

**RISK-BASED STANDARDS FOR KANSAS
RSK MANUAL – 4th VERSION**

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KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT

DIVISION OF ENVIRONMENT

BUREAU OF ENVIRONMENTAL REMEDIATION

PREFACE:

The Kansas Department of Health and Environment (KDHE)/Bureau of Environmental Remediation (BER) originally developed the Risk-Based Standards for Kansas (RSK) Manual in March of 1999. 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 KDHE/BER project managers to fairly and consistently address contaminated sites in the State of Kansas.

This June 2007 RSK Manual, the fourth version, replaces the March 1, 2003 version. All previous versions are obsolete and should not be used for future decisions related to the characterization or remediation of contaminated properties/sites. This June 2007 version of the RSK Manual contains several updates to the existing text, tables, and appendices. KDHE/BER has edited and reorganized the text for improved clarity. In addition, this fourth version of the RSK Manual includes a new discussion on acceptable concentrations of contaminants in indoor air at residences, along with corresponding values in Appendix A-2. Modifications to the other appendices are highlighted.

The RSK Manual is only applicable to contaminated properties or sites participating in appropriate state cleanup programs. Use of risk-based values established within the RSK Manual without KDHE/BER oversight may constitute misapplication of the RSK Manual and may result in risk management decisions not supported by KDHE/BER. A more detailed discussion of the appropriate use of the RSK Manual is included in Section 2.2.

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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 the need for additional assessment or cleanup at contaminated sites, when considered in conjunction with other site-specific conditions. The RSK Manual is a compilation of risk-based cleanup goals for contaminants in soil and ground water for which federal standards have not been established; ground water cleanup goals based on federal Safe Drinking Water Act Maximum Contaminant Levels (MCLs) for public drinking water supplies; risk-based acceptable concentrations of contaminants in indoor air at residences; 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).

KDHE calculated the chemical-specific and media-specific risk-based cleanup goals in this document 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 8, "REFERENCES." This document is the fourth version of the Risk-Based Standards for Kansas Manual and supercedes all previous versions.

2.0 PUBLIC USE OF THE RSK MANUAL

2.1 Benefits of the RSK Manual

The primary benefit of the RSK Manual 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. The RSK Manual provides the public with a streamlined, cost-effective approach to determine whether some form of remedial action is warranted at a

contaminated site. Use of the RSK Manual by Kansas industry, Kansas residents, and KDHE/BER will also promote consistency of remedial requirements at contaminated sites and ensure that remedial actions are protective of human health and the environment. The RSK Manual promotes flexibility by providing tabulated risk-based cleanup goals as well as the opportunity to develop site-specific cleanup goals, based on factors including land use and institutional controls.

2.2 Limitations of Use

The RSK Manual is only applicable to contaminated properties or sites that are participating in appropriate state cleanup programs. KDHE/BER project managers will work with the public and regulated community to ensure appropriate application of this guidance. Risk-based cleanup levels defined in this manual are applicable for a single contaminant, in a single medium, under standard and conservative default exposure assumptions. Risk-based cleanup levels have several additional limitations. Specifically excluded from consideration in the RSK Manual are cumulative risk from multiple contaminants or media, relative source contribution, and risk to ecological receptors. KDHE/BER recommends consideration of the following additional limitations when using the RSK Manual:

- Additional state, federal, and/or local laws or regulations may be applicable at certain sites. Examples of such applicable or relevant and appropriate requirements include local public health laws and ordinances, requirements of ground water management districts, zoning for land use designation, and compliance with Resource Conservation and Recovery Act (RCRA) regulations.
- Aesthetic or other criteria may drive the need for remediation independent of risk-based standards;
- The risk-based cleanup values for soils do not apply to sediments. Users of the RSK Manual must consult with the KDHE/BER project manager regarding appropriate sediment screening and remediation goals, and also follow KDHE/BER policy. “BER-ARS-045 - Sediment Policy.”
- The risk-based cleanup values for ground water do not apply to surface water. Surface water cleanup levels shall meet the Kansas surface water quality criteria as established in K.A.R. 28-16-28.

The RSK Manual should not be used for environmental audits, environmental assessments, or other non-KDHE/BER managed activities. Use of risk-based values established within the RSK Manual without KDHE/BER oversight may constitute misapplication of the RSK Manual and may result in risk management decisions not supported by KDHE/BER. 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/BER cleanup program.

The KDHE/BER project manager will make the final determination if the risk-base cleanup values in this manual are appropriate for the current and future use of a contaminated site.

3.0 TIERED APPROACH

A primary goal of KDHE/BER programs is to insure contaminated sites are remediated to the extent necessary to protect the public from unacceptable risks potentially caused by exposure to contaminated media. The RSK Manual provides a tiered approach for establishing cleanup goals at contaminated sites in Kansas. The tiers are summarized as follows:

- Tier 1 is a comparison of the concentration of a naturally occurring contaminant to the background concentration of that contaminant in the affected medium, using methods approved by KDHE/BER to determine background.
- Tier 2 is a comparison of the concentration of a contaminant to the risk-based cleanup values in the KDHE Tier 2 Risk-Based Summary Table, found in Appendix A of this document.
- Tier 3 involves collecting the necessary data, under KDHE/BER direction, to replace default values in the Tier 2 equations with site-specific information.

The following sections of the RSK Manual contain detailed information on definitions, formulas, input parameters and the use of the three tiers, including a discussion of the rationale and process for determining soil and ground water cleanup levels for contaminated sites.

The tiered approach presented in the RSK Manual is not acceptable at all contaminated sites. In some instances, KDHE/BER may require a full baseline risk assessment. Examples of such instances include sites at which a cumulative risk from multiple contaminants must be examined and sites at which the remedial efforts must be consistent with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). Coordination with the appropriate state program is necessary to determine if the tiered approach in the RSK Manual is applicable to a contaminated site.

3.1 Tier 1 - Comparison to Background

Tier 1 cleanup levels may be 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, KDHE/BER may allow the background concentration to be the cleanup goal in that medium.

To establish Tier 1 cleanup levels, background concentrations of naturally-occurring contaminants must be determined at the site. 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 samples, approved by KDHE/BER, must be collected. Review and approval of the background sampling plan by the KDHE/BER project manager is necessary prior to the collection of any background samples.

3.2 Tier 2 Risk-Based Summary Table

Appendix A of the RSK Manual is the Tier 2 Risk-Based Summary Table. The table contains chemical-specific, risk-based cleanup values for over 170 contaminants in soil and ground water, including metals, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, herbicides, and polychlorinated biphenyls (PCBs). These cleanup values, based upon current EPA toxicity values for the contaminants and default exposure factors, represent the concentrations at which the contaminants pose an acceptable human health risk to receptors, including sensitive groups (children or the elderly), over a lifetime.

