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Technical Report:

Development of Soil Cleanup Target Levels (SCTLs) for Chapter 62-785, F.A.C.

Prepared for the
Division of Waste Management
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by

Lisa Tonner-Navarro, Ph.D.
N. Christine Halmes, Ph.D.
Stephen M. Roberts, Ph.D.

Center for Environmental & Human Toxicology
University of Florida
Gainesville, Florida

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I. Introduction

This document describes a procedure for the development of risk-based cleanup target levels for chemicals of concern in soil based on direct human contact and migration of chemicals of concern from soil to groundwater. It provides equations that can be used for calculating these values and recommended sources for input values for these equations. In addition, it provides the information necessary for the derivation of the soil cleanup target levels (SCTLs) which are found in Chapter 62–785, F.A.C., and here as Table 1. For purposes of calculating SCTLs that are site-specific, procedures for identifying the necessary input values are also presented.

The approach in calculating SCTLs described here borrows from methodologies developed and described elsewhere, most notably the USEPA Soil Screening Guidance (SSG; USEPA, 1996a, 1996b) and the USEPA Region IX Preliminary Remediation Goals (USEPA, 1996c). The rationale for selecting specific aspects of the methodology developed for Florida from these and other sources is discussed in this report. While an attempt has been made to provide a comprehensive description of methods for calculating Florida SCTLs, in some instances the reader is referred to the source document for a more detailed explanation.

SCTLs for direct human contact can be developed for a variety of exposure scenarios. Only two scenarios are presented in this report — exposure from residential and commercial/industrial land use — although SCTLs for other scenarios can also be calculated using this methodology. SCTLs based on either default or site-specific characteristics can also be used as remediation goals.

It is important to note that the SCTL methods for direct human contact described in this report are based on protection of human health only. Soil contamination limits to protect non-human species or ecosystems are very much dependent upon the site characteristics and species present and are therefore difficult to generalize. Under some circumstances, the SCTLs based on human health may not be protective of other species; for example, human health SCTLs for some metals exceed concentrations shown to produce phytotoxicity (USEPA, 1996b). It should also be recognized that the SCTL methodology described here is based on direct exposure, and does not consider intake and human health risk that may occur via indirect pathways such as uptake into plants and animals that are used as a food source.[1] Lastly, the SCTL methodology does not address issues such as objectionable odors and visible staining. It is possible that the human health SCTLs for some constituents, particularly those with relatively low toxicity and low mobility potential (such as TRPH) could result in staining, odors and/or nuisance conditions. As such, depending upon the setting and the management for a site, the SCTLs described here may not address all of the potential issues of concern.

II. Development of SCTLs Based on Direct Contact

A. Equation for calculating direct contact SCTLs

The equations for calculating SCTLs based on direct contact are shown in Figures 1 and 2. These equations are functionally equivalent to those used by USEPA Region IX in developing their preliminary remediation goals (USEPA, 1996c). One equation is provided for calculating an SCTL based on non-cancer health effects and another for calculating an SCTL based on cancer risk, if

[1] While not commonly considered a pathway at all contaminated sites, it can be an issue for other risk assessments.

appropriate (i.e., if the chemical is regarded as a potential carcinogen). Both equations consider intake from ingestion of contaminated soil, dermal contact with the soil, and inhalation of chemicals of concern present in soil that have volatilized or have adhered to soil-derived particulates [dust]. The combined impact of exposure from all three routes[2] simultaneously is used to calculate the SCTL. For purposes of discussion, this is termed the *multi-route approach.*

In their Soil Screening Guidance (SSG), the USEPA. has employed a somewhat different approach from the one used here. In the SSG, SSLs[3] for a chemical are calculated separately for ingestion and inhalation exposure, in what could be called a *route-specific approach.* In determining an SSL based on direct contact, the lower of the two values for a chemical would be selected. As a general rule, dermal intake is ignored unless there is evidence in the literature of substantial dermal absorption of the chemical (e.g., pentachlorophenol). In such instances, some adjustment of the SSL is made to account for this uptake.

The principal advantage of the multi-route approach is that it is easier to defend on conceptual grounds. In all but the most unusual circumstances, an individual exposed to contaminated soil will be exposed by all three routes simultaneously. The multi-route approach considers the risk or hazard from a chemical to that individual to be the sum of the risks or hazards from each of these exposure routes. The route-specific approach, in contrast, considers the risk or hazard posed by each route of exposure in isolation and makes the implicit assumption that risks or hazards from exposure to a chemical by multiple routes

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[2] In this context, *route* refers to route of entry into the body, such as through dermal contact or inhalation. Pathway refers to the means by which chemicals of concern in soil (or other environmental media) reach the body, such as volatilization into the air, direct contact with the skin, migration to groundwater which is used as a drinking water source, etc.

[3] The USEPA Soil Screening Guidance soil concentrations are defined as Soil Screening Levels (SSLs). The Florida soil values are defined as Soil Cleanup Target Levels (SCTLs).

are unrelated, even if they involve the same target organ. Such an argument could be made if the toxicity posed by the chemical is route-dependent, i.e., is associated specifically and exclusively with a particular route of exposure. This situation is seldom the case. For the vast majority of chemicals, the toxicity upon which the SSL/SCTL is based is systemic in nature. That is, the reference doses and slope factors used to calculate the soil values are based on systemic toxicity endpoints, and a chemical reaching the target organ from any and all routes is likely to contribute to toxicity.[4] Under these circumstances it is difficult to consider the risks to be less than additive.

From a practical standpoint, the difference between the values derived for a given chemical by the multi-route and route-specific approaches is relatively small, provided both ingestion and inhalation toxicity values are available and the risk from dermal exposure is small. In basing an SSL on only one route of exposure, and ignoring other routes, the route-specific approach will tend to underestimate exposure and risk. Assuming for the moment that risks from dermal exposure are negligible and that the lower of the ingestion and inhalation SSLs is selected, the maximum underestimation of risk would be by a factor of 2. This maximum underestimation would occur when ingestion and inhalation risks from a chemical in soil are equal. Under these circumstances, choosing either the ingestion or inhalation SSL as the value for that chemical will capture only 50% of the total risk. In situations where risk from soil contamination is dominated by one exposure route — ingestion, for example — ignoring other routes has little effect on risk, and the error introduced into health-based soil target level development by the route-specific

[4] The *amount* of chemical reaching the target organ can be affected by the route of entry through physiological processes such as extent of local vascularization, diffusional barriers, presence or absence of transport mechanisms, pre-systemic elimination, and distribution. Such differences can be taken into account through estimation of relative systemic bioavailability from different routes.

approach is minimal. In this situation, the multi-route and route-specific approaches should yield nearly identical health-based soil target levels.

Despite this small theoretical difference in soil levels between the multi-route and the route-specific approaches, the route-specific approach could conceivably result in compatibility problems with baseline risk assessments. In baseline risk assessments, the hazard index for a chemical is calculated from the sum of the hazard quotients for each of the exposure routes. When a soil target level is based on exposure from only one of those routes, it can provide a different indication of hazard potential. To illustrate the potential problem, suppose a site has Chemical A in the soil at a concentration just below a soil target level developed using a route-specific approach. Because the concentration of Chemical A is below the target level, the risk assessor for the site might choose to drop it from the baseline risk assessment. If it is retained, however, its hazard index could be as high as 2 (based on the discussion in the preceding paragraph). Any value greater than 1 signals a possible non-cancer health problem. In this example, the use of a route-specific soil target level can make possible the elimination, from a baseline risk assessment, of a chemical that would otherwise be flagged as posing a potentially unacceptable health risk. This inconsistency cannot occur for soil target levels developed using the multi-route approach since, like baseline risk assessments, they are based on risks summed from all relevant routes.

The multi-route approach does not preclude the development of soil target levels based on route-specific toxicity. For chemicals with toxicities unique and specific to certain routes of administration, the analysis may default to a route-specific approach. Perhaps the best example of this situation is toxicity resulting strictly from local effects at the site of contact (e.g., skin, gastrointestinal tract, or lungs). In this case, chemical exposure by other routes would probably not contribute

to this toxicity, and risks for individual routes arguably should not be summed. In these instances, while the multi-route approach forces all routes to be considered, it results in a route-specifically determined soil target level. In order to derive a route-specific soil target level, the equations presented in Figures 1 and 2 can be modified by deleting equation components for all but the relevant exposure route (e.g., delete the dermal and inhalation equation components when developing a soil target level based solely on ingestion). In many cases it can be difficult to determine whether or not a toxicity value is route-specific. In the absence of definitive. information, one approach is to infer route specificity when the target organ is the portal of entry for the administered dose (i.e., the GI tract in the case of ingestion and the pulmonary tract in the case of inhalation) in the study providing the toxicity information. While no doubt imperfect, this approach allows route specificity to be addressed in soil target level development for a broad range of chemicals.

Unlike the SSG, the approach presented here explicitly includes dermal exposure as a contributor to risk and a component of the SCTL for direct contact with soil. Using default assumptions regarding the absorption of chemicals in soil through the skin, the contribution of this route to risk and to the SCTL for most chemicals is very small. This method is consistent with the generally held notion that dermal absorption of chemicals of concern present in soil is a minor exposure route for all but a few chemicals. Despite the typically small contribution of dermal exposure, it is included in the SCTL equations for two reasons: 1) so that the equations can be considered complete with respect to potential exposure routes; and 2) from a practical perspective, so that a mechanism is in place to address those chemicals for which dermal absorption truly represents a significant exposure route.

The inhalation component of both equations includes intake from airborne concentrations of chemicals of concern resulting from volatilization as well as

contaminated soil-derived dust particles. As noted in the SSG, inhalation of soil-derived particulates is a significant contributor to risk in only a few instances, such as the risk of cancer from hexavalent chromium. Volatilization is an issue only for chemicals with the appropriate physical/chemical properties. In response to this fact, when developing their SSLs the SSG evaluates separately the particulate inhalation of non-volatile inorganics in surface soil and volatilization for subsurface chemicals of concern. This approach requires the use of different equations for different chemicals, depending upon their classification or grouping. Rather than develop multiple equations, the approach taken in this report is to use a single equation each for cancer and non-cancer health effects, with the influence of physical/chemical properties on inhalation exposure handled through the input values selected for use in the equation rather than through changes in the equation itself. The inhalation component for volatilization does not take into account volatilization from subsurface soil into structures through cracks in building foundations. If the possibility exists for this route of exposure, then potential volatilization into buildings should be assessed using models such as that developed by Johnson and Ettinger (1991).

B. Input values for direct exposure

Risk or hazard. When calculating an SCTL for direct exposure, the target risk or hazard must be specified. In the examples included in this report for petroleum site related chemicals of concern, SCTLs are calculated to correspond to an excess cancer risk of 10^{-6} and a hazard index of 1, as these are the target risks specified in Section 376.81, F.S. When selecting the target risk or hazard for SCTL development, it must be kept in mind that this is the accepted incremental excess risk per chemical, and not necessarily the accepted increase in risk to the individual. For many (perhaps most) sites, exposure is to more than one chemical, and the

overall risk to the individual posed by contamination at the site will be some composite of the individual chemical risks. SCTLs for generic application cannot be developed based on total target risk to the exposed individual, since this risk will vary depending upon the number and type (i.e., carcinogenic versus non-carcinogenic) of chemicals present at specific sites. However, SCTLs based on total target risk to the individual can be developed on a site-specific basis using methods described in the SSG Section 2.5.3 (USEPA, 1996a). [For more discussion of risks from multiple chemicals of concern, see Section II E.]

Virtually all carcinogenic chemicals are also capable of producing non-cancer health effects. At target cancer risks typically employed by regulatory agencies, SCTLs based on carcinogenicity are usually lower than SCTLs based on non-cancer health effects for the same chemical. This is not always the case, however. For example, the residential SCTL for the carcinogen cadmium is based on non-cancer effects because it is lower than the SCTL based on carcinogenicity. Therefore, when developing SCTLs it is important to consider both carcinogenic and non-carcinogenic effects to ensure that the SCTL for a given chemical is protective for both kinds of toxicity.

Exposure parameters. Most sites can be evaluated using SCTLs based on either of two basic land uses — residential and industrial/commercial. In the case of residential land use, potentially exposed individuals include both children and adults. For industrial/commercial land use, only adult exposure to contaminated soil is assumed to exist.

Children are assumed to experience the greatest daily exposure to soil under residential land use scenarios. When risk is a function of the daily intake rate of a chemical of concern (as in the evaluation of non-cancer health effects), SCTLs must

be based on childhood exposure assumptions in order to be protective. When risk is a function of cumulative exposure (as in the evaluation of cancer risk), the exposure period may cover time spent both as a child and as an adult for the residential scenario. Physiological parameters such as body weight, surface area, and inhalation rate of course change with age. Other exposure parameters such as soil ingestion rate are also age-dependent. In this situation, time-weighted average values reflecting both childhood and adult exposures must be used in calculating SCTLs for residential land use. In this report, the individual exposed both as a child and as an adult is termed the *aggregate resident*.

For generic SCTLs (i.e., SCTLs applicable and protective for a broad range of sites), default exposure assumptions are available from the USEPA for both residential and commercial/industrial land uses. These are listed in Table 2. Some input parameters for the aggregate resident, such as inhalation rate and exposed dermal surface area, are not readily available from the USEPA and had to be developed from USEPA data sources. The values calculated for these parameters are also listed in Table 2, and the method of derivation is described in Appendix A.

In the case of the soil ingestion rate for the aggregate resident, the USEPA uses an age-adjusted soil ingestion rate of 114 mg-yr/kg-d in their SSG. This value is based on a 30-year exposure period being divided into 6 years of consumption of 200 mg of soil per day at a body weight of 15 kg, followed by 24 years of consumption of 100 mg of soil per day at a body weight of 70 kg (see USEPA, 1996b, for more information on the calculation of this value). While there is logic in this method of calculation, there is a potential problem in using this approach along with cancer slope factors in developing SCTLs based on carcinogenicity. Specifically, the problem involves the way the body weight is used in the averaging process. When cancer slope factors are developed, the typical approach in determining dose is to use

an average intake rate of the chemical divided by an average body weight over the exposure period, usually a lifetime in the case of rodent bioassays. To be strictly comparable, a similar approach should be used in the development of the aggregate resident (time-weighted average) soil ingestion rate for use in calculating SCTLs. That is, a time-weighted average soil ingestion rate is calculated (e.g., 120 mg/day, based on 6 years at 200 mg/day and 24 years at 100 mg/day) and is then divided by a time-weighted average body weight (e.g., 59 kg, based on 6 years at 15 kg plus 24 years at 70 kg divided by an exposure duration of 30 years) to yield a time-weighted average soil ingestion rate, in mg soil/kg body weight/day. Aggregate resident values derived using this approach are employed in the calculation of SCTLs based on carcinogenicity. These values are listed in Table 2. The practical implications of this difference in time-weighted averaging is that, all other factors being equal, the SCTLs derived based on carcinogenicity are about two-fold higher than those calculated using the SSG approach (e.g., the USEPA SSL for arsenic based on direct exposure is 0.4 mg/kg whereas the residential Florida SCTL for arsenic is 0.8 mg/kg).

One of the exposure variables, the particulate emission factor (PEF), is used to address intake from inhalation of contaminated soil-derived particulates. This value is a function both of site and local climatic conditions. The formula for calculating a PEF value is taken from the SSG (USEPA, 1996a) and appears in Figure 3. In calculating a PEF for Florida sites, default parameters from the SSG were used except for the Q/C term. The SSG selected as default a Q/C for 0.5 acres of contaminated soil in Los Angeles, CA. In order to make the default PEF more relevant to Florida climatic conditions, a Q/C for 0.5 acres in Miami[5] is used instead.

[5] The only city in Florida for which a modeled Q/C value is presented in the SSG.

Another input parameter used to assess the soil-to-air pathway of exposure is the volatilization factor, VF. This term is used to define the relationship between the concentration of the chemical of concern in soil and the flux of the volatilized chemical of concern to air. The VF is calculated using an equation from the SSG as shown in Figure 4. Parameters related to characteristics of both the chemical and the soil are used in the calculation of a VF. For the purposes of establishing default SCTLs, default soil characteristics specified in the SSG have been adopted, although it is recognized that the relevant characteristics can vary widely in Florida soils. As discussed above, a Q/C for Miami is used rather than the default Q/C from the SSG, which is based on meteorological conditions in Southern California.

The default exposure assumptions identified in Table 2 are intended to be health protective under circumstances of chronic exposure. Site-specific conditions may restrict exposure to such an extent that the default assumptions are not valid, and the desired target risk goals can be achieved with higher SCTLs. On the other hand, there may be situations in which exposure exceeds the default assumptions employed in developing generic SCTLs, e.g., workers with extensive soil contact and opportunity for exposure, such as construction workers involved in excavation, or children with soil pica. For these sites, the SCTLs may not be sufficiently protective. Whenever generic SCTLs are used for site evaluation, it is important to verify, to the extent possible, that the default assumptions upon which they are based are neither greatly above nor below actual present and future exposure conditions. Approaches for developing site-specific exposure assumptions, when necessary, are discussed in Section II C, below.

Physical/chemical parameters. The equations for the calculation of SCTLs for direct contact require the input of several chemical-specific factors. These values, which include the organic carbon normalized soil-water partition coefficient for

organic compounds (K_{oc}), Henry's Law constant (HLC), air diffusivity (D_i), and water diffusivity (D_w), are a function of the physical/chemical properties of each chemical of concern. It may be necessary sometimes to calculate values such as K_{oc} or HLCs when published values do not exist. In these cases, additional physical/chemical values such as the water solubility (S) or the octanol-water partition coefficient (K_{ow}) are needed. There are many sources for physical/chemical parameter values, but unfortunately the values listed in various sources can differ dramatically. In order to foster consistency in the development of SCTLs, it is important to have a designated hierarchy of sources for the selection of physical/chemical values.

In agreement with SSG, chemical-specific values for S, HLC, and K_{ow} are preferentially selected from the *Superfund Chemical Data Matrix* (SCDM) (EPA/540/R-96/028). This database is composed of carefully selected information taken from specified literature sources or other databases, or values are calculated. The SCDM then ranks those values which reasonably apply to the hazardous substance. K_{oc} values are from the *Soil Screening Guidance: Technical Background Document* (SSG) (EPA/540/R-95/128). ATSDR Toxicant Profiles, the Electronic Handbook of Risk Assessment Values (EHRAV), the Hazardous Substance Database (HSDB), and other reference sources (in that order of preference) are used when data are unavailable from the SCDM or SSG. For diffusivity values, the sources are the CHEMDAT 8 Database (EPA/453/C-94/080B) and the WATER 8 Model (EPA/453/C-94/080C). The physical/chemical parameters for chemicals specifically listed in Chapter 62-785, F.A.C., are provided in Table 3a.

Toxicity values. The SCTL equations for direct exposure also require inputs in the form of chemical- and route-specific toxicity values. The USEPA provides such values for many chemicals, with preference given in the following order to: 1) IRIS; 2) HEAST; 3) USEPA-NCEA; and 4) Withdrawn values from IRIS or HEAST. When

toxicity values are not available from the USEPA, alternative sources/approaches are available. Provisional toxicity values can be extrapolated from occupational exposure limits (see for example Williams et al., 1994), can be based on "surrogate values" (i.e., toxicity values for substances from the same chemical class and with similar toxicological properties), can be extrapolated from toxicity values available for other routes of exposure (i.e., route-to-route extrapolation), can be calculated using toxicity equivalency factors (TEFs), or developed from toxicological information in the primary literature. TEFs are commonly used when they are available. Beyond this step, there is no fixed hierarchy for these approaches, and preference should be given to the one that appears to be based on the best information. Each of these alternative approaches has strengths and weaknesses that must be kept in mind when evaluating their suitability for developing toxicity values for SCTL calculation:

- Occupational exposure limits are often based on relatively extensive study in humans, which is an advantage. Because they are intended for healthy adults, an adjustment must be made in order for them to be considered protective for a broader range of exposed individuals which may include some with special sensitivity. By incorporating the appropriate "safety factor," toxicity values from occupational exposure limits can be, in general, conservative and health protective (Williams et al., 1994). There may be, however, some situations in which a chemical poses special toxicity to sensitive individuals not found in the workplace (e.g., lead in children), where any extrapolation from occupational limits may be troublesome.

- For chemicals with little or no toxicity information, the use of surrogate toxicity values from chemically-related compounds offers a means to provide some estimate of risk, and of acceptable soil concentrations. Small changes

in chemical structure can produce profound differences in toxicity, however (compare CO and CO_2, acetate and fluoroacetate, ethanol and methanol, for example), and this approach carries with it significant uncertainty.

- Often, inhalation and dermal toxicity criteria are not available. In these cases, route-to-route extrapolation can be used to expand upon dose-toxicity relationships observed for one route of exposure to develop toxicity values for other routes. For example, the oral toxicity value can be used to derive corresponding inhalation or dermal values (see Appendix B). Intake from different routes is not necessarily equivalent, and information regarding toxicokinetics of the chemical (or assumptions in this regard) must be taken into account when performing route-to-route extrapolation. Further, route-to-route extrapolation is not appropriate when there is evidence that the toxicity value serving as the basis for extrapolation is likely to be route-specific. If a slope factor (SF) or a reference dose (RfD) is known or presumed to be route-specific, it should not be regarded as suitable for route-to-route extrapolation.[6]

While the USEPA originally recommended route-to-route extrapolation as a means of developing toxicity values (e.g., in USEPA, 1989a), more recently they have discouraged its use, citing the uncertainties involved (see for example the discussion in the USEPA, 1996b). While these uncertainties

[6] In the case of carcinogenic PAHs the toxic endpoint (cancer) occurs regardless of the route of exposure. This effect is clearly evidenced by the fact that while the OSF for benzo(a)pyrene is based on data in which oral dosing resulted in GI tract tumors in rodents, arguably a route-specific cancer, benzo(a)pyrene has also been observed to produce other types of cancer in several species when administered by a variety of routes, including inhalation and dermal contact. Although no slope factor has yet been derived for these routes, the rather strong evidence that benzo(a)pyrene (and, by implication, other carcinogenic PAHs) is carcinogenic by a variety of routes, indicates that PAH induced cancer is not wholly route-specific. Because of this property, route-to-route extrapolation was performed to derive both inhalation and dermal slope factors from the OSF for this group of chemicals in developing SCTLs for Chapter 62-785, F.A.C.

cannot be denied, when route-to-route extrapolation is performed with knowledge of the disposition and toxicity of the chemical, these uncertainties are hardly disproportionate to the uncertainties associated with other aspects in the calculation of SCTLs. Further, when the alternative is to omit a particular route of exposure from the SCTL calculation, in effect assuming that risk from this route is zero, this too is a source of uncertainty that is not well addressed by SSG methodology. In fact, for some chemicals, the absence of a toxicity value can mean that the dominant source of risk is ignored. In light of this discussion, the cause of minimizing uncertainty is arguably best served by judicial use of route-to-route extrapolation in SCTL development.

- Toxicity equivalency factors are numerical expressions of the relative potency of a series of compounds, with a reference compound assigned a value of one (1). For example, a chemical with a TEF of 0.5 would be only half as potent as the reference compound. Using the toxicity value for the reference compound and the TEFs, toxicity values for the series of compounds can be calculated. For a chemical with a TEF of 0.5, for example, a provisional RfD can be developed by dividing the RfD for the reference compound by 0.5. In the case of a cancer slope factor (CSF), the CSF for the reference compound would be multiplied by the TEF to derive a provisional CSF for the related compound. TEFs are based on comparative potency regarding some effect thought to be related to the toxicity of interest. The ability of this surrogate effect to accurately portray relative toxic potency is a source of uncertainty in this approach.

- Development of a toxicity value from the primary literature is labor-intensive and requires judgment of an experienced toxicologist. If a sufficient body of information regarding dose-response relationships for toxicity is available in

the literature for a chemical, however, it represents an important and useful approach to developing a provisional toxicity value.

For Chapter 62-785, F.A.C. chemicals, many toxicity values were available from USEPA sources whereas others had to be extrapolated using a combination of the above approaches. To identify toxicity values needed for SCTL calculations, the TEF approach, surrogate values, and route-to-route extrapolation were used. The toxicity values and their sources/bases are provided in Tables 4a and 4b.

C. Developing site-specific direct contact SCTLs

While default SCTLs are useful tools in site evaluation and when formulating remediation strategies for a broad range of sites, there will be some sites for which default SCTL values are overly conservative or not conservative enough. That is, there will be some sites in which present and future site and exposure characteristics are so different from the assumptions used to calculate default SCTLs, that these SCTLs do not accurately correspond to the risk goals for that site. This section identifies variables in the SCTL equations for which site-specific information can be substituted in order to obtain a more accurate SCTL, as well as some considerations in making site-specific modifications.

Exposure variables. When evaluating whether to use alternative assumptions for exposure frequency and exposure duration, responsible risk management requires consideration of not only the present use of the site, but also the range of plausible future uses. If site use is unrestricted, or only broadly restricted (e.g., to residential or commercial use), this range will almost always include some uses or site conditions in which exposure to soil can be substantial. In these situations, the default assumptions will represent the best choice. If site

management includes engineering and/or institutional controls, then exposure assumptions should be based on the upper limit of exposures possible within those controls. Deviation from the default assumptions should occur only in circumstances where it can be shown that the engineering and/or institutional controls proposed for the site will reliably restrict exposure frequency and duration. Also, caution must be exercised in proposing limited exposure frequencies and/or durations even if the effectiveness of engineering and institutional controls can be assured. The SCTL methodology described here is based on chronic exposure. When exposure is of short duration or intermittent, the SCTLs calculated with these exposure assumptions are not valid, and a very different type of toxicological analysis directed to this type of exposure must be conducted in order to establish limits of chemicals of concern in soil.

Under extraordinary circumstances, the exposed dermal surface area and inhalation rates could be modified (e.g., if protective clothing and/or a respirator is required while on site). There will be very few, if any, sites where the long term management involves such restrictions, however. The adherence factor (the amount of soil which adheres to skin, per unit of surface area) might conceivably be influenced by local soil conditions, but empirical data to support an alternative value would probably be required.

Site soil and weather characteristics. Site soil characteristics can influence the rate of volatilization of organic chemicals into air, and thus the level of chemical of concern that may be acceptable. Measuring appropriate soil characteristics in order to develop site-specific volatilization factors (VF) may be useful, particularly if risks from soil at a site are thought to be dominated by inhalation of volatile chemicals from soil. Parameters necessary for the determination of the VF include the average soil moisture content (w), the dry soil

bulk density (ρ_b), fraction of organic carbon (f_{oc}), and soil pH (used to select pH-specific K_{oc} and K_d values). Methods for determining these site-specific measured values for the derivation of the VF are listed below and outlined in the SSG (USEPA, 1996a).

Soil Characteristic	Data Source	Method
Soil moisture content (w)	Lab measurement	ASTM D 2216
Dry soil bulk density (ρ_b)	Field measurement	All soils: ASTM D 2937; shallow soils: ASTM D 1556, ASTM D 2167, ASTM D 2922
Soil organic carbon (f_{oc})	Lab measurement	Nelson & Sommers (1982)
Soil texture	Lab measurement	Particle size analysis (Gee & Bauder, 1986) and USDA classification; used to estimate Θ_w & I
Soil pH	Field measurement	McLean (1982)

It is important to note that many site-specific values require data collected over a one-year period. Thus, while site-specific SCTLs may be desirable, the use of generic SCTLs may in fact be more cost-effective and less time-consuming. In addition to the time needed for the collection of soil-specific data, the investigator must be in strict accordance with the approved methods. This condition is particularly important because the collected data are also used for the derivation of other site-specific parameters. Values derived from site-specific data include Θ_w (water-filled soil porosity), Θ_a (air-filled soil porosity), total soil porosity (n) and soil-water organic partition coefficient (organics) (K_d). Therefore, errors in the collection of data would result not only in one incorrect value, but in several other incorrectly derived values as well. For example Θ_w and Θ_a are derived from the soil moisture content (w). To adequately generate w, the soil moisture content must represent the *annual* average. The use of moisture content data from discrete soil samples which may be affected by preceding rainfall events would incorrectly

represent the moisture content and therefore result in the incorrect derivation of Θ_w and Θ_a. Correctly deriving values such as Θ_a is of great significance, because other than the initial soil concentration, air-filled soil porosity (Θ_a) is the most significant soil parameter affecting the volatilization of chemicals of concern from soil. The higher the Θ_a, the greater the potential for emission of volatile chemicals of concern. The equations, sources, and methods for deriving soil characteristics using site-specific data are provided in the following table.

Soil Characteristic	Data Source	Method
Water-filled soil porosity (Θ_w) (Average soil moisture content)	$\Theta_w = n\ (I/K_s)^{1/(2b+3)}$ or $\Theta_w = w\rho_b$	Where, n = total soil porosity (L_{pore}/L_{soil}) I = infiltration rate (m/yr) K_s = saturated hydraulic conductivity (m/yr) b = soil-specific exponential parameter (unitless) w = soil moisture content (g_{water}/g_{soil}) ρ_b = dry soil bulk density (g/cm^3)
Total soil porosity (n)	$n = 1 - (\rho_b/\rho_s)$	Where, ρ_b = dry soil bulk density (g/cm^3) ρ_s = soil particle density = 2.65 kg/L
Infiltration rate (I)	HELP model; Regional estimates	HELP (Schroeder et al., 1984); may be used for site-specific infiltration estimates; used to calculate Θ_w
Soil-specific exponential parameter (b) (Moisture retention component)	Look-up	Attachment A (USEPA, 1996a); used to calculate Θ_w
Saturated hydraulic conductivity (K_s)	Look-up	Attachment A (USEPA, 1996a); used to calculate Θ_w
Air-filled soil porosity (Θ_a)	$\Theta_a = n - w\rho_b$ or $\Theta_a = n - \Theta_w$	Where, n = total soil porosity (L_{pore}/L_{soil}) w = soil moisture content (g_{water}/g_{soil}) ρ_b = dry soil bulk density (g/cm^3) Θ_w = average soil moisture content (L_{water}/L_{soil})
Soil-water organic partition coefficient (organics) (K_d)	$K_d = K_{oc} \times f_{oc}$	Where, K_{oc} = chemical-specific soil-organic carbon partition coefficient (cm^3/g) f_{oc} = organic carbon content of soil (g/g)

VF is also a function of local climatic conditions and the size of contaminated area as expressed in the Q/C term. The USEPA (1996b) has tabulated Q/C values for contaminated areas ranging from 0.5 to 30 acres in size for selected cities around

the U.S. These values are based on a modeling exercise which incorporated, among other things, meteorological data for these cities. The only city in Florida included in this exercise was Miami, and the next closest city was Atlanta. The default Q/C recommended in Figure 4 is based on Miami data and a 0.5 acre contaminated area. A site-specific Q/C term should be considered if the area of contaminated soil is significantly greater than 0.5 acres and inhalation exposure is a significant concern. Development of a site-specific Q/C term for a contaminated area outside the range presented by the SSG, or using meteorological data from a location in Florida other than Miami, is possible but would require a sophisticated and expensive analysis. In all but the most unusual circumstances, this level of effort to develop a site-specific Q/C term beyond the use of the SSG tabulated values would not be worthwhile.

The PEF term is also influenced by local meteorological conditions, as well as site characteristics (Figure 3). An important site characteristic influencing PEF is the percent of vegetative cover over the contaminated soil. The default assumption is that 50% of the contaminated area has vegetative cover. This value can be adjusted for a specific site, but if a higher value is used some mechanism must be in place to ensure that the vegetative cover remains in place in the future. Local wind conditions can also influence PEF and could conceivably be used to adjust the PEF in the development of site-specific SCTLs. A preliminary analysis of annual average meteorological data from cities around Florida found average windspeeds only slightly different from the default value, however (unpublished observations). Because PEF is a quantitatively important factor in the SCTL of only a very few chemicals, there is generally little incentive for developing site-specific PEF values. It is important to note that the PEF is applicable only for undisturbed soil. If there is significant soil disturbance at a site, such as from vehicular traffic, site-specific

estimates of dust levels may have to be substituted for the PEF in deriving an SCTL.

Mass limits. The VF equation is based in part on the assumption of an infinite source. When the volume of contaminated soil is known (i.e., the area and depth), the VF equation can be modified to take mass of chemicals of concern into consideration. An alternative VF equation incorporating estimates of volume of contaminated soil is described in the SSG (USEPA, 1996a, 1996b).

Values that do not change from site to site. It is worth stating explicitly that there are some variables and assumptions that are unrelated to site conditions and circumstances and therefore should not be modified in deriving a site-specific SCTL. These parameters include toxicity values, absorption rates, fundamental physical/chemical properties of chemicals of concern, and the averaging time for carcinogenic effects. [Note: The averaging time for non-carcinogenic effects is a function of the exposure duration, which could be modified at a particular site.] Also, it is generally impractical to consider body weight as a site-specific variable (except as it relates to the age of the exposed individuals, e.g., adults versus children).

D. Developing alternative direct contact SCTLs based on C_{sat}

To calculate the inhalation component of the SCTL for residential and industrial exposure to volatile carcinogens and non-carcinogens, a volatilization factor is used, as described in Section II B, "Input values for direct exposure." The equation for the volatilization factor (Figure 4), which defines the relationship between the concentration of the chemical of concern in soil and its flux to air, assumes an infinite source of the chemical and only one mechanism of transport,

vapor phase diffusion. With this model, other than the initial soil concentration, air-filled soil porosity is the most significant soil parameter affecting the final steady-state flux of volatile chemicals. The higher the air-filled soil porosity, the greater the emission flux of volatile constituents. However, there are limits to this model. One limit of particular importance is the chemical concentration at which the soil pore air and pore water are saturated and the adsorptive limits of the soil particles have been reached. At this point, the emission flux from soil to air for a chemical reaches a plateau and volatile emissions will not increase above this level no matter how much more chemical is added to the soil. This property is referred to as the soil saturation limit (C_{sat}) (Figure 5).

For chemicals of relatively low toxic potency, the use of the equations in Figures 1 and 2 to calculate SCTLs may result in soil concentrations that exceed C_{sat} for that chemical. This situation creates a problem in that the model used for the inhalation component of these equations is not predictive of air concentrations when the C_{sat} is exceeded, as discussed above. Also, for chemicals that are liquid at ambient temperatures (≥25°C), soil concentrations above the saturation limit will be present as non-aqueous phase liquids (NAPLs), which may be undesirable at the site for a number of reasons. For these reasons, the C_{sat} is used by the USEPA as an upper limit for SCTLs in soil (USEPA, 1996a).

Among the chemicals listed in Chapter 62-785, F.A.C., this is an issue for several chemicals. That is, for certain chemicals, identified below and in Table 1 with a double asterisk (**), the calculated risk-based value for the SCTL exceeds the calculated C_{sat} value. For these chemicals [only], the FDEP has determined that the SCTLs for direct contact in Chapter 62-785, F.A.C., should be their respective C_{sat} values.

Chemical Name	Residential SCTL (mg/kg)	Industrial SCTL (mg/kg)	Chemical Name	Residential SCTL (mg/kg)	Industrial SCTL (mg/kg)
acetophenone	680**	680**	ethylene glycol	65000	120000**
benzaldehyde	4500**	4500**	isobutyl alcohol	3500	11000**
benzyl alcohol	5500**	5500**	malathion	1100**	1100**
bis (2-ethylhexyl) phthalate	75	230**	methyl acrylate	1300	8000**
butyl benzyl phthalate, N-	220**	220**	methyl styrene (mixed)	36	200**
butylphthalyl butylglycolate	240**	240**	methyl styrene, alpha	1100	3000**
carbon disulfide	200	730**	methylnaphthalene, 1-	290**	290**
chlorobenzotrifluoride, 4-	80	190**	methylphenol, 3-	2600	20000**
chlorobutane, 1-	430	540**	nitrotoluene, m-	160	480**
cycloate	150	160**	nitrotoluene, o-	220	1100**
cyclohexanone	980**	980**	parathion	160**	160**
cyhalothrin, lambda (karate)	6**	6**	phorate	13	160**
cypermethrin	60**	60**	propylene glycol	100000**	100000**
dichlorobenzene, 1,2-	88	370**	propylene glycol monomethyl ether	31000	41000**
dichlorobenzene, 1,3-	390**	390**	styrene	1700**	1700**
diethylene glycol, monoethyl ether	84000	170000**	thiobencarb	150**	150**
diethylphthalate	640**	640**	toluene	300	520**
dimethylphthalate	1600**	1600**	trichloro-1,2,2-trifluoroethane, 1,1,2-	880**	880**
di-n-butylphthalate	110**	110**	trichlorobenzene, 1,2,4-	560	3000**
ethion	37	56**	trichloroethane, 1,1,1-	480	1400**
ethoxyethanol acetate, 2-	7700	30000**	trimethylbenzene, 1,2,3-	240	260**
ethyl acetate	4100	11000**	xylenes, total	290**	290**
ethylbenzene	240**	240**			

It should be noted that in some instances even though a chemical fulfills the C_{sat} criteria, the residential value is based on human health endpoints whereas the industrial value is based on C_{sat}. This situation occurs when the difference between C_{sat} and the human health-based value is relatively small, such that the industrial human health-based value exceeds C_{sat} and the residential value does not. When developing site-specific SCTLs using default assumptions, particular attention should be paid to these chemicals, as well as others that may be liquid at ambient soil temperatures, but do <u>not</u> meet C_{sat} criteria. Because site-specific SCTLs are usually less conservative than default SCTLs, they may exceed corresponding C_{sat} values when the default SCTLs do not.

E. Chemical Interactions for Chapter 62-785, F.A.C.

Exposure to combinations of chemicals may result in interactions leading to a significant increase or decrease in the overall toxicity of the mixture compared to the summation of the toxicity of the individual chemicals. As a result, the concept of toxic interactions from multiple chemical exposures is a subject of considerable interest and concern for hazardous waste sites where multiple chemical exposures are probable.

Toxic interactions may occur as a result of an alteration in the absorption, distribution, metabolism, and excretion of one chemical by another, modifying its toxicity. Studies in animals have reported the occurrence of such interactions among gaseous pollutants, pesticides, metals, and solvents. Interactions may also occur when one chemical alters the responsiveness of cells and target organs to the effects of other chemicals, such as through receptor up-regulation or altered cell signalling pathways. Very little information exists on toxic interactions in humans, and inferences must be made from studies of toxicant effects in laboratory animals. Even in circumstances where significant interactions have been observed in these studies, 1) the dosages at which the interaction occurs are usually not well characterized; 2) there is often uncertainty as to whether the mechanism for the interaction is relevant to humans, particularly at the comparatively low levels of exposure typically encountered from contaminated environmental media; and 3) most such studies involve exposure to two chemicals, whereas exposure at contaminated sites can involve several toxicants. For these reasons, the utility of these observations in evaluating the human health implications of multiple chemical exposures is limited, and it is extremely difficult to address chemical interactions in quantitative risk assessment other than on a rather simplistic level.

The standard approach taken in baseline risk assessments for contaminated sites is to assume that risks to the individual from multiple chemicals of concern are, at most, additive. The incremental excess cancer risk to the exposed individual is the sum of the cancer risks from individual carcinogenic site chemicals of concern. For non-carcinogens, hazard quotients for individual chemicals are summed only when there is evidence that the chemicals may have additive effects. The same mechanism of action or the same target organ for toxicity are usually taken as evidence for potential additivity.

The Florida statutes which provide for Chapter 62-785, F.A.C. specify that "In establishing soil cleanup target levels for human exposure to each contaminant found in soils from the land surface to 2 feet below land surface, the department shall consider the following, as appropriate: calculations using a lifetime cancer risk level of 1.0E-6; a hazard index of 1 or less; the best achievable detection limit; or the naturally occurring background concentration." They further specify "The criteria for determining what constitutes a rehabilitation program task or completion of a site rehabilitation program task or site rehabilitation program must: . . . Consider the additive effects of contaminants. The synergistic and antagonistic effects shall also be considered when the scientific data become available." These aspects of the law have been interpreted as indicating that contaminants at a brownfield site should, in their aggregate, pose a cancer risk no greater than 1E-06 and a hazard index no greater than 1. Derivation of direct exposure SCTLs for a brownfield site therefore requires consideration of interactive toxicity among the contaminants present.

Within the context of a tiered approach to site evaluation, the initial assessment of risk (and hazard) posed by site contaminants requires an approach that is both relatively simple and conservative. For most sites, this objective can be achieved by assuming simple additivity of risk among the contaminants present. In

the case of cancer risk, it is recognized that the cancer risks from individual chemicals are not truly independent (e.g., death from cancer from one contaminant reduces the risk of cancer from other contaminants to zero; also, there is evidence suggesting that developing one cancer may increase the risk of developing a second cancer), and therefore some error will be introduced in calculating total cancer risk from the sum of the individual cancer risks. However, since the probability of developing cancer from environmental exposure to contaminants is usually small, the error in summing them will also be small and of little consequence in estimating total cancer risk. When more than one carcinogen is present at a brownfield site, the direct exposure SCTLs in Table 1 must be adjusted to reflect total cancer risk. For initial site evaluation, to ensure that the total cancer risk does not exceed 1E-06, the SCTL from Table 1 for each carcinogen should be divided by the number of carcinogens to derive site-specific SCTLs.

For non-carcinogens, additivity of effect is most likely to occur when the contaminants affect the same target organ. With this concept in mind, initial evaluation of a site should employ SCTLs adjusted to reflect additivity in target organ toxicity. That is, for contaminants affecting the same target organ, the SCTLs from Table 1 for each should be divided by the number of contaminants affecting that organ. For example, if four contaminants present at a brownfield site characteristically produce liver toxicity, the relevant SCTLs for these chemicals would be their direct exposure SCTL values in Table 1 divided by four. To assist in identifying chemicals affecting the same target organ, Table 4 lists each of the non-carcinogenic chemicals of concern for which an SCTL was derived for Chapter 62–785, F.A.C., the reference dose for that chemical and the toxic endpoint upon which the reference dose is based. To further facilitate the identification of chemicals with common target organs and/or effects, the chemicals in Chapter 62-785, F.A.C. have been sorted by target organ or effect (Table 5).

