4E-03	ca	6.0E-02
	1.0E-02	p	3.0E-04	p	y	96-19-5	1,2,3-Trichloropropene	5.2E+00	nc	1.7E+01	nc	1.1E+00	nc	2.2E+00	nc	3.0E-03	
	3.0E-03	i	3.0E-03	r	0.1	58138-08-2	Tridiphane	1.8E+02	nc	1.8E+03	nc	1.1E+01	nc	1.1E+02	nc		
	2.0E-03	r	2.0E-03	i	y	121-44-8	Triethylamine	2.3E+01	nc	8.6E+01	nc	7.3E+00	nc	1.2E+01	nc		
7.7E-03	i	7.5E-03	i	7.7E-03	r	7.5E-03	r	0.1	1582-09-8	Trifluralin	6.3E+01	ca**	2.2E+02	ca*	8.7E-01	ca*	8.7E+00
	1.4E-04	r	1.4E-04	n	0.1	552-30-7	Trimellitic Anhydride (TMAN)	8.6E+00	nc	8.6E+01	nc	5.1E-01	nc	5.1E+00	nc		
	5.0E-02	p	1.7E-03	p	y	95-83-6	1,2,4-Trimethylbenzene	5.2E+01	nc	1.7E+02	nc	6.2E+00	nc	1.2E+01	nc		
	5.0E-02	p	1.7E-03	p	y	108-67-8	1,3,5-Trimethylbenzene	2.1E+01	nc	7.0E+01	nc	6.2E+00	nc	1.2E+01	nc		
3.7E-02	h	3.7E-02	r		0.1	512-56-1	Trimethyl phosphate	1.3E+01	ca	4.7E+01	ca	1.8E-01	ca	1.8E+00	ca		
	3.0E-02	i	3.0E-02	r	0.1	99-35-4	1,3,5-Trinitrobenzene	1.8E+03	nc	1.8E+04	nc	1.1E+02	nc	1.1E+03	nc		
	1.0E-02	h	1.0E-02	r	0.1	479-45-8	Trinitrophenylmethylnitramine	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc		
3.0E-02	i	5.0E-04	i	3.0E-02	r	5.0E-04	r	0.1	118-96-7	2,4,6-Trinitrotoluene	1.6E+01	ca**	5.7E+01	ca**	2.2E-01	ca**	2.2E+00

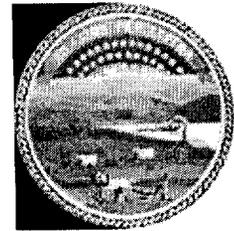
Key: SFo,=Cancer Slope Factor oral, inhalation RfDo,=Reference Dose oral, inhalation i=IRIS p=PPRTV c=California EPA n=NCEA h=HEAST x=Withdrawn r=Route-extrapolation ca=Cancer PRG nc=Noncancer PRG ca* (where: nc PRG < 100X ca PRG)
 ca** (where nc PRG < 10X ca PRG) +++=Non-Standard Method Applied (See User's Guide) sat=Soil Saturation (See User's Guide) max=Ceiling limit (See User's Guide) DAF=Dilution Attenuation Factor (See User's Guide) CAS=Chemical Abstract Services

TOXICITY VALUES					V O C	skin abs. soils	CAS No.	CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs)				SOIL SCREENING LEVELS				
SFo 1/(mg/kg-d)	RfDo (mg/kg-d)	SFi 1/(mg/kg-d)	RfDi (mg/kg-d)	"Direct Contact Exposure Pathways"					"Migration to Ground Water"								
					Residential Soil (mg/kg)	Industrial Soil (mg/kg)	Ambient Air (ug/m ³)	Tap Water (ug/l)	DAF 20 (mg/kg)	DAF 1 (mg/kg)							
	2.0E-02	p		2.0E-02	r	0.1	791-28-8	Triphenylphosphine oxide	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc	
1.4E-02	p	3.1E-01	p	1.4E-02	r	0.1	115-96-8	Tris(2-chloroethyl) phosphate	3.5E+01	ca	1.2E+02	ca	4.8E-01	ca	4.8E+00	ca	
3.2E-03	p	1.0E-01	p	3.2E-03	r	0.1	78-42-2	Tris(2-ethylhexyl) phosphate	1.5E+02	ca*	5.4E+02	ca	2.1E+00	ca	2.1E+01	ca	
	2.0E-04	n					7440-61-1	Uranium (chemical toxicity only)	1.6E+01	nc	2.0E+02	nc			7.3E+00	nc	
	1.0E-03	n					7440-62-2	Vanadium and compounds	7.8E+01	nc	1.0E+03	nc			3.6E+01	nc	6.0E+03 3.0E+02
	1.0E-03	i		1.0E-03	r	0.1	1929-77-7	Vernam	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc	
	2.5E-02	i		2.5E-02	r	0.1	50471-44-8	Vinclozolin	1.5E+03	nc	1.5E+04	nc	9.1E+01	nc	9.1E+02	nc	
	1.0E+00	h		5.7E-02	i	y	108-05-4	Vinyl acetate	4.3E+02	nc	1.4E+03	nc	2.1E+02	nc	4.1E+02	nc	1.7E+02 8.0E+00
1.1E-01	r	8.6E-04	r	1.1E-01	h	8.6E-04	593-60-2	Vinyl bromide (bromoethene)	1.9E-01	ca*	4.2E-01	ca*	6.1E-02	ca*	1.0E-01	ca*	
1.5E+00	i	3.0E-03	i	3.1E-02	i	2.9E-02	75-01-4	Vinyl chloride (child/adult)+++	7.9E-02	ca			1.1E-01	ca	2.0E-02	ca	1.0E-02 7.0E-04
7.5E-01	i	3.0E-03	i	1.6E-02	i	2.9E-02	75-01-4	Vinyl chloride (adult)			7.5E-01	ca					
	3.0E-04	i		3.0E-04	r	0.1	81-81-2	Warfarin	1.8E+01	nc	1.8E+02	nc	1.1E+00	nc	1.1E+01	nc	
	2.0E-01	i		2.9E-02	i	y	0.1 1330-20-7	Xylenes	2.7E+02	nc	4.2E+02	sat	1.1E+02	nc	2.1E+02	nc	2.1E+02 1.0E+01
	3.0E-01	i					7440-66-8	Zinc	2.3E+04	nc	1.0E+05	max			1.1E+04	nc	1.2E+04 6.2E+02
	3.0E-04	i					1314-84-7	Zinc phosphide	2.3E+01	nc	3.1E+02	nc			1.1E+01	nc	
	5.0E-02	i		5.0E-02	r	0.1	12122-67-7	Zineb	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc	