3.2.1 Contaminant Toxicity

Human health risk can be 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. The Tier 2 cleanup values in Appendix A for non-carcinogens are based upon an HI equal to 1.

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. The Tier 2 cleanup values in Appendix A for carcinogens are based upon a 1×10^{-5} risk.

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 were obtained from the *Integrated Risk Information System (IRIS)*, 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 governmental resources approved by KDHE. Contaminant toxicological data used in developing the Tier 2 Risk-Based Summary Table are provided in Appendix C.

KDHE/BER evaluated the contaminants in Appendix A for both carcinogenic and non-carcinogenic health effects. The determining risk-based concentration is based upon the lower contaminant concentration of the carcinogenic risk or non-carcinogenic risk.

For contaminants which lack toxicological data for a given route of exposure, KDHE/BER used route-to-route extrapolations. For example, an oral reference dose may be used in the inhalation and dermal exposure pathways for a contaminant if the oral reference dose is the only existing toxicological value.

3.2.2 Exposure Factors

Individuals exposed to environmental contaminants are referred to as receptors. For the Tier 2 Risk-Based Summary Table, KDHE/BER has identified two general categories of receptors, 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 scenarios and are more sensitive to environmental contaminants. The non-residential land-use scenario 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 organic contaminants only is based upon chemical-specific absorption factors. For organic contaminants, 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 typically the only receptors in a non-residential land-use scenario.

3.2.3 Ground Water

The Tier 2 Risk-Based Summary Table ground water concentrations presented in Appendix A are derived with the assumption that aquifers in Kansas are sources of potable water. (For a detailed discussion on aquifer use, RSK Manual users are encouraged to refer to KDHE/BER policy “BER-RS-045 - Considerations for Groundwater Use and Applying RSK Standards to Contaminated Groundwater.”) Accordingly, for those contaminants for which the federal Safe Drinking Water Act has promulgated primary maximum contaminant levels (MCLs), Tier 2 ground water cleanup concentrations for both residential and non-residential land use scenarios are the MCLs. For all other contaminants addressed within this document, cleanup values are risk-based and are the product of Equations 1 and 2, for carcinogenic and non-carcinogenic contaminants, respectively. 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. Exposure factors used in the equations are provided in Table 1. Contaminant chemical, physical, and toxicological data are provided in Appendices B and C.

Independent of the MCLs and risk-based cleanup standards in Appendix A, KDHE/BER requires remediation at all sites with non-aqueous phase liquid (NAPL) contaminants present in the ground water.

3.2.4 Soils

KDHE/BER 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 VOCs 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 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.

KDHE/BER calculated the risk-based cleanup values for each contaminant in soil using the exposure factors provided in Table 2, the contaminant chemical, physical, and toxicological data provided in Appendices B and C, and Equations 3 and 4 (for carcinogens and non-carcinogens, respectively). For each of the two land use scenarios, 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 has a letter beside to inform the user of the adverse health effect upon which the Tier 2 Soil Pathway is based. 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 is 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 incorporates the additive adverse human health effects associated with the inhalation of vapors from soil contaminated with VOCs. 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, VOCs are those organic 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 that are identified in Appendix B under the column "Volatilization Factor" (VF). To calculate inhalation exposure risk, each contaminant's VF must first be calculated. The VF is assumed to be 0.5 liters per cubic meter (L/m³) for volatilization from water to air 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) represents a dispersion model that simulates the dispersion of contaminants into 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. KDHE/BER has calculated a soil saturation concentration using Equation 6 for each organic compound in the Tier 2 Risk-Based Summary Table. 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 Tier 2 cleanup value.

3.2.5 Soil to Ground Water Protection

Contaminants leaching from soil to ground water may pose a significant threat to ground water quality. Soil contamination cleanups may be driven by chemical-specific soil to ground water pathway concentrations to protect ground water quality. The methodology for calculating soil concentrations sufficiently 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. The “*Soil Screening Guidance*” document was employed because it is supported by EPA, has been extensively peer-reviewed, and the methodology presented therein is relatively simple.

Migration of a contaminant from soil to ground water can be simplified for modeling purposes to 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, conceptually, to a receptor well at that location. For the purposes of this document, KDHE/BER’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/BER has adopted EPA’s screening dilution factor of 20 for calculating chemical-specific soil-to-ground water pathway concentrations.

Equation 7 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 1 and 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.

3.2.6 Exceptions to Tier 2 Methodology

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, are environmentally safe, or preserve the aesthetic quality of drinking water supplies. Alternative methods include the use of health advisory data in the absence of chemical-specific toxicological data, consideration of drinking water odor and taste thresholds, and the consideration of potential for explosive environments, as examples. For these contaminants, the cleanup concentrations are generally more stringent than strictly human health risk-based concentrations.

3.3 Tier 3

Tier 3 offers the opportunity to determine site-specific risk-based contaminant concentrations that are protective of human health and the environment. Tier 3 involves the substitution of site-specific parameters into the equations used to calculate Tier 2 cleanup values. Tier 3 evaluations can be a substantial increase in effort relative to Tier 2, and must be performed with KDHE/BER oversight, including the submittal of appropriate work plans to perform any necessary additional work. KDHE/BER 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 the federal Safe Drinking Water Act which mandates MCLs for drinking water aquifers.

Default assumption parameters employed by KDHE/BER to calculate Tier 2 risk-based cleanup goals are included in Equations 5, 6, and 7. Parameters for which site-specific data may be substituted to perform a Tier 3 analysis are denoted with an asterisk. Data which may be necessary to complete a Tier 3 evaluation can include additional geological, geophysical or hydrological data, including items such as unsaturated zone physical and geological properties (vertical distribution profiling of 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.

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 (Any model used for a Tier 3 evaluation 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/BER does not possess is used in a Tier 3 analysis, the department may request a copy of the model for review and approval.);
- Characterization of property sources and exposure pathways by using property assessment data to identify relevant sources, transport mechanisms, impacted media, and exposure pathways;
- Research to determine appropriate pesticide-specific standard application rates, followed by a comparison of site-specific pesticide contaminant levels to the modeled pesticide levels in the contaminated media based upon proper application;
- 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,
- Recalculation of health-based risk considering the site-specific speciation of metal contaminants. (Tier 2 uses the most toxic form of each metal.)

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.

4.0 INDOOR AIR CONCENTRATIONS

VOC contamination may migrate from soil and/or ground water into dwellings or other occupied structures. Appendix A-2 of the RSK Manual contains the concentrations of contaminants in indoor air at or above which KDHE/BER may require actions to mitigate the potential risk to human health posed by inhalation of those contaminants. Indoor air concentrations are provided for the residential scenario for each VOC present in the Tier 2 Risk-Based Summary Table in Appendix A. Because not all laboratories report air sample analytical results in the same manner, Appendix A-2 includes concentrations in both micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) and parts per billion by volume (ppbv) for each VOC. KDHE/BER provides a detailed discussion on sampling of indoor air at residences and interpretation of data in *Kansas Vapor Intrusion Guidance - Chemical Vapor Intrusion and Residential Indoor Air*, dated June 2007.