If risks are unevenly distributed among chemicals at a site, the simple method of apportionment described above for deriving site-specific SCTLs may lead to total site risk below the goals of 1E-06 and a hazard index of 1. In these circumstances, within the context of a site-specific risk assessment, a weighted approach to calculating SCTLs may be more appropriate. For example, consider the situation of four chemicals that affect the same target organ, each with an SCTL of 1 ppm. Chemical A is present at 0.05 ppm, Chemical B at 0.1 ppm, Chemical C at 0.25 ppm, and Chemical D at 0.9 ppm. Since there are four chemicals present that affect the same target organ, the SCTL for each would be divided by 4 — in this case leading to an SCTL of 0.25 ppm for each. In this example, only chemical D poses a potential problem (i.e., it is present at a concentration greater than its modified SCTL of 0.25 ppm). Cleanup of Chemical D to its SCTL of 0.25 ppm would lead to a total hazard index of only 0.65 for all four chemicals. If a weighted apportionment is used instead, Chemical D could be cleaned to 0.55 instead of 0.25 ppm, and still retain a hazard index ≤ 1.

While, in principle, interactions can occur among chemicals, resulting in greater-than-additive effects, at present there are no specific examples which indicate that the additive approach described above is not sufficiently conservative for initial site evaluation purposes. If evidence arises in the future for specific interactions that would render this approach less than health-protective, the approach should be modified to take these interactions into consideration.

Although simple additivity is the most commonly recommended approach for risk assessment, the incorporation of quantitative information on toxicologic interactions as a means to more specifically evaluate the potential for additivity is an alternative for more detailed, site-specific risk assessments (as per Rule 62–785.650, F.A.C.). Additivity may result from *dose addition*, which occurs when

chemicals act on similar biological systems and elicit a common response, whereas *response addition* occurs when chemicals act by independent mechanisms to produce toxicity to the same organ or tissue (Hertzberg et al., 1997). With *dose addition*, the chemicals are assumed to be functional clones and thereby follow similar pathways of uptake, metabolism, distribution and elimination, and elicit the same toxicologic effect. Thus, although the dose of one chemical may be too small to elicit an effect, the addition of a second chemical may be enough so as to increase the total dose to a level that results in an adverse effect. Under *response addition*, different physiologic pathways are followed and the response to one chemical occurs whether or not the second chemical is present. For example, the liver may be the common target organ, but the mechanism of injury can differ (e.g., peroxisomal proliferation, induction of oxidant stress, protein adduction). However, it is the sum of the responses at the common target organ that is measured as the additive effect, regardless of the differences in mechanism of action. Dose addition should always be treated as a summation of hazard quotients. Response addition, however, may not always be accurately characterized by a simple summation of hazard quotients, depending upon the toxic mechanisms involved. In cases of response addition, approaches other than simple addition can be used to derive site-specific SCTLs, but must be carefully justified by the mechanism(s) of action of the chemicals and supported by empirical observations.

In the context of a detailed, site-specific risk assessment, chemical interactions other than addition need to be considered, such as antagonism, inhibition, masking, synergism, and potentiation.[7] As with response addition,

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[7] *Antagonism*- When the toxic effects from exposure to a combination of chemicals is less than what would occur following individual chemical exposures.
Inhibition- When one substance's toxic effect to a specific organ is reduced by the presence of a second chemical, which does not have a toxic effect on the same organ.
Masking- When the toxic effects produced, at the same site, are opposite or functionally competing effects, reducing the toxic effects that would be elicited by the chemicals on an individual basis.

manipulation of SCTLs based on these interactions should be soundly and carefully based on mechanistic principles supported by empirical observations from the peer-reviewed scientific literature.

F. Acute Toxicity Concerns for Chemicals in Chapter 62-785, F.A.C.

The default residential direct exposure SCTLs for non-carcinogenic chemicals at a brownfield site are intended to be health protective for children as well as adults, and are developed based on assumptions of chronic exposure. While it is generally assumed that these contaminant concentration limits are health protective for acute as well as chronic exposure, there may be circumstances where acute exposure is significantly larger than the time-averaged chronic exposure. This could result in an exposure that is acutely toxic. A striking example of this situation can be seen with soil ingestion rates in children. While most children may ingest up to 200 mg of soil per day (the standard USEPA default assumption), in some instances episodic ingestion can be 250-times that amount or more (Calabrese et al., 1997). Although a soil ingestion rate of 5 g soil/day has been proposed by the USEPA (USEPA, 1986) to address the possibility that some children may exhibit soil pica (ingestion) in quantities far greater than the 200 mg/day value, this approach is regularly disregarded in practice. To prevent this oversight when assessing a brownfield site whose future uses may include scenarios in which contact with soil by small children is possible, the potential for acute toxicity must be adequately addressed in the development of SCTLs.

Synergism- When the toxic effect(s) from exposure to a combination of chemicals is greater than the effects produced by the individual chemicals (effects greater than additive).
Potentiation- When one substance's toxic effect to a specific organ is increased by the presence of a second chemical, which does not have a toxic effect on the same organ.

Calabrese and coworkers evaluated the potential for acute toxicity from a pica episode involving soil with contaminant concentrations regarded by the USEPA as conservative[8] (Calabrese et al., 1997). Contaminant doses expected to result from a one-time soil pica episode of 5 to 50 g of soil were estimated and compared with acute dosages demonstrated to produce toxicity in humans in poisoning episodes. The findings indicated that some residential soil cleanup target levels could result, following a single large soil ingestion event, in doses in the range reported to produce acute toxicity and even death. Of the thirteen chemicals included in the analysis, ingestion of soil containing cyanide, fluoride, phenol, or vanadium was found to result in a contaminant dose exceeding the acute human lethal dose; and ingestion of barium, cadmium, copper, fluoride, nickel, or phenol from soil was found to produce doses associated with acute toxicity other than death.

Although the selective use of human data contributes greater confidence in the relevance and implications of these findings, it is important to acknowledge the limitations associated with this analysis. Estimates of the acute toxic and lethal doses were primarily extrapolated from reports on accidental ingestion, and exact dose estimation was difficult. In addition, most incidents of exposure were limited to adults; doses were then modified to approximate a dose that would have the same effect in children. Doses reported to be lethal to humans indicate only that the dose needed to cause death was met or exceeded, thus doses lower than those reported could also produce death. On the other hand, some observations may represent a particularly sensitive individual and not apply to the population in general. Also, the doses in this analysis were ingested doses rather than absorbed doses, and in many cases involved solutions where absorption may be extensive. The presence of these contaminants in soil may reduce their bioavailability, and therefore their

[8] USEPA Soil Screening Levels and USEPA Region III Risk-Based Concentrations for residential soil.

toxicity. Despite these limitations, the serious nature of acute toxicity potentially associated with consumption of contaminated soil during a soil pica episode, requires that attention be paid to this issue when developing residential soil cleanup target levels.

The chemicals identified in the study by Calabrese and coworkers as having the potential to produce an acute toxicity problem were evaluated for Chapter 62-785, F.A.C. to determine whether an adjustment in the residential SCTL was required. Because the intake under these circumstances would be driven almost exclusively by ingestion, the SCTL equation was altered to remove dermal contact and inhalation components. Also, because the value is based on a single exposure event, terms related to averaging time and exposure frequency were deleted to produce the following equation:

$$SCTL = \frac{BW}{\frac{1}{RfD_{acute}} \times SI \times CF}$$

where BW = body weight (kg); RfD_{acute} = safe dose for acute exposure (mg/kg); SI = amount of soil ingested (g) and CF = conversion factor for units (kg/g) (10^{-3}). Consistent with other SCTLs based on exposure of a child, a body weight of 15 kg was assumed. So as not to make the derivation of acute toxicity SCTLs excessively conservative, an amount of soil ingested per event (SI) was selected (10 g) that is well within the range of values reported by Calabrese and others.

Unfortunately, safe acute doses are not routinely provided by the USEPA, and such information is extremely limited in the literature. As a starting point in the analysis, subacute and chronic oral reference doses were considered, with the logic that a dose that is safe for chronic consumption will also be safe for a single

exposure. This value was then compared with observations in the medical and toxicological literature to determine whether the value might be excessively conservative. This analysis included, where possible, an attempt to derive differential dose-response information for more-serious and less-serious health effects specific to humans. In some cases, as discussed below, doses higher than the subchronic or chronic oral reference dose were identified that were consistent with the health protection goals of FDEP. A brief summary of the analysis for each of the eight chemicals appears below.

Acute Toxicity Summaries

Barium. There is a clear distinction in the toxic potential of soluble and insoluble salts of barium. Barium sulfate is insoluble and commonly used in medicine as radiocontrast media. Its toxicity potential is regarded as extremely low. Soluble barium salts, however, can be quite toxic and have been used as rodenticides. Numerous poisonings with soluble forms of barium have been reported in the medical literature, predominantly from the first half of this century. Some have resulted from accidental ingestion, suicide attempts, or mistaken use of a soluble form of barium in medicine (e.g., barium sulfide instead of barium sulfate). One case, for example, involved 144 persons poisoned when barium carbonate was substituted accidentally for potato starch in the preparation of sausage (Ogen et al., 1967). Among the individuals poisoned, 19 were hospitalized and one died. Vomiting, abdominal pain and spasms, diarrhea, weakness, hypokalemia (decreased blood potassium levels), cardiac arrhythmias, paresthesias (abnormal sensation such as tingling), and muscle paralysis are typical signs and symptoms of barium poisoning (Ellenhorn, 1997). Acute renal failure has occasionally been reported (Wetherill et. al., 1981). For barium carbonate, the lowest acute lethal dose is 57 mg/kg, and the lowest toxic dose is 29 mg/kg (Ellenhorn, 1997). Effects at

this lowest toxic dose include muscle paralysis, weakness, and paresthesia. Barium chloride is somewhat more toxic, and the lowest lethal dose is reported to be 11 mg/kg (Ellenhorn, 1997). A value of 200 mg [corresponding to about 3 mg/kg in a 70 kg adult] has been proposed as the low end of the toxic dose range for soluble barium compounds (McNally, 1925), and a public health guide by the WHO reports the lowest toxic doses of barium to be 3-7 mg/kg (WHO, 1991). Clinical symptoms from acute ingestion of lesser barium doses usually subside by 24 hours and the patient is ambulatory within 48 hours, although in some cases muscle paralysis and weakness can last for over a week (Ellenhorn, 1997). There is no clear distinction in the literature between doses producing gastrointestinal symptoms and those resulting in other symptoms that may require medical intervention. One report of mass poisoning with barium noted that none of the children were hospitalized and that their symptoms were generally less severe than the adults (Ogen et al., 1967). However, the children did not eat the same meal as the adults that were poisoned, and it is unclear whether the children received comparable barium doses.

From our survey of the medical literature, it appears that an acute barium dose of approximately 3 mg/kg is at the lower end of the range of toxic doses for soluble forms in adults. Given the nature of barium toxicity, symptoms at the lower end of the toxic range would be expected to be reversible within a few days, but may require medical attention. Data with which to derive an upper bound no-effect dose for soluble barium in humans do not exist. The USEPA chronic oral RfD for barium (0.07 mg/kg/day) is approximately 40-fold less than the lower end of the frank toxicity level of soluble barium in humans, which is not an unreasonable margin of safety. Using the chronic oral RfD as a safe acute exposure dose, a residential SCTL for barium based on acute exposure of a child would be 105 ppm.

The difficulty posed by this SCTL is that natural background concentrations of barium will frequently exceed this value. Of course, naturally occurring barium is not in the form of water-soluble salts, and therefore poses little risk of toxicity. Operationally, barium concentrations at residential sites will probably have to be screened first against background concentrations. If elevated barium concentrations are found, the residential SCTL for barium will be of value only if the fraction of barium present that is soluble can be determined.

Cadmium. With chronic exposure, the health effects of primary concern are renal toxicity and lung cancer. Both require long-term exposure, and neither is an issue with acute (one-time) ingestion of cadmium. The health effects occurring at the lowest acute dosages are primarily gastrointestinal — nausea, vomiting, salivation, abdominal pain, cramps, and diarrhea (ATSDR, 1997). Several cases of acute cadmium poisoning occurred during the 1940s and 1950s when cadmium was substituted for scarce chromium in plating cooking utensils and containers. In one report, two adults and four children experienced vomiting and cramps after drinking tea from a pitcher plated on the inside with cadmium (Frant and Kleeman, 1941). From information provided in this report, doses ranging from 0.2 to 1 mg/kg can be calculated. Other studies have reported that doses as low as 0.04 to 0.07 mg/kg cadmium are capable of inducing vomiting (Nordberg et al., 1973; Lauwerys, 1979). In all cases of cadmium ingestion within this dose range, recovery was rapid and complete, usually within 24 hours.

Use of the chronic oral RfD for cadmium as a safe acute toxic dose, on an interim basis, in order to establish a protective residential SCTL for this chemical is possible. However, because this RfD is based on an effect (renal toxicity) that is not a concern with acute ingestion, it could be argued that this value is too conservative. The SCTL for cadmium based on chronic exposure to children (75

ppm) would result in a dose of 0.05 mg/kg if a child ingests 10 g of soil in a single event. This is at the lower end of the dose range for nausea and vomiting for cadmium, suggesting that some children ingesting soil at this concentration might experience transient GI symptoms.

Copper. Several studies have reported that ingestion of drinking water or beverages with elevated copper concentrations results in gastrointestinal effects including nausea, vomiting, diarrhea, and abdominal pain (Knobeloch et al., 1994; Sidhu et al., 1995; ATSDR, 1990). In fact, copper sulfate was used historically in medicine to induce vomiting (Goodman and Gilman, 1941). Three separate reports provide relatively consistent information regarding the doses of copper required to produce these effects. In one report, military nurses experienced nausea, vomiting, and diarrhea within 30 minutes to one hour after consuming cocktails from a copper lined shaker (Wyllie, 1957). All but five of the fifteen nurses experienced weakness, abdominal cramps, dizziness, and headache the next day. Reconstruction of the cocktail mixture and measurement of copper concentrations, coupled with consumption estimates for each of the nurses, can be used to derive copper dose estimates. The lowest dose (received by three of the nurses who became sick), was 0.09 mg/kg. Nicholas (1968) reported an incident in which twenty workmen became sick after drinking tea at work which contained 30 ppm copper. All experienced nausea and several had diarrhea, with or without vomiting. The estimated dose of copper was 0.07 mg/kg. Spitalney et al. (1984) reported recurrent, acute gastrointestinal symptoms including nausea, vomiting, and abdominal pain in a family associated with drinking copper-contaminated well water, or beverages (juice or coffee) made with the water. Based on the concentration of copper in the water (7.8 ppm), a copper dose of 0.06 mg/kg is estimated. It is not clear whether children have increased sensitivity to gastrointestinal irritation from copper. One study of gastrointestinal complaints from copper in drinking water in two communities in

Wisconsin found higher prevalences of symptoms in children, but this could have resulted from higher exposures than adults (Knobeloch et al., 1994).

It should be noted that copper is considered to be an essential element, and a WHO expert committee has recommended intake of 0.08 mg/kg/day for infants and children (as cited in NRC, 1989). The American Academy of Pediatrics has recommended the inclusion of copper in infant formulas that could result in approximately 0.4 mg copper per day (as cited in NRC, 1989), and many vitamin and mineral products available for children contain about 2 mg copper. When expressed on a per-kg body weight basis, the copper doses resulting from this dietary supplementation are well within the range reported to produce nausea and vomiting (above) — an apparent inconsistency. The explanation appears to be that the effect of copper is dependent upon its form. Each of the case reports of copper-induced gastrointestinal effects involved copper ions in solution. Dietary copper and copper in supplements is typically in less soluble forms (i.e., cupric oxide). For example, a recent WHO report on trace elements in nutrition states,

> "In the assessment of a safe level of intake for copper, it is important to distinguish ionic copper ingested in water or as a supplement from dietary copper in foods, which is largely present in the form of organic compounds. While there is little doubt that the uncontrolled ingestion of soluble inorganic copper salts in milligram quantities should be regarded with caution, levels of copper in food up to around 10 mg/day seem to have no detrimental effect on human health. The upper limit to the safe range of population mean intakes, Cu^{tox}_{PImax}, for adults has accordingly been set at 12 mg/day for men and 10 mg/day for women (Table 7.4). This will take account of the quantity likely to be consumed from the usual diet (< 10 mg/day) and will limit both the amount of copper that can be introduced by dietary fortification and the quantity of contaminating copper that can be regarded as tolerable." (WHO, 1996).[9]

[9] The WHO has set the upper limit of the safe range of population mean intakes of copper for children 1-6 years of age (the most relevant age range for an acute soil ingestion episode) at 1.5 mg/day, based on an assumed body weight of 16 kg (WHO, 1996). This corresponds to a dose of 0.09 mg/kg/day.

The USEPA previously established an oral RfD for copper of 0.006 mg/kg/day, but this was subsequently withdrawn. In the absence of an updated value, a "guidance" concentration range of 0.04 to 0.07 mg/kg/day has been developed by the National Center for Environmental Assessment (NCEA). The NCEA believes that existing data are not adequate to develop an oral reference dose for copper (consistent with USEPA practice not to develop an RfD based on human data unless the dataset is unusually extensive); hence, presentation of these values as guidance. Use of the upper end of the USEPA guidance range for a copper dose, 0.07 mg/kg, as a safe acute dose would place it at the lower end of the effective dose range for gastrointestinal symptoms. The SCTL corresponding to this dose, based on acute exposure for a child, would be 105 ppm.

Beyond gastrointestinal symptoms, the health effect of copper of greatest concern for children is probably hepatotoxicity. In one study of teen-agers and adults acutely poisoned with copper sulfate, 23% developed signs or symptoms of hepatic injury (Chuttani et al., 1965). No information on the copper dose received by these patients was provided. Children have poorly developed homeostatic mechanisms for copper, making them more susceptible to excessive copper accumulation in the liver. Presumably, the acute copper dose required to produce hepatotoxicity would be lower in children, but again, no quantitative information is available. Some children appear to be particularly sensitive to copper accumulation, and severe, usually fatal hepatic disease has been reported from chronic ingestion of relatively modest doses of copper. Childhood cirrhosis from copper is endemic in the Indian subcontinent, where copper contamination of milk from the use of copper and brass containers is common, but rare in other parts of the world (Scheinberg and Sternlieb, 1996; Pandit and Bhave, 1996). Vulnerability to copper hepatotoxicity is probably a function of copper intake and perhaps genetic and other factors that have not been well characterized. While it is reasonable to conclude that doses protective of GI

effects are also protective of hepatic effects, a safe acute, upper bound copper dose that would not push hepatic copper stores in children to a toxic level would be very difficult to estimate.

Cyanide. Cyanide is a potent and rapid-acting toxicant that has been involved in numerous intentional and accidental poisonings. The USEPA reviewed the medical literature and determined that the average fatal dose of cyanide is 1.52 mg/kg (as cited in ATSDR, 1997). The lowest human lethal dose reported in the medical literature is 0.5 mg/kg (Gettler and Baine, 1938). Interestingly, in developing their Soil Screening Guidance, the USEPA acknowledged that their SSL (Soil Screening Level) for cyanide in residential soil was not protective of children who might ingest soil during a pica event:

> "Review of clinical reports on contaminants addressed in this guidance suggests that acute effects of cyanide and phenol may be of concern in children exhibiting pica behavior. If soils containing cyanide and phenol are present at a site, the protectiveness of the chronic ingestion SSLs for these chemicals should be reconsidered." (USEPA, 1996).

While clinical experience with cyanide is extensive, an upper-bound no-effect level has not been identified in humans. Any dose of cyanide capable of producing symptoms is potentially serious and medical attention will be required. The USEPA oral RfD for cyanide is 0.02 mg/kg/day, and this dose should also be protective for acute exposures. It is, however, only 25-fold lower than the lowest dose reported to cause death in humans. Given the severity of the endpoint, this margin of safety is not overly conservative, and we would strongly recommend that no higher dose be used in setting residential SCTLs based on acute exposure in children. The SCTL corresponding to this dose, based on acute exposure for a child, would be 30 ppm.

Fluoride. Acute fluoride poisoning has resulted from its use as an insecticide and in products intended to prevent tooth decay. Soluble forms of fluoride are the most toxic (WHO, 1984). Fluoride is corrosive to the gastrointestinal tract, and toxicity from acute, low dose exposure principally involves gastrointestinal symptoms such as nausea, vomiting, and diarrhea. More severe acute intoxication with fluoride is characterized by excessive salivation, muscle twitching, muscle spasms, tetany, and convulsions (Spoerke et al., 1980). Estimates of the acute lethal dose vary widely. From information in the literature, Hodge and Smith (1965) have placed the lethal dose for adults at approximately 70 to 140 mg/kg sodium fluoride (corresponding to 32 to 64 mg/kg as fluoride). Two case reports of fatalities in small children following acute fluoride ingestion suggest that the lethal dose in children may be smaller. In one case, a 3-year old boy died after ingesting sodium fluoride tablets (Eichler et al., 1982), corresponding to a dose of 16 mg/kg. In another case, a 27-month old child died after ingesting sodium fluoride tablets corresponding to a dose of 8 mg/kg (Whitford, 1990). Based on this case, Whitford (1990) proposed that 5 mg/kg is a "probably toxic dose" for a child, and this value is often cited. This value appears to represent a threshold for serious toxicity, i.e., prolonged symptoms or intoxication requiring medical attention. Transient gastrointestinal symptoms from fluoride (nausea, vomiting, and diarrhea) can occur at lower fluoride doses.

A review of 150 reported accidental poisonings with fluoride found that a dose below 5 mg (absolute dose, not mg/kg) produced no gastrointestinal symptoms, 10% of individuals receiving 5-9 mg had gastrointestinal symptoms, 21% at 10-19 mg, nearly 50% at 20-29 mg, and 100% of individuals who received 30-39 mg. From this information, it can be concluded that to avoid gastrointestinal symptoms from acute ingestion of soil (10 g on a single occasion), fluoride concentrations in soil should not exceed 500 ppm (5 mg fluoride per 10 g of soil). Acute ingestion of soil (10 g by a 15 kg child) containing fluoride at the residential SCTL based on chronic exposure

(4,700 mg/kg) would result in a dose of about 3 mg/kg (45 mg absolute dose). This dose is less than that associated with serious acute toxicity (5 mg/kg, see above), but corresponds to fluoride doses that have a very high incidence of gastrointestinal symptoms (i.e., 45 mg). Consumption of 20 g of soil by a child at this concentration would result in a dose just below the lowest reported lethal dose. In the case of flouride, a reduction of the residential SCTL to 500 ppm is recommended.

Phenol. Acute ingestion of non-fatal doses of phenol results in symptoms of burning mouth and gastrointestinal irritation and distress (Deichman, 1969). An acute lethal dose for an adult was reported by Bennett et al. (1950) as 230 mg/kg. Deichman (1969) reports the lethal range for adults to be between 14.3 mg/kg and 143 mg/kg. Interestingly, there is also a report of an ingestion of 14 mg/kg which caused only gastrointestinal effects (Cleland and Kingsbury, 1977). Intake of water contaminated with phenol for a period of several weeks resulted in diarrhea, mouth sores, and burning mouth (Baker et al., 1978). The dose calculated to have been ingested in these cases ranged from 0.14-3.4 mg/kg/day.

Phenol is another chemical for which the USEPA acknowledges that their residential soil screening level based on chronic exposure may not be protective of children under acute exposure circumstances (see discussion for cyanide, above). The USEPA chronic oral RfD is actually within the lower end of the range of subchronic doses reported to cause effects and, while about 20-fold lower than the lowest dose reported to produce acute effects in humans, is within a factor of 25 of the lowest reported human lethal dose. Under the circumstances, any adjustment of the acute toxicity dose above the USEPA chronic oral RfD for phenol would appear ill advised. Thus, the recommended residential SCTL for children based on acute exposure is 900 ppm.

Nickel. There is only one report of a death from acute ingestion of nickel. A 2-year old child ingested nickel sulfate crystals (approx. 570 mg/kg) and died from cardiac arrest 8 hours later. Sunderman et al. (1988) reported a case in which 35 workers drank from a water fountain contaminated with nickel sulfate, nickel chloride, and boric acid. Twenty of the workers reported symptoms and 10 were hospitalized. The authors indicated that the dose of boric acid received by the workers was insufficient to have caused the symptoms, and attributed them to the nickel. Symptoms included nausea, vomiting, abdominal cramps, diarrhea, muscular pain, giddiness, weariness, headache, cough, and shortness of breath. The symptoms typically lasted a few hours, but in 7 cases lasted 1-2 days. All of the hospitalized subjects were discharged on day 5 after exposure. Clinical chemistry results indicated evidence of transient liver and kidney abnormalities. Estimated nickel doses for these workers ranged from about 7 to 36 mg/kg.

Several studies indicate that ingestion of a single oral dose of nickel can result in dermatitis in nickel-sensitive individuals (ATSDR, 1995). Dermal reactions can include generalized eruptions of maculopapular vesicles, typically affecting the elbows, sides of the neck, armpits, eyelids, and the genital area (WHO, 1991). A vesicular eczema of the hand may also develop. The prevalence of nickel sensitivity is about 1% in men and 10% in women (WHO, 1991). Among the various studies of dermal sensitivity to nickel, the lowest single oral dose reported to elicit a reaction is 0.009 mg/kg (Cronin et al., 1980). In another study, women with known nickel sensitivity and hand eczema were fed a diet with elevated nickel (0.007 mg/kg) for a total of four days (Nielsen et al., 1990). Hand eczema was exacerbated in half of the women by the end of the 4-day diet treatment, and in 10 of 12 a week later. Time to resolution of symptoms was not indicated in the studies reviewed.

The USEPA RfD for nickel is 0.02 mg/kg/day. In discussing this RfD, the USEPA acknowledges that this value may not be protective for nickel-sensitive individuals. If the risk management goal focuses instead on health endpoints occurring at higher exposures, the only real source of human data is the Sunderman et al. (1988) report. While the symptoms of poisoned workers in this study were predominantly gastrointestinal and resolved within a day or two, 10 of 25 were hospitalized for 5 days. Consequently, this should be regarded as a serious toxicity episode. The lower end of the range of estimated doses was 7 mg/kg, and a health protective dose for acute exposure, particularly for children, should be well below this value. Tentatively, this dose could be reduced by a factor of 100, yielding an acute dose of 0.07 mg/kg. This would correspond to a residential acute exposure SCTL of approximately 105 ppm.

Vanadium. Information on the toxicity of vanadium in humans is limited, and much of what is available concerns effects on the respiratory tract of inhaling vanadium dusts in an occupational setting. In the early part of this century, vanadium was used medicinally in doses of 1 to 8 mg. Higher dosages (e.g., 75 to 125 mg/day) were tested for effects on cholesterol, but produced clear evidence of toxicity (Louria et al., 1972). Human lethal doses of vanadium were reported as 0.86-1.7 mg/kg (Stokinger, 1981). As with other metals, the toxicity of vanadium probably depends on its form. Humans who were given 0.47-1.3 mg/kg vanadium (in the form of ammonium vanadyl tartrate) for 45-68 days experienced gastrointestinal distress (abdominal cramping and diarrhea) (Dimond et al., 1963). Some subjects in this study also complained of fatigue or lethargy, and three participants noted increased dysmenorrhea.

The USEPA has developed an oral RfD for vanadium pentoxide of 0.009 mg/kg-day based on changes in hair cystine content in rats chronically fed vanadium

pentoxide in the diet for 2.5 years. Arguably, this RfD may not be particularly valuable in determining what constitutes a safe acute dose of vanadium in humans. The difficulty in determining a safe acute vanadium dose is that there is little data with which to work. The lower end of the range of doses reported to produce gastrointestinal effects from vanadium ingestion (0.47 mg/kg) is only marginally less than the reported lower end of the range of lethal doses. The reliability of the lethal dose information provided by Stokinger is uncertain because of the absence of documentation. Several clinical studies have been conducted using vanadium doses within the lethal range reported by Stokinger, and while some side effects may have occurred, clearly there was not massive lethality. This apparent discrepancy might be explained by differences in the toxicity of different forms of vanadium — clinical studies conducted with less toxic forms (for obvious reasons) and Stokinger reporting lethalities from more toxic forms — but information are lacking to verify this. A vanadium dose of 0.01 mg/kg would be nearly 50-fold less than the lowest dose reported to produce gastrointestinal and other symptoms and about 80-fold less than the lowest reported lethal dose. Using this value to calculate a residential SCTL based on acute exposure results in a soil vanadium concentration of 15 ppm.

Caveats in the Acute Toxicity Analysis

There are several caveats to the above analysis that should be acknowledged. These include the following:

- The focus of the analysis was intentionally on data relevant to acute (single dose) exposure in humans. In our opinion, these data are most pertinent in assessing potential human health risks from acute ingestion of soils. These data are limited, however, and there are several uncertainties inherent in human studies. Principal among these is the fact that doses must nearly always be estimated.

The only alternative to this approach would be to use animal data. While dose estimation is more precise, studies of acute toxicity in animals are usually restricted to death as the endpoint, and extrapolation of safe human doses from lethal doses in animals is an extremely uncertain process.

- It is quite possible that some poisoning reports or other relevant data were missed in this analysis, particularly those appearing during the first half of this century that are not accessible through computerized search vehicles such as Medline or Toxline. Finding older literature citations (pre-1966) is both time-consuming and labor-intensive, and an exhaustive search was not possible within the time constraints of this analysis.

- The chemicals selected for this analysis were those identified by Calabrese et al. (1997) as representing a potential acute toxicity problem for children. While these are regarded as the most likely to pose an acute toxicity hazard, it is possible that there are other chemicals for which a similar concern is warranted. Should evidence arise that a chemical might pose an acute toxicity hazard for small children, the residential SCTL for that chemical should be reconsidered.

- None of the studies in the analysis involved exposure to the chemical in soil. In most of the cases reported, the chemical was ingested in a soluble form, and the dose from soil required to produce equivalent toxicity may be much different. Presence of the chemical in soil in an insoluble form, or interactions between the chemical and soil that reduce its aborption from the gut could significantly reduce toxicity.

Calculating Residential SCTLs Based on Acute Toxicity

Based on the information provided above and discussions with FDEP regarding health protection goals, provisional acute oral reference doses were selected for each of the eight chemicals. These are tabulated below, along with their corresponding acute toxicity SCTL. For comparison purposes, the residential SCTL based on chronic exposure is also provided.

		Residential SCTL	
Chemical	Acute Oral Reference Dose mg/kg	Based on Acute Toxicity (ppm)	Based on Chronic Exposure (ppm)
Barium	7.0E-02	105	5200
Cadmium	1.00E-02	75	75
Copper	7.00E-02	105	5500
Cyanide	2.00E-02	30	570
Fluoride	3.30E-01	500	4700
Nickel	7.00E-02	105	1500
Phenol	6.00E-01	900	31000
Vanadium	1.00E-02	15	510

There are several points relevant to the application of these SCTLs:

- These values are based on protection of small children. Examples of situations where they would be applicable would be residential sites, playgrounds, and daycare facilities. They would not be relevant for industrial sites.

- For chemicals which occur naturally in soils (e.g., barium), the acute toxicity SCTLs may be below natural background levels for a site. If the SCTL value is lower than natural background, a site-specific SCTL should be set equal to the naturally-occurring background concentration.

- In the absence of specific information regarding the form of a chemical present at a site or its bioavailability, a conservative approach in developing default SCTLs is warranted. In developing these SCTLs, we have assumed that the most toxic form of the chemical is present in soils and that bioavailability is equivalent to the chemical in solution. For many of these chemicals, toxic potential can vary dramatically with the form of the chemical, e.g., whether the chemical is present in a soluble or non-soluble form. Presumably for soils, soluble forms would be removed through leaching and, for "mature" sites, the assumption that all of the chemical present is soluble and toxic may be quite conservative. In some cases (e.g., barium), the assumption that all of the chemical present is in a toxic form leads to SCTLs that are below natural background concentrations. For specific sites, a determination of the form of chemical present and/or its bioavailability may be warranted, and might provide justification for higher acute toxicity SCTLs.

III. Development of SCTLs Based on Migration to Groundwater (Leaching)

A. Equation for calculating SCTLs based on leachability

The migration to groundwater pathway was developed to identify chemical concentrations in soil that have the potential to contaminate groundwater. The migration of chemicals of concern from soil to groundwater can be envisioned as a two-stage process: the release of chemicals of concern in soil into leachate, and the transport of chemicals of concern through the soil to and within an underlying aquifer. The method for calculating a leachability-based SCTL is taken from the SSG and incorporates a standard linear equilibrium soil/water partition equation to estimate release of chemicals of concern in soil leachate and a dilution factor to

account for dilution of soil leachates in an aquifer. The SCTLs are then back-calculated from applicable groundwater cleanup target levels (GCTLs). In circumstances where contaminated soil is adjacent to surface water bodies, GCTLs based on protection of the surface water body can also be employed. The GCTL is multiplied by a dilution attenuation factor (DAF) to derive a target leachate concentration. The equation for calculating SCTLs based on migration of chemicals of concern from soil to groundwater is shown in Figure 6.

B. Input values for leachability

The equation for the calculation of SCTLs based on leachability requires the input of several chemical-specific factors. These values include the organic carbon normalized soil-water partition coefficient for organic compounds (K_{oc}) and the Henry's Law constant (HLC). For the development of leachability-based SCTLs for inorganics, K_d values (soil-water partition coefficient) for inorganic constituents are needed. While most of these values can be found in a variety of sources, sometimes it may be necessary to calculate values such as K_{oc} or HLCs when they are not otherwise available. In these cases, additional physical/chemical values such as the water solubility (S) or the octanol-water partition coefficient (K_{ow}) are needed. Different references for physical/chemical parameters can cite very different values and, as discussed in Section II B above, a hierarchy of sources for these values is recommended. Chemical-specific values for S, HLC, and K_{ow} are preferentially selected from the *Superfund Chemical Data Matrix* (SCDM) (EPA/540/R-96/028). K_{oc} values are from the *Soil Screening Guidance: Technical Background Document* (SSG) (EPA/540/R-95/128). ATSDR Toxicant Profiles, the Electronic Handbook of Risk Assessment Values (EHRAV), the Hazardous Substance Database (HSDB) and other reference sources (in that order of preference) are used when data are unavailable in the SCDM or SSG.

Currently, generating K_d values for metals is difficult. For this reason, the USEPA suggests using an equilibrium geochemical speciation model (MINTEQ) for estimating these values. However, modeled values may not accurately represent the potential for leachability because, unlike organic compounds, K_d values (soil/water partition) for metals are significantly affected by a variety of soil conditions. Iron oxide content, soil organic matter content, cation exchange capacity, pH, oxidation-reduction conditions, and major ion chemistry, are significant parameters that can affect the soil/water partition of metals and hence the leachability values. Therefore, in some instances, a leach test may be more useful than an SCTL based on a partitioning equation (see Section III C below).

C. Developing site-specific SCTLs based on leachability

In Florida, soil types vary significantly across the state, from quartz sand to muck, and leaching potential covers an extreme range. The default soil characteristics used to develop generic leachability-based SCTLs lie somewhere in the middle of this range. Development of site-specific leachability-based SCTLs can be quite important, because the soil characteristics at a given site may bear little resemblance to the default assumptions. It should be recognized, however, that site-specific SCTLs for leachability calculated using the equation in Figure 6 can be either higher or lower than the generic values because the default assumptions are not skewed toward the conservative end of the range of values possible in Florida. Site-specific characteristics important in calculating a leachability-based SCTL include the f_{oc}, Θ_w, Θ_a, n, and ρ_b, and procedures for developing site-specific SCTLs are described in the SSG (USEPA, 1996a).

Another parameter that is important in calculating leachability-based SCTLs is the dilution attenuation factor (DAF). The USEPA arrived at a default

DAF using results from OSW's EPACMTP Model. This model utilized a Monte Carlo analysis with input parameters obtained from nationwide surveys of waste sites and from applying the SSL dilution model to 300 groundwater sites across the country. The model distributions were repeated 15,000 times for each scenario and a cumulative frequency distribution of DAF values was generated. The results of the accompanying sensitivity analysis indicated that climate, soil type, and size of the contaminated area have the greatest effect on the DAF. To gain further information on the national range and distribution of DAF values, the dilution model was applied to two large surveys of hydrogeologic site investigations. These were the American Petroleum Institute's hydrogeologic database (HGDB) and USEPA's database of conditions at DNAPL sites. DAF modeling information from a combination of 300 sites indicated that the geometric mean DAF of all sites combined was 20 for a source area of 0.5 acre. This value was carefully selected using a "weight of evidence" approach which best represents a nationwide average and is therefore regarded as an acceptable default for use at most sites. In only special circumstances, such as very complex sites, a site-specific DAF can be calculated, but the aquifer hydraulic conductivity, the hydraulic gradient, the mixing zone depth, the infiltration rate, and the source length parallel to groundwater flow must be determined (USEPA, 1996a).

It has been demonstrated that the leachability-based SCTLs partition equation can be used to derive leaching based SCTLs for organic compounds. However, inorganics present at cleanup sites can also pose risks to an underlying aquifer. To derive leachability-based values for most metals is more complicated, however. Unlike organic compounds, K_d values (soil/water partition) for metals are significantly affected by a variety of soil conditions. In some instances, a leach test may be more useful than the partitioning method. Therefore, FDEP recommends the use of a leach test instead of the soil/water partition equation. However, site-

specific leachability values for metals derived using K_d values estimated with the MINTEQA2 model are considered acceptable leachability SCTLs, if oily wastes are not present. If the decision is made to determine site-specific leachate values, the Synthetic Precipitation Leaching Procedure (SPLP), developed to model an acid rain leaching environment, can be used when there are no oily soil chemicals of concern.[10] When oily wastes are present, FDEP specifically requires the use of the Toxicity Characteristic Leaching Procedure (TCLP) for cleanup of these sites. While this procedure was developed to model leaching from the bottom of a landfill, it more closely estimates leaching from soil contaminated with oily constituents, such as used oil or similar petroleum products.

IV. Development of SCTLs for Total Recoverable Petroleum Hydrocarbons (TRPHs)

The TRPH SCTLs were developed to be used in a two-tiered approach with a primary TRPH soil cleanup target level as the starting value. Primary TRPH values for direct exposure and leachability included in Table 1 are based on the assumption that the TRPHs consist exclusively of aromatic hydrocarbons in the $>C_8$-C_{10} range. While SCTLs derived for hydrocarbons in the C_5-C_7 range are the most restrictive (Table C4, Appendix C), these compounds are not detected using the Florida Petroleum Residual Organic (FL-PRO) analysis. Currently, the FL-PRO method of TRPH analysis is limited to measuring the concentration of mixed petroleum hydrocarbons in the range of C_8-C_{40}. While FL-PRO does not measure hydrocarbons in the C_5-C_7 range, the most toxic and prevalent COCs among these are addressed by other analyses and individual cleanup target levels. Therefore, the primary

[10] Direct leachability testing should include a minimum of three representative soil samples, pursuant to USEPA Test Method 1312 (SPLP). Leachate concentrations from SPLP should not exceed the applicable GCTLs. SPLP should not be used for chemicals of concern derived from used oil or similar petroleum products.

TRPH SCTL is based on the most conservative and health protective carbon range that can be detected by FL-PRO, the >C_8-C_{10} carbon range.

TRPH SCTLs are derived from chemical/physical parameters and toxicity values assigned to each carbon range as described in Appendix C. It should be noted, however, that while the >C_8-C_{10} aromatic fraction has the most restrictive inhalation RfD, the >C_{16} aromatic fractions currently have the most restrictive oral RfD (TPHCWG, 1997b; Table C3, Appendix C). Therefore, under certain site-specific conditions in which there may be elevated soil moisture and fraction organic carbon, such that volatilization would not be a significant consideration relative to ingestion, the potential exists for the >C_{16} aromatic hydrocarbon concentrations to pose the greater risk.

If the primary SCTL is exceeded, it is proposed that a second tier would be employed, such that each TRPH sub-classification would possess its own SCTL. However, individual SCTLs could not be set for each C-range because the current FL-PRO method of analysis cannot distinguish between aliphatics and aromatics. Additionally, the quantitation of individual compounds is difficult and not confirmative, as only "fresh" petroleum hydrocarbons provide distinct peaks in analysis by gas chromatography (GC). Weathered petroleum hydrocarbons such as those found at contaminated sites, produce "hills" not peaks when analyzed by GC. Therefore, one can only obtain an estimate over the entire C-range of the fraction of petroleum hydrocarbons that are present in the sample. While analytical methods for separating aliphatics and aromatics exist (i.e., Massachusetts Department of Environmental Protection), they are outside the current analytical capabilities of accepted methods employed in Florida. However, as modifications to FL-PRO are developed in the future, the second tier would allow differentiation based on site-specific analyses.

V. Development of the Industrial Direct Exposure SCTL for Lead

To calculate the industrial direct exposure SCTL for lead, the approach outlined in *Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil* (USEPA, 1996d) (TRW) was followed. This guidance document provides methodology for assessing risks associated with non-residential adult exposures to lead in soil based on the potentially most sensitive workers – women of child-bearing age. The methodology focuses on estimating fetal blood lead concentrations in pregnant women exposed to lead contaminated soil. That is, the model is designed to estimate an acceptable soil lead concentration to which women could be exposed, while pregnant, without the risk of producing unacceptable blood lead concentrations in the developing fetus, i.e., levels above 10 μg/dL.

This method is based, in part, on a simplified representation of lead biokinetics assumed to predict quasi-steady state blood lead concentrations among adults (women of child-bearing age) who are relatively consistently exposed to a site. A constant of proportionality between fetal blood lead concentration at birth and maternal blood lead concentration is also employed. As such, this model provides a means for consistency in calculating acceptable industrial soil lead levels.

A series of equations, discussed in detail in the TRW document, are used to derive an acceptable lead concentration in soil. $PbB_{a,c,g}$ is derived first. This value represents the risk-based goal for the central estimate of blood lead concentrations in adult women that ensures the fetal blood lead concentration goal of 10 μg/dL is not exceeded. This value is derived from the equation below in which $PbB_{fetal,0.95,goal}$ = 10, the goal for the 95th percentile blood lead concentration (μg/dL) among fetuses born to women having exposures to the specified site soil concentration; R = 0.9, the

constant of proportionality between fetal blood lead concentration at birth and maternal blood lead concentration; and GSD, the geometric standard deviation for blood lead concentrations among adults having exposures to similar on-site lead concentrations but having non-uniform response to site lead (intake, biokinetics) and non-uniform off-site lead exposures. Ideally the GSD used in the model is estimated from the population of concern at the site. In the absence of site-specific blood lead data, the TRW recommends estimates of 1.8-2.1 μg/dL as the plausible range based on an evaluation of available blood lead concentration.data for different types of populations.

$$PbB_{a,c,g} = \frac{PbB_{fetal,0.95,goal}}{GSD_{i,adult}^{1.645} \times R_{fetal/maternal}}$$

As such, a value of 1.8 is recommended by the TRW for homogeneous populations whereas 2.1 is recommended for heterogeneous populations. For the default industrial direct exposure SCTL, heterogeneity of populations at a workplace was assumed. Thus, the GSD selected from the recommended defaults is 2.1 μg/dL, resulting in a $PbB_{a,c,g}$ = 3.28 μg/dL. Next, the target blood lead concentration ($PbB_{a,c,g}$) is employed along with several other variables to calculate PbS, the SCTL.