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Remedial Section



Remediation (a noun pronounced - ri-"mE-dE-'A-shun) dates back to 1818 and means the act or process of remedying, of repairing, of restoring.

Risk Based Standards for Kansas

RSK Manual - 3rd Version

March 1,2003

BACKGROUND: The Risk-based Standards for Kansas (RSK) Manual was originally developed in March of 1999 in collaboration with CH2M Hill, a private environmental contractor with expertise in risk assessments. Chemical-specific and media-specific risk-based cleanup goals were calculated using guidance and directives from the United States Environmental Protection Agency and various other technical resources. Prior to initial development of the RSK Manual, an Environmental Workgroup was established consisting of members of industry and the public to assist in determining appropriate risk-based cleanup levels. The risk-based cleanup levels determined by the Environmental Workgroup are incorporated into the RSK Manual. The RSK Manual assists the Kansas Department of Health and Environment (KDHE) to fairly and consistently address contaminated sites in the State of Kansas.



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LIMITATIONS ON USE: The RSK Manual is only applicable to contaminated

Site Photos	<p>properties or sites that are participating in appropriate state cleanup programs. KDHE project managers will work with the public and industry to ensure appropriate application of this guidance. Tier 2 risk-based cleanup levels defined in the RSK Manual are applicable for a single contaminant, in a single medium, under standard and conservative default exposure assumptions. Tier 2 risk-based cleanup levels have several additional limitations. Specifically excluded from consideration are transfers of contaminants from soil to air, vapor intrusion of volatile contaminants from ground water to indoor air, cumulative risk from multiple contaminants or media, and risk to ecological receptors.</p>
KDHE Search:	<p>The RSK document should not be used for environmental audits, environmental assessments or other non-KDHE managed activities. Use of Tier 2 risk-based values established within the RSK Manual without KDHE oversight may constitute misapplication of the RSK manual and may result in risk management decisions not supported by KDHE. The RSK Manual is not intended for use by environmental consultants on contaminated sites in the State of Kansas that are not participating in a KDHE cleanup program.</p>
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Region 9: Superfund

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Preliminary Remediation Goals

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Preliminary Remediation Goals (PRGs) are tools for evaluating and cleaning up contaminants. They are risk-based concentrations that are intended to assist risk assessors and others in screening-level evaluations of environmental measurements. The PRGs contained in the PRG Table are generic; they are calculated without site specific information. However, they are calculated using site specific data.

PRGs should be viewed as Agency guidelines, not legally enforceable standards. They are site "screening" and as initial cleanup goals if applicable. PRGs are not *de facto* cleanup goals and should not be applied as such. However, they are helpful in providing long-term targets to use in the analysis of different remedial alternatives. By developing PRGs early in the decision-making process, design staff may be able to streamline the consideration of remedial alternatives.

- [What's New in 2004](#)
- [User's Guide/Technical Background Document](#) (PDF, 30 pp., 682 KB, [About PDF](#))
- [Frequently Asked Questions About the PRG Tables](#)
- [Useful Toxicology/Risk Assessment Links](#)

[Region 9 PRGs 2004 Table](#) (PDF, 16 pp., 962 KB, [About PDF](#))

A summary table that presents the final list of generic PRG (for soil, air, and water) selected for screening in Region 9. Also available as a Microsoft Excel file (XLS, 581KB).

Notice: Slight Revision to the 2004 PRG Table
Revision Date: 12/28/04

1) There were two entries for cumene (isopropylbenzene) in the original 2004 Table. The correct values are presented on page 4 under "cumene". The outdated values for this compound that were previously listed for "isopropylbenzene" on page 12 have been deleted.

2) Entries for "1,1-dimethylhydrazine" and "1,2-dimethylhydrazine" were inadvertently listed on Page 6 in the original 2004 Table. These entries have been removed. The correct values for hydrazines are listed on Page 8.

3) It has come to my attention that California EPA's inhalation slope factor for MTBE has been revised from 1.8 E-3 to 9.1E-4. Therefore, with this revision to the 2004 Table, we have also updated the inhalation slope factor for MTBE.

InterCalc Tables: present additional information not available in the R9 PRG Table above

- [Soil Calculations](#) (PDF, 13 pp., 355 KB, [About PDF](#)): lists pathway-specific values for soil residential and industrial land-use scenarios.
- [Air-Water Calculations](#) (PDF, 13pp., 191 KB, [About PDF](#)): lists pathway-specific values for water assuming a residential exposure scenario
- [Phys-Chem Data](#) (PDF, 3 pp., 140 KB, [About PDF](#)): includes volatilization factors (VF) and saturation values (SAT) for VOCs only.

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