KDHE/BER calculated the concentrations in Appendix A-2 using Equations 8 and 9 for carcinogenic and non-carcinogenic contaminants, respectively. For each VOC contaminant, the default exposure factors (from Table 3) and toxicity data (Appendix C) used to establish indoor air concentrations were the same as those used for the calculations of soil and ground water cleanup values. The indoor air concentrations in Appendix A-2 for non-carcinogens are based upon an HI equal to 1; the concentrations for carcinogens are based upon a 1×10^{-5} risk level.

The indoor air concentrations in Appendix A-2 are considered acceptable for only a single contaminant, and do not consider potential cumulative adverse health effects of multiple chemicals. The concentrations also do not consider cumulative effects of exposure to the same contaminant through multiple pathways. Consultation with the KDHE/BER project manager is essential before applying the concentrations in Appendix A-2 to a residence. If multiple contaminants are present in the home, or more than one exposure pathway exists, a Baseline Risk Assessment may be necessary to evaluate the health risk to exposed residents.

5.0 TOTAL PETROLEUM HYDROCARBONS

Total petroleum hydrocarbons (TPH) for the purpose of this section of the RSK Manual include all undifferentiated hydrocarbon compounds with carbon ranges C⁵ through C³⁵, and 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, must be quantified by summing TPH using EPA SW-846 modified method 8015, or 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 must 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 naphthalene, chrysene, pyrene, benzo[a]pyrene, and anthracene for TPH-DRO.

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 KDHE/BER project manager.

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

- sites where contamination is caused by a responsible party that does not own or control the property;
- sites where an Environmental Use Control cannot be used to control future use of the property; and
- 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 cleanup 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 3.2.4. 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 using Tier 3 methodology.

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.

6.0 NITRATE, NITRITE, AND AMMONIA

Nitrate and ammonium are common soil contaminants of concern in Kansas related to agricultural fertilizer spills, animal wastes, septic systems, and a variety of other sources. These contaminants are treated differently from other Tier 2 contaminants as the soil cleanup guidelines provided below are not based on their potential toxicity to humans through exposure to contaminated soil, but on the potential for contamination in the soil to leach to ground water. Nitrate and/or nitrite in ground water pose significant threats of toxicity to human and animal infants, and cleanup of nitrate in ground water can be an expensive, difficult, and time-consuming prospect. The soil cleanup guidelines provided below were developed by KDHE/BER in consultation with Kansas State University agronomy experts to provide non-site specific soil cleanup goals that are generally protective of ground water and capable of sustaining vegetative growth.

Nitrate, nitrite, and ammonia or ammonium concentrations are typically reported “as nitrogen” or “as N.” Analytical results expressed “as ammonia,” “as nitrate,” or “as nitrite” must be converted to “as N” based on the ratios of the molecular weight of nitrogen to the molecular weights of the compounds in question for comparison to the soil cleanup guidelines and ground water standards provided below.

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 milligrams/kilogram (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 10.0 milligrams/liter (mg/L); the MCL for nitrite is 1.0 mg/L.

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/BER.
- 2) If ground water is 50 feet or less in depth then ground water monitoring wells may be requested by KDHE/BER in the area of contamination and hydraulically downgradient to the nitrate concentration in ground water. Additional actions may be required:
 - a) If nitrate (N) in groundwater exceeds 20 mg/l then the responsible party may be required by KDHE/BER to install a remedial system to hydraulically contain and/or remove the contamination.
 - b) 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/BER identified sites reclassification criteria to monitor ground water quality. Please refer to KDHE/BER policy “BER-RS-024 - Reclassification Plan.”
- 3) If ground water depth exceeds 50 feet, the need for installation of monitoring wells will be determined by KDHE/BER on a case by case basis depending on ground water usage, soil type, and soil concentration of nitrate plus ammonia (N). Depending on nitrate and nitrite concentrations in ground water, additional actions may be required.
- 4) If vertical soil profiling indicates the presence of impervious bedrock (e.g., shale) isolating the nitrate/ammonia from ground water, up to 200 mg/kg nitrate plus ammonia (N) can be left in place (as determined in consultation with the KDHE/BER 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/BER project manager.

Similar to the Tier 3 evaluations (see Section 3.3) for other contaminants, KDHE/BER will consider the use of site-specific information to modify nitrate cleanup goals. KDHE/BER will also consider cost/benefit analyses in the determination of cleanup goals.

7.0 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)	30	25
Edncc	Noncancer (Child)	6	NA
AT	Averaging Time		
ATca	Cancer (adult)	70	70
Atnca	Noncancer (adult)	30	25
Atncc	Noncancer (child)	6	NA
SF	Slope Factor (carcinogens)	Chemical-specific	Chemical-specific
RfD	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 1

GROUND WATER / CARCINOGENS

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

EQUATION 2

GROUND WATER / NON-CARCINOGENS

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

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)	30	25
Edncc	Noncancer (child)	6	NA
AT	Averaging Time		
Atca	Cancer (adult)	70	70
Atnca	Noncancer (adult)	30	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

SOIL / CARCINOGENS

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

EQUATION 4

SOIL / NON-CARCINOGENS

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

EQUATION 5 VOLATILIZATION FACTOR EQUATION AND PARAMETERS

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

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

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 6 SOIL SATURATION EQUATION AND PARAMETERS

$C_{\text{sat}} = \frac{S}{P_b} (K_d P_b + \theta_w + H' \theta_a)$	
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 \times 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 7 SOIL TO GROUND WATER MIGRATION PATHWAY EQUATION

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

SOIL TO 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.