Technical Review Workgroup Model

$$PbS = \frac{\left(PbB_{a,c,g} - PbB_{a,0}\right) \times AT}{BKSF \times IR_{soil} \times AF_{soil} \times EF_{soil}}$$

where:

$PbB_{adult, central, goal} = 3.28 - 4.23\ \mu g/dL$

$PbB_{adult, 0\ (background)} = 1.7 - 2.2\ \mu g/dL$

$AT = 365$ days/year

BKSF (biokinetic slope factor) = 0.4 $\mu g/dL$ per $\mu g/day$

IR_{soil} (ingestion rate) = 0.05 g/day

AF_{soil} (absorption factor) = 0.12 [unitless]

EF_{soil} (exposure frequency) = 219 days/year

In this equation, the baseline blood lead concentration, $PbB_{a,0}$, represents the adult blood lead concentration (µg/dL) in the absence of site exposures. It is intended to be a best estimate of a reasonable central value of blood lead concentrations in women of child-bearing age who are not exposed to lead-contaminated non-residential soil or dust at the site. Ideally, this value is obtained from a representative sample of adult women from the area. In the absence of site-specific data, the TRW recommends a range of 1.7-2.2 µg/dL, representative of women aged 20-49 years. For Chapter 62-785, F.A.C. an average value of 1.95 µg/dL was selected, taken from the middle of the range of values provided by the TRW. In the TRW model, the baseline $PbB_{a,0}$ is subtracted from the target $PbB_{a,c,g}$ to obtain a value representative of the allowable increase in blood lead level that will not cause an exceedance of the target blood lead level. Using the default values selected for Chapter 62-785, F.A.C., this value equals 1.33 µg/dL (3.28 µg/dL minus 1.95 µg/dL). Additionally, the model uses an averaging time of 365 days/year, an exposure frequency of 219 days/year (based on USEPA guidance for average time spent at work by both full-time and part-time workers), and an exposure duration of one year (not shown in the denominator of the equation because it is 1). The other variables are defined as follows:

- BKSF = Biokinetic slope factor relating increase in the typical adult blood lead concentration to average daily lead uptake. Recommended value is 0.4 µg/dL blood lead increase per µg/day lead uptake.
- AF_{soil} = Fraction of lead in soil ingested daily that is absorbed from the gastrointestinal tract. TRW recommends a default value of 0.12 based on the assumption that the absorption factor for soluble lead is 0.2 and that the relative bioavailability of lead in soil compared to soluble lead is 0.6, thus 0.2 x 0.6 = 0.12.
- IR_{soil} = Intake rate of soil. Recommended value is 0.05 g/day*.

*Although the 0.05 g/day default value addresses all occupational soil intake by an individual, whether directly from soil or indirectly through contact with dust, risks associated with more intensive soil contact activities such as construction and excavation are not included. Site-specific data on soil contact intensity should be considered when evaluating the applicability of the default industrial direct exposure SCTL. Depending on the duration of exposure and type of exposure scenario being evaluated, larger ingestion rates may be more appropriate and should, therefore, be employed.

Using these standard equations with the recommended defaults and values selected to best represent a brownfield site, a value of 920 mg/kg lead is calculated as the industrial direct exposure SCTL.

For Chapter 62 - 785, F.A.C.:

$$PbB_{a,c,g} = \frac{10\ \mu g/dL}{2.1^{1.645} \times 0.9} = 3.28\ \mu g/dL$$

$$SCTL_{Pb} = \frac{(3.28\ \mu g/dL - 1.95\ \mu g/dL) \times 365\ days/yr}{0.4\ \mu g/dL\ per\ \mu g/day \times 0.05\ g/day \times 0.12 \times 219\ days/yr} = 923.6 \text{ or } 920\ mg/kg$$

Applying other default values provided in the TRW documentation to the model results in a range of possible lead soil cleanup target levels, from 750 mg/kg to 1800 mg/kg. Following the guidance in the TRW document for selection of appropriate default values based on population statistics and descriptions, and

provided the soil intake rate is 0.05 g/day, a soil lead value within this range can be derived on a site-specific basis.

The TRW recognizes that other models with more detailed blood lead kinetics could provide better estimates regarding brief acute exposures or intermittent exposure patterns. However, pending further development and evaluation of other biokinetic models, the methodology provided by the TRW is the recommended approach. It should also be noted that although the format for calculating the industrial direct exposure SCTL for lead resembles the Integrated Exposure Uptake Biokinetic (IEUBK) Model for Lead in Children (USEPA, 1994), the IEUBK approach continues to be the recommended approach for assessment where residential soil lead levels are of concern.

VI. Development of SCTLs for Ammonia

Ammonia is an inorganic compound that exists in a state of equilibrium between un-ionized ammonia (NH_3) and ammonium ion (NH_4^+). The state of ionization, and thus the percentages present as NH_3 versus NH_4^+, is generally dependent upon the pH of the medium (i.e., soil or water), and to a lesser degree upon temperature. Higher pH levels result in a greater percentage as NH_3 and lower pH favors the formation of NH_4^+. Current literature suggests that ammonia as NH_3 is the more toxic form of this compound and toxicity values exist only for NH_3 (ATSDR, 1990). Current analytical methods detect total ammonia ($NH_3 + NH_4^+$), however, and interpretation of this value from a toxicological perspective requires an estimation of the NH_3 content based on pH and temperature.

The residential and industrial SCTLs for ammonia are 90 and 600 mg/kg, respectively, and the leachability value at a neutral soil pH is 2100 mg/kg. The

leachability value is based on an acceptable groundwater cleanup target level of 2800 µg/L ammonia as NH_3, derived by using the standard FDEP equation for the calculation of health-based groundwater cleanup target levels and an oral minimal risk level (MRL) of 0.4 mg/kg/day (ATSDR, 1990)[11]. The residential and industrial SCTLs for ammonia were calculated using the oral MRL and the inhalation reference dose of 0.03 mg/kg-day, which was derived from the inhalation reference concentration of 0.1 mg/m^3 (IRIS) assuming an inhalation rate of 20 m^3/day and a body weight of 70 kg.

When leachability is calculated according to the equation in Figure 6 using the default parameters listed and the appropriate chemical-physical constants, a value of 12 mg/kg is derived. This equation and defaults do not take into account that ammonia generally exists as a pH dependent ratio of ammonia to ammonium ion, thus a leachability value based on the GCTL must be adjusted to reflect leachability at a specified pH. The neutral pH of 7.0 was used to establish the default leachability-based SCTL, based on guidance in Chapter 62-550, F.A.C. that the potable groundwater pH in Florida must be within the range of 6.5 - 8.5. As a result, a leachability-based SCTL of 2100 mg/kg is calculated when an ambient temperature of 25°C is assumed. However, variation in pH will affect the ammonia/ammonium ratio and can result in a range of acceptable SCTLs as shown in Table 1.

[11] It should be noted that the oral MRL for ammonia currently listed in the ATSDR Toxicant Profile for Ammonia is 0.3 mg/kg/day. This value was derived by adjusting the NOAEL of 40 mg/kg/day by an uncertainty factor of 100 and an adjustment factor for intermittent exposure. Per discussion with John Wheeler at ATSDR it was indicated that the use of an intermittent exposure factor in the extrapolation of the NOAEL to the MRL is no longer recommended. As such, the ATSDR recommended oral MRL for ammonia has been modified to 0.4 mg/kg/day and the drinking water MRL is 14 mg/L. Although an MRL of 14 mg/L exists for ammonia in drinking water, a value of 2.8 mg/L was used here since it incorporates a relative source contribution factor of 20%, which FDEP includes in the development of groundwater guidance concentrations for non-carcinogens.

Table 1: Range of Leachability-based SCTLs at 25°C

Groundwater pH	Percent Unionized Ammonia*	Leachability-based SCTLs**
8.5	15.2%	80 mg/kg
7.8	3.46%	350 mg/kg
7.7	2.77%	430 mg/kg
7.6	2.21%	540 mg/kg
7.5	1.77%	680 mg/kg
7.0	**0.566%**	**2100 mg/kg**
6.5	0.18%	6700 mg/kg

*USEPA: Aqueous Ammonia Equilibrium-Tabulation of Percent Un-ionized Ammonia, EPA/600/3-79/091.
**Calculated by dividing 12mg/kg (the default leachability value) by the percent corresponding to the selected pH.

The SCTLs for direct exposure to soil are based on the assumption that ammonia is present in the soil as NH_3. However, as stated above, the NH_3/NH_4^+ ratio will vary with soil pH. In addition, ammonia as NH_3 has a significant capacity to volatilize while NH_4^+ will be fully dissolved in water within the soil matrix. Thus, when the NH_3/NH_4^+ ratio is primarily NH_4^+ volatilization will be minimal. The SCTL for ammonia is predominantly driven by the inhalation component of the equation, and therefore reflects the capacity of these compounds to volatilize. Thus, to accurately select an SCTL for ammonia, the soil pH must be known, otherwise one must make a conservative assumption and use the default SCTLs, which are based on 100% NH_3. Table 2 provides SCTLs for ammonia based on soil pH at an ambient soil temperature of 25°C.

Table 2: Range of SCTLs for Direct Exposure to Soil (at 25°C)

Soil pH	Percent Un-ionized Ammonia	Residential (mg/kg)**	Industrial (mg/kg)**
11.5	**99.4%**	**90**	**600**
10.5	94.7%	95	630
9.5	64.3%	140	930
8.5	15.2%	590	4000
7.5	1.77%	5100	34000
6.5	0.18%	50000	330000
6.4	0.143%	63000	420000
6.3	0.1134%	79000	529000
6.2	0.0901%	100000	666000
6.1	0.0716%	126000	840000
6.0	0.0568%	158000	1000000
5.9	0.0452%	199000	1000000
5.8	0.0359%	251000	1000000
5.7	0.0285%	316000	1000000
5.6	0.0226%	398000	1000000
5.5	0.0180%	500000	1000000
5.4	0.0143%	629000	1000000
5.3	0.01135%	793000	1000000
5.2	0.00901%	999000	1000000
5.1	0.00716%	1000000	1000000
5.04☆	0.00624%	1000000	1000000
5.0	0.00569%	1000000	1000000

*USEPA: Aqueous Ammonia Equilibrium-Tabulation of Percent Un-ionized Ammonia, EPA/600/3-79/091.

**Calculated by dividing 90 mg/kg or 600 mg/kg by the percent corresponding to the selected pH. Values rounded. Values greater than 1E+6 mg/kg were set equal to 1E+6 mg/kg.

☆Average soil pH for Florida soils based on empirical data from 450 samples (value provided by Dr. Lena Ma, University of Florida).

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4. HSDB: Hazardous Substance Database
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VIII. Figures & Tables

Figure 1. Model Equation for Developing Acceptable Risk-Based Concentrations in Soil

Acceptable Soil Cleanup Target Levels for Carcinogens

Using the slope factor:

$$SCTL = \frac{TR \times BW \times AT}{EF \times ED \times FC \times \left[\left(SF_o \times IR_o \times 10^{-6} kg/mg\right) + \left(SF_d \times SA \times AF \times DA \times 10^{-6} kg/mg\right) + \left(SF_i \times IR_i \times \left(\frac{1}{VF} + \frac{1}{PEF}\right)\right)\right]}$$

SCTL = Soil Cleanup Target Level
TR = Target Risk (unitless)
BW = body weight (kg)
AT = averaging time (days)
EF = exposure frequency (days/yr)
ED = exposure duration (years)
FC = fraction from contaminated source (unitless)

IR_O = ingestion rate, oral (mg/day)
SA = surface area of skin exposed (cm^2)
AF = adherence factor (mg/cm^2/day)
DA = dermal absorption (unitless)
IR_i = inhalation rate (m^3/day)
VF = volatilization factor (m^3/kg)
PEF = particulate emission factor (m^3/kg)

SF = slope factor $(mg/kg/day)^{-1}$
SF_O = oral
SF_d = dermal
SF_i = inhalation

Sample SCTL Calculation for Direct Exposure (Aggregate Resident): BENZENE

$$SCTL = \frac{0.000001 * 59kg * 25550days}{350d/yr * 30yr * 1 * \left[\left(0.029(mg/kg/d)^{-1} * 120mg/d * 1x10^{-6} kg/mg\right) + \left(0.032(mg/kg/d)^{-1} * 3674cm^2 * 0.2mg/cm^2 * 0.01 * 1x10^{-6} kg/mg\right) + \left(0.029(mg/kg/d)^{-1} * 15m^3/d * \left(\frac{1}{3.40x10^3} + \frac{1}{1.24x10^9}\right)\right)\right]}$$

$$SCTL = \frac{1.51}{10500 * \left[\left(3.48x10^{-6}\right) + \left(2.35x10^{-7}\right) + \left(1.28x10^{-4}\right)\right]} = \frac{1.51}{10500 * 1.32x10^{-4}} = \frac{1.51}{1.38} = 1.1 mg/kg \ddagger$$

Given: $SF_o = 0.029$ $(mg/kg/day)^{-1}$
$SF_d = 0.032$ $(mg/kg/day)^{-1}$
$SF_i = 0.029$ $(mg/kg/day)^{-1}$
$VF = 3.40 \times 10^3$ m^3/kg
$PEF = 1.24 \times 10^9$ m^3/kg

‡All calculations carried out to 18 decimal places. For simplicity of demonstration, calculated values shown are to three significant figures. Final SCTL value is rounded to two significant figures if >1 and to one significant figure if <1.

Figure 2. Model Equation for Developing Acceptable Risk-Based Concentrations in Soil

Acceptable Soil Cleanup Target Levels for Non-Carcinogens

Using the reference dose:

$$SCTL = \frac{THI \times BW \times AT}{EF \times ED \times FC \times \left[\left(\frac{1}{RfD_o} \times IR_o \times 10^{-6}\,kg/mg\right) + \left(\frac{1}{RfD_d} \times SA \times AF \times DA \times 10^{-6}\,kg/mg\right) + \left(\frac{1}{RfD_i} \times IR_i \times \left(\frac{1}{VF} + \frac{1}{PEF}\right)\right)\right]}$$

SCTL = Soil Cleanup Target Level
THI = Target Hazard Index (unitless)
BW = body weight (kg)
AT = averaging time (days)
EF = exposure frequency (days/yr)
ED = exposure duration (years)
FC = fraction from contaminated source (unitless)

IR_O = ingestion rate, oral (mg/day)
SA = surface area of skin exposed (cm^2)
AF = adherence factor (mg/cm^2/day)
DA = dermal absorption (unitless)
IR_i = inhalation rate (m^3/day)
VF = volatilization factor (m^3/kg)
PEF = particulate emission factor (m^3/kg)

RfD = reference dose (mg/kg/day)
RfD_O = oral
RfD_d = dermal
RfD_i = inhalation

Sample SCTL Calculation for Direct Exposure (Child Resident): FLUORENE

$$SCTL = \frac{1.00 * 15kg * 2190days}{350d/yr * 6yr * 1 * \left[\left(\frac{1}{0.04mg/kg/d} * 200mg/d * 1x10^{-6}kg/mg\right) + \left(\frac{1}{0.02mg/kg/d} * 1800cm^2 * 0.2mg/cm^2 * 0.01 * 1x10^{-6}kg/mg\right) + \left(\frac{1}{0.02mg/kg/d} * 10m^3/d * \left(\frac{1}{2.09 \times 10^5 m^3/kg} + \frac{1}{1.24 \times 10^9 m^3/kg}\right)\right)\right]}$$

$$SCTL = \frac{3.29 \times 10^4}{2100 * \left[\left(5.00 \times 10^{-3}\right) + \left(1.80 \times 10^{-4}\right) + \left(2.39 \times 10^{-8}\right)\right]} = \frac{3.29 \times 10^4}{2100 * 7.57 \times 10^{-3}} = \frac{3.29 \times 10^4}{15.9} = 2100 mg/kg \ddagger$$

Given: RfD_o = 0.04 mg/kg/day
RfD_d = 0.02 mg/kg/day
RfD_i = 0.02 mg/kg/day
VF = 2.09×10^5 m^3/kg
PEF = 1.24×10^9 m^3/kg

‡All calculations carried out to 18 decimal places. For simplicity of demonstration, calculated values shown are to three significant figures.
Final SCTL value is rounded to two significant figures if >1 and to one significant figure if <1.

Figure 3. Derivation of the Particulate Emission Factor[a]

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

Parameter	Definition (units)	Default
PEF:	particulate emission factor (m^3/kg)	1.241005×10^9
Q/C:	inverse of mean conc. at center of a 0.5-acre-square source (g/m^2-s per kg/m^3)	85.61[b]
V:	fraction of vegetative cover (unitless)	0.5 (50%)‡
U_m:	mean annual windspeed (m/s)	4.69‡
U_t:	equivalent threshold value of windspeed at 7m (m/s)	11.32
F(x):	function dependent on U_m/U_t, derived using Cowherd et al. (1985)[c] (unitless)	0.194

[a] Equation taken from USEPA *1996b Soil Screening Guidance: Technical Background Document.* EPA/540/R-95/128.

[b] Based on Q/C Value for Zone IX (Miami, FL) as listed in USEPA *Soil Screening Guidance.*

[c] Cowherd, C., Muleski, G., Engelhardt, P., and Gillette, D. (1985). *Rapid Assessment of Exposure to Particulate Emissions from Surface Contamination.* EPA/600/8-85/002.

‡ Value may be substituted with documented, FDEP accepted site-specific information.

**All calculations carried out to 18 decimal places. For simplicity of demonstration, calculated values shown are to seven significant figures.

Calculation of PEF based on Zone IX Q/C Value:**

$$PEF\ (m^3/kg) = 85.61\ g/m^2\text{-s per } kg/m^3 * \frac{3600\ sec/hr}{0.036 * (1-0.5) * (4.69(m/s)/11.32(m/s))^3 * 0.194} = 1.241005 \times 10^9\ (m^3/kg)$$

Figure 4.
Equation Used for the Determination of the Volatilization Factor[a]

$$VF = Q/C \times CF \times \frac{(3.14 \times D_A \times T)^{1/2}}{2 \times \rho_b \times D_A}$$

WHERE:

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

Model Parameters (Units)		Default Value
VF:	Volatilization factor (m^3/kg)	-
D_A:	Apparent diffusivity (cm^2/s)	-
CF:	Conversion factor (m^2/cm^2)	10^{-4}
Q/C:	Inverse of the mean concentration[b] (g/m^2-s per kg/m^3)	85.61[c]
T:	Exposure interval (s)	ED * 3.15×10^7 s/yr
ED:	Exposure duration (years)	Exposure-specific[e]
n:	Total soil porosity (L_{pore}/L_{soil})	1- (ρ_b/ρ_s)‡
w:	Average soil moisture content (g_{water}/g_{soil})	0.1 (10%)‡
ρ_b:	Dry soil bulk density (g/cm^3)	1.5‡
ρ_s:	Soil particle density (g/cm^3)	2.65
θ_a:	Air-filled soil porosity (L_{air}/L_{soil})	n - θ_w
θ_w:	Water-filled soil porosity (L_{water}/L_{soil})	0.15‡
K_d:	Soil-water partition coefficient (cm^3/g)	K_{oc} * f_{oc}
D_i:	Diffusivity in air (cm^2/s)	Chemical-specific[d]
D_w:	Diffusivity in water (cm^2/s)	Chemical-specific[d]
H:	Henry's Law constant (atm-m^3/mol)	Chemical-specific[d]
H':	Dimensionless Henry's Law constant	H * 41
K_{oc}:	Soil-organic carbon partition coefficient (cm^3/g)	Chemical-specific[d]
f_{oc}:	Organic carbon content of soil (g/g)	0.006 (0.6%)‡

[a] Model equation taken from USEPA 1996b *Soil Screening Guidance: Technical Background Document.* EPA/540/R-95/128.
[b] Assumes the center of a 0.5 acre plot.
[c] Based on Q/C Value for Zone IX (Miami, FL) as listed in EPA *Soil Screening Guidance.*
[d] Listed in Table 3a.
[e] Based on Aggregate Resident exposure for a duration of 30 years (ED).
‡Value may be substituted with documented, FDEP accepted site-specific information.

Sample VF Calculation for Benzene Exposure**

**All calculations carried out to 18 decimal places. For simplicity of demonstration, calculated values shown are to seven significant figures.

Given:
$D_i = 0.088\ cm^2/s$
$D_w = 9.80 \times 10^{-6}\ cm^2/s$
$H' = 0.2296000$
$T = 9.460000 \times 10^8\ s$
$K_{oc} = 62\ cm^3/g$
$K_d = 3.720000 \times 10^{-1}\ cm^3/g$

Then:

$$D_A = \frac{\left[(1.504996\times10^{-2} \times 0.088 \times 2.296000\times10^{-1}) + (1.793236\times10^{-3} \times 9.80\times10^{-6})/1.883232\times10^{-1}\right]}{(1.5 \times 3.720000\times10^{-1}) + (0.15) + (0.2839362 \times 0.2296000)}$$

$$= \frac{1.614772\times10^{-3}}{7.731977\times10^{-1}}\ cm^2/s = 2.088433\times10^{-3}\ cm^2/s$$

And:

$$VF = 85.61\left(\frac{g \cdot m^3}{m^2 \cdot s \cdot kg}\right) \times 1\times10^{-4}\left(\frac{m^2}{cm^2}\right) \times \frac{\left(3.14 \times 2.088433\times10^{-3}\left(\frac{cm^2}{s}\right) \times 9.460000\times10^8 (s)\right)^{\frac{1}{2}}}{2 \times 1.5 \times 2.088433\times10^{-3}\left(\frac{cm^2}{s}\right)}$$

$$= \frac{2.132285\times10^{1}}{6.265300\times10^{-3}} = 3403.324\ \left(\frac{m^3}{kg}\right)$$

Figure 5. Equation[a] Used for the Determination of C_{sat}

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

Parameter	Definition (Units)	Default Value
C_{sat}	Soil saturation concentration (mg/kg)	-
S	Solubility in water (mg/L)	Chemical-specific[b]
ρ_s	Soil particle density (kg/L)	2.65
ρ_b	Dry soil bulk density (kg/L)	1.5‡
n	Total soil porosity (L_{pore}/L_{soil})	$1 - (\rho_b/\rho_s)$ ‡
θ_a	Air-filled soil porosity (L_{air}/L_{soil})	$n - w\rho_b$
θ_w	Water-filled soil porosity (L_{water}/L_{soil})	0.15‡
K_d	Soil-water partition coefficient (L/kg)	$K_{oc} * f_{oc}$
w	Average soil moisture content (kg_{water}/kg_{soil})	0.1 (10%)
H	Henry's Law constant (atm-m^3/mol)	Chemical-specific[b]
H'	Dimensionless Henry's Law constant	H * 41
K_{oc}	Soil-organic carbon partition coefficient (L/kg)	Chemical-specific[b]
f_{oc}	Fraction organic carbon in soil (g/g)	0.006 (0.6%)‡

[a] Model equation taken from USEPA 1996b *Soil Screening Guidance: Technical Background Document.* EPA/540/R-95/128.

[b] Listed in Table 3a.

‡ Value may be substituted with documented, FDEP accepted site-specific information.

**All calculations carried out to 18 decimal places. For simplicity of demonstration, calculated values shown are to seven significant figures. C_{sat} values used as SCTLs are rounded to two significant figures if >1 and to one significant figure if <1.

Sample C_{sat} Calculation for Ethylbenzene**

Given:

$S = 170$ mg/L

$K_d = 1.224000$ L/kg

$K_{oc} = 204$ L/kg

$H' = 3.239000 \times 10^{-1}$

Then:

$$C_{sat} = \frac{170 \text{ mg/L}}{1.5 \text{ kg/L}}\left((1.224 \text{ L/kg} * 1.5 \text{kg/L}) + (0.15) + (3.239\text{x}10^{-1} * 0.2839362)\right)$$

$C_{sat} = 113.3333$ mg/L * 2.077967 L/kg

$C_{sat} = 235.5029$ mg/kg

$C_{sat} = 240$ mg/kg

Figure 6. Equation for the Determination of Soil Cleanup Target Levels (SCTLs) Based on Leachability

$$SCTL(mg/kg) = GCTL(\mu g/L) * CF(mg/\mu g) * DF * \left[K_{oc}(L/kg) * f_{oc}(g/g) + \frac{\Theta_w(L_{water}/L_{soil}) + \Theta_a(L_{air}/L_{soil}) * H'}{\rho_b(kg/L)} \right]$$

Parameter	Definition (units)	Variables and Default
GCTL:	Groundwater cleanup target level (µg/L)	Table-Specific Value[1]
CF:	Conversion factor (mg/µg)	0.001
DF:	Dilution factor (unitless)	20
K_{oc}:	Soil-organic carbon partition coefficient (L/kg)	Chemical-Specific Value[2]
f_{oc}:	Fraction organic carbon in soil (g/g)	0.002‡
Θ_w:	Water-filled soil porosity (L_{water}/L_{soil})	0.3 or $w\rho_b$‡
Θ_a:	Air-filled soil porosity (L_{air}/L_{soil})	$n - \Theta_w$
H:	Henry's Law constant (atm-m^3/mol)	Chemical-Specific Value[2]
H':	Henry's Law constant (unitless)	H * 41
ρ_b:	Dry soil bulk density (kg/L)	1.5 or $(1-n)\rho_s$‡
w:	Average soil moisture content (kg_{water}/kg_{soil})	0.2 (20%)‡
n:	Total soil porosity (L_{pore}/L_{soil})	$1-(\rho_b/\rho_s)$‡
ρ_s:	Soil particle density (kg/L)	2.65

[1] Groundwater Cleanup Target Levels (See Table 3b).

[2] Values selected (listed in Table 3a) as available in order of preference from:

1. Superfund Chemical Data Matrix (EPA/540/R-96/028).
2. USEPA *Soil Screening Guidance: Technical Background Document* (EPA/540/R-95/128).
3. USEPA Integrated Risk Information System (IRIS), May 96 Update.
4. Toxicological Profiles, Agency for Toxic Substances and Disease Registry, US Department of Health and Human Services.

‡ Value may be substituted with documented, FDEP accepted site-specific information.

**All calculations carried out to 18 decimal places. For simplicity of demonstration, calculated values shown are to seven significant figures. Final SCTL is rounded to two significant figures if >1 and to one significant figure if <1.

Sample SCTL Calculation for Benzene Migration into Groundwater

Given: GCTL = 1 µg/L
K_{oc} = 62 L/kg
H' = 0.2296000

Then:

$$SCTL(mg/kg) = 1.0\ \mu g/L * 0.001\ mg/\mu g * 20 * \left[62\ L/kg * 0.002\ g/g + \frac{0.3\ L_{water}/L_{soil} + \left(1.339623x10^{-03}\ L_{air}/L_{soil} * 0.2296000\right)}{1.5\ kg/L} \right] =$$

SCTL = 0.0068901 mg/kg soil

SCTL = 0.007 mg/kg soil **

Table 1
Soil Cleanup Target Levels for Chapter 62-785, F.A.C.

Chemical Name	Direct Exposure (mg/kg)		Leachability Based on Groundwater Criteria	Leachability Based on Freshwater Surface Water Criteria	Leachability Based on Marine Surface Water Criteria	Leachability Based on Groundwater of Low Yield/ Poor Quality	Target Organ/System or Effect
	I[a]	II[aa]	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	
acenaphthene	2300	22000	4.0	0.6	0.6	40	liver
acenaphthylene	1100	11000	22	0.003*	0.003*	220	decreased body weight, liver
acephate	67	140	0.03	0.8	0.8	0.3	carcinogen
acetone	770	5500	2.8	6.8	6.8	28	central nervous system, kidney, liver
acetonitrile	52	370	2.3	93	93	23	blood, liver
acetophenone	680**	680**	2.9	32	32	29	general toxicity
acrolein	0.03	0.2	0.08	0.001	0.001	0.8	respiratory (nasal epithelium)
acrylamide	0.2	0.3	0.004	0.02	0.02	0.04	carcinogen
acrylic acid	33	220	14	NA	NA	140	decreased offspring weights
acrylonitrile	0.3	0.4	0.02	0.2	0.2	0.2	carcinogen
alachlor	4	6.7	0.02	0.006	0.006	0.2	carcinogen
aldicarb	57	790	0.03	0.004	0.004	0.3	central nervous system
aldrin	0.06	0.2	0.01	2.5	2.5	0.1	carcinogen
allyl alcohol	72	550	1	0.02	0.02	10	kidney, liver
aluminum	72000	1.00E+06	☆	☆	☆	☆	altered body weight
aluminum phosphide	31	800	☆	☆	☆	☆	altered body weight
ametryn	600	9600	1.2	0.1	0.1	12	liver
ammonia[m]	90	600	2100	0.08	NA	21000	systemic effects
ammonium sulfamate	16000	370000	☆	☆	☆	☆	decreased body weight
aniline	17	130	0.03	0.02	0.02	0.3	carcinogen
anthracene	19000	290000	2000	0.3	0.3	20000	none observed
antimony	26	240	5•	☆	☆	50	blood, increased mortality
antimony pentoxide (as Sb)	39	1000	☆	☆	☆	☆	blood, increased mortality
antimony potassium tartrate (as Sb)	69	1500	☆	☆	☆	☆	blood, increased mortality
antimony tetroxide (as Sb)	31	800	☆	☆	☆	☆	blood, increased mortality
antimony trioxide (as Sb)	31	800	☆	☆	☆	☆	blood, increased mortality
arsenic	0.8	3.7	29•	☆	☆	290	carcinogen
atrazine	4.1	12	0.06	0.04	0.04	0.6	carcinogen
azobenzene	7.6	20	0.5	0.07	0.07	5	carcinogen
barium[n]	105	87000	1600•	☆	☆	16000	increased blood pressure
bayleton	2300	45000	5	12	12	50	blood, decreased body weight gain
benomyl	3500	58000	31	0.03	0.03	310	decreased offspring weights
bentazon	1800	25000	0.1	NA	NA	1	blood
benzaldehyde	4500**	4500**	5.4	0.4	0.4	54	kidney, stomach
benzene	1.1	1.5	0.007	0.007	0.5	0.07	carcinogen
benzenethiol	0.1	0.8	0.3	NA	NA	3	liver
benzo(a)anthracene	1.4	5.2	2.9	0.4	0.4	29	carcinogen
benzo(a)pyrene	0.1	0.5	7.8	1.2	1.2	78	carcinogen
benzo(b)fluoranthene	1.4	5.1	9.8	1.5	1.5	98	carcinogen
benzo(g,h,i)perylene	2300	45000	13000	2	2	130000	central nervous system
benzo(k)fluoranthene	15	52	25	1.5	1.5	250	carcinogen
benzoic acid	150000	1.00E+06	110	48	48	1100	none observed
benzotrichloride	0.02	0.04	0.003	0.0002	0.0002	0.03	carcinogen
benzyl alcohol	5500**	5500**	8.9	2	2	89	eye, stomach
benzyl chloride	1.3	2	0.008	0.05	0.05	0.08	carcinogen
beryllium[l]	120	700	63•	☆	☆	630	carcinogen
betanal [or phenmedipham]	18000	280000	180	NA	NA	1800	none observed

Table 1
Soil Cleanup Target Levels for Chapter 62-785, F.A.C.

April 30, 1998

Chemical Name	Direct Exposure (mg/kg)		Leachability Based on Groundwater Criteria	Leachability Based on Freshwater Surface Water Criteria	Leachability Based on Marine Surface Water Criteria	Leachability Based on Groundwater of Low Yield/ Poor Quality	Target Organ/System or Effect
	I[a]	II[a]	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	
bidrin [or dicrotophos]	7.5	140	0.008	0.2	0.2	0.08	decreased offspring survival
biphenyl, 1,1- [or diphenyl]	1000	8400	0.03	1.1	1.1	0.3	kidney
bis (2-chloro-1-methylethyl) ether	0.3	0.5	0.1	NA	NA	1	carcinogen
bis (2-chloroethyl) ether	0.4	0.7	0.03	0.07	0.07	0.3	carcinogen
bis (2-chloroisopropyl) ether	0.3	0.5	0.3	0.1	0.1	3	carcinogen
bis (2-ethylhexyl) phthalate	75	230**	27	0.09	0.09	270	carcinogen
bisphenol A	3500	57000	14	2.2	2.2	140	decreased body weight
boron	7000	170000	☆	☆	☆	☆	male reproductive, respiratory
bromacil	5300	63000	0.6	NA	NA	6	decreased body weight
bromochloromethane	38	260	0.7	NA	NA	7	liver
bromodichloromethane	1.4	2	0.006	0.1	0.1	0.06	carcinogen
bromoform	53	95	0.04	3.3	3.3	0.4	carcinogen
bromomethane [or methyl bromide]	2.2	15	0.05	0.2	0.2	0.5	stomach
butanol, 1-	1300	10000	3	107	107	30	central nervous system
butanone, 2- [or MEK]	4800	35000	22	639	639	220	fetus
butyl benzyl phthalate, N-	220**	220**	77	14	14	770	liver
butylate	2000	21000	7	0.2	0.2	70	liver
butylphthalyl butylglycolate	240**	240**	120	NA	NA	1200	none observed
cadmium[a]	75	1300	8•	☆	☆	80	kidney, liver/carcinogen
calcium cyanide	3100	80000	☆	☆	☆	☆	none observed
captan	250	720	24	NA	NA	240	carcinogen
carbaryl	6800	120000	9.2	0.0007	0.0007	92	kidney, liver
carbazole	53	200	0.6	NA	NA	6	carcinogen
carbofuran	52	380	0.3	0.001	0.001	3	blood, reproductive
carbon disulfide	200	730**	5.6	0.8	0.8	56	fetus
carbon tetrachloride	0.4	0.6	0.04	0.05	0.05	0.4	carcinogen
carbophenothion	9.5	170	0.5	0.06	0.06	5	blood, central nervous system
chlordane	3	11	4.1	0.008	0.008	41	carcinogen
chlorine	7800	200000	☆	☆	☆	☆	none observed
chlorine cyanide	3900	100000	☆	☆	☆	☆	none observed
chlorine dioxide	780	19000	☆	☆	☆	☆	no effect level on neurological development in offspring
chlorite	230	6000	☆	☆	☆	☆	neurobehavorial
chloro-1,3-butadiene	2.7	18	1.9	NA	NA	19	respiratory (nasal epithelium)
chloro-m-cresol, p-	390	4100	18	NA	NA	180	reproductive system
chloroacetic acid	86	900	0.07	NA	NA	0.7	heart
chloroaniline, 4-	190	2000	0.2	0.02	0.02	2	spleen
chlorobenzene	30	210	1.3	0.2	0.2	13	kidney, liver
chlorobenzilate	3.9	14	0.04	0.009	0.009	0.4	carcinogen
chlorobenzoic acid, p-	14000	240000	28	NA	NA	280	none observed
chlorobenzotrifluoride, 4-	80	190**	3.8	NA	NA	38	kidney
chlorobutane, 1-	430	540**	26	NA	NA	260	blood, central nervous system, increased mortality
chloroethane [or ethyl chloride]	5.8	8	23	NA	NA	230	fetus
chloroethylvinylether, 2-	99	690	0.8	NA	NA	8	NA
chloroform	0.4	0.6	0.04	3	3	0.4	carcinogen
chloromethane	1.7	2.3	0.01	2.2	2.2	0.1	carcinogen
chloronaphthalene, beta	3300	35000	110	NA	NA	1100	liver, respiratory
chloronitrob e, o-	2.5	3.5	0.02	NA	NA	0.2	carcinogen

Table 1
Soil Cleanup Target Levels for Chapter 62-785, F.A.C.

Chemical Name	Direct Exposure (mg/kg)		Leachability Based on Groundwater Criteria	Leachability Based on Freshwater Surface Water Criteria	Leachability Based on Marine Surface Water Criteria	Leachability Based on Groundwater of Low Yield/ Poor Quality	Target Organ/System or Effect
	I[#]	II[##]	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	
chloronitrobenzene, p-	29	57	4.1	NA	NA	41	carcinogen
chlorophenol, 2-	82	640	0.7	2.6	2.6	7	reproductive system
chlorophenol, 3-	240	2800	0.2	2.6	2.6	2	reproductive system
chlorophenol, 4-	270	3400	0.08	2.4	2.4	0.8	reproductive system
chloropropane, 2-	35	230	5.2	NA	NA	52	liver
chlorothalonil	86	260	0.2	NA	NA	2	carcinogen
chlorotoluene, o-	110	740	2.7	NA	NA	27	decreased body weight gain
chlorotoluene, p-	120	880	2.5	NA	NA	25	HAL RfD
chlorpropham	13000	200000	51	NA	NA	510	bone marrow, kidney, liver, spleen
chlorpyrifos	210	4000	5.2	0.0004	0.0004	52	blood
chromium (hexavalent)	290	430	38•	☆	☆	380	carcinogen
chrysene	140	510	80	0.5	0.5	800	carcinogen
cobalt	4700	110000	☆	☆	☆	☆	NA
copper cyanide	390	9100	☆	☆	☆	☆	decreased body and organ weights, kidney, liver
copper[a]	105	1.40E+05	☆	☆	☆	☆	GI irritation/liver damage
coumaphos	18	270	0.3	0.0006	0.0006	3	blood
crotonaldehyde	0.09	0.1	0.00009	NA	NA	0.0009	carcinogen
cumene [or isopropyl benzene]	150	1000	0.2	23	23	2	kidney
cyanide[a]	30	5000	40•	0.004	0.004	400	decreased body weight, thyroid, nerve damage
cyanogen	37	250	54	NA	NA	540	none observed
cycloate	150	160**	0.6	2.3	2.3	6	nerve damage
cyclohexanone	980**	980**	160	122	122	1600	body weight depression
cyhalothrin, lambda [or karate]	6**	6**	360	50	50	3600	decreased body weight, decreased body weight gain in offspring
cypermethrin	60**	60**	70	0.005	0.005	700	gastrointestinal tract
DDD, 4,4'-	4.5	17	0.2	0.006	0.006	2	carcinogen
DDE, 4,4'-	3.2	12	0.3	0.002	0.002	3	carcinogen
DDT, 4,4'-	3.2	13	2.7	0.03	0.03	27	carcinogen
decabromodiphenyl ether	740	13000	9.3	NA	NA	93	liver
di-n-butylphthalate	110**	110**	47	1.5	1.5	470	increased mortality
di-n-octylphthalate	1500	27000	4.7E+05	NA	NA	4700000	kidney, liver
diallate	11	25	0.02	NA	NA	0.2	carcinogen
diazinon	64	1100	0.06	0.0001	0.0001	0.6	blood
dibenz(a,h)anthracene	0.1	0.5	14	2.2	2.2	140	carcinogen
dibenzofuran	270	4400	10	25	25	100	NA
dibromo-3-chloropropane, 1-2-	0.8	2.7	0.002	NA	NA	0.02	carcinogen
dibromobenzene, 1,4-	150	1200	7.8	NA	NA	78	liver
dibromochloromethane	1.4	2.1	0.003	0.3	0.3	0.03	carcinogen
dibromoethane, 1,2-	0.01	0.04	0.0001	0.08	0.08	0.001	carcinogen
dicamba	9.8	60	0.9	0.8	0.8	9	fetus
dichloroacetic acid	190	2200	0.2	8.1	8.1	2	cerebellum, cerebrum, liver, testes
dichloroacetonitrile	130	1000	0.03	NA	NA	0.3	HAL RfD
dichlorobenzene, 1,2-	88	370**	12	1.9	1.9	120	no adverse effects observed
dichlorobenzene, 1,3-	390**	390**	0.2	2.1	2.1	2	NA
dichlorobenzene, 1,4-	5.6	8.3	2.2	NA	NA	22	carcinogen
dichlorobenzidine, 3,3-	2.1	6.3	0.4	0.002	0.002	4	carcinogen
dichlorodifluoromethane	63	420	52	NA	NA	520	decreased body weight
dichloroethane, 1,1-	340	2300	0.5	NA	NA	5	central nervous system, kidney

Table 1
Soil Cleanup Target Levels for Chapter 62-785, F.A.C.

April 30, 1998

Chemical Name	Direct Exposure (mg/kg)		Leachability Based on Groundwater Criteria	Leachability Based on Freshwater Surface Water Criteria	Leachability Based on Marine Surface Water Criteria	Leachability Based on Groundwater of Low Yield/ Poor Quality	Target Organ/System or Effect
	I*	II**	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	
dichloroethane, 1,2-	0.6	0.9	0.02	0.03	0.03	0.2	carcinogen
dichloroethene, 1,1-	0.01	0.02	0.06	0.03	0.03	0.6	carcinogen
dichloroethene, cis-1,2-	19	130	0.4	NA	NA	4	blood, liver
dichloroethene, trans-1,2-	35	240	0.6	68.3	68.3	6	blood, liver
dichlorophenol, 2,3-	180	2500	0.2	1.2	1.2	2	immune system
dichlorophenol, 2,4-	150	1700	0.04	0.1	0.1	0.4	immune system
dichlorophenol, 2,5-	190	2700	0.3	2.5	2.5	3	immune system
dichlorophenol, 2,6-	170	2300	0.06	1.1	1.1	0.6	immune system
dichlorophenol, 3,4-	200	3100	0.6	3.4	3.4	6	immune system
dichlorophenoxy acetic acid, 2,4-	580	8000	0.3	0.4	0.4	3	blood, kidney, liver
dichloropropane, 1,2-	0.6	0.8	0.03	NA	NA	0.3	carcinogen
dichloropropene, 1,3-	0.1	0.2	0.001	0.08	0.08	0.01	carcinogen
dichlorprop	270	3400	0.0006	0.25	0.25	0.006	OPP RfD
dichlorvos	0.3	0.4	0.0005	0.00003	0.00003	0.005	carcinogen
dicofol	2.3	7.4	0.06	0.0004	0.0004	0.6	carcinogen
dicrotophos [or bidrin]	7.5	140	0.008	0.2	0.2	0.1	decreased offspring survival
dieldrin	0.07	0.3	0.005	0.002	0.002	0.05	carcinogen
diethylene glycol, monoethyl ether	84000	170000**	63	NA	NA	630	kidney
diethylphthalate	640**	640**	41	2.8	2.8	410	brain, decreased growth rate, kidney, liver
diisopropyl methylphosphonate	1900	16000	2.9	70	70	29	none observed
dimethoate	9.4	100	0.02	0.0005	0.0005	0.2	brain
dimethrin	20000	320000	2500	1.4	1.4	25000	HAL RfD
dimethylaniline, 2,4-	0.8	1.7	0.0006	NA	NA	0.006	carcinogen
dimethylformamide, N,N-	990	7200	3	214	214	30	liver
dimethylphenol, 2,4-	910	9800	1.7	2.3	2.3	17	central nervous system, blood
dimethylphenol, 2,6-	20	190	0.06	3.6	3.6	0.6	body weight changes, kidney, liver, spleen
dimethylphenol, 3,4-	54	660	0.09	5.5	5.5	0.9	body weight changes, blood pressure, kidney, liver, spleen
dimethylphthalate	1600**	1600**	410	8.5	8.5	4100	kidney
dinitrobenzene, 1,2- (o)	30	550	1	0.4	0.4	10	spleen
dinitrobenzene, 1,3- (m)	4.3	45	0.04	0.2	0.2	0.4	spleen
dinitrophenol, 2,4-	67	630	0.1	0.01	0.01	1	eye
dinitrotoluene, 2,4-	1.3	3.7	0.002	0.07	0.07	0.02	carcinogen
dinitrotoluene, 2,6-	0.9	2.1	0.0007	NA	NA	0.007	carcinogen
dinoseb	74	1400	0.8	0.69	0.69	8	fetus
dioxane, 1,4-	23	37	0.02	1.1	1.1	0.2	carcinogen
dioxin [or 2,3,7,8-TCDD]	7.00E-06	3.00E-05	0.005	NA	NA	0.05	carcinogen
diphenamid	1700	24000	2.6	19.8	19.8	26	liver
diphenyl [or biphenyl, 1,1-]	1000	8400	0.03	1.1	1.1	0.3	kidney
diphenylhydrazine, 1,2-	1.2	3.7	0.4	0.02	0.02	4	carcinogen
disulfoton	2.6	41	0.03	0.02	0.02	0.3	blood, eye
diuron	140	2600	0.3	0.2	0.2	3	blood
endosulfan	410	6700	3.6	0.0007	0.001	36	blood vessels, decreased weight gain, kidney
endothall	800	8100	0.4	0.4	0.4	4	small intestine, stomach
endrin	21	380	0.9	0.001	0.001	9	central nervous system, liver
epichlorohydrin	8.8	61	0.04	2.4	2.4	0.4	carcinogen
EPTC [or ethyl dipropylthiocarbamate, S-]	770	7000	2.2	2.9	2.9	22	heart
ethion	37	56**	2.2	0.002	0.002	22	blood

Table 1
Soil Cleanup Target Levels for Chapter 62-785, F.A.C.

Chemical Name	Direct Exposure (mg/kg)		Leachability Based on Groundwater Criteria	Leachability Based on Freshwater Surface Water Criteria	Leachability Based on Marine Surface Water Criteria	Leachability Based on Groundwater of Low Yield/ Poor Quality	Target Organ/System or Effect
	I#	II##	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	
ethoprop	5.3	65	0.006	0.003	0.003	0.06	blood
ethoxyethanol acetate, 2-	7700	30000**	8.8	8.4	8.4	88	fetus
ethoxyethanol, 2-	6800	53000	120	NA	NA	1200	male reproductive, blood
ethyl acetate	4100	11000**	27	26	26	270	body weight loss, increased mortality
ethyl acrylate	1.3	1.8	25	NA	NA	250	carcinogen
ethyl chloride	5.8	8.0	23	NA	NA	230	fetus
ethyl dipropylthiocarbamate, S- [or EPTC]	770	7000	2.2	2.9	2.9	22	heart
ethyl ether	190	1300	7	1195	1195	70	decreased body weight
ethyl methacrylate	640	4500	9.4	NA	NA	94	kidney
ethyl p-nitrophenyl phenylphosphorothioate	0.7	14	0.01	0.0008	0.0008	0.1	nerve damage
ethylbenzene	240**	240**	0.4	7.7	7.7	4	central nervous system, kidney, liver
ethylene diamine	1500	28000	42	3.4	3.4	420	blood, heart
ethylene glycol	65000	120000**	58	67.8	67.8	580	kidney
ethylene oxide	0.2	0.3	0.05	NA	NA	0.5	carcinogen
fenamiphos	15	190	0.02	0.003	0.003	0.2	blood, central nervous system
fenamiphos metabolites	8.7	140	0.1	NA	NA	1	blood, central nervous system
fensulfothion	13	160	0.01	0.004	0.004	0.1	blood
fluometuron	790	11000	1	2.2	2.2	10	none observed
fluoranthene	2800	45000	550	0.6	0.6	5500	blood, kidney, liver
fluorene	2100	24000	87	9.4	9.4	870	blood
fluoride[a]	500	120000	☆	☆	☆	☆	dental
fonofos	120	1700	0.5	0.004	0.004	5	central nervous system, liver
formaldehyde	12	19	2.5	NA	NA	25	carcinogen
furan	2	14	0.07	NA	NA	0.7	liver
furfural	180	2500	1.2	3	3	12	liver
glycidaldehyde	13	120	0.01	NA	NA	0.1	adrenals, hematopoiesis, kidney, altered weight gain
guthion	110	2100	0.2	NA	NA	2	blood
heptachlor	0.01	0.02	0.2	0.002	0.002	2	carcinogen
heptachlor epoxide	0.1	0.4	0.7	0.007	0.007	7	carcinogen
hexachloro-1,3-butadiene	6.2	12	1.1	0.02	0.02	11	carcinogen
hexachlorobenzene	0.5	1.2	3.2	0.001	0.001	32	carcinogen
hexachlorocyclohexane, alpha-	0.2	0.5	0.0005	0.0009	0.0009	0.005	carcinogen
hexachlorocyclohexane, beta-	0.6	2.2	0.002	0.004	0.004	0.02	carcinogen
hexachlorocyclohexane, delta-	22	430	0.2	NA	NA	2	kidney, liver
hexachlorocyclohexane, gamma-	0.7	2.3	0.01	0.005	0.009	0.1	carcinogen
hexachlorocyclopentadiene	2.4	16	400	24	24	4000	nasal cavity, stomach
hexachloroethane	17	78	0.2	0.08	0.08	2	carcinogen
hexahydro-1,3,5-trinitro-1,3,5-triazine	6.7	16	0.008	NA	NA	0.08	carcinogen
hexane, n-	420	3000	1.3	445	445	13	male reproductive, central nervous system
hexanone, 2- [or methyl butyl ketone]	650	5000	2	NA	NA	20	kidney, liver, whole body
hexazinone	2400	42000	36	160	160	360	decreased body weight
hydroquinone	1900	20000	1.5	0.02	0.02	15	blood
indeno(1,2,3-cd)pyrene	1.5	5.2	28	4.3	4.3	280	carcinogen
iron	23000	490000	☆	☆	☆	☆	NHANES Study
isobutyl alcohol	3500	11000**	8.9	200	200	89	central nervous system
isophorone	340	580	0.2	3.8	3.8	2	carcinogen
isopropyl benzene [or cumene]	150	1000	0.2	23	23	2	kidney

Table 1
Soil Cleanup Target Levels for Chapter 62-785, F.A.C.

April 30, 1998

Chemical Name	Direct Exposure (mg/kg)		Leachability Based on Groundwater Criteria	Leachability Based on Freshwater Surface Water Criteria	Leachability Based on Marine Surface Water Criteria	Leachability Based on Groundwater of Low Yield/ Poor Quality	Target Organ/System or Effect
	I#	II##	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	
karate [or cyhalothrin, lambda]	6**	6**	360	50	50	3600	decreased body weight, decreased body weight gain in offspring
lead***	500	920	☆	☆	☆	☆	NA
linuron	130	1900	0.03	0.9	0.9	0.3	blood
lithium	1600	40000	☆	☆	☆	☆	NA
malathion	1100**	1100**	7.7	0.005	0.005	77	blood
maleic hydrazide	1100	7200	42	9.1	9.1	420	kidney
malonitrile	0.1	0.8	0.0004	NA	NA	0.004	liver, spleen
maneb	350	6000	6.3	0.5	0.5	63	thyroid
manganese	1600	20000	☆	☆	☆	☆	central nervous system
MEK [or butanone, 2-]	4800	35000	22	639	639	220	fetus
mercury, inorganic	3.7	28	2.1	NA	NA	21	central nervous system
mercury, methyl	0.3	2.1	0.002	NA	NA	0.02	
merphos	2.1	35	2.5	NA	NA	25	central nervous system, decreased body weight
merphos oxide	220	4200	0.2	0.3	0.3	2	central nervous system, decreased body weight
methacrylonitrile	1	6.9	0.02	NA	NA	0.2	liver
methamidophos	2.1	22	0.02	5E-08	5E-08	0.2	central nervous system
methanol	4300	31000	20	181	181	200	brain, liver
methidathion	50	570	0.04	0.0002	0.0002	0.4	liver
methomyl	25	170	1.2	0.007	0.007	12	kidney
methoxy-5-nitroaniline, 2-	17	42	0.4	NA	NA	4	carcinogen
methoxychlor	380	7600	130	0.1	0.1	1300	reproductive system
methyl acetate	6500	46000	23	NA	NA	230	liver
methyl acrylate	1300	8000**	0.9	NA	NA	9	none observed
methyl bromide [or bromomethane]	2.2	15	0.05	0.2	0.2	0.5	stomach
methyl butyl ketone [or hexanone, 2-]	650	5000	2	NA	NA	20	kidney, liver, whole body
methyl isobutyl ketone	280	1900	3.7	NA	NA	37	kidney, liver, whole body
methyl methylacrylate	8300	58000	0.2	NA	NA	2	none observed
methyl parathion	16	250	0.04	NA	NA	0.4	blood
methyl styrene (mixed)	36	200**	0.8	NA	NA	8	nasal cavity
methyl styrene, alpha	1100	3000**	19	NA	NA	190	kidney, liver
methyl tert-butyl ether	350	5900	0.2	151	151	2	increased prostration, kidney, liver, eye
methyl-4-chlorophenoxy acetic acid, 2-	31	460	0.02	0.4	0.4	0.2	kidney, liver
methylaniline, 2-	2	3.7	0.5	NA	NA	5	carcinogen
methylene bis(2-chloroaniline), 4,4'-	7.8	26	9.8	NA	NA	98	carcinogen
methylene bromide	28	190	0.4	NA	NA	4	blood
methylene chloride	16	23	0.02	7.2	7.2	0.2	carcinogen
methylnaphthalene, 1-	290**	290**	1.6	7.5	7.5	16	blood
methylnaphthalene, 2-	1500	15000	6.4	9.6	9.6	64	blood
methylphenol, 2-	2500	29000	0.3	1.9	1.9	3	blood, central nervous system, decreased body weight, kidney, liver
methylphenol, 3-	2600	20000**	0.3	3.4	3.4	3	central nervous system, decreased body weights
methylphenol, 4-	220	2400	0.03	0.5	0.5	0.3	blood, central nervous system, kidney, liver, respiratory
metolachlor	9300	130000	13	0.01	0.01	130	decreased body weight gain
metribuzin	18	120	2.2	0.8	0.8	22	decreased weight, kidney, liver, mortality
mevinphos	16	250	0.01	0.0003	0.0003	0.1	blood
molinate	130	2000	1.3	1.52	1.52	13	reproductive system
molybdenum	390	9600	☆	☆	☆	☆	increased uric acid levels
naled	130	2200	0.1	0.0002	0.0002	1	central nervous system

Table 1
Soil Cleanup Target Levels for Chapter 62-785, F.A.C.

Chemical Name	Direct Exposure (mg/kg)		Leachability Based on Groundwater Criteria	Leachability Based on Freshwater Surface Water Criteria	Leachability Based on Marine Surface Water Criteria	Leachability Based on Groundwater of Low Yield/ Poor Quality	Target Organ/System or Effect
	I[#]	II[##]	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	
naphthalene	1000	8600	1	1.3	1.3	10	blood
nickel [a]	105	28000	130*	☆	☆	1300	decreased body weight, kidney, liver, female reproductive, skin
nickel subsulfide	7000	10000	☆	☆	☆	☆	carcinogen
nitrate	120000	1.00E+06	☆	☆	☆	☆	blood
nitrite	7800	180000	☆	☆	☆	☆	blood
nitroaniline, o-	3.4	43	0.3	NA	NA	3	blood
nitroaniline, p-	160	2100	0.1	7.4	7.4	1	NA
nitrobenzene	16	150	0.04	0.8	0.8	0.4	adrenal, blood, kidney, liver
nitrophenol, 4-	380	4100	2.4	0.3	0.3	24	HAL RfD
nitroso-di-ethylamine, N-	0.003	0.006	0.02	0.001	0.001	0.2	carcinogen
nitroso-di-n-butylamine, N-	0.04	0.06	0.06	0.002	0.002	1	carcinogen
nitroso-di-n-propylamine, N-	0.06	0.1	0.02	0.004	0.004	0.2	carcinogen
nitroso-N-methylethylamine, N-	0.02	0.05	0.04	0.002	0.002	0.4	carcinogen
nitrosodimethylamine, N-	0.01	0.02	0.009	2.5	2.5	0.09	carcinogen
nitrosodiphenylamine, N-	170	430	0.4	0.007	0.007	4	carcinogen
nitrotoluene, m-	160	480**	2.4	3.6	3.6	24	spleen
nitrotoluene, o-	220	1100**	3.8	8.3	8.3	38	spleen
nitrotoluene, p-	240	2100	4.1	9.0	9.0	41	spleen
octamethylpyrophosphoramide	29	79	4.3	NA	NA	43	blood
oxamyl	1000	11000	0.9	0.04	0.04	9	decreased body weight gain and food consumption
paraquat	320	4100	650	955	955	6500	respiratory
parathion	160**	160**	6.9	0.007	0.007	69	blood
PCBs	0.6	2.2	6.2	0.2	0.4	62	carcinogen
pebulate	1200	11000	7.8	6.8	6.8	78	blood
pendimethalin	1900	22000	65	2.3	2.3	650	blood, liver
pentachlorobenzene	22	190	3.1	0.9	0.9	31	kidney, liver
pentachloronitrobenzene	2	4	10	0.03	0.03	100	carcinogen
pentachlorophenol	8.6	30	0.8	6.3	6.3	8	carcinogen
permethrin	3800	71000	880	0.003	0.003	8800	liver
phenanthrene	1900	29000	120	0.02*	0.02*	1200	central nervous system, decreased body weight, liver
phenmedipham [or betanal]	18000	280000	180	NA	NA	1800	none observed
phenol[a]	900	390000	0.05	0.03	0.03	1	central nervous system, lung, female reproductive, fetus
phenylenediamine, m-	260	2700	0.2	NA	NA	2	liver
phenylenediamine, o-	14	30	0.004	NA	NA	0.04	carcinogen
phenylenediamine, p-	8300	89000	6.2	NA	NA	62	whole body
phenylphenol, 2-	480	1400	0.7	NA	NA	7	carcinogen
phorate	13	160**	0.03	0.0001	0.0001	0.3	central nervous system
phosmet	1400	21000	5.2	0.004	0.004	52	blood, decreased body weight, liver
phthalic acid, p-	3800	26000	110	NA	NA	1100	bladder
phthalic anhydride	7800	53000	76	NA	NA	760	kidney, lung
prometon	990	15000	2.6	15	15	26	none observed
prometryn	280	4500	2	1.5	1.5	20	bone marrow, kidney, liver,
propachlor	690	8400	0.7	0.08	0.08	7	decreased body weight, liver
propanil	310	4400	0.3	0.2	0.2	3	spleen
propazine	1300	20000	0.5	6.1	6.1	5	decrease in body weight
propylene glycol	100000**	100000**	560	142	142	5600	blood
propylene glycol monomethyl ether	31000	41000**	20	NA	NA	200	kidney, liver

Table 1
Soil Cleanup Target Levels for Chapter 62-785, F.A.C.

April 30, 1998

Chemical Name	Direct Exposure (mg/kg)		Leachability Based on Groundwater Criteria	Leachability Based on Freshwater Surface Water Criteria	Leachability Based on Marine Surface Water Criteria	Leachability Based on Groundwater of Low Yield/ Poor Quality	Target Organ/System or Effect
	I#	II##	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	
propylene oxide	2.8	6.4	21	NA	NA	210	carcinogen
pydrin	1800	29000	770	0.0002	0.0002	7700	central nervous system
pyrene	2200	40000	570	0.8	0.8	5700	central nervous system, decreased body weight, kidney
pyridine	15	120	0.07	5.4	5.4	0.7	liver
resmethrin	680	5600	0.9	1E-05	1E-05	9	reproductive system
ronnel	2800	36000	120	0.02	0.02	1200	blood, central nervous system, liver
selenium	390	10000	5*	☆	☆	50	central nervous system, gastrointestinal, skin
silver	390	9100	34*	☆	☆	340	heart, liver, skin
simazine	8	25	0.2	0.3	0.3	2	carcinogen
strontium	47000	1.00E+06	☆	☆	☆	☆	bone
strychnine	20	310	1.5	0.6	0.6	15	increased mortality
styrene	1700**	1700**	4.1	19	19	41	blood, liver
TCDD, 2,3,7,8- [or dioxin]	7.00E-06	3.00E-05	0.005	NA	NA	0.05	carcinogen
terbacil	590	6400	0.5	NA	NA	5	liver, thyroid
terbufos	1	10	0.05	0.001	0.001	0.5	blood
tetrachlorobenzene, 1,2,4,5-	4.9	38	1.2	0.7	0.7	12	kidney
tetrachloroethane, 1,1,1,2-	4.1	6.0	0.01	NA	NA	0.1	carcinogen
tetrachloroethane, 1,1,2,2-	0.7	1	0.004	0.06	0.06	0.04	carcinogen
tetrachloroethene	10	20	0.05	1.3	1.3	0.5	carcinogen
tetrachlorophenol, 2,3,4,6-	2000	30000	53	1.1	1.1	530	liver
tetraethyl dithiopyrophosphate	34	560	0.1	0.0004	0.0004	1	blood
thiobencarb	150**	150**	2.8	0.3	0.3	28	decreased body weight, kidney
thiram	330	5100	1.1	0.005	0.005	11	central nervous system
tin	44000	710000	☆	☆	☆	☆	kidney, liver
toluene	300	520**	0.4	4.8	4.8	4	kidney, liver
toluidine, p-	2.6	4.9	3.3	NA	NA	33	carcinogen
toxaphene	1	3.7	31	0.002	0.002	310	carcinogen
triallate	620	7000	8.4	6	6	84	liver, spleen
tributyltin oxide	2.3	45	360	1.8	1.8	3600	immune system
trichloro-1,2,2-trifluoroethane, 1,1,2-	880**	880**	24000	NA	NA	240000	psychomotor impairment
trichloroacetic acid	3600	34000	2.8	404	404	28	developmental effects to offspring. kidney, liver, spleen
trichlorobenzene, 1,2,3-	330	3100	6.7	8.2	8.2	67	central nervous system, increased adrenal weights
trichlorobenzene, 1,2,4-	560	3000**	4.9	1.6	1.6	49	central nervous system, increased adrenal weights
trichlorobenzene, 1,3,5-	510	6200	7.4	NA	NA	74	HAL RfD
trichloroethane, 1,1,1-	420	1400**	2.1	2.9	2.9	21	NA
trichloroethane, 1,1,2-	1.4	2.1	0.04	0.2	0.2	0.4	carcinogen
trichloroethene	4.8	6.8	0.03	0.7	0.7	0.3	carcinogen
trichlorofluoromethane	210	1400	37	NA	NA	370	central nervous system, heart, liver, lung
trichlorophenol, 2,4,5-	6300	88000	0.4	2.2	2.2	4	kidney, liver
trichlorophenol, 2,4,6-	81	230	0.5	0.3	0.3	5	carcinogen
trichlorophenoxy acetic acid, 2,4,5-	670	11000	0.8	1.7	1.7	8	proteinuria
trichlorophenoxy propionic acid, 2(2,4,5)-	590	12000	5.4	NA	NA	54	liver
trichloropropane, 1,1,2-	30	210	0.2	NA	NA	2	kidney, liver, thyroid
trichloropropane, 1,2,3-	0.01	0.02	0.03	0.002	0.002	0.3	carcinogen
trichloropropene, 1,2,3-	6.5	44	0.4	NA	NA	4	eye
trifluralin	34	54	0.2	0.03	0.03	2	carcinogen
trimethyl phc e	15	31	0.2	NA	NA	2	carcinogen

Table 1
Soil Cleanup Target Levels for Chapter 62-785, F.A.C.

Chemical Name	Direct Exposure (mg/kg)		Leachability Based on Groundwater Criteria	Leachability Based on Freshwater Surface Water Criteria	Leachability Based on Marine Surface Water Criteria	Leachability Based on Groundwater of Low Yield/ Poor Quality	Target Organ/System or Effect
	I[a]	II[aa]	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	
trimethylbenzene, 1,2,3-	240	260**	0.3	NA	NA	3	NA
trimethylbenzene, 1,2,4-	8.4	56	0.2	3.3	3.3	2	NA
trimethylbenzene, 1,3,5-	8.5	57	0.3	6.8	6.8	3	NA
trinitrobenzene, 1,3,5-	200	3300	1	0.6	0.6	10	spleen
trinitrophenylmethylnitramine	640	9300	1.4	NA	NA	14	kidney, liver, spleen
trinitrotoluene, 2,4,6-	32	100	0.7	3.3	3.3	7	carcinogen
TRPHs	350	2500	340	NA	NA	3400	decreased body weight
uranium, natural	120	470	21	NA	NA	210	NA
vanadium pentoxide	700	18000	☆	☆	☆	☆	decreased hair cystine
vanadium[a]	15	7700	6000◆	☆	☆	60000	no adverse effects observed
vernam	24	200	0.1	0.2	0.2	1	decreased body weight
vinyl acetate	230	1600	0.4	3	3	4	nasal epithelial lesions
vinyl chloride	0.04	0.05	0.007	NA	NA	0.07	carcinogen
white phosphorous	1.6	36	☆	☆	☆	☆	hair loss, increased maternal death at parturition
xylenes, total	290**	290**	0.3	5.3	5.3	3	central nervous system, kidney, whole body
zinc	23000	560000	12000◆	☆	☆	120000	blood
zinc phosphide	23	600	☆	☆	☆	☆	decreased body weight
zineb	3500	58000	19	0.7	0.7	190	thyroid

Values rounded to two significant figures if >1 and to one significant figure if <1.

*Unless the method detection limit (MDL) using the most sensitive and currently available technology is higher than the specified criterion.

**Direct exposure values based on soil saturation limit (C_{sat}).

***Residential direct exposure value from USEPA *Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities.* OSWER Directive 9355.4-12 (1994). Residential Value is the middle of the USEPA suggested range of 400-600 mg/kg. The industrial direct exposure value was derived using methodologies outlined in USEPA *Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil,* December 1996.

☆ = Leachability values may be derived using the SPLP Test to calculate site-specific SCTLs or may be determined using TCLP in the event oily wastes are present.

HAL RfD = Reference dose obtained from USEPA *Drinking Water Regulations and Health Advisories,* Office of Water, EPA 822-B96-002, October 1996.

OPP RfD = Reference dose obtained from USEPA *Office of Pesticide Programs Reference Dose Tracking Report,* 2/19/97.

◆Values from the USEPA Soil Screening Guidance (1996). These values were derived assuming soil pH 6.8. These leachability values are dependent upon both the metal concentration in soil and soil characterisitics. Thus, if site-specific soil characteristics are different than the defaults, these leachability values may not apply. If this is the case, site-specific leachability values should be derived using methods such as TCLP/SPLP.

[a]Values based on residential use assumptions.

[aa]Values based on worker industrial exposure assumptions.

NA = Not available at time of rule adoption.

[I] Based on a dermal absorption of 0.0001.

[II]Based on acute toxicity considerations.

[f]Phytotoxicity must be considered.

[III]See discussion on the Development of SCTLs for Ammonia in the Technical Report: Development of Soil Cleanup Target Levels for Chapter 62-785, F.A.C., March 12, 1998.

Table 2: Default Factors

Symbol	Definition (units)	Default	Reference
BW	body weight (kg) (aggregate resident)**	59	Derived from equation using child and adult body weights (See Appendix A)
	body weight (kg) (child)*	15	Exposure Factors, USEPA 1991 (OSWER No. 9285.6-03)
	body weight (kg) (adult/worker)	70	RAGS (part A), USEPA 1989a (EPA/540/1-89/002)
IRo	ingestion rate, oral (mg/day) (aggregate resident)	120	Derived from equation using child and adult ingestion rates (Technical Report, page 11)
	ingestion rate, oral (mg/day) (child)	200	Exposure Factors, USEPA 1991 (OSWER No. 9285.6-03)
	ingestion rate, oral (mg/day) (worker)	50	Exposure Factors, USEPA 1991 (OSWER No. 9285.6-03)
EF	exposure frequency (days/yr) (aggregate resident)	350	Exposure Factors, USEPA 1991 (OSWER No. 9285.6-03)
	exposure frequency (days/yr) (child)	350	Exposure Factors, USEPA 1991 (OSWER No. 9285.6-03)
	exposure frequency (days/yr) (worker)	250	Exposure Factors, USEPA 1991 (OSWER No. 9285.6-03)
ED	exposure duration (years) (aggregate resident)	30	Exposure Factors, USEPA 1991 (OSWER No. 9285.6-03)
	exposure duration (years) (child)	6	Exposure Factors, USEPA 1991 (OSWER No. 9285.6-03)
	exposure duration (years) (worker)	25	Exposure Factors, USEPA 1991 (OSWER No. 9285.6-03)
SA	surface area exposed (cm^2/day) (aggregate resident)	3674	Derived based on data from the Exposure Factors Handbook, USEPA 1989b (EPA/600/8-89/043) (See Appendix A)
	surface area exposed (cm^2/day) (child)	1800	Derived based on data from the Exposure Factors Handbook, USEPA 1989b (EPA/600/8-89/043) (See Appendix A)
	surface area exposed (cm^2/day) (worker)	2000	Derived based on data in Dermal Exposure Assessment: Principles and Applications, USEPA 1992 (EPA/600/8-91/011B)
AF	adherence factor (mg/cm^2) (aggregate resident and child)	0.2	Selected from range of values in Dermal Exposure Assessment: Principles and Applications, USEPA 1992 (EPA/600/8-91/011B)
	adherence factor (mg/cm^2) (worker)	0.6	Selected from range of values in Dermal Exposure Assessment: Principles and Applications, USEPA 1992 (EPA/600/8-91/011B)
AT	averaging time (days) (carcinogens)	25550 (70 years)	RAGS (part A), USEPA 1989a (EPA/540/1-89/002)
	averaging time (days) (non-carcinogens) (aggregate resident)	10950 (30 years)	RAGS (part A), USEPA 1989a (EPA/540/1-89/002) (AT=ED)
	averaging time (days) (non-carcinogens) (child)	2190 (6 years)	RAGS (part A), USEPA 1989a (EPA/540/1-89/002) (AT=ED)
	averaging time (days) (non-carcinogens) (worker)	9125 (25 years)	RAGS (part A), USEPA 1989a (EPA/540/1-89/002) (AT=ED)
DA	dermal absorption (unitless) (organics)	0.01	USEPA Region IV Guidance
	dermal absorption (unitless) (inorganics)	0.001	USEPA Region IV Guidance
IRi	inhalation rate (m^3/day) (aggregate resident)	15	Derived based on data from the Exposure Factors Handbook, USEPA 1989b (EPA/600/8-89/043) (See Appendix A)
	inhalation rate (m^3/day) (child)	10	RAGS (part A), USEPA 1989a (EPA/540/1-89/002)
	inhalation rate (m^3/day) (worker)	20	Exposure Factors, USEPA 1991 (OSWER No. 9285.6-03)
VF	volatilization factor (m^3/kg)	chemical-specific	Soil Screening Guidance, USEPA 1996b (EPA/540/R-95/128) (See Fig. 4)
PEF	particulate emission factor (m^3/kg)	1.24×10^9	Soil Screening Guidance, USEPA 1996b (EPA/540/R-95/128) (See Fig. 3)
TR	target cancer risk (unitless)	10^{-6}	Per Section 376.81(5), F.S.
THI	target hazard index (unitless)	1	Per Section 376.81(5), F.S.

*Child: Age 1-6 years **Aggregate Resident: Age 1-30 years

Chemical-Specific Values

Chemical Name	Values from Reference Sources												Calculated Values***				
	CAS #	MP	S(mg/L)		Koc(cm^3/g)		H(atm-m^3/mol)		Di (cm^2/s)**		Dw (cm^2/s)**		H Prime	K_d (cm^3/g)*	Da (cm^2/s)	Residential Volatilization Factor	Industrial (m^3/kg)
acenaphthene	83-32-9	93	4.24E+00	N	4898	N	1.60E-04	L	0.0421	N	7.69E-06	N	6.56E-03	2.94E+01	5.0E-07	9.83E+04	2.01E+05
acenaphthylene	208-96-8	93	1.60E+01	L	2500	C	1.10E-04	L	0.0670	C	7.44E-06	B	4.51E-03	1.50E+01	1.1E-06	6.73E+04	1.37E+05
acephate	30560-19-1	64	8.18E+05	D	8	D	5.00E-13	D	0.0939	B	7.96E-06	B	2.10E-11	4.80E-02	3.4E-07	2.66E+05	2.43E+05
acetone	67-64-1	-95	1.00E+06	N	0.575	N	3.88E-05	N	0.1240	N	1.14E-05	N	1.59E-03	3.45E-03	1.0E-04	6.89E+03	1.41E+04
acetonitrile	75-05-8	-44	1.00E+06	L	16	D	3.50E-05	L	0.2205	B	1.41E-05	B	1.44E-03	9.60E-02	8.6E-05	7.48E+03	1.53E+04
acetophenone	98-86-2	20	6.10E+03	L	1.885	D	1.10E-05	L	0.1118	B	8.72E-06	B	4.51E-04	1.13E-02	2.5E-05	1.40E+04	2.86E+04
acrolein	107-02-8	-88	2.50E+05	L	0.49	C	1.20E-04	L	0.1915	B	1.22E-05	B	4.92E-03	2.94E-03	4.8E-04	3.16E+03	6.45E+03
acrylamide	79-06-1	85	2.05E+05	D	1	D	2.61E-10	B	0.0970	B	1.06E-05	B	1.07E-08	6.00E-03	6.4E-07	1.95E+05	1.78E+05
acrylic acid	79-10-7	-84	1.00E+06	L	1	D	1.20E-07	L	0.0980	B	1.06E-05	B	4.92E-06	6.00E-03	8.8E-07	7.43E+04	1.52E+05
acrylonitrile	107-13-1	-84	7.40E+04	L	0.85	C	1.00E-04	L	0.2107	B	1.23E-05	B	4.10E-03	5.10E-03	4.4E-04	7.45E+03	6.80E+03
alachlor	15972-60-8	40	2.40E+02	P	155	D	1.70E-04	L	0.0198	B	5.69E-06	B	6.97E-03	9.30E-01	7.2E-06	5.81E+04	5.30E+04
aldicarb	116-06-3	99	6.00E+03	L	17	C	1.40E-09	L	0.0301	B	7.24E-06	B	5.74E-08	1.02E-01	2.3E-07	1.46E+05	2.97E+05
aldrin	309-00-2	104	1.80E-01	N	48700	N	1.70E-04	N	0.0132	N	4.86E-06	N	6.97E-03	2.92E+02	1.7E-08	1.20E+06	1.09E+06
allyl alcohol	107-18-6	-129	1.00E+06	L	1.47	D	5.60E-06	L	0.114	B	1.14E-05	B	2.30E-04	8.80E-03	1.3E-05	1.89E+04	3.87E+04
aluminum	7429-90-5	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
aluminum phosphide	20859-73-8	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
ametryn	834-12-8	89	1.85E+02	D	388	D	1.36E-09	D	0.0767	B	6.50E-06	B	5.58E-08	2.33E+00	1.7E-08	5.32E+05	1.09E+06
ammonia	7664-41-7	-78	5.30E+05	L	3.1	G	2.80E-04	J	0.259	B	6.93E-05	B	1.15E-02	1.86E-02	1.3E-03	1.92E+03	3.91E+03
ammonium sulfamate	7773-06-0	NF	2.16E+03	D	1	D	NF		0.115		NF		n/a	n/a	n/a	n/a	n/a
aniline	62-53-3	-6	3.60E+04	L	25.5	D	1.90E-06	L	0.07	B	8.30E-06	B	7.79E-05	1.53E-01	1.4E-06	1.34E+05	1.22E+05
anthracene	120-12-7	215	4.30E-02	L	23493	N	6.50E-05	L	0.0324	N	7.74E-06	N	2.67E-03	1.41E+02	3.3E-08	3.83E+05	7.82E+05
antimony	7440-36-0	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
antimony pentoxide	1314-60-9	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
antimony potassium tartrate	304-61-0	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
antimony tetroxide	1332-81-6	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
antimony trioxide	1309-64-4	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
arsenic	7440-38-2	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
atrazine	1912-24-9	173	7.00E+01	L	405	L	1.19E-09	D	0.0794	B	6.69E-06	B	4.87E-08	2.43E+00	1.7E-08	1.19E+06	1.09E+06
azobenzene	103-33-3	68	6.40E+00	D	2822	D	1.35E-05	D	0.0861	B	7.08E-06	B	5.54E-04	1.69E+01	1.5E-07	3.99E+05	3.64E+05
barium	7440-39-3	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
bayleton	43121-43-3	82	2.60E+02	D	493	D	8.11E-11	D	0.065	B	5.65E-06	B	3.33E-09	2.96E+00	1.2E-08	6.42E+05	1.31E+06
benomyl	17804-35-2	NF	4.00E+00	D	2100	D	7.50E-07	D	0.0368	B	2.83E-06	B	3.08E-05	1.26E+01	6.2E-09	8.86E+05	1.81E+06
bentazon	25057-89-0	138	5.00E+02	D	91	D	2.20E-09	D	0.0813	B	7.13E-06	B	9.02E-08	5.46E-01	7.1E-08	2.62E+05	5.34E+05
benzaldehyde	100-52-7	-57	6.95E+03	D	92	D	4.23E-05	B	0.0705	B	9.51E-06	B	1.73E-03	5.52E-01	1.0E-05	2.19E+04	4.47E+04
benzene	71-43-2	6	1.80E+03	L	62	N	5.60E-03	L	0.0880	N	9.80E-06	N	2.30E-01	3.72E-01	2.1E-03	3.40E+03	3.11E+03
benzenethiol	108-98-5	-15	8.36E+02	D	334	D	3.50E-04	D	0.121	B	9.43E-06	B	1.44E-02	2.00E+00	4.4E-05	1.05E+04	2.14E+04
benzo(a)anthracene	56-55-3	84	9.00E-03	L	357537	N	3.40E-06	L	0.0510	N	9.00E-06	N	1.39E-04	2.15E+03	2.0E-10	1.09E+07	9.96E+06

Table 3a

Chemical-Specific Values

April 30, 1998

Chemical Name	Values from Reference Sources												Calculated Values***				
	CAS #	MP	S(mg/L)		Koc(cm³/g)		H(atm-m³/mol)		Di (cm²/s)**		Dw (cm²/s)**		H Prime	K_d (cm³/g)*	Da (cm²/s)	Residential Volatilization Factor (m³/kg)	Industrial Factor (m³/kg)
benzo(a)pyrene	50-32-8	177	1.62E-03	N	968774	N	1.10E-06	L	0.0430	N	9.00E-06	N	4.51E-05	5.81E+03	2.8E-11	2.96E+07	2.70E+07
benzo(b)fluoranthene	205-99-2	168	1.50E-07	L	1230000	N	1.10E-04	L	0.0226	N	5.56E-06	N	4.51E-03	7.38E+03	7.4E-10	5.72E+06	5.22E+06
benzo(g,h,i)perylene	191-24-2	273	2.60E-04	L	1600000	C	1.40E-07	L	0.0420	C	5.27E-06	B	5.74E-06	9.60E+03	4.8E-12	3.17E+07	6.47E+07
benzo(k)fluoranthene	207-08-9	217	1.00E-03	L	1230000	N	8.30E-07	L	0.0226	N	5.56E-06	N	3.40E-05	7.38E+03	1.0E-11	4.84E+07	4.42E+07
benzoic acid	65-85-0	122	3.50E+03	N	0.6	N	1.54E-06	N	0.0536	N	7.97E-06	N	6.31E-05	3.60E-03	2.8E-06	4.66E+04	9.51E+04
benzotrichloride	98-08-7	-5	5.30E+01	D	1200	D	9.80E-04	B	0.0275	B	7.78E-06	B	4.02E-02	7.20E+00	8.1E-06	5.48E+04	5.00E+04
benzyl alcohol	100-51-6	-15	4.00E+04	L	6.31	C	6.10E-07	B	0.0690	B	9.36E-06	B	2.50E-05	3.79E-02	1.1E-06	6.64E+04	1.36E+05
benzyl chloride	100-44-7	-45	5.30E+02	D	303	D	3.20E-04	B	0.0543	B	8.80E-06	B	1.31E-02	1.82E+00	2.0E-05	3.50E+04	3.19E+04
beryllium	7440-41-7	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
bidrin (dicrotophos)	141-66-2	NF	1.00E+06	D	93	D	1.20E-12	D	0.0752	B	6.41E-06	B	4.90E-11	5.58E-01	6.2E-08	2.80E+05	5.71E+05
biphenyl, 1,1- (diphenyl)	92-52-4	69	7.50E+00	D	1445	D	4.00E-04	L	0.0943	B	7.56E-06	B	1.64E-02	8.67E+00	9.4E-06	2.27E+04	4.63E+04
bis (2-chloro-1-methylethyl) ether	108-06-1	NF	1.30E+03	Q	63	Q	0.103	Q	0.0905	B	7.40E-06	B	4.21E+00	3.78E-01	1.6E-02	1.23E+03	1.13E+03
bis(2-chloroethyl)ether	111-44-4	-52	1.72E+04	N	76	N	1.80E-05	N	0.0692	N	8.71E-06	N	7.38E-04	4.56E-01	5.0E-06	6.96E+04	6.35E+04
bis(2-chloroisopropyl)ether	39638-32-9	-99	1.30E+03	D	63	D	0.103	J	0.0905	B	7.40E-06	B	4.21E+00	3.78E-01	1.6E-02	1.23E+03	1.13E+03
bis(2-ethylhexyl)phthalate	117-81-7	-55	3.40E-01	N	111123	N	1.02E-07	N	0.0351	N	4.18E-06	N	4.18E-06	6.67E+02	5.2E-11	2.17E+07	1.98E+07
bisphenol A	80-05-7	155	1.20E+02	D	919	D	1.00E-10	D	0.0766	B	6.50E-06	B	4.10E-09	5.51E+00	7.3E-09	8.11E+05	1.66E+06
boron	7440-42-8	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
bromochloromethane	74-97-5	160	1.67E+04	D	80	D	1.50E-03	D	0.139	B	1.22E-05	B	6.15E-02	4.80E-01	7.7E-04	2.51E+03	5.12E+03
bromodichloromethane	75-27-4	-87	6.74E+03	N	55	N	1.60E-03	L	0.0298	N	1.06E-05	N	6.56E-02	3.30E-01	2.4E-04	1.01E+04	9.25E+03
bromoform	75-25-2	8	3.21E+03	N	126	N	5.35E-04	N	0.0149	N	1.03E-05	N	2.19E-02	7.56E-01	2.0E-05	3.45E+04	3.15E+04
bromomethane (methyl bromide)	74-83-9	-94	1.52E+04	N	9	N	6.24E-03	N	0.0728	N	1.21E-05	N	2.56E-01	5.40E-02	4.9E-03	9.93E+02	2.03E+03
butanol, 1-	71-36-3	-90	7.40E+04	N	6.92	N	8.81E-06	N	0.08	N	9.30E-06	N	3.61E-04	4.15E-02	1.1E-05	2.07E+04	4.23E+04
butanone,2 (MEK)	78-93-3	-87	2.68E+05	L	33	I	5.60E-05	L	0.0808	B	9.80E-06	B	2.30E-03	1.98E-01	3.3E-05	1.20E+04	2.46E+04
butyl benzyl phthalate, N-	85-68-7	-35	2.69E+00	N	13700	N	1.26E-06	N	0.0174	N	5.18E-06	N	5.17E-05	8.22E+01	9.8E-10	2.22E+06	4.53E+06
butylate	2008-41-5	NF	4.40E+01	D	400	D	8.45E-06	D	0.0709	B	5.79E-06	B	3.46E-04	2.40E+00	5.4E-07	9.48E+04	1.94E+05
butylphthalyl butylglycolate	85-70-1	-35	1.20E+02	D	314	D	3.88E-07	D	0.0563	B	4.89E-06	B	1.59E-05	1.88E+00	4.0E-08	3.49E+05	7.13E+05
cadmium	7440-43-9	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
calcium cyanide	592-01-8	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
captan	133-06-2	173	3.30E+00	L	2328	D	7.20E-06	L	0.0141	B	6.89E-06	B	2.95E-04	1.40E+01	1.9E-08	1.13E+06	1.03E+06
carbaryl	63-25-2	145	1.00E+02	L	230	E	3.50E-09	L	0.2780	B	7.13E-06	B	1.44E-07	1.38E+00	3.2E-08	3.89E+05	7.93E+05
carbazole	86-74-8	246	7.48E+00	N	3390	N	1.53E-08	N	0.0390	N	7.03E-06	N	6.27E-07	2.03E+01	2.2E-09	3.28E+06	3.00E+06
carbofuran	1563-66-2	151	3.20E+02	L	72	E	9.20E-05	L	0.0778	B	6.57E-06	B	3.77E-03	4.32E-01	2.9E-05	1.28E+04	2.62E+04
carbon disulfide	75-15-0	-115	1.19E+03	N	45.7	N	3.03E-02	N	0.1040	N	1.00E-05	N	1.24E+00	2.74E-01	1.1E-02	6.56E+02	1.34E+03
carbon tetrachloride	56-23-5	-23	7.93E+02	N	152	N	3.04E-02	L	0.0780	N	8.80E-06	N	1.25E+00	9.12E-01	4.2E-03	2.41E+03	2.20E+03
carbophenothion	786-19-6	NF	6.30E-01	D	13976	D	2.14E-07	D	0.0596	B	5.28E-06	B	8.77E-06	8.39E+01	7.3E-10	2.57E+06	5.25E+06
chlordane	57-74-9	106	5.60E-02	N	51300	N	4.86E-05	L	0.0118	N	4.37E-06	N	1.99E-03	3.08E+02	4.2E-09	2.41E+06	2.20E+06
chlorine	7782-50-5	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a