EQUATION 8 INDOOR AIR / CARCINOGENS

$$\text{RBC } (\mu\text{g}/\text{m}^3) = \frac{\text{TR} \times \text{BW} \times \text{AT} \times 365 \text{ days / year}}{\text{EF} \times \text{ED} \times \text{Inh} \times \text{CF} \times \text{SF}_i}$$

EQUATION 9 INDOOR AIR / NON-CARCINOGENS

$$\text{RBC } (\mu\text{g}/\text{m}^3) = \frac{\text{THI} \times \text{BW} \times \text{AT} \times 365 \text{ days / year}}{\text{EF} \times \text{ED} \times \text{Inh} \times \text{CF} \times 1/\text{RfD}_i}$$

**TABLE 3
INDOOR AIR EXPOSURE FACTORS**

ID	Description	Value
TR	Target cancer risk	1E-06, 1E-05, 1E-04
THI	Target hazard index	1
BW	Body weight (kg)	
	Adult	70
Inh	Child	15
	Inhalation rate (m ³ /day)	
CF	Adult	20
	Child	10
CF	Conversion factor (mg/μg)	1E-03
EF	Exposure frequency (days/year)	350
ED	Exposure duration (years)	
	Cancer (adult)	30
	Non-cancer (adult)	30
AT	Non-cancer (child)	6
	Averaging time (years)	
	Cancer (adult)	70
	Non-cancer (adult)	30
SF _i	Non-cancer (child)	6
	Slope factor, inhalation	Chemical-specific
RfD _i	Reference dose, inhalation	Chemical-specific

See references in Table 1

8.0 REFERENCES

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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 (mg/kg)	Ground Water Pathway (mg/L)	Soil Pathway (mg/kg)	Soil to Ground Water Protection Pathway (mg/kg)	Ground Water Pathway (mg/L)
			(mg/kg)			(mg/kg)	
Acenaphthene	83-32-9	300 s	190	0.13 n	300 s	300 s	0.49 n
Acetochlor	34256-82-1	696.00 s	20.10	0.312 n	696.00 s	124.1	1.927 n
Acetone	67-64-1	1700 n	1.1	0.26 n	6200 n	3.8	0.93 n
Acetophenone	98-86-2	0.86 n	2.6E-04	2.E-05 n	2.54 n	7.9E-04	6.E-05 n
Acrolein	107-02-8	0.13 n	1.5E-04	1.8E-05 n	0.41 n	4.8E-04	5.8E-05 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	N/A	0.01 m	38 c	N/A	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
Bentazon	25057-89-0	237.5 s	5.28	0.460 n	237.5 s	34.22	2.977 n
Benzene	71-43-2	9.8 n	0.08	0.005 m	17 c	0.08	0.005 m
Ben-zidine	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
Bromoform	75-25-2	1100 c	1.72	0.08 m	2400 c	1.72	0.08 m

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 (mg/kg)	Ground Water Pathway (mg/L)	Soil Pathway (mg/kg)	Soil to Ground Water Protection Pathway (mg/kg)	Ground Water Pathway (mg/L)
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
Butylate	2008-41-5	282 s	64.0	0.503 n	282 s	282 s	2.847 n
n-Butylbenzene	104-51-8	190 n	11.9	0.021 n	395 s	45.2	0.08 n
sec-Butylbenzene	135-98-8	156 n	9.8	0.022 n	378 s	35.6	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
Chloroethane	75-00-3	35.1 c	0.457	0.048 c	53.9 c	0.848	0.089 c
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
2-Chloronaphthalene	91-58-7	188 s	58	0.181 n	188 s	188.0 s	0.665 n
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
Cumene	98-82-8	512 s	37.7	0.224 n	512 s	138.6	0.824 n
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	1.45 s	1.45 s	0.137 n	1.45 s	1.45 s	0.854 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

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)	
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
Dicamba	1918-00-9	1997 n	23.3	0.468 n	10755 s	146.4	2.94 n
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
Dimethylphthalate	131-11-3	665629 n	1781	156 n	6812563 n	11456	1005.0 n
Di-n-butyl Phthalate	84-74-2	3798 s	3798 s	1.5 n	3798 s	3798 s	6.39 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

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 (mg/kg)	Ground Water Pathway (mg/L)	Soil Pathway (mg/kg)	Soil to Ground Water Protection Pathway (mg/kg)	Ground Water Pathway (mg/L)
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
Ethylene glycol	107-21-1	133126 n	125.34	31.27 n	1362513 n	818.64	204.23 n
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
Freon - 113	76-13-1	955 s	955 s	25.22 n	955 s	955 s	84.87 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
Hexachlorocyclopentadiene	77-47-4	398 n	1989	0.05 m	3581 s	1989	0.05 m
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

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)	
Methyl Isobutyl Ketone	108-10-1	1000 n	0.41	0.07 n	3600 n	1.4	0.23 n
2-Methylnaphthalene	91-57-6	213 n	12.2	0.009 n	1461 n	45.0	0.033 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	104 n	1.05	0.003 n	325 n	3.52	0.009 n
Nickel	7440-02-0	1600 n	N/A	0.10 h	41000 n	N/A	0.10 h
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	556-88-7	6700 n	190	1.6 n	12000 s	1200	10 n
2-Nitropropane	79-46-9	83.6 n	0.08	0.015 n	296 n	0.29	0.053 n
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
Perchlorate	7790-98-9	54.75 n	0.044	0.011 n	1430 n	0.288	0.072 n
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
Picloram (Tordon)	1918-02-1	4659 n	3.40	0.500 m	47688 n	3.40	0.50 m
Profluralin	26399-36-0	100 s	100 s	0.09 n	100 s	100 s	0.61 n
Prometon	1610-18-0	998 n	7.7	0.218 n	1252 s	48.8	1.385 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	190 n	11.3	0.02 n	395 s	45.2	0.08 n

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 (mg/kg)	Ground Water Pathway (mg/L)	Soil Pathway (mg/kg)	Soil to Ground Water Protection Pathway (mg/kg)	Ground Water Pathway (mg/L)
Pyrene	129-00-0	140 s	140 s	0.14 n	140 s	140 s	0.72 n
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
Tert-butyl Alcohol (TBA)	75-65-0	1054 c	0.49	0.043 c	1853 c	0.90	0.079 c
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)	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
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
Triflualine (Treflan)	1582-09-8	500 n	1800	0.05 c	2500 c	6000	0.18 c
1,2,4-Trimethylbenzene	95-63-6	36.5 n	0.78	0.005 n	109.4 n	2.6	0.017 n

APPENDIX A
KDHE TIER 2 RISK-BASED SUMMARY TABLE

Chemical Name	CAS No.	RESIDENTIAL SCENARIOS			NON-RESIDENTIAL SCENARIOS		
		Soil Pathway	Soil to Ground Water Protection Pathway	Ground Water Pathway	Soil Pathway	Soil to Ground Water Protection Pathway	Ground Water Pathway
		(mg/kg)	(mg/kg)	(mg/L)	(mg/kg)	(mg/kg)	(mg/L)
1,3,5-Trimethylbenzene	108-67-8	31.4 n	0.77	0.005 n	94.0 n	2.51	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

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

All soil values are to be compared to analytical results on a dry-weight basis.

Spreadsheet values with modifications since the printing of the 03 RSK Manual are denoted by the shaded cells.