Chemical-Specific Values

Chemical Name	Values from Reference Sources												Calculated Values***				
	CAS #	MP	S(mg/L)		Koc(cm^3/g)		H(atm-m^3/mol)		Di (cm^2/s)**		Dw (cm^2/s)**		H Prime	K_s (cm^3/g)*	Da (cm^2/s)	Residential Volatilization Factor	Industrial Volatilization Factor (m^3/kg)
chlorine cyanide	506-77-4	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
chlorine dioxide	10049-04-4	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
chlorite	7758-19-2	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
chloro-1,3-butadiene	126-99-8	-130	1.70E+03	D	183	D	3.20E-02	D	0.135	B	1.00E-05	B	1.31E+00	1.10E+00	6.5E-03	8.62E+02	1.76E+03
chloro-m-cresol	59-50-7	56	3.80E+03	L	50	D	4.00E-07	L	0.1062	B	8.64E-06	B	1.64E-05	3.00E-01	3.7E-07	1.15E+05	2.34E+05
chloroacetic acid	79-11-8	50	6.14E+06	D	30	D	1.30E-09	D	0.0699	B	1.30E-05	B	5.33E-08	1.80E-01	3.0E-07	1.28E+05	2.61E+05
chloroaniline, 4-	106-47-8	73	5.30E+03	N	66	N	3.31E-07	N	0.0483		1.01E-05	N	1.36E-05	3.96E-01	2.0E-07	1.56E+05	3.18E+05
chlorobenzene	108-90-7	-45	4.72E+02	N	224	N	3.70E-03	N	0.0730	N	8.70E-06	N	1.52E-01	1.34E+00	4.0E-04	3.48E+03	7.09E+03
chlorobenzilate	510-15-6	37	2.19E+01	C	2340	C	2.34E-08	C	0.0147	B	5.47E-06	B	9.59E-07	1.40E+01	2.5E-09	3.11E+06	2.83E+06
chlorobenzoic acid, p-	74-11-3	243	7.70E+01	D	400	D	8.03E-08	D	0.0352	B	9.48E-06	B	3.29E-06	2.40E+00	2.7E-08	4.27E+05	8.72E+05
chlorobenzotrifluoride, 4-	98-56-6	-36	5.56E+01	D	520	D	3.47E-02	D	0.0308	B	8.05E-06	B	1.42E+00	3.12E+00	6.7E-04	2.69E+03	5.49E+03
chlorobutane, 1-	109-69-3	-123	6.60E+02	D	98	D	1.67E-02	D	0.126	B	9.33E-06	B	6.85E-01	5.88E-01	5.6E-03	9.27E+02	1.89E+03
chloroethylvinylether, 2-	110-75-8	-70	1.50E+04	D	8	D	2.40E-04	L	0.1230	B	9.51E-06	B	9.84E-03	4.80E-02	4.3E-04	3.35E+03	6.84E+03
chloroform	67-66-3	-64	7.92E+03	N	52.5	N	3.67E-03	N	0.1040	N	1.00E-05	N	1.50E-01	3.15E-01	1.9E-03	3.59E+03	3.27E+03
chloromethane	74-87-3	-98	5.30E+03	L	6.3	N	8.80E-03	L	0.2000	B	1.36E-05	B	3.61E-01	3.78E-02	1.9E-02	1.25E+03	1.04E+03
chloronaphthalene, beta-	91-58-7	61	1.20E+01	L	4800	C	3.10E-04	L	0.0351	B	8.66E-06	B	1.27E-02	2.88E+01	8.2E-07	7.66E+04	1.56E+04
chloronitrobenzene, o-	88-78-3	33	4.40E+02	D	277	D	7.88E-03	B	0.0351	B	9.37E-06	B	3.23E-01	1.66E+00	3.3E-04	8.54E+03	7.80E+03
chloronitrobenzene, p-	100-00-5	83	4.53E+02	D	314	D	3.60E-05	D	0.0349	B	9.42E-06	B	1.48E-03	1.88E+00	1.4E-06	1.31E+05	1.19E+05
chlorophenol, 2-	95-57-8	10	2.20E+04	N	388	N	3.91E-04	N	0.0501	N	9.46E-06	N	1.60E-02	2.33E+00	1.8E-05	1.66E+04	3.38E+04
chlorophenol, 3-	108-43-0	33	2.60E+04	D	281	D	3.25E-06	B	0.0505	B	9.37E-06	C	1.33E-04	1.69E+00	2.3E-07	1.44E+05	2.93E+05
chlorophenol, 4-	106-48-9	43	2.70E+04	D	246	D	1.12E-06	B	0.0493	B	9.68E-06	C	4.59E-05	1.48E+00	1.2E-07	2.05E+05	4.18E+05
chloropropane, 2-	75-29-6	-117	3.10E+03	D	53	D	1.70E-02	B	0.116	B	1.01E-05	C	6.97E-01	3.18E-01	7.9E-03	7.85E+02	1.60E+03
chlorothalonil	1897-45-6	251	6.00E-01	D	1800	D	2.00E-07	D	0.0811	B	7.32E-06	B	8.20E-06	1.08E+01	7.5E-09	1.79E+06	1.64E+06
chlorotoluene, o-	95-49-8	-36	3.74E+02	D	370	D	3.57E-03	D	0.11	B	8.72E-06	B	1.46E-01	2.22E+00	3.7E-04	3.63E+03	7.42E+03
chlorotoluene, p-	106-43-4	6	1.06E+02	D	340	D	4.66E-03	B	0.055	B	8.65E-06	B	1.91E-01	2.04E+00	2.6E-04	4.34E+03	8.85E+03
chlorpropham	101-21-3	41	8.90E+01	D	816	D	2.50E-08	D	0.0797	B	6.71E-06	B	1.03E-06	4.90E+00	9.4E-09	7.18E+05	1.46E+06
chlorpyrifos	2921-88-2	42	1.10E+00	L	6070	D	2.93E-06	D	0.0614	B	5.52E-06	B	1.20E-04	3.64E+01	1.2E-08	6.42E+05	1.31E+06
chromium	18540-29-9	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
chromium (hexavalent)	18540-29-9	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
chrysene	218-01-9	258	1.60E-03	N	398000	N	9.46E-05	L	0.0248	N	6.21E-06	N	3.88E-03	2.39E+03	2.2E-09	3.34E+15	3.05E+06
cobalt	7440-48-4	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
copper	7440-50-8	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
copper cyanide	544-92-3	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
coumaphos	56-72-4	93	1.50E+00	L	4230	D	3.18E-08	D	0.0615	B	5.58E-06	B	1.30E-06	2.54E+01	1.6E-09	1.76E+06	3.60E+06
crotonaldehyde	123-73-9	-77	1.55E+05	D	6.2	D	1.94E-05	D	0.152	B	1.08E-05	B	7.95E-04	3.72E-02	4.7E-05	2.26E+04	2.06E+04
cumene (isopropyl benzene)	98-82-8	-96	6.10E+01	D	2818	D	1.2	L	0.065	B	7.83E-06	B	4.92E+01	1.69E+01	6.5E-03	8.65E+02	1.76E+03
cyanide	57-12-5	NF	6.30E+05	P	0.575	C	2.70E-08	B	0.6310	B	1.67E-05	B	1.11E-06	3.45E-03	1.4E-06	5.91E+04	1.21E+05

Chemical-Specific Values

Chemical Name	Values from Reference Sources												Calculated Values***				
	CAS #	MP	S(mg/L)		Koc(cm^3/g)		H(atm-m^3/mol)		Di (cm^2/s)**		Dw (cm^2/s)**		H Prime	K_d (cm^3/g)*	Da (cm^2/s)	Residential Volatilization Factor	Industrial (m^3/kg)
cyanogen	460-19-5	-21	8.50E+03	D	26	D	4.90E-03	B	0.204	B	1.37E-05	B	2.01E-01	1.56E-01	7.4E-03	8.08E+02	1.65E+03
cycloate	1134-23-2	12	7.50E+01	D	345	D	2.35E-05	D	0.0740	B	6.10E-06	B	9.64E-04	2.07E+00	1.8E-06	5.23E+04	1.07E+05
cyclohexanone	108-94-1	-31	5.00E+03	L	16	D	8.40E-06	L	0.082	B	9.38E-06	B	3.44E-04	9.60E-02	8.0E-06	2.46E+04	5.03E+04
cyhalothrin, lambda (karate)	68085-85-8	10	4.00E-03	D	254842	D	1.48E-06	D	0.0491	B	4.44E-06	B	6.07E-05	1.53E+03	1.2E-10	6.29E+06	1.28E+07
cypermethrin	52315-07-8	-70	4.10E-02	D	250000	Q	1.92E-07	D	0.0491	B	4.36E-06	B	7.87E-06	1.50E+03	3.2E-11	1.23E+07	2.50E+07
DDD, 4,4-	72-54-8	110	9.00E-02	N	45800	N	4.00E-06	L	0.0169	B	4.76E-06	B	1.64E-04	2.75E+02	6.5E-10	6.11E+06	5.58E+06
DDE, 4,4-	72-55-9	89	1.20E-01	N	86405	N	2.10E-05	L	0.0144	N	5.87E-06	N	8.61E-04	5.18E+02	1.3E-09	4.24E+06	3.87E+06
DDT, 4,4-	50-29-3	109	2.50E-02	N	677934	N	8.10E-06	L	0.0137	N	4.95E-06	N	3.32E-04	4.07E+03	6.7E-11	1.90E+07	1.73E+07
decabromodiphenyl ether	1163-19-5	295	2.50E-02	D	33000	D	4.45E-08	D	0.045	B	4.77E-06	B	1.83E-06	1.98E+02	1.7E-10	5.26E+06	1.07E+07
di-n-butylphthalate	84-74-2	-35	1.12E+01	N	1570	N	9.38E-10	N	0.0438	N	7.86E-06	B	3.85E-08	9.42E+00	5.3E-09	9.60E+05	1.96E+06
di-n-octylphthalate	117-84-0	-30	2.00E-02	N	83200000	N	6.68E-05	D	0.0151	N	3.58E-06	N	2.74E-03	4.99E+05	4.5E-12	1.68E+05	6.72E+07
diallate	2303-16-4	25	4.00E+01	D	708	D	3.80E-06	D	0.0841	B	7.73E-06	B	1.56E-04	4.25E+00	1.7E-07	3.75E+05	3.42E+05
diazinon	333-41-5	NF	4.00E+01	L	2230	C	1.40E-07	C	0.0171	B	5.22E-06	B	5.74E-06	1.34E+01	2.8E-09	1.30E+06	2.66E+06
dibenz(a,h)anthracene	53-70-3	270	2.49E-03	N	1789101	N	1.47E-08	N	0.0202	N	5.18E-06	N	6.03E-07	1.07E+04	3.1E-12	8.80E+07	8.03E+07
dibenzofuran	132-64-9	87	1.00E+01	L	9120	C	1.30E-05	L	0.0373	B	7.37E-06	B	5.33E-04	5.47E+01	2.0E-08	4.90E+05	1.00E+06
dibromo-3-chloropropane, 1,2-	96-12-8	6	1.20E+03	D	98	C	1.50E-04	L	0.0708	C	8.90E-06	B	6.15E-03	5.88E-01	3.4E-05	2.68E+04	2.44E+04
dibromobenzene, 1,4-	106-37-6	87	2.00E+01	D	2700	D	8.93E-04	D	0.0677	B	5.60E-06	B	3.66E-02	1.62E+01	8.1E-06	2.44E+04	4.99E+04
dibromochloromethane	124-48-1	-20	2.60E+03	N	63.1	N	7.80E-04	L	0.0196	B	1.05E-05	B	3.20E-02	3.79E-01	6.9E-05	1.87E+04	1.71E+04
dibromoethane, 1,2- (EDB)	106-93-4	10	4.20E+03	L	44	C	7.40E-04	L	0.0856	C	1.05E-05	B	3.03E-02	2.64E-01	3.7E-04	8.04E+03	7.34E+03
dicamba	1918-00-9	115	5.60E+03	L	4.4	D	7.90E-09	L	0.0886	B	7.80E-06	B	3.24E-07	2.64E-02	4.0E-07	1.09E+05	2.23E+05
dichloroacetic acid	79-43-6	-4	8.36E+04	O	75	D	6.80E-08	D	0.127	B	1.07E-05	B	2.79E-06	4.50E-01	1.6E-07	1.75E+05	3.57E+05
dichloroacetonitrile	3018-12-0	NF	NF		12.9	D	3.79E-06	D	0.135	B	1.09E-05	B	1.55E-04	7.74E-02	6.7E-06	2.69E+04	5.50E+04
dichlorobenzene, 1,2-	95-50-1	-17	1.56E+02	N	379	N	1.90E-03	N	0.0690	N	7.90E-06	N	7.79E-02	2.27E+00	1.2E-04	6.35E+03	1.30E+04
dichlorobenzene, 1,3-	541-73-1	-25	1.23E+02	L	498	L	3.10E-03	L	0.0414	B	8.85E-06	B	1.27E-01	2.99E+00	9.0E-05	7.33E+03	1.50E+04
dichlorobenzene, 1,4-	106-46-7	53	7.38E+01	N	616	N	2.43E-03	L	0.0690	N	7.90E-06	N	9.96E-02	3.70E+00	9.6E-05	1.59E+04	1.45E+04
dichlorobenzidine, 3,3-	91-94-1	133	3.11E+00	N	724	N	4.00E-09	N	0.0194	N	6.74E-06	N	1.64E-07	4.34E+00	9.7E-09	1.58E+06	1.44E+06
dichlorodifluoromethane	75-71-8	-158	2.80E+02	D	200	D	3.40E-01	L	0.0509	B	1.08E-05	B	1.39E+01	1.20E+00	9.6E-03	7.10E+02	1.45E+03
dichloroethane, 1,1-	75-34-3	-97	5.06E+03	N	53.4	N	5.62E-03	N	0.0742	N	1.05E-05	N	2.30E-01	3.20E-01	2.0E-03	1.57E+03	3.20E+03
dichloroethane, 1,2- (EDC)	107-06-2	-36	8.52E+03	N	38	N	9.79E-04	N	0.1040	N	9.90E-06	N	4.01E-02	2.28E-01	6.6E-04	6.04E+03	5.51E+03
dichloroethene, 1,1-	75-35-4	-123	2.25E+03	N	65	N	2.61E-02	N	0.0900	N	1.04E-05	N	1.07E+00	3.90E-01	7.4E-03	1.81E+03	1.65E+03
dichloroethene, cis-1,2-	156-59-2	-80	3.50E+03	N	35.5	N	4.08E-03	N	0.0736	N	1.13E-05	N	1.67E-01	2.13E-01	1.9E-03	1.59E+03	3.25E+03
dichloroethene, trans-1,2-	156-60-5	-50	6.30E+03	N	38	N	9.38E-03	N	0.0707	N	1.19E-05	N	3.85E-01	2.28E-01	3.6E-03	1.16E+03	2.36E+03
dichlorophenol, 2,3-	576-24-9	57	NF		426	D	4.77E-07	D	0.103	B	8.67E-06	B	1.96E-05	2.56E+00	6.1E-08	2.81E+05	5.74E+05
dichlorophenol, 2,4-	120-83-2	45	4.50E+03	N	159	N	3.16E-06	N	0.0346	N	8.77E-06	N	1.30E-04	9.54E-01	2.8E-07	1.32E+05	2.69E+05
dichlorophenol, 2,5	583-78-8	58	NF		610	D	4.77E-07	D	0.103	B	8.67E-06	B	1.96E-05	3.66E+00	4.3E-08	3.35E+05	6.83E+05
dichlorophenol, 2,6-	87-65-0	64	2.63E+03	D	270	D	4.77E-07	D	0.103	B	8.67E-06	B	1.96E-05	1.62E+00	9.4E-08	2.26E+05	4.62E+05
dichlorophenol, 3,4-	95-77-2	67	9.26E+03	D	1300	D	4.77E-07	D	0.103	B	8.67E-06	B	1.96E-05	7.80E+00	2.1E-08	4.85E+05	9.91E+05

Chemical-Specific Values

Chemical Name	Values from Reference Sources												Calculated Values***				
	CAS #	MP	S(mg/L)		Koc(cm^3/g)		H(atm-m^3/mol)		Di (cm^2/s)**		Dw (cm^2/s)**		H Prime	K_d (cm^3/g)*	Da (cm^2/s)	Residential Volatilization Factor	Industrial Volatilization Factor (m^3/kg)
dichlorophenoxy acetic acid, 2,4-	94-75-7	141	6.20E+02	L	20	N	1.00E-08	L	0.2440	B	6.84E-06	B	4.10E-07	1.20E-01	2.2E-07	1.48E+05	3.02E+05
dichloropropane, 1,2-	78-87-5	-70	2.80E+03	N	47	N	2.80E-03	L	0.0782	N	8.73E-06	N	1.15E-01	2.82E-01	1.2E-03	4.52E+03	4.12E+03
dichloropropene, 1,3-	542-75-6	-84	2.80E+03	N	27	N	1.77E-02	N	0.0626	N	1.00E-05	N	7.26E-01	1.62E-01	6.1E-03	2.00E+03	1.82E+03
dichlorprop	120-36-5	117	8.25E+02	D	50	D	1.22E-08	D	0.0812	B	7.08E-06	B	5.00E-07	3.00E-01	1.7E-08	1.21E+06	1.10E+06
dichlorvos	62-73-7	NF	1.60E+04	L	28	E	1.50E-03	L	0.0232	B	7.33E-06	B	6.15E-02	1.68E-01	2.7E-04	4.22E+03	8.62E+03
dicofol	115-32-2	78	1.30E+00	L	3950	D	2.43E-07	D	0.0534	B	4.70E-06	B	9.96E-06	2.37E+01	2.4E-09	1.41E+06	2.87E+06
dieldrin	60-57-1	176	1.95E-01	N	25500	N	1.51E-05	L	0.0125	N	4.74E-06	N	6.19E-04	1.53E+02	2.9E-09	2.90E+06	2.64E+06
diethylene glycol, monoethyl ether	111-90-0	-90	1.00E+06	K	12	D	4.86E-08	B	0.0524	B	8.02E-06	B	1.99E-06	7.20E-02	3.3E-07	1.21E+05	2.48E+05
diethylphthalate	84-66-2	-41	1.08E+03	N	82.2	N	4.50E-07	N	0.0265	N	6.35E-06	N	1.85E-05	4.93E-01	1.1E-07	2.08E+05	4.25E+05
diisopropyl methylphosphonate	1445-75-6	NF	1.60E+05	D	31	D	3.88E-06	D	0.0822	B	6.63E-06	B	1.59E-04	1.86E-01	2.6E-06	4.33E+04	8.83E+04
dimethoate	60-51-5	52	2.50E+04	L	20	D	6.20E-11	L	0.0231	B	6.74E-06	B	2.54E-09	1.20E-01	1.9E-07	1.58E+05	3.22E+05
dimethrin	70-38-2	NF	NF		30200	D	7.60E-05	D	0.0598	B	5.05E-06	B	3.11E-03	1.81E+02	5.5E-08	2.97E+05	6.06E+05
dimethylaniline, 2,4-	95-68-1	-14	1.45E+03	D	200	D	2.50E-06	D	0.0606	B	8.43E-06	B	1.03E-04	1.20E+00	3.0E-07	2.86E+05	2.61E+05
dimethylformamide, N,N-	68-12-2	-61	1.00E+06	K	7	D	1.91E-07	B	0.0939	B	1.03E-05	B	7.82E-06	4.20E-02	7.4E-07	8.11E+04	1.65E+05
dimethylphenol, 2,4-	105-67-9	26	7.87E+03	N	209	N	2.00E-06	N	0.0584	N	8.69E-06	N	8.20E-05	1.25E+00	2.3E-07	1.45E+05	2.97E+05
dimethylphenol, 2,6-	576-26-1	45	5.90E+03	D	248	D	4.90E-06	D	0.115	B	9.15E-06	B	2.01E-04	1.49E+00	8.1E-07	7.71E+04	1.57E+05
dimethylphenol, 3,4-	95-65-8	65	5.10E+03	D	214	D	4.41E-07	D	0.0589	B	8.59E-06	B	1.81E-05	1.28E+00	8.0E-08	2.45E+05	5.01E+05
dimethylphthalate	131-11-3	6	4.19E+03	N	46	N	5.78E-07	N	0.0570	N	7.14E-06	B	2.37E-05	2.76E-01	3.1E-07	1.25E+05	2.54E+05
dinitrobenzene, 1,2- (o)	528-29-0	118	2.60E-01	K	29.5	D	2.30E-06	D	0.107	B	9.19E-06	B	9.43E-05	1.77E-01	2.1E-06	4.75E+04	9.70E+04
dinitrobenzene, 1,3- (m)	99-65-0	90	8.60E+02	K	24.5	D	2.30E-07	L	0.0318	B	9.15E-06	B	9.43E-06	1.47E-01	3.0E-07	1.27E+05	2.59E+05
dinitrophenol, 2,4-	51-28-5	112	2.79E+03	N	0.8	N	4.43E-07	N	0.0273	N	9.06E-06	N	1.82E-05	4.80E-03	8.0E-07	7.77E+04	1.59E+05
dinitrotoluene, 2,4-	121-14-2	71	2.70E+02	N	96	N	9.26E-08	N	0.2030	N	7.26E-06	N	3.80E-06	5.76E-01	1.3E-07	4.33E+05	3.95E+05
dinitrotoluene, 2,6-	606-20-2	66	1.82E+02	N	69	N	7.47E-07	N	0.0327	N	7.26E-06	N	3.06E-05	4.14E-01	1.9E-07	3.54E+05	3.23E+05
dinoseb	88-85-7	40	5.20E+01	L	2820	C	4.60E-07	L	0.0218	B	6.51E-06	B	1.89E-05	1.69E+01	3.7E-09	1.14E+06	2.33E+06
dioxane, 1,4-	123-91-1	12	1.00E+06	L	17	D	4.80E-06	L	0.092	B	1.05E-05	B	1.97E-04	1.02E-01	5.1E-06	6.88E+04	6.28E+04
dioxin (2,3,7,8-TCDD)	1746-01-6	295	7.90E-06	L	4570000	C	7.90E-05	L	0.0126	B	6.82E-06	B	3.24E-03	2.74E+04	8.1E-11	1.73E+07	1.58E+07
diphenamid	957-51-7	135	2.60E+02	D	210	D	2.42E-11	D	0.156	B	1.82E-05	B	9.92E-10	1.26E+00	8.5E-08	2.38E+05	4.87E+05
diphenylhydrazine, 1,2-	122-66-7	131	6.80E+01	L	950	D	1.50E-06	L	0.0321	B	7.24E-06	B	6.15E-05	5.70E+00	2.6E-08	9.64E+05	8.80E+05
disulfoton	298-04-4	-25	1.60E+01	L	2130	C	6.00E-06	L	0.0661	B	5.67E-06	B	2.46E-04	1.28E+01	7.0E-08	2.63E+05	5.36E+05
diuron	330-54-1	158	4.20E+01	L	400	D	1.46E-09	D	0.0726	B	6.10E-06	B	5.99E-08	2.40E+00	1.6E-08	5.57E+05	1.14E+06
endosulfan	115-29-7	106	5.10E-01	N	2040	N	1.12E-05	L	0.0115	N	4.55E-06	N	4.59E-04	1.22E+01	2.5E-08	4.39E+05	8.95E+05
endothall	145-73-3	144	2.10E+04	L	2	D	2.60E-10	L	0.0822	B	7.16E-06	B	1.07E-08	1.20E-02	4.1E-07	1.09E+05	2.23E+05
endrin	72-20-8	392	2.50E-01	N	10800	N	7.52E-06	L	0.0125	N	4.74E-06	N	3.08E-04	6.48E+01	3.6E-09	1.15E+06	2.36E+06
epichlorohydrin	106-89-8	-26	6.60E+04	L	123	L	3.00E-05	L	0.143	B	1.11E-05	B	1.23E-03	7.38E-01	1.1E-05	4.64E+04	4.24E+04
ethion	563-12-2	-13	6.00E-01	L	15400	D	1.26E-06	D	0.0578	B	5.10E-06	B	5.19E-05	9.24E+01	2.1E-09	1.53E+06	3.12E+06
ethoprop	13194-48-4	20	7.50E+02	D	102	D	1.62E-07	D	0.0705	B	5.94E-06	B	6.64E-06	6.12E-01	8.8E-08	2.34E+05	4.79E+05
ethoxyethanol acetate, 2-	111-15-9	-62	2.29E+05	D	5	D	1.80E-06	D	0.102	B	7.98E-06	B	7.38E-05	3.00E-02	3.5E-06	3.73E+04	7.61E+04

Chemical-Specific Values

Chemical Name	Values from Reference Sources												Calculated Values***				
	CAS #	MP	S(mg/L)		Koc(cm^3/g)		H(atm-m^3/mol)		Di (cm^2/s)**		Dw (cm^2/s)**		H Prime	K_d (cm^3/g)*	Da (cm^2/s)	Residential Volatilization Factor	Industrial (m^3/kg)
ethoxyethanol, 2-	110-80-5	-70	1.00E+06	L	16	D	1.25E-07	L	0.131	B	9.76E-06	B	5.13E-06	9.60E-02	5.0E-07	9.85E+04	2.01E+05
ethyl acetate	141-78-6	-84	8.00E+04	L	5	D	1.40E-04	L	0.132	B	9.70E-06	B	5.74E-03	3.00E-02	3.1E-04	3.96E+03	8.09E+03
ethyl acrylate	140-88-5	-71	1.50E+04	D	22	D	3.05E-04	D	0.122	B	9.12E-06	B	1.25E-02	1.32E-01	3.5E-04	8.37E+03	7.64E+03
ethyl chloride	75-00-3	-139	5.71E+03	L	88	D	8.80E-03	D	0.1670	B	1.19E-05	B	3.61E-01	5.28E-01	4.6E-03	2.29E+03	2.09E+03
ethyl dipropylthiocarbamate, S- (EP	759-94-4	NF	3.65E+02	D	208	D	2.26E-05	D	0.0786	B	6.35E-06	B	9.27E-04	1.25E+00	2.9E-06	4.08E+04	8.33E+04
ethyl ether	60-29-7	-116	5.70E+04	L	73	D	3.30E-02	L	0.135	B	9.36E-06	B	1.35E+00	4.38E-01	1.2E-02	6.27E+02	1.28E+03
ethyl methacrylate	97-63-2	-75	3.70E+03	L	271	D	8.40E-04	L	0.11	B	8.38E-06	B	3.44E-02	1.63E+00	1.2E-04	6.44E+03	1.31E+04
ethyl p-nitrophenyl phenylphosporo	2104-64-5	36	3.10E+00	D	1321	D	1.30E-07	D	0.0621	B	5.47E-06	B	5.33E-06	7.93E+00	6.5E-09	8.61E+05	1.76E+06
ethylbenzene	100-41-4	-95	1.69E+02	N	204	N	7.88E-03	N	0.0750	N	7.80E-06	N	3.23E-01	1.22E+00	9.3E-04	2.28E+03	4.65E+03
ethylene diamine	107-15-3	9	1.00E+06	D	5	D	7.08E-08	D	0.174	B	1.22E-05	B	2.90E-06	3.00E-02	8.0E-07	7.76E+04	1.59E+05
ethylene glycol	107-21-1	-13	1.00E+06	L	4	D	6.00E-08	L	0.185	B	1.36E-05	B	2.46E-06	2.40E-02	8.9E-07	7.37E+04	1.50E+05
ethylene oxide	75-21-8	-111	1.00E+06	K	16	D	1.48E-04	D	0.219	B	1.45E-05	B	6.07E-03	9.60E-02	3.6E-04	8.21E+03	7.49E+03
fenamiphos	22224-92-6	49	4.00E+02	D	207	D	7.76E-10	D	0.0616	B	5.33E-06	B	3.18E-08	1.24E+00	2.5E-08	4.37E+05	8.93E+05
fenamiphos metabolites	NCASRN	NF	4.00E+02	Q	1675	D	7.48E-10	D	0.0619	B	5.36E-06	B	3.07E-08	1.01E+01	3.4E-09	1.20E+06	2.45E+06
fensulfothion	115-90-2	NF	2.00E+03	E	91	D	1.38E-10	E	0.0625	B	5.45E-06	B	5.66E-09	5.43E-01	5.4E-08	3.00E+05	6.12E+05
fluometuron	2164-17-2	163	9.00E+01	D	187	D	1.45E-09	D	0.0811	B	7.04E-06	B	5.95E-08	1.12E+00	3.7E-08	3.63E+05	7.40E+05
fluoranthene	206-44-0	108	2.06E-01	N	49096	N	1.60E-05	L	0.0302	N	6.35E-06	N	6.56E-04	2.95E+02	3.7E-09	1.14E+06	2.32E+06
fluorene	86-73-7	115	1.98E+00	N	7707	N	6.36E-05	L	0.0363	N	7.88E-06	N	2.61E-03	4.62E+01	1.1E-07	2.00E+05	4.28E+05
fluoride	16984-58-8	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
fonofos	944-22-9	NF	1.30E+01	D	870	D	5.24E-06	D	0.0717	B	6.10E-06	B	2.15E-04	5.22E+00	1.6E-07	1.73E+05	3.53E+05
formaldehyde	50-00-0	109	5.50E+05	L	2.2	F	3.40E-07	L	0.453	B	2.05E-05	B	1.39E-05	1.32E-02	4.1E-06	7.66E+04	6.99E+04
furan	110-00-9	-86	1.00E+04	L	128	D	5.40E-03	L	0.138	B	1.16E-05	B	2.21E-01	7.68E-01	1.8E-03	1.64E+03	3.36E+03
furfural	98-01-1	-37	1.00E+05	L	20	D	4.00E-06	L	0.0777	B	1.07E-05	B	1.64E-04	1.20E-01	3.4E-06	3.78E+04	7.71E+04
glycidaldehyde	765-34-4	-62	1.00E+06	L	10	D	5.10E-07	L	0.168	B	1.26E-05	B	2.09E-05	6.00E-02	1.7E-06	5.38E+04	1.10E+05
guthion	86-50-0	74	2.09E+01	E	404	D	9.49E-08	D	0.0667	B	5.96E-06	B	3.89E-06	2.42E+00	2.0E-08	4.86E+05	9.92E+05
HCH, alpha	319-84-6	96	2.00E+00	N	1790	N	1.06E-05	L	0.0142	N	7.34E-06	N	4.35E-04	1.07E+01	3.5E-08	8.36E+05	7.63E+05
HCH, beta-	319-85-7	NF	2.40E-01	N	2140	N	7.43E-07	L	0.0142	N	7.34E-06	N	3.05E-05	1.28E+01	5.4E-09	2.12E+06	1.94E+06
HCH, delta-	319-86-8	142	3.10E+01	L	2300	L	4.30E-07	L	0.0142	Q	7.34E-06	Q	1.76E-05	1.38E+01	4.3E-09	1.06E+06	2.16E+06
HCH, gamma- (lindane)	58-89-9	113	6.80E+00	N	1350	N	1.40E-05	N	0.0142	N	7.34E-06	N	5.74E-04	8.10E+00	5.9E-08	6.42E+05	5.86E+05
heptachlor	76-44-8	96	1.80E-01	N	9528	N	1.48E+00	N	0.0112	N	5.69E-06	N	6.07E+01	5.72E+01	5.3E-04	6.78E+03	6.19E+03
heptachlor epoxide	1024-57-3	160	2.00E-01	N	83200	N	9.50E-06	N	0.0132	N	4.23E-06	N	3.90E-04	4.99E+02	6.0E-10	6.34E+06	5.79E+06
hexachlorobenzene	118-74-1	232	6.20E+00	N	80000	N	1.32E-03	L	0.0542	N	5.91E-06	N	5.41E-02	4.80E+02	3.3E-07	2.73E+05	2.49E+05
hexachlorobutadiene	87-68-3	-21	3.23E+00	N	53700	N	8.15E-03	N	0.0561	N	6.16E-06	N	3.34E-01	3.22E+02	3.1E-06	8.84E+04	8.07E+04
hexachlorocyclopentadiene	77-47-4	10	1.80E+00	N	200000	N	2.70E-02	N	0.0161	N	7.12E-06	N	1.11E+00	1.20E+03	7.9E-07	7.82E+04	1.60E+05
hexachloroethane	67-72-1	187	5.00E+01	N	1780	N	3.89E-03	N	0.0025	N	6.80E-06	N	1.59E-01	1.07E+01	2.0E-06	4.96E+04	1.01E+05
hexahydro-1,3,5-trinitro-1,3,5-triazi	121-82-4	206	6.00E+01	D	93	D	6.30E-08	D	0.0943	B	8.50E-06	B	2.58E-06	5.58E-01	1.0E-07	4.88E+05	4.45E+05
hexane, n-	110-54-3	-95	1.20E+01	L	3150	C	1.40E-02	L	0.1150	B	8.16E-06	B	5.74E-01	1.89E+01	1.8E-04	5.12E+03	1.05E+04

Chemical-Specific Values

Chemical Name	Values from Reference Sources												Calculated Values***				
	CAS #	MP	S(mg/L)		Koc(cm^3/g)		H(atm-m^3/mol)		Di (cm^2/s)**		Dw (cm^2/s)**		H Prime	K_d (cm^3/g)*	Da (cm^2/s)	Residential Volatilization Factor (m^3/kg)	Industrial Factor (m^3/kg)
hexanone, 2- (methyl butyl ketone)	591-78-6	-57	1.60E+03	L	78	E	9.57E-05	E	0.077	B	8.44E-06	B	3.92E-03	4.68E-01	2.8E-05	1.31E+04	2.66E+04
hexazinone	51235-04-2	116	3.30E+04	D	3830	D	3.00E-09	D	0.0730	B	6.28E-06	B	1.23E-07	2.30E+01	1.7E-09	1.66E+06	3.39E+06
hydroquinone	123-31-9	172	7.00E+04	D	30	D	1.32E-09	D	0.0685	B	9.04E-06	B	5.41E-08	1.80E-01	2.1E-07	1.53E+05	3.13E+05
indeno(1,2,3-cd)pyrene	193-39-5	162	2.20E-05	N	3470000	N	1.60E-06	N	0.0190	N	5.66E-06	N	6.56E-05	2.08E+04	4.9E-12	7.02E+07	6.40E+07
iron	7439-89-6	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
isobutyl alcohol	78-83-1	-108	8.50E+04	L	5.6	F	1.20E-05	L	0.142	B	1.00E-05	B	4.92E-04	3.36E-02	2.8E-05	1.31E+04	2.67E+04
isophorone	78-59-1	-8	1.20E+04	N	46.8	N	6.64E-06	N	0.0623	N	6.76E-06	N	2.72E-04	2.81E-01	2.5E-06	9.87E+04	9.01E+04
lead	7439-92-1	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
linuron	330-55-2	94	8.10E+01	D	400	D	6.07E-08	D	0.0483	B	3.74E-06	B	2.49E-06	2.40E+00	1.2E-08	6.33E+05	1.29E+06
lithium	7439-93-2	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
magnesium	7439-95-4	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
malathion	121-75-5	3	1.43E+02	L	1268	D	4.90E-09	L	0.0148	B	5.24E-06	B	2.01E-07	7.61E+00	4.3E-09	1.06E+06	2.16E+06
maleic hydrazide	123-33-1	53	6.00E+03	L	191	D	6.60E-03	L	0.142	B	1.19E-05	B	2.71E-01	1.15E+00	1.6E-03	1.75E+03	3.58E+03
malonitrile	109-77-3	33	1.33E+05	D	6.6	D	1.27E-08	D	0.173	B	1.26E-05	B	5.21E-07	3.96E-02	6.1E-07	8.91E+04	1.82E+05
maneb	12427-38-2	NF	6.00E+00	D	2000	D	4.36E-09	D	0.0858	B	7.89E-06	B	1.79E-07	1.20E+01	4.2E-09	1.07E+06	2.19E+06
manganese	7439-96-5	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
mercury	7438-97-6	NF	5.60E-02	A	26000	O	1.14E-02	N	0.031	N	6.30E-06	N	4.67E-01	1.56E+02	4.9E-06	3.1E+04	6.4E+04
merphos	150-50-5	NF	1.16E+01	D	62000	D	2.27E-05	D	0.048	B	4.97E-06	B	9.31E-04	3.72E+02	6.5E-09	8.64E+05	1.76E+06
merphos oxide	78-48-8	-25	1.16E+01	D	30000	D	2.94E-07	D	0.0579	B	4.98E-06	B	1.21E-05	1.80E+02	3.8E-10	3.56E+06	7.26E+06
methacrylonitrile	126-98-7	-36	2.50E+04	L	18	D	2.50E-04	L	0.153	B	1.06E-05	B	1.03E-02	1.08E-01	4.0E-04	3.48E+03	7.11E+03
methamidophos	10265-92-6	45	2.00E+06	D	4	D	8.70E-10	D	0.111	B	9.16E-06	B	3.57E-08	2.40E-02	4.7E-07	1.01E+05	2.07E+05
methanol	67-56-1	-98	1.00E+06	L	0.2	F	4.50E-06	L	0.458	B	1.64E-05	B	1.85E-04	1.20E-03	4.5E-05	1.03E+04	2.11E+04
methidathion	950-37-8	40	2.50E+02	D	32	D	7.17E-09	D	0.0701	B	6.28E-06	B	2.94E-07	1.92E-01	1.4E-07	1.86E+05	3.79E+05
methomyl	16752-77-5	78	5.80E+04	L	1.88	C	3.80E-02	L	0.0362	B	8.36E-06	B	1.56E+00	1.13E-02	7.4E-03	8.09E+02	1.65E+03
methoxy-5-nitroaniline, 2-	99-59-2	118	2.21E+03	D	107	D	1.25E-08	D	0.0949	B	7.85E-06	B	5.13E-07	6.42E-01	7.1E-08	5.85E+05	5.34E+05
methoxychlor	72-43-5	87	4.50E-02	N	80000	N	1.68E-05	L	0.0156	N	4.46E-06	N	6.89E-04	4.80E+02	1.2E-09	2.02E+06	4.13E+06
methyl acetate	79-20-9	-98	2.40E+05	D	17	D	1.15E-04	D	0.123	B	1.10E-05	B	4.72E-03	1.02E-01	1.5E-04	5.64E+03	1.15E+04
methyl acrylate	96-33-3	-77	4.90E+04	D	11	D	1.44E-07	B	0.0976	B	1.02E-05	B	5.90E-06	6.60E-02	5.8E-07	9.17E+04	1.87E+05
methyl isobutyl ketone (MIBK)	108-10-1	-84	2.04E+04	E	63	D	1.09E-04	D	0.1140	B	8.38E-06	B	4.47E-03	3.78E-01	5.7E-05	9.23E+03	1.88E+04
methyl methylacrylate	80-62-6	-48	1.50E+04	L	87	D	3.40E-04	L	0.123	B	9.25E-06	B	1.39E-02	5.22E-01	1.5E-04	5.76E+03	1.18E+04
methyl parathion	298-00-0	38	6.00E+01	C	460	C	2.23E-06	B	0.0187	B	6.44E-06	B	9.14E-05	2.76E+00	4.6E-08	3.24E+05	6.61E+05
methyl styrene (mixed)	25013-15-4	-77	8.90E+01	D	370	D	1.92E-03	D	0.106	B	8.08E-06	B	7.87E-02	2.22E+00	1.9E-04	5.04E+03	1.03E+04
methyl styrene, alpha	98-83-9	-23	5.60E+02	D	860	D	5.28E-04	D	0.107	B	8.18E-06	B	2.17E-02	5.16E+00	2.3E-05	1.44E+04	2.93E+04
methyl tert-butyl ether	1634-04-4	-109	3.66E+04	A	11	A	5.87E-04	A	0.1030	B	1.05E-05	B	2.41E-02	6.60E-02	7.7E-04	2.50E+03	5.11E+03
methyl-4-chlorophenoxy acetic acid	94-74-6	120	8.25E+02	D	54	D	1.89E-09	D	0.0942	B	8.23E-06	B	7.75E-08	3.24E-01	1.2E-07	1.97E+05	4.03E+05
methylaniline, 2-	95-53-4	-16	1.70E+04	L	145	D	2.70E-06	L	0.12	B	9.18E-06	B	1.11E-04	8.70E-01	7.9E-07	1.75E+05	1.60E+05
methylene bis(2-chloroaniline), 4,4'-	101-14-4	110	1.40E+01	L	4810	D	4.10E-11	L	0.0749	B	6.61E-06	B	1.68E-09	2.89E+01	1.4E-09	4.09E+06	3.73E+06

Table 3a

Chemical-Specific Values

Chemical Name	Values from Reference Sources												Calculated Values***				
	CAS #	MP	S(mg/L)		Koc(cm^3/g)		H(atm-m^3/mol)		Di (cm^2/s)**		Dw (cm^2/s)**		H Prime	K_d (cm^3/g)*	Da (cm^2/s)	Residential Volatilization Factor	Industrial (m^3/kg)
methylene bromide	74-95-3	-53	1.20E+04	L	25	D	8.60E-04	L	0.127	B	1.19E-05	B	3.53E-02	1.50E-01	9.3E-04	2.28E+03	4.66E+03
methylene chloride	75-09-2	-95	1.30E+04	N	10	N	2.20E-03	L	0.1010	N	1.17E-05	N	9.02E-02	6.00E-02	2.7E-03	2.98E+03	2.72E+03
methylnaphthalene, 1-	90-12-0	-22	2.58E+01	I	1883	D	7.10E-04	B	0.0990	B	7.80E-06	B	2.91E-02	1.13E+01	1.3E-05	1.90E+04	3.87E+04
methylnaphthalene, 2-	91-57-6	34	2.50E+01	L	7940	C	5.20E-04	L	0.0480	B	7.84E-06	B	2.13E-02	4.76E+01	1.1E-06	6.51E+04	1.33E+05
methylphenol, 2- (o-cresol)	95-48-7	30	2.60E+04	N	91.2	N	1.20E-06	N	0.0740	N	8.30E-06	N	4.92E-05	5.47E-01	3.8E-07	1.13E+05	2.30E+05
methylphenol, 3- (m-cresol)	108-39-4	12	3.10E+04	N	92.5	F	8.70E-07	N	0.0693	B	9.30E-06	B	3.57E-05	5.55E-01	2.9E-07	1.29E+05	2.63E+05
methylphenol, 4- (p-cresol)	106-44-5	36	3.10E+04	N	92.5	F	7.90E-07	N	0.0740	B	5.00E-05	B	3.24E-05	5.55E-01	6.8E-07	8.44E+04	1.72E+05
metolachlor	51218-45-2	NF	5.30E+02	D	205	D	9.00E-09	D	0.064	B	5.48E-06	B	3.69E-07	1.23E+00	2.7E-08	4.22E+05	8.62E+05
metribuzin	21087-64-9	126	1.20E+03	L	60	D	8.80E-02	L	0.0834	B	7.13E-06	B	3.61E+00	3.60E-01	1.4E-02	5.87E+02	1.20E+03
mevinphos	7786-34-7	NF	6.00E+05	D	44	D	3.90E-09	D	0.0792	B	6.75E-06	B	1.60E-07	2.64E-01	1.2E-07	2.01E+05	4.11E+05
molinate	2212-67-1	NF	8.80E+02	D	2138	D	4.10E-06	D	0.0976	B	8.43E-06	B	1.68E-04	1.28E+01	7.2E-08	2.60E+05	5.30E+05
molybdenum	7439-98-7	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
naled	300-76-5	27	2.00E+03	D	119	D	4.99E-09	D	0.0680	B	6.43E-06	B	2.05E-07	7.14E-01	5.1E-08	3.08E+05	6.28E+05
naphthalene	91-20-3	80	3.10E+01	N	1191	N	4.80E-04	L	0.0590	N	7.50E-06	N	1.97E-02	7.15E+00	8.5E-06	2.38E+04	4.86E+04
nickel	7440-02-0	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
nickel (refinery dust)	7440-02-0	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
nickel subsulfide	12035-72-2	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
nitrate	14797-55-8	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
nitrite	14797-65-0	71	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
nitroaniline, o-	88-74-4	147	2.90E+02	P	59	D	3.43E-07	D	0.0429	B	9.81E-06	B	1.41E-05	3.54E-01	2.1E-07	1.53E+05	3.11E+05
nitroaniline, p-	100-01-6	6	7.30E+02	L	54	D	2.10E-09	L	0.0431	B	9.75E-06	B	8.61E-08	3.24E-01	1.5E-07	1.82E+05	3.71E+05
nitrobenzene	98-95-3	114	2.09E+03	N	119	N	2.40E-05	L	0.0760	N	8.60E-06	N	9.84E-04	7.14E-01	5.0E-06	3.12E+04	6.37E+04
nitrophenol, 4-	100-02-7	114	1.20E+04	L	38	D	4.20E-10	L	0.118	B	9.94E-06	B	1.72E-08	2.28E-01	1.9E-07	1.58E+05	3.23E+05
nitroso-di-ethylamine, N-	55-18-5	NF	9.30E+04	L	43	D	3.60E-06	L	0.121	B	9.13E-06	B	1.48E-04	2.58E-01	2.8E-06	9.27E+04	8.46E+04
nitroso-di-n-butylamine, N-	621-64-7	NF	1.30E+03	L	263	D	3.20E-04	L	0.0868	B	6.83E-06	B	1.31E-02	1.58E+00	3.6E-05	2.59E+04	2.36E+04
nitroso-di-n-propylamine, N-	621-64-7	NF	9.89E+03	N	24	N	2.25E-06	N	0.0545	N	8.17E-06	N	9.23E-05	1.44E-01	1.3E-06	1.36E+05	1.24E+05
nitroso-dimethylamine, N-	62-75-9	NF	1.00E+06	L	12	D	1.20E-06	L	0.1570	B	1.15E-05	B	4.92E-05	7.20E-02	2.8E-06	9.28E+04	8.47E+04
nitroso-diphenylamine, N-	86-30-6	67	3.51E+01	N	1293	N	5.00E-06	N	0.0312	N	7.19E-06	N	2.05E-04	7.76E+00	4.9E-08	3.14E+05	6.40E+05
nitroso-N-methylethylamine, N-	10595-95-6	NF	2.00E+04	L	39	D	4.25E-07	D	0.138	B	1.03E-05	B	4.92E-05	7.20E-02	2.8E-06	2.05E+05	1.87E+05
nitrotoluene, m-	99-08-1	16	4.98E+02	D	143	D	7.50E-05	D	0.107	B	8.65E-06	B	3.08E-03	8.58E-01	1.8E-05	1.62E+04	3.31E+04
nitrotoluene, o-	88-72-2	-10	6.52E+02	D	275	D	5.60E-05	D	0.108	B	8.67E-06	B	2.30E-03	1.65E+00	7.5E-06	2.53E+04	5.17E+04
nitrotoluene, p-	99-99-0	51	4.42E+02	D	309	D	5.00E-05	D	0.105	B	8.41E-06	B	2.05E-03	1.85E+00	5.9E-06	2.86E+04	5.84E+04
octamethylpyrophosphoramide	152-16-9	17	1.00E+06	L	7	D	6.30E-17	D	0.064	B	5.50E-06	B					
oxamyl	23135-22-0	NF	2.80E+05	D	13	D	2.37E-10	D	0.0718	B	5.91E-06	B	9.72E-09	7.80E-02	2.1E-07	1.51E+05	3.09E+05
paraquat	1910-42-5	NF	1.00E+06	O	508000	D	1.00E-09	D	0.0899	B	7.54E-06	B	4.10E-08	3.05E+03	1.6E-11	1.76E+07	3.58E+07
parathion	56-38-2	6	6.50E+00	L	3980	C	5.70E-07	L	0.0666	B	5.82E-06	B	2.34E-05	2.39E+01	5.0E-09	9.84E+05	2.01E+06
PCBs	1336-36-3	NF	7.00E-02	L	309000	N	1.81E-04	I	0.0127	N	5.39E-06	B	7.42E-03	1.85E+03	2.7E-09	2.98E+06	2.72E+06

Chemical-Specific Values

Chemical Name	Values from Reference Sources												Calculated Values***				
	CAS #	MP	S(mg/L)		Koc(cm^3/g)		H(atm-m^3/mol)		Di (cm^2/s)**		Dw (cm^2/s)**		H Prime	K_d (cm^3/g)*	Da (cm^2/s)	Residential Volatilization Factor (m^3/kg)	Industrial Volatilization Factor (m^3/kg)
pebulate	1114-71-2	NF	6.00E+01	D	460	D	1.56E-04	D	0.0745	B	6.05E-06	B	6.40E-03	2.76E+00	8.9E-06	2.33E+04	4.76E+04
pendimethalin	40487-42-1	56	3.00E-01	D	5720	D	3.70E-05	D	0.0662	B	5.22E-06	B	1.52E-03	3.43E+01	1.6E-07	1.76E+05	3.59E+05
pentachlorobenzene	608-93-5	86	1.30E+00	L	13812	D	7.10E-04	L	0.0873	B	7.95E-06	B	2.91E-02	8.29E+01	1.6E-06	5.44E+04	1.11E+05
pentachloronitrobenzene	82-68-8	144	5.50E-01	L	21000	D	3.80E-04	L	0.0759	B	6.92E-06	B	1.56E-02	1.26E+02	5.0E-07	2.20E+05	2.01E+05
pentachlorophenol	87-86-5	174	1.95E+03	N	19953	N	2.44E-08	N	0.056	N	6.10E-06	N	1.00E-06	1.20E+02	3.5E-10	8.34E+06	7.61E+06
permethrin	52645-53-1	34	4.00E-02	D	63100	D	2.51E-08	D	0.0528	B	4.69E-06	B	1.03E-06	3.79E+02	8.6E-11	7.49E+06	1.53E+07
phenanthrene	85-01-8	99	1.20E+00	L	14000	C	2.30E-05	L	0.0543	C	7.48E-06	B	9.43E-04	8.40E+01	3.3E-08	3.83E+05	7.82E+05
phenmedipham (betanal)	13684-63-4	139	4.70E+00	D	2400	D	8.41E-13	D	0.0288	B	2.16E-06	B	3.40E-11	1.44E+01	9.4E-10	2.26E+06	4.62E+06
phenol	108-95-2	41	8.28E+04	N	28.8	N	3.97E-07	N	0.0820	N	9.10E-06	N	1.63E-05	1.73E-01	4.7E-07	1.01E+05	2.07E+05
phenylenediamine, m-	108-45-2	64	2.60E+06	L	16	D	1.40E-10	L	0.12	B	9.19E-06	B	5.74E-09	9.60E-02	3.0E-07	1.27E+05	2.60E+05
phenylenediamine, o-	95-54-5	103	4.07E+04	D	29	D	7.20E-09	D	0.12	B	9.19E-06	B	2.95E-07	1.74E-01	2.2E-07	3.32E+05	3.03E+05
phenylenediamine, p-	106-50-3	153	3.80E+04	D	16	D	6.70E-10	D	0.12	B	9.19E-06	B	2.75E-08	9.60E-02	3.0E-07	1.27E+05	2.60E+05
phenylphenol, 2-	90-43-7	55	7.00E+02	D	860	D	5.23E-08	D	0.0944	B	7.82E-06	B	2.14E-06	5.16E+00	1.1E-08	1.45E+06	1.32E+06
phorate	298-02-2	-43	5.00E+01	L	513	C	5.47E-06	C	0.0205	B	5.89E-06	B	2.24E-04	3.08E+00	8.9E-08	2.33E+05	4.76E+05
phosmet	732-11-6	72	2.44E+01	D	820	D	8.38E-09	D	0.0569	B	4.88E-06	B	3.44E-07	4.92E+00	6.4E-09	8.71E+05	1.78E+06
phthalic acid, p-	100-21-0	NF	1.50E+01	D	290	D	3.88E-03	D	0.106	B	9.04E-06	B	1.59E-01	1.74E+00	4.8E-04	3.18E+03	6.49E+03
phthalic anhydride	85-44-9	131	6.20E+03	L	36	D	1.60E-08	L	0.115	B	9.75E-06	B	6.56E-07	2.16E-01	2.1E-07	1.52E+05	3.11E+05
prometon	1610-18-0	91	7.50E+02	D	524	D	2.30E-09	D	0.074	B	6.19E-06	B	9.43E-08	3.14E+00	1.2E-08	6.29E+05	1.28E+06
prometryn	7287-19-6	119	4.05E+01	D	1710	D	6.61E-09	D	0.0726	B	6.16E-06	B	2.71E-07	1.03E+01	3.9E-09	1.12E+06	2.28E+06
propachlor	1918-16-7	67	6.13E+02	D	84	D	1.09E-07	D	0.0821	B	6.96E-06	B	4.47E-06	5.04E-01	1.1E-07	2.14E+05	4.37E+05
propanil	709-98-8	85	5.00E+02	O	149	D	4.50E-09	D	0.0746	B	6.19E-06	B	1.85E-07	8.94E-01	4.0E-08	3.47E+05	7.07E+05
propazine	139-40-2	213	5.00E+00	D	726	D	1.27E-09	D	0.0752	B	6.36E-06	B	5.21E-08	4.36E+00	9.1E-09	7.29E+05	1.49E+06
propylene glycol	57-55-6	-59	1.00E+06	K	0.125	F	1.31E-10	D	0.0301	B	1.54E-06	B	5.37E-09	8.00E-04	9.7E-08	2.23E+05	4.56E+05
propylene glycol monomethyl ether	107-98-2	-96	4.05E+05	D	0.21	D	1.81E-08	D	0.133	B	9.96E-06	B	7.42E-07	1.30E-03	6.8E-07	8.46E+04	1.73E+05
propylene oxide	75-56-9	-112	4.05E+05	D	3.6	D	8.30E-05	D	0.173	B	1.19E-05	B	3.40E-03	2.16E-02	2.6E-04	9.69E+03	8.85E+03
pydrin	51630-58-1	150	1.00E+00	D	10936	D	1.19E-07	D	0.0498	B	4.45E-06	B	4.88E-06	6.56E+01	6.3E-10	2.78E+06	5.67E+06
pyrene	129-00-0	151	1.40E-01	L	67992	N	1.10E-05	L	0.0272	N	7.24E-06	N	4.51E-04	4.08E+02	1.7E-09	1.68E+06	3.43E+06
pyridine	110-86-1	-42	1.00E+06	L	3.02	C	8.90E-06	L	0.0901	C	1.09E-05	B	3.65E-04	1.81E-02	1.5E-05	1.77E+04	3.62E+04
resmethrin	10453-86-8	43	1.00E+00	D	5.15	D	5.56E-06	D	0.0525	B	4.49E-06	B	2.28E-04	3.09E-02	5.1E-06	3.08E+04	6.30E+04
ronnel	299-84-3	41	1.10E+00	L	8333	D	3.20E-05	D	0.0661	B	5.91E-06	B	1.31E-03	5.00E+01	9.3E-08	2.28E+05	4.66E+05
selenium	7782-49-2	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
silver	7440-22-4	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
simazine	122-34-9	NF	5.00E+00	D	1170	D	3.24E-10	D	0.0867	B	7.37E-06	B	1.33E-08	7.02E+00	6.6E-09	1.92E+06	1.75E+06
strontium	7440-24-6	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
strychnine	57-24-9	287	1.00E+02	L	267	D	7.00E-14	L	0.0626	B	5.58E-06	B	3.00E-12	1.60E+00	2.1E-08	4.82E+05	9.84E+05
styrene	100-42-5	-31	3.10E+02	N	912	N	2.75E-03	L	0.0710	N	8.00E-06	N	1.13E-01	5.47E+00	7.6E-05	7.97E+03	1.63E+04
terbacil	5902-51-2	175	7.10E+02	D	46	D	2.90E-07	D	0.0836	B	7.18E-06	B	1.19E-05	2.76E-01	2.6E-07	1.36E+05	2.77E+05

Chemical-Specific Values

Chemical Name	Values from Reference Sources												Calculated Values***				
	CAS #	MP	S(mg/L)		Koc(cm^3/g)		H(atm-m^3/mol)		Di (cm^2/s)**		Dw (cm^2/s)**		H Prime	K_s (cm^3/g)*	Da (cm^2/s)	Residential Volatilization Factor	Industrial Factor (m^3/kg)
terbufos	13071-79-9	-29	1.50E+01	D	2400	D	2.40E-05	D	0.0628	B	5.39E-06	B	9.84E-04	1.44E+01	2.3E-07	1.45E+05	2.96E+05
tetrachlorobenzene, 1,2,4,5-	95-94-3	140	5.90E-01	L	7579	D	2.60E-03	L	0.097	B	8.75E-06	B	1.07E-01	4.55E+01	1.2E-05	2.00E+04	4.09E+04
tetrachloroethane, 1,1,1,2-	630-20-6	-70	2.90E+03	L	153	D	2.40E-03	L	0.0315	B	9.30E-06	B	9.84E-02	9.18E-01	1.6E-04	1.23E+04	1.12E+04
tetrachloroethane, 1,1,2,2-	79-34-5	-44	2.97E+03	N	79	N	3.50E-04	L	0.0710	N	7.90E-06	N	1.44E-02	4.74E-01	9.3E-05	1.61E+04	1.47E+04
tetrachloroethene (PCE)	127-18-4	-22	2.00E+02	N	265	N	1.84E-02	L	0.0720	N	8.20E-06	N	7.54E-01	1.59E+00	1.6E-03	3.91E+03	3.57E+03
tetrachlorophenol, 2,3,4,6-	58-90-2	70	1.00E+02	L	6190	N	4.40E-06	L	0.0918	B	8.31E-06	B	1.80E-04	3.71E+01	2.5E-08	4.39E+05	8.96E+05
tetraethyl dithiopyrophosphate	3689-24-5	88	2.50E+01	L	740	D	7.20E-09	B	0.0604	B	5.28E-06	B	2.95E-07	4.44E+00	7.6E-09	7.98E+05	1.63E+06
thallium	7440-28-0	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
thiobencarb	28249-77-6	3	2.80E+01	D	900	D	2.67E-07	D	0.069	B	5.89E-06	B	1.10E-05	5.40E+00	1.4E-08	5.85E+05	1.20E+06
thiram	137-26-8	156	3.00E+01	L	670	D	1.82E-07	D	0.0766	B	6.59E-06	B	7.46E-06	4.02E+00	1.8E-08	5.25E+05	1.07E+06
tin	7440-31-5	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
toluene	108-88-3	-95	5.26E+02	N	140	N	6.60E-03	L	0.0870	N	8.70E-06	N	2.71E-01	8.40E-01	1.3E-03	1.95E+03	3.98E+03
toluidine, p-	106-49-0	44	6.64E+06	D	442	D	7.22E-06	D	0.118	B	8.98E-06	B	2.96E-04	2.65E+00	7.0E-07	1.86E+05	1.70E+05
toxaphene	8001-35-2	NF	7.40E-01	N	257000	N	6.00E-06	N	0.0116	N	4.34E-06	N	2.46E-04	1.54E+03	1.2E-10	1.44E+07	1.32E+07
triallate	2303-17-5	29	4.00E+00	D	2220	D	1.93E-05	D	0.0647	B	5.67E-06	B	7.91E-04	1.33E+01	2.1E-07	1.53E+05	3.13E+05
tributyltin oxide	56-35-9	NF	4.00E+00	D	908000	D	1.27E-07	D	0.0391	B	3.61E-06	B	5.21E-06	5.45E+03	6.2E-12	2.79E+07	5.70E+07
trichloro-1,2,2-trifluoroethane, 1,1,2	76-13-1	-35	1.70E+02	N	225	D	4.80E-01	B	0.0275	B	8.59E-06	B	1.97E+01	1.35E+00	5.6E-03	9.32E+02	1.90E+03
trichloroacetic acid	76-03-9	58	1.20E+06	D	1	D	2.40E-08	D	0.11	B	9.50E-06	B	9.84E-07	6.00E-03	6.2E-07	8.81E+04	1.80E+05
trichlorobenzene, 1,2,3-	87-61-6	54	6.57E+00	I	2287	D	7.87E-03	B	0.0966	B	8.23E-06	B	3.23E-01	1.37E+01	1.3E-04	6.11E+03	1.25E+04
trichlorobenzene, 1,2,4-	120-82-1	17	3.00E+02	N	1659	N	1.42E-03	N	0.0300	N	8.23E-06	N	5.82E-02	9.95E+00	9.3E-06	2.29E+04	4.67E+04
trichlorobenzene, 1,3,5-	108-70-3	63	5.80E+00	D	4300	D	1.90E-03	D	0.101	B	8.78E-06	B	7.79E-02	2.58E+01	1.6E-05	1.73E+04	3.53E+04
trichloroethane, 1,1,1-	71-55-6	-30	1.33E+03	N	135	N	1.72E-02	N	0.0780	N	8.80E-06	N	7.05E-01	8.10E-01	2.8E-03	1.31E+03	2.68E+03
trichloroethane, 1,1,2-	79-00-5	-37	4.42E+03	N	75	N	9.13E-04	N	0.0780	N	8.80E-06	N	3.74E-02	4.50E-01	2.8E-04	9.31E+03	8.50E+03
trichloroethene (TCE)	79-01-6	-85	1.10E+03	N	94	N	1.03E-02	N	0.0790	N	9.10E-06	N	4.22E-01	5.64E-01	2.4E-03	3.18E+03	2.90E+03
trichlorofluoromethane	75-69-4	-111	1.10E+03	L	159	C	9.70E-02	L	0.0870	B	9.70E-06	B	3.98E+00	9.54E-01	1.0E-02	6.89E+02	1.41E+03
trichlorophenol, 2,4,5-	95-95-4	69	1.20E+03	N	2380	N	4.33E-06	N	0.0985	B	8.69E-06	B	1.78E-04	1.43E+01	2.2E-08	4.66E+05	9.52E+05
trichlorophenol, 2,4,6-	88-06-2	69	8.00E+02	N	1070	N	7.79E-06	N	0.0318	N	6.25E-06	N	3.19E-04	6.42E+00	8.9E-08	5.21E+05	4.76E+05
trichlorophenoxy acetic acid	93-76-5	153	2.70E+02	L	194	D	9.41E-11	D	0.0854	B	7.76E-06	B	3.86E-09	1.16E+00	3.9E-08	3.52E+05	7.19E+05
trichlorophenoxy proprionic acid	93-72-1	182	3.10E+01	D	2600	D	7.80E-11	L	0.0687	B	5.92E-06	B	3.20E-09	1.56E+01	2.4E-09	1.42E+06	2.90E+06
trichloropropane, 1,1,2-	598-77-6	-15	1.75E+03	D	72	D	4.10E-04	D	0.111	B	9.24E-06	B	1.68E-02	4.32E-01	1.9E-04	5.11E+03	1.04E+04
trichloropropane, 1,2,3-	96-18-4	-15	1.80E+03	L	72	D	4.10E-04	L	0.111	B	9.24E-06	B	1.68E-02	4.32E-01	1.9E-04	1.14E+04	1.04E+04
trichloropropene, 1,2,3-	96-19-5	NF	NF		130	D	1.80E-02	D	0.112	B	9.41E-06	B	7.38E-01	7.80E-01	4.3E-03	1.06E+03	2.16E+03
trifluralin	1582-09-8	49	8.10E+00	L	866	D	2.60E-05	L	0.0611	B	5.41E-06	B	1.07E-03	5.20E+00	6.6E-07	1.91E+05	1.75E+05
trimethyl phosphate	512-56-1	-46	5.00E+05	D	7.6	D	7.20E-09	D	0.108	B	8.79E-06	B	2.95E-07	4.56E-02	3.9E-07	2.47E+05	2.26E+05
trimethylbenzene, 1,2,3-	526-73-8	-44	5.70E+01	D	720	D	5.83E-03	D	0.1050	B	8.02E-06	B	2.39E-01	4.32E+00	3.0E-04	4.02E+03	8.20E+03
trimethylbenzene, 1,2,4-	95-63-6	-44	5.70E+01	C	271	C	6.16E-03	C	0.0642	C	7.92E-06	B	2.53E-01	1.63E+00	4.9E-04	3.15E+03	6.43E+03
trimethylbenzene, 1,3,5-	108-67-8	-45	2.69E+01	D	661	C	1.43E-02	B	0.0648	C	7.85E-06	B	5.86E-01	3.97E+00	4.8E-04	3.16E+03	6.45E+03

Chemical-Specific Values

Chemical Name	Values from Reference Sources												Calculated Values***				
	CAS #	MP	S(mg/L)		Koc(cm^3/g)		H(atm-m^3/mol)		Di (cm^2/s)**		Dw (cm^2/s)**		H Prime	K_d (cm^3/g)*	Da (cm^2/s)	Residential Volatilization Factor (m^3/kg)	Industrial Volatilization Factor (m^3/kg)
trinitrobenzene, 1,3,5-	99-35-4	122	3.50E+02	L	660	D	1.60E-08	L	0.0884	B	7.69E-06	B	6.56E-07	3.96E+00	1.3E-08	6.15E+05	1.26E+06
trinitrophenylmethylnitramine	479-45-8	130	2.00E-02	D	406	D	1.00E-11	D	0.0743	B	6.67E-06	B	4.10E-10	2.44E+00	1.7E-08	5.38E+05	1.10E+06
trinitrotoluene, 2,4,6-	118-96-7	80	1.20E+02	L	1600	D	4.90E-09	L	0.089	B	7.92E-06	B	2.01E-07	9.60E+00	5.3E-09	2.14E+06	1.95E+06
TRPH	See Appendix C: Technical Basis for the TRPH Soil Cleanup Target Levels																
uranium	7440-61-1	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
vanadium	7440-62-2	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
vanadium pentoxide	1314-62-1	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
vernam	1929-77-7	NF	9.00E+01	D	370	D	3.05E-05	D	0.0744	B	6.04E-06	B	1.25E-03	1.99E+00	2.4E-06	4.48E+04	9.15E+04
vinyl acetate	108-05-4	-93	2.00E+04	N	5.25	N	5.10E-04	L	0.0850	N	9.20E-06	N	2.09E-02	3.15E-02	7.0E-04	2.63E+03	5.36E+03
vinyl chloride	75-01-4	-154	2.76E+03	N	18.6	N	2.70E-02	L	0.1060	N	1.23E-06	N	1.11E+00	1.12E-01	1.5E-02	1.28E+03	1.17E+03
white phosphorous	7723-14-0	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
xylenes	1330-20-7	-20	1.75E+02	N	249	N	6.70E-03	L	0.0780	N	8.75E-06	N	2.75E-01	1.49E+00	7.0E-04	2.64E+03	5.38E+03
zinc	7440-66-6	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
zinc phosphide	1314-84-7	NF	n/a		n/a		n/a		n/a		n/a		n/a	n/a	n/a	n/a	n/a
zineb	12122-67-7	NF	1.00E+01	D	1230	D	2.72E-09	J	0.08	B	7.27E-06	B	1.12E-07	7.38E+00	6.2E-09	8.81E+05	1.80E+06

* = K_d values listed are calcualted as K_{oc} multiplied by an f_{oc} of 0.006 (for volatilization). For leachability calculations, K_d should be calculated as K_{oc} multiplied by an foc of 0.002.

A = ATSDR Toxicant Profile

B = CHEMDAT8 (EPA/453/C-94/080B) or WATER8 Model (EPA/453/C-94/080C) or calculated using the methodology described in the databases.

C = Electronic Handbook of Risk Assessment Values (EHRAV)

D = Hazardous Substance Data Base (HSDB)

E = Howard, P.H., Handbook of Environmental Fate and Exposure Data

F = K_{oc} calculated using Equation 70 [log K_{oc} = 0.00028 + (0.983*log K_{ow})] in the USEPA 1996 SSG.

G = K_{oc} calculated using Equation 4-5 (log K_{oc} = -0.55 log S + 3.64) in: Lyman, W.J. et al., Handbook of Chemical Property Estimation Methods, 1990.

H = K_{oc} calculated using Equation 71 (log K_{oc} = 0.0784 + (0.7919 X log K_{ow})) in the USEPA 1996 SSG. Equation specific for VOC's, chlorinated benzenes, and some chlorinated pesticides.

I = Mackay, D. et al., Illustrated Handbook of Physical-Chemical Properties and Environmental Fate for Organic Chemicals

J = HLC calculated using Equation 68 [HLC = (VP)(M)/(S)] in the USEPA 1996 SSG

K = Merck Index, 11th Edition, 1989

L = Superfund Chemical Database Matrix

M = Total Petroleum Hydrocarbon Criteria Work Group, 1997

N = USEPA 1996 Soil Screening Guidance (EPA/540/R-95/128) Note: Some information for Aroclor Mixture (PCBs), carbazole, di-n-butylphthalate, and dimethylphthalate is from the USEPA Draft 1994 Soil Screening Guidance when unavailable in USEPA 1996.

O = Verschueren, K. (1996) Handbook of Environmental Data on Organic Chemicals, 3rd Edition.

Q = Assumed to equal 250,000 L/kg based on data from HSDB which indicate immobility in soil

**For most compounds the D_{air} or D_{water} was derived from the CHEMDAT8 or WATER8. These were calculated using chemical-specific values for density and molecular weight. In some cases, CHEMDAT8/WATER8 does not contain a chemical-specific density value and assumes a default density value of 1 g/m The use of this default density value can result in under- or overestimation of the diffusivity, particularly when the difference between the default and actual density values is large. For compounds without substantial volatility this will not significantly impact the resulting SCTLs chemical-specific factors. In the case of volatile calculated using these estimated compounds (i.e., Henry's Law Constant of ≥ 10-2) actual chemical-specific density values should be used, when available, to estimate diffusivity in order to avoid errors in SCTL development.

Chemical-Specific Values

Chemical Name	Values from Reference Sources							Calculated Values***				
	CAS #	MP	S(mg/L)	Koc(cm^3/g)	H(atm-m^3/mol)	Di (cm^2/s)**	Dw (cm^2/s)**	H Prime	K_d (cm^3/g)*	Da (cm^2/s)	Residential Volatilization Factor (m^3/kg)	Industrial

NF= Not found

n/a = Not applicable

Notes:

Except as noted otherwise, H values are from SCDM: Superfund Chemical Data Matrix (EPA/540/R-96/028), June 1996, selected in the same order of preference as outlined in the SCDM.

Koc values from the EPA Soil Screening Guidance: Technical Background Document (EPA/540/R-95/128), May 1996 are geometric mean values when available. Values selected from Tables 38 and 39 with preference for the geometric mean over the calculated value.

*VFs for residential SCTLs based on exposure duration of 30 years for carcinogens and 6 years for non-carcinogens.

***All Calculations are carried out to 18 decimal places, Da values have rounded to two significant figures and VF values have been rounded to three significant figures for presentation in this table.

Table 3b
Groundwater Cleanup Target Levels for Chapter 62-785, F.A.C.

		A		B	C		D	
Chemical Name	Chemical Abstract Registry Number CAS #	Groundwater Criteria (ug/L)	Basis for A	Freshwater Surface Water Criteria (ug/L)e	Marine Surface Water Criteria (ug/L)e	Basis for B & C	Groundwater of Low Yield/Poor Quality Criteria (ug/L)	Target Organ/System or Effect
2,3,7,8-TCDD [or dioxin]	1746-01-6	0.00003	P/C	ND	ND		0.0003	carcinogen
acenaphthene	83-32-9	20	MC/O	3	3	TC	200	liver
acenaphthylene	208-96-8	210	MC/ST	0.031 annual average	0.031 annual average	N	2100	decreased body weight, liver
acephate	30560-19-1	7.5	PQL/C	190	190	TC	75	carcinogen
acetone	67-64-1	700	MC/ST	1692	1692	TC	7000	central nervous system, kidney, liver
acetonitrile	75-05-8	500	PQL/ST	19983	19983	TC	5000	blood, liver
acetophenone	98-86-2	700	MC/ST	7750	7750	TC	7000	none observed
acifluorfen, sodium [or Blazer]	62476-59-9	1	HAL/ST	190	190	TC	10	increased mortality, kidney
acrolein	107-02-8	20	O/ST	0.4	0.4	TC	200	respiratory (nasal epithelium)
acrylamide	79-06-1	1	PQL/C	5.98	5.98	HH	10	carcinogen
acrylic acid	79-10-7	3500	MC/ST	NA	NA		35000	decreased offspring weight
acrylonitrile	107-13-1	5	PQL/C	49.9	49.9	HH	50	carcinogen
alachlor	15972-60-8	2	P/C	0.596	0.596	HH	20	carcinogen
aldicarb	116-06-3	7	MC/ST	0.85	0.85	TC	70	central nervous system
aldicarb sulfone	1646-88-4	7	MC/ST	46	46	TC	70	central nervous system
aldicarb sulfoxide	1646-87-3	7	HAL/ST	4.2	4.2	TC	70	central nervous system
aldrin	309-00-2	0.005	PQL/C	0.00014 annual average; 3.0 max.	0.00014 annual average; 1.3 max.	N	0.05	carcinogen
ally [or metsulfuron-methyl]	74223-64-6	1750	MC/ST	NA	NA		17500	decreased body weight
allyl alcohol	107-18-6	250	PQL/ST	5	5	TC	2500	kidney, liver
allyl chloride	107-05-1	35	MC/ST	NA	NA		350	nerve damage
aluminum	7429-90-5	200	S/	13	13	TC	2000	altered body weight
aluminum phosphide (as Al)	20859-73-8	50	PQL/ST	6.5	6.5	TC	500	body weight and clinical parameters
ametryn	834-12-8	63	MC/ST	6.2	6.2	TC	630	liver
ammonia	7664-41-7	2800	MC/ST	20	NA	N	28000	sensory (taste threshold)
ammonium sulfamate	7773-06-0	1400	MC/ST	10150	10150	TC	14000	decreased body weight
anilazine	101-05-3	100	PQL/ST	NA	NA		1000	OPP RfD
aniline	62-53-3	6.1	MC/C	4	4	TC	61	carcinogen
anthracene	120-12-7	2100	MC/ST	0.3	0.3	TC	21000	no observed effects
antimony	7440-36-0	6	P/ST	4300	4300	N	60	blood
antimony pentoxide (as Sb)	1314-60-9	3.5	MC/ST	NA	NA		35	blood, increased mortality
antimony potassium tartrate (as Sb)	304-61-0	6.3	MC/ST	NA	NA		63	blood, increased mortality
antimony tetroxide (as Sb)	1332-81-6	2.8	MC/ST	NA	NA		28	blood, increased mortality

Table 3b
Groundwater Cleanup Target Levels for Chapter 62-785, F.A.C.

		A		B	C		D	
Chemical Name	Chemical Abstract Registry Number CAS #	Groundwater Criteria (ug/L)	Basis for A	Freshwater Surface Water Criteria (ug/L)c	Marine Surface Water Criteria (ug/L)c	Basis for B & C	Groundwater of Low Yield/Poor Quality Criteria (ug/L)	Target Organ/System of Effect
antimony trioxide (as Sb)	1309-64-4	2.8	MC/ST	3	3	TC	28	blood, increased mortality
aramite	140-57-8	10	PQL/C	3	3	TC	100	carcinogen
Aroclor [or polychlorinated biphenyls (PCBs)]	1336-36-3	0.5	P/C	0.000045 annual average; 0.014 max.	0.000045 annual average; 0.03 max.	N	5	carcinogen
arsenic	7440-38-2	50	P/C	50	50	N	500	carcinogen
atrazine	1912-24-9	3	P/C	1.8	1.8	HH	30	carcinogen
azobenzene	103-33-3	4	PQL/C	0.559	0.559	HH	40	carcinogen
barium	7440-39-3	2000	P/ST	*b*	*b*	#	20000	increased blood pressure
baygon [or propoxur]	114-26-1	5	PQL/ST	0.35	0.35	TC	50	blood, central nervous system
bayleton	43121-43-3	210	MC/ST	500	500	TC	2100	blood, decreased weight gain
baythroid	68359-37-5	175	MC/ST	0.015	0.015	TC	1750	decreased body weight, kidney
bendiocarb	22781-23-3	35	MC/ST	NA	NA		350	blod, eyes
benefin	1861-40-1	2100	MC/ST	40	40	TC	21000	blood
benomyl	17804-35-2	35	MC/ST	0.3	0.3	TC	350	decreased offspring weights
bensulide	741-58-2	46.2	MC/ST	NA	NA		462	OPP RfD
bentazon	25057-89-0	210	MC/ST	NA	NA		2100	blood
benzaldehyde	100-52-7	700	MC/ST	53.5	53.5	TC	7000	kidney, stomach
benzene	71-43-2	1	P/C	71.28 annual average	71.28 annual average	N	10	carcinogen
benzenethiol	108-98-5	20	PQL/ST	NA	NA		200	liver
benzidine	92-87-5	400	PQL/C	NA	NA		4000	carcinogen
benzo(a)anthracene	56-55-3	0.2	PQL/C	0.031 annual average	0.031 annual average	N	2	carcinogen
benzo(a)pyrene	50-32-8	0.2	P/C	0.031 annual average	0.031 annual average	N	2	carcinogen
benzo(b)fluoranthene	205-99-2	0.2	PQL/C	0.031 annual average	0.031 annual average	N	2	carcinogen
benzo(g,h,i)perylene	191-24-2	210	MC/ST(a)	0.031 annual average	0.031 annual average	N	2100	central nervous system
benzo(k)fluoranthene	207-08-9	0.5	MC/C	0.031 annual average	0.031 annual average	N	5	carcinogen
benzoic acid	65-85-0	28000	MC/ST	9000	9000	TC	280000	none observed
benzotrichloride	98-07-7	0.06	PQL/C	0.0029	0.0029	HH	0.6	carcinogen
benzyl alcohol	100-51-6	2100	MC/ST	500	500	TC	21000	eye, stomach
benzyl chloride	100-44-7	0.5	PQL/C	2.95	2.95	HH	5	carcinogen

Table 3b
Groundwater Cleanup Target Levels for Chapter 62-785, F.A.C.

Chemical Name	Chemical Abstract Registry Number CAS #	A Groundwater Criteria (ug/L)	Basis for A	B Freshwater Surface Water Criteria (ug/L)f	C Marine Surface Water Criteria (ug/L)f	Basis for B & C	D Groundwater of Low Yield/Poor Quality Criteria (ug/L)	Target Organ/System of Effect
beryllium	7440-41-7	4	P/C	0.13 annual average	0.13 annual average	N	40	carcinogen
beta radiation		4 mrem/year	P	NA	NA			NA
betanal [or phenmedipham]	13684-63-4	1750	MC/ST	199	199	TC	17500	no adverse effects
bidrin [or dicrotophos]	141-66-2	1	MDL/ST	21.5	21.5	TC	10	decreased offspring survival
bioallethrin	28057-48-9	35	MC/ST	NA	NA		350	alteration of clinical chemistries, liver
biphenyl, 1,1- [or diphenyl]	92-52-4	0.5	O/ST	18	18	TC	5	kidney
bis(2-chloro-1-methylethyl)ether	108-06-1	10	PQL/C	0.5	0.5	HH	100	carcinogen
bis(2-chloroethyl)ether	111-44-4	4	PQL/C	9.99	9.99	HH	40	carcinogen
bis(2-chloroisopropyl)ether	39638-32-9	280	MC/C	7	7	HH	2800	blood
bis(2-ethylhexyl)adipate	103-23-1	400	P/C	NA	NA		4000	carcinogen
bis(2-ethylhexyl)phthalate	117-81-7	6	P/C	0.02	0.02	HH	60	carcinogen
bisphenol A	80-05-7	350	MC/ST	55	55	TC	3500	decreased body weight
Blazer [or acifluorfen, sodium]	62476-59-9	1	HAL/ST	190	190	TC	10	increased mortality, kidney
boron	7440-42-8	630	HAL/ST	NA	NA		6300	male reproductive, respiratory
bromacil	314-40-9	91	HAL/ST	97	97	TC	910	decreased body weight
bromochloromethane	74-97-5	91	HAL/ST	NA	NA		910	NA
bromodichloromethane	75-27-4	1	PQL/C	22 annual average	22 annual average	N	10	carcinogen
bromoform	75-25-2	4.4	MC/C	360 annual average	360 annual average	N	44	carcinogen
bromomethane [or methyl bromide]	74-83-9	9.8	MC/ST	35	35	TC	98	stomach
bromophenyl phenyl ether, 4-	101-55-3	406	MC/ST	NA	NA		4060	REG III RfD
bromoxynil	1689-84-5	140	MC/ST	NA	NA		1400	none observed
bromoxynil octanoate	1689-99-2	140	MC/ST	NA	NA		1400	none observed
butanol, 1-	71-36-3	700	MC/ST	25000	25000	TC	7000	central nervous system
butanone, 2- [or MEK]	78-93-3	4200	MC/ST	120000	120000	TC	42000	fetus
butyl acetate, n-	123-86-4	43	O/	1000	1000	TC	430	organoleptic
butyl benzyl phthalate, N-	85-68-7	140	MC/ST	25.5	25.5	TC	1400	liver
butylate	2008-41-5	350	MC/ST	10.5	10.5	TC	3500	liver
butylphthalyl butylglycolate	85-70-1	7000	MC/ST	NA	NA		70000	none observed
cacodylic acid (as As)	75-60-5	21	MC/ST	850	850	TC	210	calculated by analogy to arsenic
cadmium	7440-43-9	5	P/C	*a*	9.3	N	50	kidney, liver/carcinogen
calcium cyanide	592-01-8	280	MC/ST	NA	NA		2800	nerve damage, thyroid, weight loss
captafol	2425-06-1	100	PQL/C	0.85	0.85	TC	1000	carcinogen
captan	133-06-2	250	PQL/C	1.9	1.9	TC	2500	carcinogen

Table 3b
Groundwater Cleanup Target Levels for Chapter 62-785, F.A.C.

		A		B	C		D	
Chemical Name	Chemical Abstract Registry Number CAS #	Groundwater Criteria (ug/L)	Basis for A	Freshwater Surface Water Criteria (ug/L)/	Marine Surface Water Criteria (ug/L)/	Basis for B & C	Groundwater of Low Yield/Poor Quality Criteria (ug/L)	Target Organ/System or Effect
carbaryl	63-25-2	700	MC/ST	0.06	0.06	TC	7000	kidney, liver
carbazole	86-74-8	4	PQL/C	46.5	46.5	TC	40	carcinogen
carbofuran	1563-66-2	40	P/ST	0.1	0.1	TC	400	blood, reproductive
carbon disulfide	75-15-0	700	MC/ST	105	105	TC	7000	fetus
carbon tetrachloride	56-23-5	3	P/C	4.42 annual average	4.42 annual average	N	30	carcinogen
carbophenothion	786-19-6	0.9	MC/ST	0.1	0.1	TC	9	blood, central nervous system
carboxin	5234-68-4	700	MC/ST	60	60	TC	7000	decreased body weight, increased mortality, organ weight changes
chloral	75-87-6	14	MC/ST	NA	NA		140	liver
chloramben	133-90-4	105	MC/ST	NA	NA		1050	liver
chlordane	57-74-9	2	P/C	0.00059 annual average; 0.0043 max.	0.00059 annual average; 0.004 max.	N	20	carcinogen
chloride	16887-00-6	250000	S/	NA	*b*	N	2500000	NA
chlorine	7782-50-5	700	MC/ST	10	10	N	7000	none observed
chlorine cyanide	506-77-4	350	MC/ST	1.45	1.45	TC	3500	none observed
chlorite	7758-19-2	100	PQL/ST	29	29	TC	1000	neurobehavioral
chloro-1,3-butadiene [or Chloroprene]	126-99-8	140	MC/ST	NA	NA		1400	respiratory (olfactory epithelium)
chloro-3-methyl phenol, 4- [or chloro-m-cresol, p-]	59-50-7	63	MC/ST	100	100	TC	630	decreased weight gain
chloro-m-cresol, p- [or 4-chloro-3-methyl phenol]	59-50-7	63	MC/ST	NA	NA		630	brain
chloroacetic acid	79-11-8	14	MC/ST	NA	NA		140	heart
chloroaniline, 4-	106-47-8	28	MC/ST	2.5	2.5	TC	280	spleen
chlorobenzene	108-90-7	100	P/ST	17	17	TC	1000	kidney, liver
chlorobenzilate	510-15-6	0.4	PQL/C	0.09	0.09	HH	4	carcinogen
chlorodibromomethane [or dibromochloromethane]	124-48-1	0.4	MC/C	34 annual average	34 annual average	N	4	carcinogen
chloroethane [or ethyl chloride]	75-00-3	12	MC/C	NA	NA		120	carcinogen
chloroethylvinylether, 2-	110-75-8	175	MC/ST	NA	NA		1750	NA
chloroform	67-66-3	5.7	MC/C	470.8 annual average	470.8 annual average	N	57	carcinogen
chloromethane	74-87-3	2.7	MC/C	470.8 annual average	470.8 annual average	N	27	carcinogen
chloronaphthalene, beta-	91-58-7	560	MC/ST	NA	NA		5600	liver, respiratory

Table 3b
Groundwater Cleanup Target Levels for Chapter 62-785, F.A.C.