APPENDIX A-2
TIER 2 RISK-BASED INDOOR AIR VALUES

Chemical Name	CAS No.	Contaminant Concentrations			MW
		ug/m3		ppbv	
Acenaphthene	83-32-9	93.857	n	14.627	154
Acetone	67-64-1	156.429	n	64.729	58
Acetophenone	98-86-2	0.009	n	0.002	120
Acrolein	107-02-8	0.009	n	0.004	56
Acrylonitrile	107-13-1	0.358	c	0.162	53
Anthracene	120-12-7	469.286	n	63.275	178
Benzene	71-43-2	2.675	n	0.823	78
Benzyl Chloride	100-44-7	0.501	c	0.095	127
Bis(2-chloroethyl)ether	111-44-4	0.074	c	0.012	143
Bis(2-chloroisopropyl)ether	39638-32-9	2.433	c	0.341	171
Bis(chloromethyl)ether	542-88-1	3.92E-04	c	8.181E-05	115
Bromodichloromethane	75-27-4	1.374	c	0.201	164
Bromomethane	74-83-9	2.237	n	0.565	95
1,3-Butadiene	106-99-0	0.087	c	0.039	54
n-Butylbenzene	104-51-8	15.643	n	2.802	134
sec-Butylbenzene	135-98-8	15.643	n	2.802	134
Carbon Disulfide	75-15-0	312.857	n	98.797	76
Carbon Tetrachloride	56-23-5	0.893	n	0.139	154
Chlorobenzene	108-90-7	8.939	n	1.899	113
Chloroethane	75-00-3	29.368	c	10.844	65
Chloroform	67-66-3	1.058	c	0.213	119
Chloromethane	74-87-3	13.519	c	6.489	50
2-Chloronaphthalene	91-58-7	125.143	n	18.426	163
Cumene	98-82-8	156.429	n	31.286	120
Dibenzofuran	132-64-9	6.257	n	0.894	168
1,2-Dichlorobenzene	95-50-1	89.388	n	14.594	147
1,4-Dichlorobenzene	106-46-7	3.549	c	0.579	147
Dichlorodifluoromethane	75-71-8	89.388	n	17.730	121
1,1-Dichloroethane	75-34-3	223.469	n	54.174	99
1,2-Dichloroethane	107-06-2	0.936	c	0.227	99
1,1-Dichloroethene	75-35-4	0.487	c	0.120	97
1,2-Dichloroethene (cis)	156-59-2	15.643	n	3.870	97
1,2-Dichloroethene (trans)	156-60-5	31.286	n	7.741	97
1,2-Dichloropropane	78-87-5	1.252	c	0.266	113
1,3-Dichloropropene	542-75-6	0.655	c	0.139	113
Ethylbenzene	100-41-4	453.643	n	102.712	106
Ethylene dibromide	106-93-4	0.089	n	0.011	188
Fluorene	86-73-7	62.571	n	9.046	166
Freon - 113	76-13-1	13452.857	n	1726.570	187
Furan	110-00-9	1.564	n	0.552	68
n-Hexane	110-54-3	89.388	n	24.945	86
Methylene Chloride	75-09-2	51.773	c	14.618	85
Methyl Ethyl Ketone (2-Butanone)	78-93-3	446.939	n	148.980	72
Methyl Isobutyl Ketone	108-10-1	35.755	n	8.581	100
2-Methylnaphthalene	91-57-6	6.257	n	1.058	142
Methyl Tertbutyl Ether	1634-04-4	1340.816	n	365.677	88
Naphthalene	91-20-3	1.341	n	0.251	128
Nitrobenzene	98-95-3	0.893	n	0.174	123
2-Nitropropane	79-46-9	0.009	c	0.002	89

APPENDIX A-2 TIER 2 RISK-BASED INDOOR AIR VALUES

Chemical Name	CAS No.	Contaminant Concentrations			MW
		ug/m3		ppbv	
n-Propylbenzene	103-65-1	15.643	n	3.129	120
Styrene	100-42-5	453.643	n	104.687	104
Tert-butyl Alcohol (TBA)	75-65-0	25.808	c	8.370	74
1,1,1,2-Tetrachloroethane	630-20-6	3.288	c	0.470	168
1,1,2,2-Tetrachloroethane	79-34-5	0.420	c	0.060	168
Tetrachloroethene (PCE)	127-18-4	41.954	c	6.066	166
Toluene	108-88-3	172.071	n	44.888	92
1,2,4-Trichlorobenzene	120-82-1	89.164	n	11.823	181
1,1,1-Trichloroethane	71-55-6	446.939	n	80.651	133
1,1,2-Trichloroethane	79-00-5	1.521	c	0.274	133
Trichloroethene (TCE)	79-01-6	14.194	c	2.600	131
1,2,3-Trichloropropane	96-18-4	0.012	c	0.002	147
1,2,4-Trimethylbenzene	95-63-6	2.659	n	0.532	120
1,3,5-Trimethylbenzene	108-67-8	2.659	n	0.532	120
Vinyl Chloride	75-01-4	0.284	c	0.108	63
Xylene (mixed)	1330-20-7	46.929	n	10.625	106

Notes

n - non-carcinogenic risk, HI = 1

c - carcinogenic risk, risk = 1×10^{-5}

Concentrations in micrograms per cubic meter (ug/m3) were calculated using equations 3-5 and 3-6, and the toxicity information in Appendix C.

Concentrations in parts per billion by volume (ppbv) were calculated by multiplying the ug/m3 value by 24, then dividing by the contaminant's molecular weight (MW).

**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
Acetochlor	223 u	3.03 u	2.48 e	3.02	5.40E-11 u			0.0061 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 r		1.66 r	0.46	1.00E-05 r	0.06 r	8.73E-06	0.0047 r	9.6E+04	8.7E+04
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	1.5E+04	1.4E+04
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		
Bentazon	500.00 r		1.57 r	0.375	2.10E-09 r			0.003 r		
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
Butylate	45 r		2.79 r	6.16	8.30E-05 r			0.0795 r		
n-Butylbenzene	14 b	4.01 b	3.45 c	28	1.30E-02 b	0.075 c	7.80E-06	0.204 m	1.7E+04	1.6E+04