		A		B	C		D	
Chemical Name	Chemical Abstract Registry Number CAS #	Groundwater Criteria (ug/L)	Basis for A	Freshwater Surface Water Criteria (ug/L)/	Marine Surface Water Criteria (ug/L)/	Basis for B &C	Groundwater of Low Yield/Poor Quality Criteria (ug/L)	Target Organ/System or Effect
chloronitrobenzene, o-	88-78-3	1.4	MC/C	NA	NA		14	carcinogen
chloronitrobenzene, p-	100-00-5	250	PQL/C	107	107	TC	2500	carcinogen
chlorophenol, 2-	95-57-8	35	MC/ST	130	130	TC	350	reproductive
chlorophenol, 3-	108-43-0	10	PQL/O(f)	173.5	173.5	TC	100	reproductive
chlorophenol, 4-	106-48-9	5.5	PQL/O(f)	175	175	TC	55	reproductive
chloropicrin	76-06-2	7.3	O/	NA	NA		73	organoleptic
chloroprene [or chloro-1,3-butadiene]	126-99-8	140	MC/ST	NA	NA		1400	respiratory (olfactory epithelium)
chlorothalonil	1897-45-6	3.2	MC/C	0.8	0.8	TC	32	carcinogen
chlorotoluene, o-	95-49-8	140	MC/ST	390	390	TC	1400	decreased body weight
chlorotoluene, p-	106-43-4	140	HAL/ST	NA	NA		1400	decreased body weight
chlorpropham	101-21-3	1400	MC/ST	190	190	TC	14000	bone marrow, kidney, liver, spleen
chlorpyrifos	2921-88-2	21	MC/ST	0.002	0.002	TC	210	blood
chlorpyrifos-methyl	5598-13-0	70	MC/ST	0.035	0.035	TC	700	decreased fertility
chlorsulfuron	64902-72-3	350	MC/ST	16	16	TC	3500	decreased body weight
chromium III	16065-83-1	100	P/ST	*a*	515	##	1000	none observed
chromium VI	18540-29-9	100	P/C	11	50	N	1000	carcinogen
chromium, total		100	P/	NA	NA		1000	carcinogen
chrysene	218-01-9	4.8	MC/C	0.031 annual average	0.031 annual average	N	48	carcinogen
cobalt	7440-48-4	420	MC/ST	NA	NA		4200	NA
copper	7440-50-8	1000	S/ST	*a*	2.9	N	10000	NA
copper cyanide	544-92-3	35	MC/ST	NA	NA		350	decreased body and organ weight, kidney, liver
coumaphos	56-72-4	1.8	MC/ST	0.004	0.004	TC	18	blood
crotonaldehyde	123-73-9	0.02	MC/C	NA	NA		0.2	carcinogen
cumene [or isopropyl benzene]	98-82-8	0.8	O/ST	255	255	TC	8	kidney
cyanazine	21725-46-2	0.5	PQL/C	5.5	5.5	TC	5	carcinogen
cyanide	57-12-5	200	P/ST	5.2	1	N	2000	central nervous system, thyroid
cyanogen	460-19-5	10000	PQL/ST	NA	NA		100000	decreased body weight, nerve damage, thyroid
cycloate	1134-23-2	35	MC/ST	130	130	TC	.350	nerve damage
cyclohexanone	108-94-1	35000	MC/ST	26350	26350	TC	350000	decreased body weight
cyclohexylamine	108-91-8	5000	PQL/ST	4000	4000	TC	50000	decreased weight gain, testis
cypermethrin	52315-07-8	7	MC/ST	0.0005	0.0005	TC	70	GI disturbances
dacthal [or DCPA]	1861-32-1	70	MC/ST	310	310	TC	700	kidney, liver, lung, thyroid
dalapon	75-99-0	200	P/ST	5000	5000	TC	2000	kidney

Table 3b
Groundwater Cleanup Target Levels for Chapter 62-785, F.A.C.

		A		B	C		D	
Chemical Name	Chemical Abstract Registry Number CAS #	Groundwater Criteria (ug/L)	Basis for A	Freshwater Surface Water Criteria (ug/L)/	Marine Surface Water Criteria (ug/L)/	Basis for B & C	Groundwater of Low Yield/Poor Quality Criteria (ug/L)	Target Organ/System or Effect
DBCP [or dibromo-3-chloropropane, 1,2-]	96-12-8	0.2	P/C	NA	NA		2	carcinogen
DCPA [or dacthal]	1861-32-1	70	MC/ST	310	310	TC	700	kidney, liver, lung, thyroid
DDD, 4,4'-	72-54-8	0.1	MC/C	0.003	0.003	HH	1	carcinogen
DDE, 4,4'-	72-55-9	0.1	MC/C	0.0006	0.0006	HH	1	carcinogen
DDT, 4,4'-	50-29-3	0.1	MC/C	0.00059 annual average; 0.001 max.	0.00059 annual average; 0.001 max.	N	1	carcinogen
decabromodiphenyl ether	1163-19-5	7	MC/ST	NA	NA		70	carcinogen
DEET	134-62-3	6300	MC/ST	NA	NA		63000	decreased body weight
demeton	8065-48-3	0.5	PQL/ST	1.35	1.35	TC	5	blood, optic nerve
di(2-ethylhexyl)adipate	103-23-1	400	P/C	33	33	TC	4000	carcinogen
di-n-butylphthalate	84-74-2	700	MC/ST	23	23	TC	7000	increased mortality
di-n-octylphthalate	117-84-0	140	MC/ST	NA	NA		1400	kidney, liver
diallate	2303-16-4	0.6	MC/C	NA	NA		6	carcinogen
diazinon	333-41-5	6.3	MC/ST	0.002	0.002	TC	63	blood
dibenz(a,h)anthracene	53-70-3	0.2	PQL/C	0.031 annual average	0.031 annual average	N	2	carcinogen
dibenzofuran	132-64-9	28	MC/ST	67	67	TC	280	NA
dibromo-3-chloropropane, 1,2- [or DBCP]	96-12-8	0.2	P/C	NA	NA		2	carcinogen
dibromoacetonitrile		14	HAL/ST	NA	NA		140	HAL RfD
dibromobenzene, 1,4-	106-37-6	70	MC/ST	590	590	HH	700	carcinogen
dibromochloromethane [or chlorodibromomethane]	124-48-1	0.4	MC/C	34 annual average	34 annual average	N	4	carcinogen
dibromoethane, 1,2- [or EDB]	106-93-4	0.02	P/C	13	13	TC	0.2	carcinogen
dibutyl phthalate	84-74-2	700	MC/ST	NA	NA		7000	increased mortality
dicamba	1918-00-9	210	MC/ST	195	195	TC	2100	fetus
dichloroacetic acid	79-43-6	28	HAL/C	1150	1150	TC	280	carcinogen
dichloroacetonitrile	3018-12-0	5.6	HAL/ST	NA	NA		56	HAL RfD
dichlorobenzene, 1,2-	95-50-1	600	P/ST	99	99	TC	.6000	no adverse effects observed
dichlorobenzene, 1,3-	541-73-1	10	MC/O	85	85	TC	100	NA
dichlorobenzene, 1,4-	106-46-7	75	P/C	100	100	TC	750	carcinogen
dichlorobenzidine, 3,3'-	91-94-1	12	PQL/C	0.06	0.06	HH	120	carcinogen
dichlorodifluoromethane	75-71-8	1400	MC/ST	NA	NA		14000	decreased body weight
dichloroethane, 1,1-	75-34-3	70	MC/ST	NA	NA		700	central nervous system, kidney

Table 3b
Groundwater Cleanup Target Levels for Chapter 62-785, F.A.C.

		A		B	C		D	
Chemical Name	Chemical Abstract Registry Number CAS #	Groundwater Criteria (ug/L)	Basis for A	Freshwater Surface Water Criteria (ug/L)f	Marine Surface Water Criteria (ug/L)f	Basis for B &C	Groundwater of Low Yield/Poor Quality Criteria (ug/L)	Target Organ/System of Effect
dichloroethane, 1,2- [or EDC]	107-06-2	3	P/C	5	5	HH	30	carcinogen
dichloroethene, 1,1-	75-35-4	7	P/C	3.2 annual average	3.2 annual average	N	70	carcinogen
dichloroethene, 1,2- (mixture)	540-59-0	63	MC/ST	7000	7000	TC	630	carcinogen
dichloroethene, cis-1,2-	156-59-2	70	P/ST	NA	NA		700	blood, liver
dichloroethene, trans-1,2-	156-60-5	100	P/ST	11000	11000	TC	1000	blood, liver
dichlorophenol, 2,3-	576-24-9	10	PQL/O(g)	56	56	TC	100	immune system
dichlorophenol, 2,4-	120-83-2	4	PQL/O(g)	13	13	TC	40	immune system
dichlorophenol, 2,5-	583-78-8	10	PQL/O(g)	90	90	TC	100	immune system
dichlorophenol, 2,6-	87-65-0	4	PQL/O(g)	73	73	TC	40	immune system
dichlorophenol, 3,4-	95-77-2	10	PQL/O(g)	61	61	TC	100	immune system
dichlorophenoxy acetic acid, 2,4-	94-75-7	70	P/ST	80	80	TC	700	blood, kidney, liver
dichlorophenoxy)butyric acid, 4-(2,4- [2,4-DB]	94-82-6	56	MC/ST	NA	NA		560	internal hemorrhage, mortality
dichloropropane, 1,2-	78-87-5	5	P/C	2600	2600	TC	50	carcinogen
dichloropropene, 1,3-	542-75-6	0.2	PQL/C	12	12	TC	2	carcinogen
dichlorprop	120-36-5	35	MC/ST	42	42	TC	350	kidney, liver
dichlorvos	62-73-7	0.1	MC/C	0.005	0.005	TC	1	carcinogen
dicofol	115-32-2	0.4	PQL/C	0.003	0.003	HH	4	carcinogen
dicrotophos [or bidrin]	141-66-2	1	MDL/ST	21.5	21.5	TC	10	decreased offspring survival
dieldrin	60-57-1	0.005	PQL/C	0.00014 annual average; 0.0019 max.	0.00014 annual average; 0.0019 max.	N	0.05	carcinogen
diethylene glycol monoethyl ether	111-90-0	14000	MC/ST	167000	167000	TC	140000	kidney
diethylphthalate	84-66-2	5600	MC/ST	380	380	TC	56000	brain, decreased growth rate, kidney, liver
diethylstilbestrol	56-53-1	100	PQL/C	NA	NA		1000	carcinogen
diisopropyl methylphosphonate [or DIMP]	1445-75-6	560	MC/ST	13350	13350	TC	5600	no observed effects
dimethoate	60-51-5	5	PQL/ST	0.1	0.1	TC	50	brain
dimethoxybenzidine, 3,3'-	119-90-4	250	PQL/C	NA	NA		2500	carcinogen
dimethrin	70-38-2	2100	HAL/ST	1.1	1.1	TC	21000	NA
dimethylaniline, 2,4-	95-68-1	0.05	MC/C	1650	1650	TC	0.5	carcinogen
dimethylaniline, N,N-	121-69-7	50	PQL/ST	1650	1650	TC	500	spleen
dimethylbenzidine, 3,3'-	119-93-7	160	PQL/C	NA	NA		1600	carcinogen
dimethylformamide, N,N-	68-12-2	700	MC/ST	50000	50000	TC	7000	liver
dimethylphenol, 2,4-	105-67-9	140	MC/ST	261	261	HH	1400	central nervous system, blood

Table 3b
Groundwater Cleanup Target Levels for Chapter 62-785, F.A.C.

Chemical Name	Chemical Abstract Registry Number CAS#	A Groundwater Criteria (ug/L)	Basis for A	B Freshwater Surface Water Criteria (ug/L)e	C Marine Surface Water Criteria (ug/L)e	Basis for B & C	D Groundwater of Low Yield/Poor Quality Criteria (ug/L)	Target Organ/System of Effect
dimethylphenol, 2,6-	576-26-1	4.2	MC/ST	560	560	TC	42	body weight changes, kidney, liver, spleen
dimethylphenol, 3,4-	95-65-8	7	MC/ST	436	436	HH	70	changes in blood pressure and body weight, liver spleen, kidney
dimethylphthalate	131-11-3	70000	MC/ST	1450	1450	TC	700000	kidney
DIMP [or diisopropyl methylphosphonate]	1445-75-6	560	MC/ST	13350	13350	TC	5600	no observed effects
dinitro-o-cyclohexyl phenol, 4,6-	131-89-5	100	PQL/ST	NA	NA		1000	eye
dinitrobenzene, 1,2- (o-)	528-29-0	200	PQL/ST	30	30	TC	2000	spleen
dinitrobenzene, 1,3- (m-)	99-65-0	8	PQL/ST	72	72	TC	80	spleen
dinitrobenzene, 1,4- (p-)	100-25-4	50	PQL/ST	30	30	TC	500	spleen
dinitrophenol, 2,4-	51-28-5	30	MC/ST	3	3	TC	300	eye
dinitrotoluene (mixture)		0.2	PQL/C	NA	NA		2	carcinogen
dinitrotoluene, 2,4-	121-14-2	0.2	PQL/C	9.1 annual average	9.1 annual average	N	2	carcinogen
dinitrotoluene, 2,6-	606-20-2	0.1	PQL/C	4	4	HH	1	carcinogen
dinoseb	88-85-7	7	P/ST	5.9	5.9	TC	70	fetus
dioxane, 1,4-	123-91-1	5	PQL/C	245	245	HH	50	carcinogen
dioxin [or 2,3,7,8-TCDD]	1746-01-6	0.00003	P/C	ND	ND		0.0003	carcinogen
diphenamid	957-51-7	210	MC/ST	1600	1600	TC	2100	liver
diphenyl [or 1,1-biphenyl]	92-52-4	0.5	O/ST	18	18	TC	5	kidney
diphenylamine, N,N-	122-39-4	175	MC/ST	NA	NA		1750	decreased weight gain, kidney, liver
diphenylhydrazine, 1,2-	122-66-7	10	PQL/C	0.38	0.38	HH	100	carcinogen
diquat	85-00-7	20	P/ST	1.5	1.5	TC	200	eye
disulfoton	298-04-4	0.3	MC/ST	0.3	0.3	TC	3	blood, eye
diuron	330-54-1	14	MC/ST	8	8	TC	140	blood
EDB [or dibromoethane, 1,2-]	106-93-4	0.02	P/C	13	13	TC	0.2	carcinogen
EDC [or dichloroethane, 1,2-]	107-06-2	3	P/C	5	5	HH	30	carcinogen
endosulfan	115-29-7	42	MC/ST	0.056	0.0087	N	420	blood vessels, decreased weight gain, kidney
endothall	145-73-3	100	P/ST	105	105	TC	1000	small intestine, stomach
endrin	72-20-8	2	P/ST	0.0023	0.0023	N	20	central nervous system, liver
EPEG [or ethylphthalyl ethylglycolate]	84-72-0	21000	MC/ST	NA	NA		210000	kidney, reduced lifespan
epichlorohydrin	106-89-8	3.5	MC/C	272	272	HH	35	carcinogen
EPN [or ethyl p-nitrophenyl phenylphosphorothioate]	2104-64-5	0.2	PQL/ST	0.015	0.015	TC	2	central nervous system

Table 3b
Groundwater Cleanup Target Levels for Chapter 62-785, F.A.C.

Chemical Name	Chemical Abstract Registry Number CAS #	A Groundwater Criteria (ug/L)	Basis for A	B Freshwater Surface Water Criteria (ug/L)e	C Marine Surface Water Criteria (ug/L)e	Basis for B &C	D Groundwater of Low Yield/Poor Quality Criteria (ug/L)	Target Organ/System or Effect
EPTC [or ethyl dipropylthiocarbamate, S-]	759-94-4	175	MC/ST	235	235	TC	1750	heart
ethion	563-12-2	3.5	MC/ST	0.007	0.007	TC	35	blood
ethoprop	13194-48-4	0.7	MC/ST	0.315	0.315	TC	7	blood
ethoxyethanol acetate, 2-	111-15-9	2100	MC/ST	2000	2000	TC	21000	fetus
ethoxyethanol, 2-	110-80-5	25000	PQL/ST	NA	NA		250000	blood, male reproductive
ethyl acetate	141-78-6	6300	MC/ST	6250	6250	TC	63000	decreased body weight, increased mortality
ethyl acrylate	140-88-5	5000	PQL/C	125	125	TC	50000	carcinogen
ethyl chloride [or chloroethane]	75-00-3	12	MC/C	NA	NA		120	carcinogen
ethyl dipropylthiocarbamate, S- [or EPTC]	759-94-4	175	MC/ST	235	235	TC	1750	heart
ethyl ether	60-29-7	750	O/ST	128000	128000	TC	7500	liver
ethyl methacrylate	97-63-2	630	MC/ST	NA	NA		6300	kidney
ethyl p-nitrophenyl phenylphosphorothioate [or EPN]	2104-64-5	0.2	PQL/ST	0.015	0.015	TC	2	central nervous system
ethylbenzene	100-41-4	30	S/ST	605	605	TC	300	central nervous system, kidney, liver
ethylene diamine	107-15-3	10000	PQL/ST	800	800	TC	100000	blood, heart
ethylene glycol	107-21-1	14000	MC/ST	16300	16300	TC	140000	fetus
ethylene oxide	75-21-8	10	PQL/C	4200	4200	TC	100	carcinogen
ethylene thiourea [or ETU]	96-45-7	5	PQL/C	1320	1320	TC	50	carcinogen
ethylphthalyl ethylglycolate [or EPEG]	84-72-0	21000	MC/ST	NA	NA		210000	kidney, reduced lifespan
ETU [or ethylene thiourea]	96-45-7	5	PQL/C	1320	1320	TC	50	carcinogen
famphur	52-85-7	3.5	MC/ST	NA	NA		35	blood
fenamiphos	22224-92-6	1.8	MC/ST	0.225	0.225	TC	18	blood, central nervous system
fenamiphos metabolites	No CAS#	0.9	MC/ST	NA	NA		9	blood, central nervous system
fensulfothion	115-90-2	1.8	MC/ST	0.5	0.5	TC	18	blood
fluometuron	2164-17-2	91	MC/ST	190	190	TC	910	no adverse effect
fluoranthene	206-44-0	280	MC/ST	0.3	0.3	TC	2800	blood, kidney, liver
fluorene	86-73-7	280	MC/ST	30	30	TC	2800	blood
fluoride	16984-58-8	2000	S/ST	10000	5000	N	20000	dental
fluoridone	59756-60-4	560	MC/ST	105	105	TC	5600	decreased body weight, kidney, testis
fonofos	944-22-9	14	MC/ST	0.095	0.095	TC	140	central nervous system, liver
formaldehyde	50-00-0	600	O/C	105	105	TC	6000	carcinogen
formic acid	64-18-6	14000	MC/ST	4500	4500	TC	140000	decreased growth
furfural	98-01-1	250	PQL/ST	650	650	TC	2500	liver
glycialdehyde	765-34-4	2.8	MC/ST	NA	NA		28	decreased body weight, kidney

Table 3b
Groundwater Cleanup Target Levels for Chapter 62-785, F.A.C.

Chemical Name	Chemical Abstract Registry Number CAS #	A Groundwater Criteria (ug/L)	A Basis for A	B Freshwater Surface Water Criteria (ug/L)e	C Marine Surface Water Criteria (ug/L)e	Basis for B & C	D Groundwater of Low Yield/Poor Quality Criteria (ug/L)	Target Organ/System or Effect
glyphosate [or Roundup]	1071-83-6	700	P/ST	115	115	TC	7000	kidney
gross alpha radiation	14127-62-9	15 pCi/L	P	15 pCi/L	15 pCi/L	N		NA
guthion	86-50-0	10.5	MC/ST	0.01	0.01	N	105	blood
heptachlor	76-44-8	0.4	P/C	0.0021 annual average; 0.0038 max.	0.0021 annual average; 0.0036 max.	N	4	carcinogen
heptachlor epoxide	1024-57-3	0.2	P/C	0.002	0.002	TC	2	carcinogen
hexachloro-1,3-butadiene	87-68-3	0.5	MC/C	49.7 annual average	49.7 annual average	N	5	carcinogen
hexachlorobenzene	118-74-1	1	P/C	0.00036	0.00036	HH	10	carcinogen
hexachlorocyclohexane, technical-	608-73-1	0.02	MC/C	0.017	0.017	TC	0.2	carcinogen
hexachlorocyclohexane, alpha- (a-BHC) or (a-HCH)	319-84-6	0.006	MC/C	0.0116	0.0116	HH	0.06	carcinogen
hexachlorocyclohexane, beta- (b-BHC) or (b-HCH)	319-85-7	0.02	MC/C	0.046 annual average	0.046 annual average	N	0.2	carcinogen
hexachlorocyclohexane, delta- (d-BHC) or (d-HCH)	319-86-8	2.1	MC/ST(b)	NA	NA		21	kidney,liver
hexachlorocyclohexane, gamma- (g-BHC) or (g-HCH) [or lindane]	58-89-9	0.2	P/C	0.063 annual average; 0.08 max.	0.063 annual average; 0.08 max.	N	2	carcinogen
hexachlorocyclopentadiene	77-47-4	50	P/ST	2.95	2.95	TC	500	nasal cavity, stomach
hexachlorodibenzo-p-dioxin mixture [HxCDD]	19408-74-3	0.00025	PQL/C	NA	NA		0.0025	carcinogen
hexachloroethane	67-72-1	2.5	MC/C	1.1	1.1	HH	25	carcinogen
hexachlorophene	70-30-4	6	PQL/ST	1.05	1.05	TC	60	brain, optic nerve, salivary gland
hexahydro-1,3,5-trinitro-1,3,5-triazine [or RDX]	121-82-4	1	PQL/C	180	180	TC	10	carcinogen
hexane, n-	110-54-3	10	PQL/ST	3400	3400	TC	100	male reproductive, nervous system
hexanone, 2- [or methyl butyl ketone]	591-78-6	280	MC/ST	NA	NA		2800	kidney, liver, whole body
hexazinone	51235-04-2	231	MC/ST	1020	1020	HH	2310	decreased body weight
hydrogen cyanide (as Cn)	74-90-8	140	MC/ST	3.45	3.45	TC	.1400	decreased body weight, nerve damage, thyroid
hydrogen sulfide (as S)	7783-06-4	100	PQL/ST	0.1	0.1	TC	1000	GI disturbances
hydroquinone	123-31-9	280	MC/ST	4.5	4.5	TC	2800	blood
indeno(1,2,3-cd)pyrene	193-39-5	0.2	PQL/C	0.031 annual average	0.031 annual average	N	2	carcinogen

Table 3b
Groundwater Cleanup Target Levels for Chapter 62-785, F.A.C.

		A		B	C		D	
Chemical Name	Chemical Abstract Registry Number CAS #	Groundwater Criteria (ug/L)	Basis for A	Freshwater Surface Water Criteria (ug/L)e	Marine Surface Water Criteria (ug/L)e	Basis for B & C	Groundwater of Low Yield/Poor Quality Criteria (ug/L)	Target Organ/System of Effect
iprodione	36734-19-7	280	MC/ST	153	153	TC	2800	blood, prostrate
iron	7439-89-6	300	S/	1000	300	N	3000	NA
isobutyl alcohol	78-83-1	2100	MC/ST	47450	47450	TC	21000	central nervous system
isophorone	78-59-1	37	MC/C	645	645	TC	370	carcinogen
isopropalin	33820-53-0	105	MC/ST	13.5	13.5	TC	1050	blood
isopropyl benzene [or cumene]	98-82-8	0.8	O/ST	255	255	TC	18	blood
karate [or cylohalothrin, lambda]	98085-85-8	35	MC/ST	5	5	HH	350	decreased body weight gain, decreased weight in offspring
kepone	143-50-0	20	PQL/C	NA	NA		200	carcinogen
lead	7439-92-1	15	P/ST	a	5.6	N	150	NA
lindane [or hexachlorocyclohexane, gamma-] (g-BHC) or (g-HCH)	58-89-9	0.2	P/C	0.063 annual average; 0.08 max.	0.063 annual average; 0.08 max.	N	2	carcinogen
linuron	330-55-2	1.4	MC/ST	44.5	44.5	TC	14	blood
lithium	7439-93-2	140	MC/ST	NA	NA		1400	NA
malathion	121-75-5	140	MC/ST	0.1	0.1	N	1400	blood
maleic hydrazide	123-33-1	3500	MC/ST	750	750	TC	35000	kidney
malononitrile	109-77-3	0.1	MC/ST	NA	NA		1	liver, spleen
mancozeb	8018-01-7	210	MC/ST	3.5	3.5	TC	2100	thyroid
maneb	12427-38-2	75	PQL/ST	5.5	5.5	TC	750	thyroid
manganese	7439-96-5	50	S/ST	NA	NA		500	central nervous system
MEK [or 2-butanone]	78-93-3	4200	MC/ST	120000	120000	TC	42000	fetus
mercuric chloride (as Hg)	7487-94-7	0.2	MC/ST	0.05	0.05	TC	2	autoimmune effects
mercury	7438-97-6	2	P/ST	0.012	0.012	N	20	CNS
mercury, methyl	22967-92-6	0.07	MC/ST	NA	NA		0.7	developmental neurologic effects in human infants
merphos	150-50-5	1	PQL/ST	NA	NA		10	decreased body weight, nervous system
merphos oxide	78-48-8	0.2	MC/ST	0.23	0.23	TC	2	decreased body weight, nervous system
metalaxyl	57837-19-1	420	MC/ST	36.5	36.5	TC	4200	blood, brain, liver
methacrylonitrile	126-98-7	5	PQL/ST	NA	NA		50	liver
methamidophos	10265-92-6	5	PQL/ST	0.000011	0.000011	TC	50	central nervous system
methanol	67-56-1	5000	PQL/ST	45037	45037	TC	50000	blood, brain
methidathion	950-37-8	0.7	MC/ST	0.03	0.03	TC	7	liver
methomyl	16752-77-5	175	MC/ST	0.95	0.95	TC	1750	kidney
methoxy-5-nitroaniline, 2-	99-59-2	50	PQL/C	NA	NA		500	carcinogen
methoxychlor	72-43-5	40	P/ST	0.03	0.03	N	400	reproduction

Table 3b
Groundwater Cleanup Target Levels for Chapter 62-785, F.A.C.

		A		B	C		D	
Chemical Name	Chemical Abstract Registry Number CAS #	Groundwater Criteria (ug/L)	Basis for A	Freshwater Surface Water Criteria (ug/L)e	Marine Surface Water Criteria (ug/L)e	Basis for B &C	Groundwater GC Low Yield/Poor Quality Criteria (ug/L)	Target Organ/System or Effect
methoxyethanol, 2-	109-86-4	100000	PQL/ST	NA	NA		1000000	testis
methyl acetate	79-20-9	5000	PQL/ST	NA	NA		50000	liver
methyl acrylate	96-33-3	210	MC/ST	NA	NA		2100	none observed
methyl bromide [or bromomethane]	74-83-9	9.8	MC/ST	35	35	TC	98	stomach
methyl butyl ketone [or hexanone, 2-]	591-78-6	280	MC/ST	NA	NA		2800	kidney, liver, whole body
methyl isobutyl ketone [or MIBK]	108-10-1	560	MC/ST	23000	23000	TC	5600	kidney, liver, whole body
methyl methylacrylate	80-62-6	25	O/ST	6500	6500	TC	250	NOAEL
methyl parathion	298-00-0	1.8	MC/ST	0.01	0.01		18	blood
methyl styrene (mixed)	25013-15-4	42	MC/ST	NA	NA		420	nasal cavity
methyl styrene, alpha	98-83-9	490	MC/ST	NA	NA		4900	liver, kidney
methyl tert-butyl ether	1634-04-4	35	MC/ST	33600	33600	TC	350	increased prostration, kidney, liver, ocular
methyl-(1,4-chlorophenoxy)propionic acid, 2-	7085-19-0	7	MC/ST	NA	NA		70	OPP RfD
methyl-4-chlorophenoxy acetic acid,2-	94-74-6	3.5	MC/ST	72	72	TC	35	kidney, liver
methyl-5-nitroaniline, 2-	99-55-8	10	PQL/C	NA	NA		100	carcinogen
methylaniline, 2-	95-53-4	50	PQL/C	26	26	TC	500	carcinogen
methylene bis(2-chloroaniline), 4,4'-	101-14-4	50	PQL/C	NA	NA		500	carcinogen
methylene bromide	74-95-3	70	MC/ST	NA	NA		700	blood
methylene chloride	75-09-2	5	P/C	1580 annual average	1580 annual average	N	50	carcinogen
methylnaphthalene, 1-	90-12-0	20	MC/O(c)	95	95	TC	200	blood
methylnaphthalene, 2-	91-57-6	20	MC/O	30	30	TC	200	blood
methylphenol, 2- (o-cresol)	95-48-7	35	MC/ST	250	250	TC	350	blood, CNS, decreased body weight, kidney, liver
methylphenol, 3- (m-cresol)	108-39-4	35	MC/ST	445	445	TC	350	decreased body weights, central nervous system
methylphenol, 4- (p-cresol)	106-44-5	4	PQL/ST	70	70	TC	40	blood, central nervous system, kidney, liver, respiratory
metolachlor	51218-45-2	105	MC/ST	1.08	1.08	TC	1050	decreased weight gain
metribuzin	21087-64-9	175	MC/ST	64	64	TC	1750	decreased weight, kidney, liver, mortality
metsulfuron-methyl [or ally]	74223-64-6	1750	MC/ST	NA	NA		17500	decreased body weight
mevinphos	7786-34-7	1.8	MC/ST	0.0475	0.0475	TC	18	blood
MIBK [or methyl isobutyl ketone]	108-10-1	560	MC/ST	23000	23000	TC	5600	kidney, liver, whole body
mirex	2385-85-5	1	MC/ST	0.001	0.001	N	10	liver, thyroid
molinate	2212-67-1	14	MC/ST	17	17	TC	140	reproductive system
molybdenum	7439-98-7	35	MC/ST	NA	NA		350	increased uric acid levels

Table 3b
Groundwater Cleanup Target Levels for Chapter 62-785, F.A.C.

Chemical Name	Chemical Abstract Registry Number CAS #	A Groundwater Criteria (ug/L)	A Basis for A	B Freshwater Surface Water Criteria (ug/L)/	C Marine Surface Water Criteria (ug/L)/	Basis for B & C	D Groundwater of Low Yield/Poor Quality Criteria (ug/L)	Target Organ/System or Effect
naled	300-76-5	14	MC/ST	0.018	0.018	TC	140	central nervous system
naphthalene	91-20-3	20	O/ST	26	26	TC	200	blood
naphthylamine, 2-	91-59-8	10	PQL/C	NA	NA		100	carcinogen
napropamide	15299-99-7	700	MC/ST	210	210	TC	7000	decreased weight gain
nickel	7440-02-0	100	P/ST	*a*	8.3	N	1000¥	decreased body weight, female reproductive, kidney, liver, skin
nickel subsulfide (as Ni)	12035-72-2	100	P/C	*a*	8.3	N	1000	carcinogen
nitrate	14797-55-8	10000	P/	*b*	*b*	N	100000	blood
nitrate + nitrite		10000	P/	*b*	*b*	N	100000	blood
nitrite	14797-65-0	1000	P/	*b*	*b*	N	10000	blood
nitroaniline, m- (3-)	99-09-2	50	PQL/ST	NA	NA		500	REG III RfD
nitroaniline, o-	88-74-4	50	PQL/ST	NA	NA		500	blood
nitroaniline, p-	100-01-6	21	MC/ST	1200	1200	TC	210	NA
nitrobenzene	98-95-3	4	PQL/ST	90	90	TC	40	adrenal, blood, kidney, liver
nitrophenol, 4-	100-02-7	56	MC/ST	55	55	TC	560	HAL RfD
nitroso-di-ethylamine, N-	55-18-5	4	PQL/C	0.18	0.18	HH	40	carcinogen
nitroso-di-n-butylamine, N-	924-16-3	4	PQL/C	0.16	0.16	HH	40	carcinogen
nitroso-di-n-propylamine, N-	621-64-7	4	PQL/C	0.83	0.83	HH	40	carcinogen
nitroso-dimethylamine, N-	62-75-9	2	PQL/C	0.53	0.53	HH	20	carcinogen
nitroso-diphenylamine, N-	86-30-6	7	MC/C	44	44	HH	70	carcinogen
nitroso-N-methylethylamine, N-	10595-95-6	8	PQL/C	1.22	1.22	HH	80	carcinogen
nitrosopyrrolidine, N-	930-55-2	8	PQL/C	NA	NA		80	carcinogen
nitrotoluene, m-	99-08-1	250	PQL/ST	375	375	TC	2500	spleen
nitrotoluene, o-	88-72-2	250	PQL/ST	550	550	TC	2500	spleen
nitrotoluene, p-	99-99-0	250	PQL/ST	550	550	TC	2500	spleen
norflurazon	27314-13-2	280	MC/ST	NA	NA		2800	liver, thyroid
octahydro-1357-tetranitro-1357-tetrazocine [HMX]	2691-41-0	350	MC/ST	1250	1250	TC	3500	blood
octamethylpyrophosphoramide	152-16-9	1000	PQL/ST	NA	NA		10000	blood
oryzalin	19044-88-3	350	MC/ST	NA	NA		3500	blood, liver, kidney
oxadiazon	19666-30-9	35	MC/ST	44	44	TC	350	liver
oxamyl	23135-22-0	200	P/ST	8.5	8.5	TC	2000	decreased body weight gain and food consumption
paraquat	1910-42-5	31.5	MC/ST	47	47	TC	315	respiratory
parathion	56-38-2	42	MC/ST	0.04	0.04	N	420	blood

Table 3b
Groundwater Cleanup Target Levels for Chapter 62-785, F.A.C.

		A		B	C		D	
Chemical Name	Chemical Abstract Registry Number CAS #	Groundwater Criteria (ug/L)	Basis for A	Freshwater Surface Water Criteria (ug/L)f	Marine Surface Water Criteria (ug/L)f	Basis for B &C	Groundwater of Low Yield/Poor Quality Criteria (ug/L)	Target Organ/System or Effect
PCBs [or Aroclor; or polychlorinated biphenyls]	1336-36-3	0.5	P/C	0.000045 annual avg.; 0.014 max.	0.000045 annual avg.; 0.03 max.	N	5	carcinogen
PCE [or tetrachloroethene]	127-18-4	3	P/C	8.85 annual average	8.85 annual average	N	30	carcinogen
pebulate	1114-71-2	350	MC/ST	305	305	TC	3500	blood
pendimethalin	40487-42-1	280	MC/ST	10	10	TC	2800	blood, liver
pentachlorobenzene	608-93-5	5.6	MC/ST	1.7	1.7	HH	56	kidney, liver
pentachloronitrobenzene	82-68-8	12	PQL/C	0.04	0.04	HH	120	carcinogen
pentachlorophenol	87-86-5	1	P/C	8.2 annual average; 30 max.; and *e*	7.9	N	10	carcinogen
permethrin	52645-53-1	350	MC/ST	0.001	0.001	TC	3500	liver
phenanthrene	85-01-8	210	MC/ST(a)	0.031 annual average	0.031 annual average	N	2100	central nervous system, decreased body weight, liver
phenmedipham [or betanal]	13684-63-4	1750	MC/ST	199	199	TC	17500	no adverse effects
phenol	108-95-2	10	O/ST	6.5	6.5	TC	100	central nervous system, female reproductive, lung, fetus
phenylenediamine, m-	108-45-2	42	MC/ST	NA	NA		420	liver
phenylenediamine, o-	95-54-5	0.7	MC/C	NA	NA		7	carcinogen
phenylenediamine, p-	106-50-3	1330	MC/ST	NA	NA		13300	whole body
phenylphenol, 2-	90-43-7	18	MC/C	35.5	35.5	TC	180	carcinogen
phorate	298-02-2	1.4	MC/ST	0.0055	0.0055		14	central nervous system
phosmet	732-11-6	140	MC/ST	0.1	0.1	TC	1400	central nervous system, decreased body weight, liver
phosphine	7803-51-2	125	PQL/ST	NA	NA		1250	altered body weight
phthalic acid, p-	100-21-0	7000	MC/ST	NA	NA		70000	NA
phthalic anhydride	85-44-9	14000	MC/ST	NA	NA		140000	kidney, lung
picloram	1918-02-1	500	P/ST	70	70	TC	5000	liver
polychlorinated biphenyls (PCBs) [or Aroclor]	1336-36-3	0.5	P/C	0.000045 annual avg.; 0.014 max.	0.000045 annual avg.; 0.03 max.	N	5	carcinogen
potassium cyanide	151-50-8	350	MC/ST	5.5	5.5	TC	3500	nerve damage, thyroid, weight loss
profluralin	26399-36-0	42	MC/ST	NA	NA		420	none observed
prometon	1610-18-0	105	MC/ST	600	600	TC	1050	none observed
prometryn	7287-19-6	28	MC/ST	21	21	TC	280	bone marrow, kidney, liver

Table 3b
Groundwater Cleanup Target Levels for Chapter 62-785, F.A.C.

		A		B	C		D	
Chemical Name	Chemical Abstract Registry Number CAS #	Groundwater Criteria (ug/L)	Basis for A	Freshwater Surface Water Criteria (ug/L)/	Marine Surface Water Criteria (ug/L)/	Basis for B & C	Groundwater of Low Yield/Poor Quality Criteria (ug/L)	Target Organ/System for Effect
pronamide	23950-58-5	53	MC/ST	NA	NA		530	none observed
propachlor	1918-16-7	91	MC/ST	11.5	11.5	TC	910	decreased weight gain
propanil	709-98-8	35	MC/ST	20	20	TC	350	spleen
propargite	2312-35-8	140	MC/ST	1.55	1.55	TC	1400	none observed
propazine	139-40-2	14	MC/ST	185	185	TC	140	decrease in body weight
propham	122-42-9	140	MC/ST	500	500	TC	1400	central nervous system, spleen
propiconazole	60207-90-1	90	MC/ST	25.5	25.5	TC	900	gastric irritation
propoxur [or baygon]	114-26-1	5	PQL/ST	0.35	0.35	TC	50	blood, central nervous system
propylene glycol	57-55-6	140000	MC/ST	35500	35500	TC	1400000	blood
propylene glycol monoethyl ether	1569-02-4	4900	MC/ST	NA	NA		49000	decreased weight gain
propylene oxide	75-56-9	5000	PQL/C	NA	NA		50000	carcinogen
pydrin	51630-58-1	1750	MC/ST	0.00035	0.00035	TC	17500	neurological dysfunction
pyrene	129-00-0	210	MC/ST	0.3	0.3	TC	2100	central nervous system, decreased body weight, kidney
pyridine	110-86-1	7	PQL/ST	1300	1300	TC	70	liver
radium, 226 and 228 combined	7440-14-4	5 pCi/L	P	5 pCi/L	5 pCi/L	N		NA
RDX [or hexahydro-1,3,5-trinitro-1,3,5-triazine]	121-82-4	1	PQL/C	180	180	TC	10	carcinogen
resmethrin	10453-86-8	210	MC/ST	0.0026	0.0026	TC	2100	reproductive
ronnel	299-84-3	350	MC/ST	0.061	0.061	TC	3500	blood, central nervous system, liver
rotenone	83-79-4	28	MC/ST	0.115	0.115	TC	280	decreased offspring weight
Roundup [or glyphosate]	1071-83-6	700	P/ST	115	115	TC	7000	kidney
selenious acid (as Se)	7783-00-8	35	MC/ST	40	40	TC	350	selenosis
selenium	7782-49-2	50	P/ST	5	71	N	500	central nervous system, gastrointestinal, skin
silver	7440-22-4	100	S/ST	0.07	0.35	N/##	1000	heart, liver, skin
silvex [or trichlorophenoxy proprionic acid, 2(2,4,5)-]	93-72-1	50	P/ST	NA	NA		500	liver
simazine	122-34-9	4	P/C	5.8	5.8	HH	40	carcinogen
sodium	7440-23-5	160000	P	*e*	NA	N	1600000	NA
sodium cyanide (as Cn)	143-33-9	280	MC/ST	3.79	3.79	TC	2800	central nervous system
strontium	7440-24-6	4200	MC/ST	NA	NA		42000	bone
strychnine	57-24-9	100	PQL/ST	38	38	TC	1000	unspecified toxicity/histopathology
styrene	100-42-5	100	P/ST	455	455	TC	1000	blood, liver
sulfate	14808-79-8	250000	S/	*b*	*b*		2500000	NA

Table 3b
Groundwater Cleanup Target Levels for Chapter 62-785, F.A.C.