**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
sec-Butylbenzene	17 b	3.94 b	3.34 c	22	1.90E-02 b	0.075 c	7.80E-06	0.182 m	1.3E+04	1.2E+04
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		
Cadmium				75				0.0010 l		
Captan	3.3 b	2.45 b	2.41 d	2.6	7.19E-06 b			0.0013 l		
Carbaryl (Sevin)	104 b	2.36 b	2.32 d	2.1	3.46E-09 b			0.0053 m		
Carbazole	7.5 a	3.59 a	3.53 a	34	1.53E-08 a	0.04 a	7.03E-06	0.080 m		
Carbofuran (Furadan)	320 b	1.61 b	1.58 d	0.38	9.20E-05 b			0.0038 m		
Carbon Disulfide	1190 a	2.00 a	1.66 a	0.46	3.03E-02 a	0.10 a	1.00E-05	0.024 l	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 l	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 l		
Chlorobenzene	472 a	2.86 a	2.34 a	2.2	3.70E-03 a	0.07 a	8.70E-06	0.041 l	9.2E+03	8.4E+03
Chloroethane	6710 r		1.38 r	0.2	1.09E-02 r	0.27 r	1.15E-05	0.008 r	1.2E+03	1.1E+03
Chloroform	7920 a	1.92 a	1.60 a	0.40	3.67E-03 a	0.10 a	1.00E-05	0.0089 l	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 l	7.3E+03	6.7E+03
2-Chloronaphthalene	11.7 r		3.02 q	16	3.12E-04 q	0.035 q	8.80E-06	0.13 r	1.2E+05	1.1E+05
Chlorpyrifos (Lorsban/Dursban)	1.12 b	5.26 b	5.17 d	1482	2.87E-05 f			0.046 m		
Chromium (trivalent)				2.E+06				0.0010 l		
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 l		
Copper								0.0010 l		
Cumene	61.3 r		2.91 r	8.17	1.13E-02 r	0.07 r	7.10E-06	0.14 r	1.1E+04	9.8E+03
Cyanazine (Bladex)	171 b	2.20 b	2.16 d	1.5	1.00E-10 b			0.0024 m		
Cyanide (free)				9.9				0.0010 l		
Dacthal	0.5 r		2.45 r	2.8	2.14E-06 r			0.0197 r		
DDD	0.09 a	6.10 a	6.00 a	9922	4.00E-06 a	0.02 a	4.76E-06	0.28 l		
DDE	0.12 a	6.76 a	6.65 a	44194	2.10E-05 a	0.01 a	5.87E-06	0.24 l		
DDT	0.03 a	6.53 a	6.42 a	26259	8.10E-06 a	0.01 a	4.95E-06	0.43 l		
Diazinon	40 b	3.35 b	3.29 d	20				0.013 m		
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 l		
Dibenzofuran	10.0 b	4.20 b	4.13 d	135	1.26E-05 b	0.06 q	1.00E-05	0.173 m	7.8E+05	7.1E+05
1,4-Dibromobenzene	3.45	3.75	3.05 e	11	4.00E+02 j			0.034 m		
Dibromochloromethane	2600 b	2.17 b	1.80 e	0.63	7.83E-04 b			0.0035 m		
Dicamba	4500 b	2.40 b	2.36 d	2.29	7.90E-09 b			0.0043 m		
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 l	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 l	1.9E+04	1.8E+04

**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
Dichlorodifluoromethane	280 b	2.16 b	1.76 c	0.58	3.43E-01 b	0.08 c	1.05E-05	0.012 l	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 l	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 l	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 l	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 m	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 m	3.2E+03	2.9E+03
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		
Dimethylphthalate	4000 b	1.60 b	1.57 d	0.37	1.10E-07 b			0.0017 m		
Di-n-butyl Phthalate	11.2 a		4.53 a	339	9.38E-10 a			0.06 r		
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		
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
Ethylene glycol	1.0E+06 b	-1.40 b	-1.38 d	0.00042	6.00E-08 b			8.08E-05 m		
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		
Freon - 113	170 k		2.20 q	1.6	5.20E-01 q	0.029 q	8.10E-06	0.0240 m	2.0E+03	1.8E+03
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		

**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
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 cm ²	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		
Hexachlorocyclopentadiene	1.8 a	5.39 a	5.30 d	1989	2.66E-02 a			0.16 r		
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		
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-Methylnaphthalene	2.50E+01 b	3.90 b	3.83 d	68.23	5.09E-04 r	0.048 r	7.84E-06	0.1420 r	1.7E+05	1.5E+05
2-Methylphenol (o-Cresol)	3.10E+04 b	2.06 b	1.04 c	0.11	1.10E-06 b			0.0101 r		
3-Methylphenol (m-Cresol)	2.50E+04 b	2.06 b	1.54 c	0.35	1.50E-06 b			0.0103 r		
4-Methylphenol (p-Cresol)	2.15E+04 b	2.06 b	1.69 c	0.49	1.00E-06 b			0.00995 r		
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	0.092 r	1.01E-05	0.0010 l	1.2E+04	1.1E+04
Oxamyl	3.E+05 g			0.09	3.85E-13 g			0.00019 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							
Paraquat	1.E+06	h			155	1.00E-09	k	0.0053									
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				
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		
Perchlorate	245000	r						0	0.00E+00	a			0.001	l			
Permethrin (Ambush)	0.01	g						393	1.87E-06	g			45	m			
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			
Picloram (Tordon)	430	r	1.36	r	1.155	e		0.14	5.20E-14	r			0.000592	r			
Profluralin	0.10	g						1000	2.88E-04	g			0.000015	m			
Prometon	750.00	r			2.19	r		1.57	3.10E-09	r			0.0107	r			
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	c	3.51	d	3.45	c		28	1.30E-02	c	0.075	c	7.80E-06	0.099	m	1.7E+04	1.6E+04
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			
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
Tert-butyl alcohol	235000	t	0.35	s	1.57	s		0.4	1.15E-05	s	0.085	t	9.11E-06	0.00119	m	6.9E+04	6.3E+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

**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
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		
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	57 r		2.86 r	7.18	6.05E-03 r	0.0644 r	7.92E-06	0.133 r	1.39E+04	1.26E+04
1,3,5-Trimethylbenzene	48.2 r		2.85 r	7.03	8.62E-03 r	0.0602 r	8.67E-06	0.094 r	1.19E+04	1.09E+04
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		

Notes:

- 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)
- Kp: skin permeability coefficient (cm/hr)

Spreadsheet values with modifications since the printing of the 03 RSK Manual are denoted by the shaded cells.

Information Source Key

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 Data for Selected Chemicals, Source: KDHE

<http://www3.bae.ncsu.edu/info1/courses/bae573/models/gleams/www-docs/tabp2.txt>

g = ARS Pesticide Properties <http://www.arsusda.gov/rsml/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 Bank*. Online search for specified chemicals. 1994

l = USEPA, Dermal Exposure Assessment Principles & Applications, EPA/600/8-9/011B, 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

r = Risk Assessment Information System (RAIS) website, sponsored by U.S. Dept. of Energy, www.rais.ornl.gov

s = *Interagency Assessment of Oxygenated Fuels*, National Science and Technology Council (NSTC), 1997

t = Texas Commission on Environment Quality, TRRP website, April 2007

u = United States National Library of Medicine, Toxnet website, www.toxnet.nlm.nih.gov, March 2003

APPENDIX C CONTAMINANT TOXICITY DATA

Chemical Name	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				6.00E-02 i	6.00E-02 r	6.00E-02 r
Acetochlor				2.00E-02 i3	2.00E-02 r	2.00E-02 r
Acetone				1.00E-01 i	1.00E-01 r	1.00E-01 r
Acetophenone				1.00E-01 i	5.71E-06 i	1.00E-01 r
Acrolein				5.00E-04 i3	5.71E-06 i3	5.00E-04 i3
Acrylamide	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	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)	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)				1.00E-03 i	1.00E-03 r	1.00E-03 r
Aldrin	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				3.00E-01 i	3.00E-01 r	3.00E-01 r
Antimony and compounds				4.00E-04 i		
Arsenic	1.50E+00 i	1.51E+01 c	1.50E+00 r	3.00E-04 i		
Atrazine	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				7.00E-02 i	1.43E-04 h	
Bentazon				3.00E-02 i3	3.00E-02 r	3.00E-02 r
Benzene	2.90E-02 i	2.90E-02 c	2.90E-02 r	3.00E-03 n	1.71E-03 n	3.00E-03 r
Benzidine	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	7.30E-01 n	3.10E-01 n	7.30E-01 r			
Benzo(b)fluoranthene	7.30E-01 n	3.10E-01 n	7.30E-01 r			
Benzo(k)fluoranthene	7.30E-02 n	3.10E-02 n	7.30E-02 r			
Benzo(a)pyrene	7.30E+00 n	3.10E+00 n	7.30E+00 r			
Benzyl Chloride	1.70E-01 i	1.70E-01 r	1.70E-01 r			
Beryllium		8.40E+00 c		2.00E-03 i	5.71E-06 i	2.00E-03 r
Bis(2-chloroethyl)ether	1.10E+00 i	1.16E+00 c	1.10E+00 r			
Bis(2-chloroisopropyl)ether	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	2.20E+02 i	2.17E+02 c	2.20E+02 r			
Bis(2-ethylhexyl)phthalate	1.40E-02 i	1.40E-02 r	1.40E-02 r	2.00E-02 i	2.00E-02 r	2.00E-02 r
Bromacil				1.00E-01 e	1.00E-01 r	1.00E-01 r
Bromodichloromethane	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	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				1.40E-03 i	1.43E-03 c	1.40E-03 r
1,3-Butadiene	9.80E-01 r	9.80E-01 c	9.80E-01 r			
Butylate				5.00E-02 i3	5.00E-02 r	5.00E-02 r
n-Butylbenzene				1.00E-02 n	1.00E-02 n	1.00E-02 n

APPENDIX C CONTAMINANT TOXICITY DATA

Chemical Name	SFo (kg-day/mg)	SFi (kg-day/mg)	SFd (kg-day/mg)	RfDo (mg/kg-day)	RfDi (mg/kg-day)	RfDd (mg/kg-day)
sec-Butylbenzene				1.00E-02 n	1.00E-02 n	1.00E-02 n
Butyl Benzyl Phthalate				2.00E-01 i	2.00E-01 r	2.00E-01 r
Cadmium		6.30E+00 c		5.00E-04 i		
Captan	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	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				1.00E-01 i	2.00E-01 i	1.00E-01 r
Carbon Tetrachloride	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	3.50E-01 i	3.50E-01 c	3.50E-01 r	5.00E-04 i	5.00E-04 r	5.00E-04 r
Chlorobenzene				2.00E-02 i	5.71E-03 h	2.00E-02 r
Chloroethane	2.90E-03 n	2.90E-03 r	2.90E-03 r	4.00E-01 n	2.86E+00 i3	4.00E-01 r
Chloroform	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	1.30E-02 h	6.30E-03 c	1.30E-02 r			
2-Chloronaphthalene				8.00E-02 i3	8.00E-02 r	8.00E-02 r
Chlorpyrifos (Lorsban/Dursban)				3.00E-03 i	3.00E-03 r	3.00E-03 r
Chromium (trivalent)				1.00E+00 i		
Chromium (hexavalent)		4.20E+01 c		5.00E-03 i		
Chrysene	7.30E-03 n	3.10E-03 n	7.30E-03 r			
Copper				3.71E-02 h		
Cumene				1.00E-01 i3	1.00E-01 r	1.00E-01 r
Cyanazine (Bladex)	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)				2.00E-02 i		
Dacthal				1.00E-02 i	1.00E-02 r	1.00E-02 r
DDD	2.40E-01 i	2.40E-01 r	2.40E-01 r			
DDE	3.40E-01 i	3.40E-01 r	3.40E-01 r			
DDT	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	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	8.40E-02 i	8.40E-02 r	8.40E-02 r	2.00E-02 i	2.00E-02 r	2.00E-02 r
Dicamba				3.00E-02 i3	3.00E-02 r	3.00E-02 r
1,2-Dichlorobenzene				9.00E-02 i	5.71E-02 c	9.00E-02 r
1,4-Dichlorobenzene	2.40E-02 h	2.40E-02 r	2.40E-02 r	2.00E-01 n	2.29E-01 c	2.29E-01 r

APPENDIX C CONTAMINANT TOXICITY DATA

Chemical Name	SFo (kg-day/mg)	SFi (kg-day/mg)	SFd (kg-day/mg)	RfDo (mg/kg-day)	RfDi (mg/kg-day)	RfDd (mg/kg-day)
Dichlorodifluoromethane				2.00E-01 i	5.71E-02 h	2.00E-01 r
1,1-Dichloroethane				1.00E-01 h	1.43E-01 c	1.00E-01 r
1,2-Dichloroethane	9.10E-02 i	9.10E-02 c	9.10E-02 r			
1,1-Dichloroethene	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)				1.00E-02 h	1.00E-02 r	1.00E-02 r
1,2-Dichloroethene (trans)				2.00E-02 i	2.00E-02 r	2.00E-02 r
2,4-Dichlorophenol				3.00E-03 i	3.00E-03 r	3.00E-03 r
2,4-Dichlorophenoxyacetic acid (2,4-D)				1.00E-02 i	1.00E-02 r	1.00E-02 r
1,2-Dichloropropane	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	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	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	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				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
Dimethylphthalate				1.00E+01 e	1.00E+01 r	1.00E+01 r
Di-n-butyl Phthalate				1.00E-01 i3	1.00E-01 r	1.00E-01 r
2,4-Dinitrophenol				2.00E-03 i	2.00E-03 r	2.00E-03 r
2,4-Dinitrotoluene	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	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				2.00E-02 h	2.00E-02 r	2.00E-02 r
1,4-Dioxane	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				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
Ethylbenzene				1.00E-01 l	2.90E-01 c	1.00E-01 r
Ethylene dibromide	8.50E+01 i	7.70E-01 c	8.50E+01 r	5.70E-05 r	5.70E-05 h	5.70E-05 r
Ethylene glycol				2.00E+00 i3	2.00E+00 r	2.00E+00 r
Fluoranthene				4.00E-02 i	4.00E-02 r	4.00E-02 r
Fluorene				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		4.55E-02 c		1.50E-01 i		1.50E-01 r
Freon - 113				3.00E+01 i3	8.60E+00 h	3.00E+01 r
Furan				1.00E-03 i	1.00E-03 r	1.00E-03 r
Glyphosate (Roundup)				1.00E-01 i	1.00E-01 r	1.00E-01 r

APPENDIX C CONTAMINANT TOXICITY DATA

Chemical Name	SFo (kg-day/mg)	SFi (kg-day/mg)	SFd (kg-day/mg)	RfDo (mg/kg-day)	RfDi (mg/kg-day)	RfDd (mg/kg-day)
Heptachlor	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	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	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	7.80E-02 i	7.70E-02 c	7.80E-02 r	2.00E-04 h	2.00E-04 r	2.00E-04 r
Hexachlorocyclopentadiene				6.00E-03 i3	5.75E-05 i3	6.00E-03 i3
Hexachloroethane	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	3.00E+00 i	1.72E+01 c	3.00E+00 r			
Hydrazine sulfate	3.00E+00 i	1.72E+01 c	3.00E+00 r			
Indeno(1,2,3-cd)pyrene	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						
Lindane	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				4.67E-02 i	1.40E-05 c	4.67E-02 r
Mercury				3.00E-04 h	8.57E-05 c	3.00E-04 r
Methoxychlor				5.00E-03 i	5.00E-03 r	5.00E-03 r
Methylene Chloride	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				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-Methylnaphthalene				4.00E-03 i3	4.00E-03 r	4.00E-03 r
2-Methylphenol				5.00E-02 i	5.00E-02 r	5.00E-02 r
3-Methylphenol				5.00E-02 i	5.00E-02 r	5.00E-02 r
4-Methylphenol				5.00E-03 h	5.00E-03 r	5.00E-03 r
Methyl Tertbutyl Ether				5.00E-02 n	8.57E-01 c	5.00E-02 r
Metolachlor (Dual)				1.50E-01 i	1.50E-01 r	1.50E-01 r
Metribuzin (Sencor)				2.50E-02 i	2.50E-02 r	2.50E-02 r
Naphthalene				2.00E-02 i	8.57E-04 i	2.00E-02 r
Nickel				2.00E-02 i		
Nitrobenzene				5.00E-04 i	5.71E-04 c	5.00E-04 r
Nitrofurazone	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				5.71E-03 r	5.71E-03 i3	5.71E-03 r
Oxamyl				2.50E-02 i	2.50E-02 r	2.50E-02 r

APPENDIX C CONTAMINANT TOXICITY DATA

Chemical Name	SFo (kg-day/mg)	SFi (kg-day/mg)	SFd (kg-day/mg)	RfDo (mg/kg-day)	RfDi (mg/kg-day)	RfDd (mg/kg-day)
Paraquat				4.50E-03 i	4.50E-03 r	4.50E-03 r
Parathion				6.00E-03 h	6.00E-03 r	6.00E-03 r
PCBs (Polychlorinated Biphenyl)	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	1.20E-01 i	1.20E-01 r	1.20E-01 r	3.00E-02 i	3.00E-02 r	3.00E-02 r
Perchlorate				7.00E-04 i3	7.00E-04 r	7.00E-04 r
Permethrin (Ambush)				5.00E-02 i	5.00E-02 r	5.00E-02 r
Phenol				6.00E-01 l	6.00E-01 r	6.00E-01 r
Phenylphenol	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
Picloram				7.00E-02 i3	7.00E-02 r	7.00E-02 r
Profluralin				6.00E-03 h	6.00E-03 r	6.00E-03 r
Prometon				1.50E-02 i3	1.50E-02 r	1.50E-02 r
Propachlor (Ramros)				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				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				5.00E-03 i		
Silver				5.00E-03 i		
Simazine (Princap)	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				2.00E-01 i	2.90E-01 c	2.00E-01 r
Tert-butyl Alcohol (TBA)	3.30E-03 o	3.30E-03 r	3.30E-03 r			
2,4,5-T as Acid				1.00E-02 i	1.00E-02 r	1.00E-02 r
2,3,7,8-TCDD (Dioxin)	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	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	2.00E-01 i	2.03E-01 c	2.00E-01 r			
Tetrachloroethene (PCE)	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				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

APPENDIX C CONTAMINANT TOXICITY DATA

Chemical Name	SFo (kg-day/mg)	SFi (kg-day/mg)	SFd (kg-day/mg)	RfDo (mg/kg-day)	RfDi (mg/kg-day)	RfDd (mg/kg-day)
TPH DRO				3.00E-02	3.00E-02	3.00E-02
Toxaphene	1.10E+00	1.12E+00	1.10E+00			
2,4,5-TP (Silvex)				8.00E-03	8.00E-03	8.00E-03
1,2,4-Trichlorobenzene				1.00E-02	5.70E-02	1.00E-02
1,1,1-Trichloroethane				3.50E-02	2.86E-01	3.50E-02
1,1,2-Trichloroethane	5.70E-02	5.60E-02	5.70E-02	4.00E-03	4.00E-03	4.00E-03
Trichloroethene (TCE)	1.10E-02	6.00E-03	1.10E-02			
2,4,5-Trichlorophenol				1.00E-01	1.00E-01	1.00E-01
2,4,6-Trichlorophenol	1.10E-02	1.09E-02	1.10E-02			
1,2,3-Trichloropropane	7.00E+00	7.00E+00	7.00E+00	6.00E-03	6.00E-03	6.00E-03
Triflualine (Treflan)	7.70E-03	7.70E-03	7.70E-03	7.50E-03	7.50E-03	7.50E-03
1,2,4-Trimethylbenzene				5.00E-02	1.70E-03	5.00E-02
1,3,5-Trimethylbenzene				5.00E-02	1.70E-03	5.00E-02
2,4,6-Trinitrotoluene	3.00E-02	3.00E-02	3.00E-02	5.00E-04	5.00E-04	5.00E-04
Vanadium				7.00E-03		
Vinyl Chloride	1.90E+00	3.00E-01	1.90E+00			
Xylene (mixed)				2.00E+00	2.00E+00	2.00E+00
Zinc				3.00E-01		
Notes						
Spreadsheet values with modifications since the printing of the 03 RSK Manual are denoted by the shaded cells.						
SFo = oral slope factor		RfDo = oral reference dose				
SFi = inhalation slope factor		RfDi = inhalation reference dose				
SFd = dermal slope factor		RfDd = dermal reference dose				
i = Integrated Risk Information System (IRIS), EPA, 1997						
i2 = Integrated Risk Information System (IRIS), EPA, 2002						
i3 = Integrated Risk Information System (IRIS), EPA, 2003-2007						
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						
o = California Office of Environmental Health Hazard Assessment, 1999						