Chemical Name	Chemical Abstract Registry Number CAS #	A Groundwater Criteria (ug/L)	Basis for A	B Freshwater Surface Water Criteria (ug/L)/	C Marine Surface Water Criteria (ug/L)/	Basis for B & C	D Groundwater of Low Yield/Poor Quality Criteria (ug/L)	Target Organ/System or Effect
TCE [or trichloroethene]	79-01-6	3	P/C	80.7 annual average	80.7 annual average	N	30	carcinogen
tebuthiruon	34014-18-1	490	MC/ST	307	307	TC	4900	decreased body weight gain
temephos	3383-96-8	140	MC/ST	0.002	0.002	TC	1400	none observed
terbacil	5902-51-2	91	MC/ST	2450	2450	TC	910	liver, thyroid
terbufos	13071-79-9	0.5	PQL/ST	0.01	0.01	TC	5	central nervous system
terbutryn	886-50-0	330	PQL/ST	3.1	3.1	TC	3300	blood
tetrachlorobenzene, 1,2,4,5-	95-94-3	4	PQL/ST	2.3	2.3	HH	40	kidney
tetrachloroethane, 1,1,1,2-	630-20-6	1	MC/C	NA	NA		10	carcinogen
tetrachloroethane, 1,1,2,2-	79-34-5	0.5	PQL/C	10.8 annual average	10.8 annual average	N	5	carcinogen
tetrachloroethene [or PCE]	127-18-4	3	P/C	8.85 annual average	8.85 annual average	N	30	carcinogen
tetrachlorophenol, 2,3,4,6-	58-90-2	210	MC/ST	4.5	4.5	TC	2100	liver
tetraethyl dithiopyrophosphate	3689-24-5	3.5	PQL/ST	0.0115	0.0115	TC	35	blood
thallium	7440-28-0	2	P/	6.3	6.3	N	20	blood, hair, liver
thallium acetate (as Tl)	563-68-8	0.6	MC/ST	NA	NA		6	blood, hair, liver
thallium carbonate (as Tl)	6533-73-9	0.6	MC/ST	NA	NA		6	blood, hair, liver
thallium chloride (as Tl)	7791-12-0	0.6	MC/ST	NA	NA		6	blood, hair, liver
thallium nitrate (as Tl)	10102-45-0	0.6	MC/ST	NA	NA		6	blood, hair, liver
thallium sulfate (as Tl)	7446-18-6	0.6	MC/ST	26	26	TC	6	blood, hair, liver
thiocyanomethylthio)-benzothiazole, 2-([TCMTB]	21564-17-0	210	MC/ST	0.435	0.435	TC	2100	stomach
thiram	137-26-8	35	MC/ST	0.168	0.168	TC	350	reproduction
tin	7440-31-5	4200	MC/ST	NA	NA		42000	kidney, liver
toluene	108-88-3	40	S/ST	475	475	TC	400	kidney, liver
toluene-2,4-diamine	95-80-7	100	PQL/C	NA	NA		1000	carcinogen
toluidine, p-	106-49-0	150	PQL/C	NA	NA		1500	carcinogen
total dissolved solids [TDS]	C-010	500000	S/	NA	NA		5000000	NA
toxaphene	8001-35-2	3	P/C	0.0002	0.0002	N	30	carcinogen
triallate	2303-17-5	91	MC/ST	65	65	TC	910	liver, spleen
tributyltin oxide (as Sn) [TBTO]	56-35-9	10	PQL/ST	0.05	0.05	TC	100	immune system
trichloro-1,2,2,-trifluoroethane, 1,1,2-	76-13-1	500000	PQL/ST	NA	NA		5000000	psychomotor impairment
trichloroacetic acid	76-03-9	300	HAL/ST	100000	100000	TC	3000	HAL RfD
trichlorobenzene, 1,2,3-	87-61-6	70	MC/ST(d)	85	85	TC	700	increased adrenal weights, central nervous system

Table 3b
Groundwater Cleanup Target Levels for Chapter 62-785, F.A.C.

Chemical Name	Chemical Abstract Registry Number CAS #	A Groundwater Criteria (ug/L)	Basis for A	B Freshwater Surface Water Criteria (ug/L)/	C Marine Surface Water Criteria (ug/L)/	Basis for B & C	D Groundwater of Low Yield/Poor Quality Criteria (ug/L)	Target Organ/System of Effect
trichlorobenzene, 1,2,4-	120-82-1	70	P/ST	22.5	22.5	TC	700	increased adrenal weights, central nervous system
trichlorobenzene, 1,3,5-	108-70-3	42	HAL/ST	NA	NA		420	HAL RfD
trichloroethane, 1,1,1-	71-55-6	200	P/ST	270	270	TC	2000	NA
trichloroethane, 1,1,2-	79-00-5	5	P/C	28.5	28.5	HH	50	carcinogen
trichloroethene [or TCE]	79-01-6	3	P/C	80.7 annual average	80.7 annual average	N	30	carcinogen
trichlorofluoromethane	75-69-4	2100	MC/ST	NA	NA		21000	central nervous system, heart, liver, lung
trichlorophenol, 2,4,5-	95-95-4	4	PQL/O	22.5	22.5	TC	40	kidney, liver
trichlorophenol, 2,4,6-	88-06-2	5	PQL/C	6.5 annual average	6.5 annual average	N	50	carcinogen
trichlorophenoxy acetic acid, 2,4,5-	93-76-5	70	MC/ST	145	145	TC	700	proteinuria
trichlorophenoxy proprionic acid, 2(2,4,5)- [or silvex]	93-72-1	50	P/ST	NA	NA		500	liver
trichloropropane, 1,1,2-	598-77-6	35	MC/ST	NA	NA		350	kidney, liver, thyroid
trichloropropane, 1,2,3-	96-18-4	5	PQL/C	0.26	0.26	HH	50	carcinogen
trichloropropene, 1,2,3-	96-19-5	35	MC/ST	NA	NA	TC	350	eye
trifluralin	1582-09-8	4.5	MC/C	0.78	0.78	HH	45	carcinogen
trimethyl phosphate	512-56-1	50	PQL/C	NA	NA		500	carcinogen
trimethylbenzene, 1,2,3-	526-73-8	10	PQL/ST (e)	NA	NA		100	NA
trimethylbenzene, 1,2,4-	95-63-6	10	PQL/O	217.5	217.5	TC	100	NA
trimethylbenzene, 1,3,5-	108-67-8	10	PQL/O	215	215	TC	100	NA
trinitrobenzene, 1,3,5-	99-35-4	32	PQL/ST	19	19	TC	320	spleen
trinitrophenylmethylnitramine	479-45-8	70	MC/ST	NA	NA		700	kidney, liver, spleen
trinitrotoluene, 2,4,6-	118-96-7	10	PQL/C	49	49	TC	100	carcinogen
TRPH		5000	###	5000	5000	###	50000	NA
uranium	7440-61-1	21	MC/ST	NA	NA		210	NA
vanadium	7440-62-2	49	MC/ST	NA	NA		490	NOAEL
vanadium pentoxide (as V)	1314-62-1	63	MC/ST	12.5	12.5	TC	630	hair
vanadium sulfate (as V)	36907-42-3	140	MC/ST	NA	NA		1400	none observed
vernam	1929-77-7	7	MC/ST	11.5	11.5	TC	70	decreased body weight
vinyl acetate	108-05-4	88	O/ST	700	700	TC	880	nasal epithelial lesions
vinyl chloride	75-01-4	1	P/C	NA	NA		10	carcinogen
white phosphorous	7723-14-0	0.1	MC/ST	NA	0.1	N	1	forelimb hair loss, parturition mortality
xylenes	1330-20-7	20	S/ST	370	370	TC	200	central nervous system, kidney, whole body

Table 3b
Groundwater Cleanup Target Levels for Chapter 62-785, F.A.C.

Chemical Name	Chemical Abstract Registry Number CAS #	A Groundwater Criteria (ug/L)	Basis for A	B Freshwater Surface Water Criteria (ug/L)e	C Marine Surface Water Criteria (ug/L)e	Basis for B & C	D Groundwater of Low Yield/Poor Quality Criteria (ug/L)	Target Organ/System or Effect
zinc	7440-66-6	5000	S/ST	*a*	86	N	50000	blood
zinc chloride (as Zn)		2100	MC/ST	1.5	1.5	TC	21000	blood
zinc phosphide	1314-84-7	2.1	MC/ST	NA	NA		21	decreased food intake, decreased weight
zineb	12122-67-7	350	MC/ST	13.5	13.5	TC	3500	thyroid
toxicity bioassay tests				pass test	pass test			

GCTLs for other chemicals can be found in Chapters 62-550 and 62-520, F.A.C.

N = As provided in Chapter 62-302, F.A.C.

TC = Toxicity Criteria, 1/20 of applicable LC50 data.

C = Carcinogen

ST= Systemic Toxicant

PQL = Permissible Quantitation Limit

MRL = Minimum Risk Level from ATSDR Toxicant Profile

= Based on similarity to chloride considerations as provided in Chapter 62-302, F.A.C.

= As provided in Chapter 62-302, F.A.C. Toxicity Criteria (marine); Numerical (freshwater)

= Based on similarity to oil and grease standard as provided in Chapter 62-302, F.A.C.

a = Hardness-dependent per Chapter 62-302, F.A.C.

b = Not greater than 10% above background.

c = pH-dependent per Chapter 62-302, F.A.C.

d = Shall not be increased more than 50% above background or to 1275, whichever is greater (Per Chapter 62-302, F.A.C.).

e = Unless otherwise stated, all criteria express the maximum not to be exceeded at any time.

P = Florida Department of Environmental Protection Groundwater Standard.

S = Florida Department of Environmental Protection Secondary Groundwater Standard.

MC = Florida Department of Environmental Protection Groundwater Guidance Concentration based on minimum criteria.

* = As provided in Chapter 62-302, F.A.C. If the PQL using the most sensitive and currently available technology is higher than the specified criterion, the PQL shall be used.

**= Based on Specific Conductance and Salinity as provided in Chapter 62-302, F.A.C.

O= Florida Department of Environmental Protection Groundwater Guidance Concentration based on organoleptic criteria.

Surrogate (a): Surrogate RfD based on other non-carcinogenic PAHs (e.g., pyrene).

Surrogate (b): Surrogate RfD based on oral RfD for HCH-gamma (lindane).

Surrogate (c): Surrogate RfD based on other non-carcinogenic PAHs (e.g., naphthalene).

Surrogate (d): Surrogate based on Primary Groundwater Standard for 1,2,4-trichlorobenzene.

Surrogate (e): Surrogate based on Primary Groundwater Standard for 1,2,4-trimethylbenzene.

Surrogate (f): Surrogate RfD based on oral RfD for 2-chlorophenol.

Surrogate (g): Surrogate RfD based on oral RfD for 2,4-dichlorophenol.

Table 3b
Groundwater Cleanup Target Levels for Chapter 62-785, F.A.C.

		A		B	C		D	
Chemical Name	Chemical Abstract Registry Number CAS #	Groundwater Criteria (ug/L)	Basis for A	Freshwater Surface Water Criteria (ug/L)#	Marine Surface Water Criteria (ug/L)#	Basis for B & C	Groundwater of Low Yield/Poor Quality Criteria (ug/L)	Target Organ/System or Effect

¥ = The residential SCTL for nickel is based on non-carcinogenic endpoints and the industrial SCTL is based on carcinogenic endpoints. As a result, the Groundwater of Low Yield/Poor Quality Criteria is based on the more conservative non-carcinogenic endpoint.

ND= Not developed at time of rule adoption. Check current status in Chapter 62-302, F.A.C.
NA = Not available at time of rule adoption.

pass test = "pass test" shall mean mortality less than fifty percent in a 96-hour acute toxicity test performed, in predominantly fresh waters, on both Cyprinella leedsi (bannerfin shiner) and Ceriodaphnia dubia (water flea), and in predominantly marine waters, on both Menidia beryllina (inland silversides) and Americamysis bahia (possum shrimp).

Note: If more than one contaminant is present at a site, the direct exposure values are to be modified, if necessary, such that the sum of the hazard quotients for non-carcinogenic contaminants affecting the same organ(s) s is 1 or less. For carcinogens, the direct exposure values shall be modified such that the excess cumulative lifetime risk level posed by the contaminants is 1.0E-06.

Table 4a

Sources and Derivation of Toxicity Values Used in Calculations for Carcinogens

April [illegible] 1998

Chemical Name	GI Absorption	GI Ref.	SFo (mg/kg/day)$^{-1}$	Tox Value Source	SFi (mg/kg/day)$^{-1}$	Tox Value Source	SFd (mg/kg/day)$^{-1}$	Tox Value Source
acephate	0.5	RS	8.7E-03	IRIS	1.7E-02	extrapolated	1.7E-02	extrapolated
acrylamide	0.5	RS	4.5E+00	IRIS	4.6E+00	REG III	9.0E+00	extrapolated
acrylonitrile	0.8	RV	5.4E-01	IRIS	2.4E-01	HEAST	6.8E-01	extrapolated
alachlor	0.8	RV	8.0E-02	HEAST	1.0E-01	extrapolated	1.0E-01	extrapolated
aldrin	1.0	HS	1.7E+01	IRIS	1.7E+01	HEAST	1.7E+01	extrapolated
aniline	0.5	RS	5.7E-03	IRIS	1.1E-02	extrapolated	1.1E-02	extrapolated
arsenic	0.95	A	1.5E+00	IRIS	1.5E+01	REG III	1.6E+00	extrapolated
atrazine	0.5	RS	2.2E-01	HEAST	4.4E-01	extrapolated	4.4E-01	extrapolated
azobenzene	0.5	RS	1.1E-01	IRIS	1.1E-01	IRIS	2.2E-01	extrapolated
benzene	0.9	A	2.9E-02	IRIS	2.9E-02	HEAST	3.2E-02	extrapolated
benzo(a)anthracene	0.5	A	7.3E-01	USEPA 93 TEF	3.1E-01	REG III	1.5E+00	extrapolated
benzo(a)pyrene	0.5	A	7.3E+00	IRIS	3.1E+00	REG III	1.5E+01	extrapolated
benzo(b)fluoranthene	0.5	A	7.3E-01	USEPA 93 TEF	3.1E-01	REG III	1.5E+00	extrapolated
benzo(k)fluoranthene	0.5	A	7.3E-02	USEPA 93 TEF	3.1E-02	REG III	1.5E-01	extrapolated
benzotrichloride	0.8	RV	1.3E+01	IRIS	1.6E+01	extrapolated	1.6E+01	extrapolated
benzyl chloride	0.8	RV	1.7E-01	IRIS	2.1E-01	extrapolated	2.1E-01	extrapolated
beryllium	0.006	A			8.4E+00	IRIS		
bis (2-chloro-1-methylethyl) ether	0.8	RV	7.0E-02	REG III	3.5E-02	REG III	8.8E-02	extrapolated
bis (2-chloroethyl)ether	0.8	RV	1.1E+00	IRIS	1.2E+00	IRIS	1.4E+00	extrapolated
bis (2-chloroisopropyl) ether	0.98	A	7.0E-02	HEAST	3.5E-02	HEAST	7.1E-02	extrapolated
bis (2-ethylhexyl)phthalate	0.5	RS	1.4E-02	IRIS	2.8E-02	extrapolated	2.8E-02	extrapolated
bromodichloromethane	0.98	A	6.2E-02	IRIS	6.3E-02	extrapolated	6.3E-02	extrapolated
bromoform	0.75	A	7.9E-03	IRIS	3.9E-03	HEAST	1.1E-02	extrapolated
captan	0.5	RS	3.5E-03	HEAST	7.0E-03	extrapolated	7.0E-03	extrapolated
carbazole	0.8	RV	2.0E-02	HEAST	2.5E-02	extrapolated	2.5E-02	extrapolated
carbon tetrachloride	0.85	A	1.3E-01	IRIS	5.3E-02	HEAST	1.5E-01	extrapolated
chlordane	0.8	A	3.5E-01	IRIS	3.5E-01	HEAST	4.4E-01	extrapolated
chlorobenzilate	0.57	HS	2.7E-01	HEAST	2.7E-01	HEAST	4.7E-01	extrapolated
chloroform	1.0	A	6.1E-03	IRIS	8.1E-02	HEAST	6.1E-03	extrapolated
chloromethane	0.8	RV	1.3E-02	HEAST	6.3E-03	HEAST	1.6E-02	extrapolated
chloronitrobenzene, o-	0.8	RV	2.5E-02	HEAST	3.1E-02	extrapolated	3.1E-02	extrapolated
chloronitrobenzene, p-	0.8	RV	1.8E-02	HEAST	2.3E-02	extrapolated	2.3E-02	extrapolated

Table 4a

Sources and Derivation of Toxicity Values Used in Calculations for Carcinogens

April 30, 1998

Chemical Name	GI Absorption	GI Ref.	SFo (mg/kg/day)$^{-1}$	Tox Value Source	SFi (mg/kg/day)$^{-1}$	Tox Value Source	SFd (mg/kg/day)$^{-1}$	Tox Value Source
chlorthalonil	0.5	RS	1.1E-02	HEAST	2.2E-02	extrapolated	2.2E-02	extrapolated
chromium (hexavalent)	0.013	A	n/a		4.2E+01	IRIS	n/a	
chrysene	0.5	A	7.3E-03	USEPA 93 TEF	3.1E-03	REG III	1.5E-02	extrapolated
crotonaldehyde	0.5	RS	1.9E+00	HEAST	1.9E+00	REG III	3.8E+00	extrapolated
DDD, 4,4'-	0.8	A	2.4E-01	IRIS	3.0E-01	extrapolated	3.0E-01	extrapolated
DDE, 4,4'-	0.8	A	3.4E-01	IRIS	4.3E-01	extrapolated	4.3E-01	extrapolated
DDT, 4,4'-	0.8	A	3.4E-01	IRIS	3.4E-01	HEAST	4.3E-01	extrapolated
diallate	0.5	RS	6.1E-02	HEAST	1.2E-01	extrapolated	1.2E-01	extrapolated
dibenzo(a,h)anthracene	0.5	A	7.3E+00	USEPA 93 TEF	3.1E+00	REG III	1.5E+01	extrapolated
dibromo-3-chloropropane, 1,2-	0.5	RS	1.4E+00	HEAST	2.4E-03	IRIS	2.8E+00	extrapolated
dibromochloromethane	0.75	A	8.4E-02	IRIS	1.1E-01	extrapolated	1.1E-01	extrapolated
dibromoethane, 1,2-	0.98	A	8.5E+01	IRIS	7.6E-01	HEAST	8.7E+01	extrapolated
dichlorobenzene, 1,4-	1.0	A	2.4E-02	HEAST	2.4E-02	extrapolated	2.4E-02	extrapolated
dichlorobenzidine, 3,3-	0.5	RS	4.5E-01	IRIS	9.0E-01	extrapolated	9.0E-01	extrapolated
dichloroethane, 1,2-	1.0	A	9.1E-02	IRIS	9.1E-02	IRIS	9.1E-02	extrapolated
dichloroethene, 1,1-	1.0	A	6.0E-01	IRIS	6.0E-01	calc - IRIS	6.0E-01	extrapolated
dichloropropane, 1,2-	1.0	A	7.0E-02	HEAST	7.0E-02	extrapolated	7.0E-02	extrapolated
dichloropropene, 1,3-	0.98	A	1.8E-01	HEAST	1.3E-01	IRIS	1.8E-01	extrapolated
dichlorvos	0.5	RS	2.9E-01	IRIS	5.8E-01	extrapolated	5.8E-01	extrapolated
dicofol	0.5	RS	4.4E-01	REG III (W)	8.8E-01	extrapolated	8.8E-01	extrapolated
dieldrin	1.0	HS	1.6E+01	IRIS	1.6E+01	HEAST	1.6E+01	extrapolated
dimethylaniline, 2,4-	0.5	RS	7.5E-01	HEAST	1.5E+00	extrapolated	1.5E+00	extrapolated
dinitrotoluene, 2,4-	1.0	HS	6.8E-01	IRIS	6.8E-01	extrapolated	6.8E-01	extrapolated
dinitrotoluene, 2,6-	0.5	RS	6.8E-01	IRIS	1.4E+00	extrapolated	1.4E+00	extrapolated
dioxane, 1,4-	0.5	RS	1.1E-02	IRIS	2.2E-02	extrapolated	2.2E-02	extrapolated
dioxin (2,3,7,8-TCDD)	0.9	A	1.5E+05	IRIS	1.5E+05	IRIS	1.7E+05	extrapolated
diphenylhydrazine, 1,2-	0.5	RS	8.0E-01	IRIS	7.7E-01	REG III	1.6E+00	extrapolated
epichlorohydrin	0.8	RV	9.9E-03	IRIS	4.2E-03	REG III	1.2E-02	extrapolated
ethyl acrylaye	0.8	RV	4.8E-02	HEAST	6.0E-02	extrapolated	6.0E-02	extrapolated
ethyl chloride	0.8	RV	2.9E-03	REG III	3.6E-03	extrapolated	3.6E-03	extrapolated
ethylene oxide	0.8	RV	1.0E+00	HEAST	3.5E-01	REG III	1.3E+00	extrapolated
formaldehyde	0.5	RS	n/a		4.6E-02	REG III	n/a	

Table 4a

Sources and Derivation of Toxicity Values Used in Calculations for Carcinogens

April __, 1998

Chemical Name	GI Absorption	GI Ref.	SFo (mg/kg/day)$^{-1}$	Tox Value Source	SFi (mg/kg/day)$^{-1}$	Tox Value Source	SFd (mg/kg/day)$^{-1}$	Tox Value Source
heptachlor	0.4	A	4.5E+00	IRIS	4.5E+00	HEAST	1.1E+01	extrapolated
heptachlor epoxide	0.4	A	9.1E+00	IRIS	9.1E+00	HEAST	2.3E+01	extrapolated
hexachlorobenzene	0.8	A	1.6E+00	IRIS	1.6E+00	HEAST	2.0E+00	extrapolated
hexachlorobutadiene	1.0	A	7.8E-02	IRIS	7.7E-02	REG III	7.8E-02	extrapolated
hexachlorocyclohexane, alpha-	0.974	A	6.3E+00	IRIS	6.3E+00	HEAST	6.5E+00	extrapolated
hexachlorocyclohexane, beta-	0.907	A	1.8E+00	IRIS	1.8E+00	HEAST	2.0E+00	extrapolated
hexachlorocyclohexane, gamma-	0.994	A	1.3E+00	HEAST	1.3E+00	extrapolated	1.3E+00	extrapolated
hexachloroethane	0.8	RV	1.4E-02	IRIS	1.4E-02	HEAST	1.8E-02	extrapolated
hexahydro-1,3,5-trinitro-1,3,5-triazine	0.5	RS	1.1E-01	IRIS	2.2E-01	extrapolated	2.2E-01	extrapolated
indeno(1,2,3-cd)pyrene	0.5	A	7.3E-01	USEPA 93 TEF	3.1E-01	REG III	1.5E+00	extrapolated
isophorone	0.5	RS	9.5E-04	IRIS	1.9E-03	extrapolated	1.9E-03	extrapolated
methoxy-5-nitroaniline, 2-	0.5	RS	4.6E-02	HEAST	9.2E-02	extrapolated	9.2E-02	extrapolated
methylaniline, 2-	0.5	RS	2.4E-01	HEAST	4.8E-01	extrapolated	4.8E-01	extrapolated
methylene bis(2-chloroaniline), 4,4'-	0.5	RS	1.3E-01	HEAST	2.6E-01	extrapolated	2.6E-01	extrapolated
methylene chloride	1.0	A	7.5E-03	IRIS	1.6E-03	IRIS	7.5E-03	extrapolated
nickel subsulfide	0.05	A	n/a		1.7E+00	HEAST	n/a	
nitroso-di-ethylamine, N-	0.5	RS	1.5E+02	IRIS	1.5E+02	REG III	3.0E+02	extrapolated
nitroso-di-n-butylamine, N-	0.80	RV	5.4E+00	IRIS	5.6E+00	REG III	6.8E+00	extrapolated
nitroso-di-n-propylamine, N-	0.475	A	7.0E+00	IRIS	1.5E+01	extrapolated	1.5E+01	extrapolated
nitroso-N-methylethylamine, N-	0.5	RS	2.2E+01	IRIS	4.4E+01	extrapolated	4.4E+01	extrapolated
nitrosodimethylamine, N-	0.5	RS	5.1E+01	IRIS	5.1E+01	HEAST	1.0E+02	extrapolated
nitrosodiphenylamine, N-	0.5	RS	4.9E-03	IRIS	9.8E-03	extrapolated	9.8E-03	extrapolated
PCBs	0.85	A	2.0E+00	IRIS	4.0E-01	REG III	2.4E+00	extrapolated
pentachloronitrobenzene	0.5	RS	2.6E-01	HEAST	5.2E-01	extrapolated	5.2E-01	extrapolated
pentachlorophenol	0.5	A	1.2E-01	IRIS	2.4E-01	extrapolated	2.4E-01	extrapolated
phenylenediamine, o-	0.5	RS	4.7E-02	HEAST	9.4E-02	extrapolated	9.4E-02	extrapolated
phenylphenol, 2-	0.5	RS	1.9E-03	HEAST	3.8E-03	extrapolated	3.8E-03	extrapolated
propylene oxide	0.8	RV	2.4E-01	IRIS	1.3E-02	REG III	3.0E-01	extrapolated
simazine	0.5	RS	1.2E-01	HEAST	2.4E-01	extrapolated	2.4E-01	extrapolated
tetrachloroethane, 1,1,1,2-	0.8	RV	2.6E-02	IRIS	2.6E-02	HEAST	3.3E-02	extrapolated
tetrachloroethane, 1,1,2,2-	0.7	A	2.0E-01	IRIS	2.0E-01	HEAST	2.9E-01	extrapolated
tetrachloroethene	1.0	A	5.2E-02	REG III	2.0E-03	REG III	5.2E-02	extrapolated

Table 4a

Sources and Derivation of Toxicity Values Used in Calculations for Carcinogens

April 30, 1998

Chemical Name	GI Absorption	GI Ref.	SFo (mg/kg/day)$^{-1}$	Tox Value Source	SFi (mg/kg/day)$^{-1}$	Tox Value Source	SFd (mg/kg/day)$^{-1}$	Tox Value Source
toluidine, p-	0.5	RS	1.9E-01	HEAST	3.8E-01	extrapolated	3.8E-01	extrapolated
toxaphene	0.63	HS	1.1E+00	IRIS	1.1E+00	IRIS	1.7E+00	extrapolated
trichloroethane, 1,1,2-	0.81	A	5.7E-02	IRIS	5.7E-02	HEAST	7.0E-02	extrapolated
trichloroethene	0.945	A	1.1E-02	REG III	6.0E-03	REG III	1.2E-02	extrapolated
trichlorophenol, 2,4,6-	0.5	RS	1.1E-02	IRIS	1.0E-02	HEAST	2.2E-02	extrapolated
trichloropropane, 1,2,3-	0.8	RV	7.0E+00	IRIS	8.8E+00	extrapolated	8.8E+00	extrapolated
trifluralin	0.2	HS	7.7E-03	IRIS	3.9E-02	extrapolated	3.9E-02	extrapolated
trimethyl phosphate	0.50	RS	3.7E-02	HEAST	7.4E-02	extrapolated	7.4E-02	extrapolated
trinitrotoluene, 2,4,6-	0.5	RS	3.0E-02	IRIS	6.0E-02	extrapolated	6.0E-02	extrapolated
vinyl chloride	0.875	A	1.9E+00	HEAST	3.0E-01	HEAST	2.2E+00	extrapolated

GI: Gastrointestinal

RS: USEPA Region IV Supplemental Guidance to RAGS: Human Health Bulletin, 1996. Absorption factor for semi-volatile organic chemicals.

RV: USEPA Region IV Supplemental Guidance to RAGS: Human Health Bulletin, 1996. Absorption factor for volatile organic chemicals.

A: Agency for Toxic Substances and Disease Registry Toxicological Profiles.

HS: Hazardous Substances Database

HEAST: Health Effects Assessment Summary Tables.

IRIS: Integrated Risk Information System.

REG III: USEPA Region III Risk-Based Concentration Table.

USEPA 93 TEF: USEPA Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons (EPA/600/R-93/089).

n/a: not applicable

WD = withdrawn

Chemical Name	GI Abs	GI Ref	RfDo (mg/kg/day)	Tox Value Source	RfDi (mg/kg/day)	Tox Value Source	RfDd (mg/kg/day)	Tox Value Source	Target Organ or Effect
acenaphthene	0.5	A	6.0E-02	IRIS	3.0E-02	extrapolated	3.0E-02	extrapolated	liver
acenaphthylene	0.5	RS	3.0E-02	IRIS (WD)	2.0E-02	extrapolated	2.0E-02	extrapolated	decreased body weight, liver
acetone	0.8	RV	1.0E-01	IRIS	8.0E-02	extrapolated	8.0E-02	extrapolated	central nervous system, kidney, liver
acetonitrile	0.8	RV	6.0E-03	IRIS	6.0E-04	extrapolated*	5.0E-03	extrapolated	blood, liver
					RfC 2.0E-03 (IRIS)				
acetophenone	0.8	RV	1.0E-01	IRIS	8.0E-02	extrapolated	8.0E-02	extrapolated	general toxicity
acrolein	0.8	RV	2.0E-02	HEAST	6.0E-06	REG III	2.0E-02	extrapolated	respiratory (nasal epithelium)
acrylic acid	0.5	RS	5.0E-01	IRIS	3.0E-01	extrapolated	3.0E-01	extrapolated	
aldicarb	1.0	HS	1.0E-03	IRIS	1.0E-03	extrapolated	1.0E-03	extrapolated	central nervous system
allyl alcohol	0.5	RS	5.0E-03	IRIS	3.0E-03	extrapolated	3.0E-03	extrapolated	kidney, liver
aluminum	0.04	A	1.0E+00	REG III	1.0E-03	REG III	4.0E-02	extrapolated	altered body weight
aluminum phosphide	0.2	RI	4.0E-04	IRIS	8.0E-05	extrapolated	8.0E-05	extrapolated	altered body weight
ametryn	0.679	HS	9.0E-03	IRIS	6.0E-03	extrapolated	6.0E-03	extrapolated	liver
ammonia	0.8	RV	NA		3.0E-02	extrapolated*	3.0E-02	extrapolated	lungs, nasal cavity
					RfC 1.0E-01 (IRIS)				
ammonium sulfamate	0.2	RI	2.0E-01	IRIS	4.0E-02	extrapolated	4.0E-02	extrapolated	decreased body weight
anthracene	0.5	A	3.0E-01	IRIS	2.0E-01	extrapolated	2.0E-01	extrapolated	none observed
antimony	0.01	A	4.0E-04	IRIS	4.0E-06	extrapolated	4.0E-06	extrapolated	blood, increased mortality
antimony pentoxide (as Sb)	0.2	RI	5.0E-04	HEAST	1.0E-04	extrapolated	1.0E-04	extrapolated	blood, increased mortality
antimony potassium tartrate (as Sb)	0.2	RI	9.0E-04	HEAST	2.0E-04	extrapolated	2.0E-04	extrapolated	blood, increased mortality
antimony tetroxide (as Sb)	0.2	RI	4.0E-04	HEAST	8.0E-05	extrapolated	8.0E-05	extrapolated	blood, increased mortality
antimony trioxide (as Sb)	0.2	RI	4.0E-04	HEAST	6.0E-05	REG III	8.0E-05	extrapolated	blood, increased mortality
barium	0.05	A	7.0E-02	IRIS	1.0E-04	extrapolated*	4.0E-03	extrapolated	increased blood pressure
					RfC 5.0E-04 (HEAST)				
bayleton	0.5	RS	3.0E-02	IRIS	2.0E-02	extrapolated	2.0E-02	extrapolated	blood, decreased body weight gain
benomyl	0.665	HS	5.0E-02	IRIS	3.0E-02	extrapolated	3.0E-02	extrapolated	decreased offspring weights
bentazon	0.5	RS	3.0E-02	IRIS	2.0E-02	extrapolated	2.0E-02	extrapolated	blood
benzaldehyde	0.8	RV	1.0E-01	IRIS	8.0E-02	extrapolated	8.0E-02	extrapolated	kidney, stomach
benzenethiol	0.8	RV	1.0E-05	HEAST	8.0E-06	extrapolated	8.0E-06	extrapolated	liver
benzo(g,h,i)perylene	0.5	A	3.0E-02	Surrogate (a)	2.0E-02	extrapolated	2.0E-02	extrapolated	central nervous system
benzoic acid	1	HS	4.0E+00	IRIS	4.0E+00	extrapolated	4.0E+00	extrapolated	none observed
benzyl alcohol	0.5	RS	3.0E-01	HEAST	2.0E-01	extrapolated	2.0E-01	extrapolated	eye, stomach
beryllium	0.006	A	2.0E-03	IRIS	1.0E-05	extrapolated	1.0E-05	extrapolated	gastrointestinal lesions
bidrin (dicrotophos)	0.5	RS	1.0E-04	IRIS	5.0E-05	extrapolated	5.0E-05	extrapolated	decreased offspring survival
biphenyl, 1,1-(diphenyl)	0.8	RV	5.0E-02	IRIS	4.0E-02	extrapolated	4.0E-02	extrapolated	kidney
bisphenol A	0.5	RS	5.0E-02	IRIS	3.0E-02	extrapolated	3.0E-02	extrapolated	decreased body weight
boron	0.2	RI	9.0E-02	IRIS	6.0E-03	extrapolated*	2.0E-02	extrapolated	male reproductive, respiratory
					RfC 2.0E-02(HEAST)				
bromacil	0.5	RS	1.0E-01	OPP	5.0E-02	extrapolated	5.0E-02	extrapolated	decreased body weight

Table 4b
Sources and Derivation of Toxicity Values Used in Calculations for Noncarcinogens

April 30, 1998

Chemical Name	GI Abs	GI Ref.	RfDo (mg/kg/day)	Tox Value Source	RfDi (mg/kg/day)	Tox Value Source	RfDd (mg/kg/day)	Tox Value Source	Target Organ or Effect
bromochloromethane	0.8	RV	1.3E-02	HAL	1.0E-02	extrapolated	1.0E-02	extrapolated	liver
bromomethane (methyl bromide)	0.8	RV	1.4E-03	IRIS	1.4E-03	extrapolated	1.1E-03	extrapolated	stomach
butanol, 1-	0.5	RS	1.0E-01	IRIS	5.0E-02	extrapolated	5.0E-02	extrapolated	central nervous system
butanone, 2- (MEK)	1.0	US	6.0E-01	IRIS	3.0E-01	extrapolated*	6.0E-01	extrapolated	fetus
					RfC 1.0E+00(HEAST)				
butyl benzyl phthalate, N-	1.0	US	2.0E-01	IRIS	2.0E-01	extrapolated	2.0E-01	extrapolated	liver
butylate	0.5	RS	5.0E-02	IRIS	3.0E-02	extrapolated	3.0E-02	extrapolated	liver
butylphthalyl butylglycolate	0.5	RS	1.0E+00	IRIS	5.0E-01	extrapolated	2.0E+00	extrapolated	none observed
cadmium	0.044	A	1.0E-03	IRIS	4.0E-05	extrapolated	4.0E-05	extrapolated	kidney, liver/carcinogen
calcium cyanide	0.2	RI	4.0E-02	IRIS	8.0E-03	extrapolated	8.0E-03	extrapolated	none observed
carbaryl	0.98	HS	1.0E-01	IRIS	1.0E-01	extrapolated	1.0E-01	extrapolated	kidney, liver
carbofuran	0.5	RS	5.0E-03	IRIS	3.0E-03	extrapolated	3.0E-03	extrapolated	blood, reproductive
carbon disulfide	0.8	RV	1.0E-01	IRIS	2.0E-01	extrapolated*	8.0E-02	extrapolated	fetus
					RfC 7.0E-01(IRIS)				
carbophenothion	0.5	RS	1.3E-04	OPP	7.0E-05	extrapolated	7.0E-05	extrapolated	blood, central nervous system
chlorine	0.2	RI	1.0E-01	IRIS	2.0E-02	extrapolated	2.0E-02	extrapolated	none observed
chlorine cyanide	0.2	RI	5.0E-02	IRIS	1.0E-02	extrapolated	1.0E-02	extrapolated	none observed
chlorine dioxide	0.2	RI	1.0E-02	HAL	6.0E-05	extrapolated	2.0E-03	extrapolated	no effect level on neurological development in offspring
chlorite	0.2	RI	3.0E-03	HAL	6.0E-04	extrapolated	6.0E-04	extrapolated	neurobehavorial effects
chloro-m-cresol									
chloro-1,3-butadiene	0.8	RV	2.0E-02	REG III	2.0E-02	extrapolated	2.0E-02	extrapolated	respiratory (nasal epithelium)
chloroacetic acid	0.5	RS	2.0E-03	HEAST	1.0E-03	extrapolated	1.0E-03	extrapolated	heart
chloroaniline	0.5	RS	4.0E-03	IRIS	2.0E-03	extrapolated	2.0E-03	extrapolated	spleen
chlorobenzene	0.31	A	2.0E-02	IRIS	6.0E-03	extrapolated*	6.0E-03	extrapolated	kidney, liver
					RfC 2.0E-02(HEAST)				
chlorobenzoic acid, p-	0.8	RV	2.0E-01	HEAST	2.0E-01	extrapolated	2.0E-01	extrapolated	none observed
chlorobenzotrifluoride, 4-	0.8	RV	2.0E-02	HEAST	2.0E-02	extrapolated	2.0E-02	extrapolated	kidney
chlorobutane, 1-	0.8	RV	4.0E-01	HEAST	3.0E-01	extrapolated	3.0E-01	extrapolated	blood, central nervous system, increased mortality
chloroethylvinylether, 2-	0.8	RV	2.5E-02	REG III	2.0E-02	extrapolated	2.0E-02	extrapolated	NA
chloronaphthalene, beta-	0.8	RV	8.0E-02	IRIS	6.0E-02	extrapolated	6.0E-02	extrapolated	liver, respiratory
chlorophenol, 2-	0.8	RV	5.0E-03	IRIS	4.0E-03	extrapolated	4.0E-03	extrapolated	reproductive system
chlorophenol, 3-	0.5	RS	5.0E-03	SURROGATE (b	3.0E-03	extrapolated	3.0E-03	extrapolated	reproductive system
chlorophenol, 4-	0.5	RS	5.0E-03	SURROGATE (b	3.0E-03	extrapolated	3.0E-03	extrapolated	reproductive system
chloropropane, 2-	0.8	RV	1.0E-01	HEAST	3.0E-02	extrapolated*	8.0E-02	extrapolated	liver
					RfC 1.0E+00(HEAST)				

Chemical Name	GI Abs	GI Ref.	RfDo (mg/kg/day)	Tox Value Source	RfDi (mg/kg/day)	Tox Value Source	RfDd (mg/kg/day)	Tox Value Source	Target Organ or Effect
chlorotoluene, o-	0.8	RV	2.0E-02	IRIS	2.0E-02	extrapolated	2.0E-02	extrapolated	decreased body weight
chlorotoluene, p-	0.8	RV	2.0E-02	HAL	2.0E-02	extrapolated	2.0E-02	extrapolated	HAL RfD
chlorpropham	0.5	RS	2.0E-01	IRIS	1.0E-01	extrapolated	1.0E-01	extrapolated	bone marrow, kidney, liver, spleen
chlorpyrifos	0.9	HS	3.0E-03	IRIS	3.0E-03	extrapolated	3.0E-03	extrapolated	blood
cobalt	0.25	HS	6.0E-02	IRIS	2.0E-02	extrapolated	2.0E-02	extrapolated	NA
copper	0.56	A	7.0E-02	NCEA Guidance Value	4.0E-02	extrapolated	4.0E-02	extrapolated	gastrointestinal irritation, liver
copper cyanide	0.2	RI	5.0E-03	IRIS	1.0E-03	extrapolated	1.0E-03	extrapolated	decreased body and organ weights, kidney, liver
coumaphos	0.5	RS	3.0E-04	OPP	2.0E-04	extrapolated	2.0E-04	extrapolated	blood
cumene (isopropyl benzene)	0.8	RV	1.0E-01	REG III	1.0E-01	REG III	3.0E-02	extrapolated	kidney
cyanide	0.5	RS	2.0E-02	IRIS	1.0E-02	extrapolated	1.0E-02	extrapolated	decreased body weight, thyroid, nerve damage
cyanogen	0.8	RV	4.0E-02	IRIS	3.0E-02	extrapolated	3.0E-02	extrapolated	none observed
cycloate	0.5	RS	5.0E-03	OPP	3.0E-03	extrapolated	3.0E-03	extrapolated	nerve damage
cyclohexanone	0.5	RS	5.0E+00	IRIS	3.0E+00	extrapolated	3.0E+00	extrapolated	body weight depression
cyhalothrin, lambda (karate)	0.5	RS	5.0E-03	IRIS	3.0E-03	extrapolated	3.0E-03	extrapolated	decreased body weight, decreased body weight gain in offspring
cypermethrin	0.5	RS	1.0E-02	IRIS	5.0E-03	extrapolated	5.0E-03	extrapolated	gastrointestinal tract
decabromodiphenyl ether	0.5	RS	1.0E-02	IRIS	5.0E-03	extrapolated	5.0E-03	extrapolated	liver
di-n-butylphthalate	1.0	A	1.0E-01	IRIS	1.0E-01	extrapolated	1.0E-01	extrapolated	increased mortality
di-n-octylphthalate	0.5	RS	2.0E-02	HEAST	1.0E-02	extrapolated	1.0E-02	extrapolated	kidney, liver
diazinon	0.5	RS	9.0E-04	HEAST	5.0E-04	extrapolated	5.0E-04	extrapolated	blood
dibenzofuran	0.8	RV	4.0E-03	REG III	3.0E-03	extrapolated	3.0E-03	extrapolated	NA
dibromobenzene, 1,4-	0.5	RS	1.0E-02	IRIS	5.0E-03	extrapolated	5.0E-03	extrapolated	liver
dicamba	0.002	HS	3.0E-02	IRIS	6.0E-05	extrapolated	6.0E-05	extrapolated	fetus
dichloroacetic acid	0.5	RS	4.0E-03	HAL	2.0E-03	extrapolated	2.0E-03	extrapolated	cerebellum, cerebrum, liver, testes
dichloroacetonitrile	0.5	RS	8.0E-03	HAL	4.0E-03	extrapolated	4.0E-03	extrapolated	HAL RfD
dichlorobenzene, 1,2-	0.8	RV	9.0E-02	IRIS	4.0E-02	extrapolated	7.2E-02	extrapolated	no adverse effects observed
dichlorobenzene, 1,3-	0.8	RV	8.9E-02	REG III	7.0E-02	extrapolated	7.0E-02	extrapolated	NA
dichlorodifluoromethane	0.8	RV	2.0E-01	IRIS	6.0E-02	REG III	2.0E-01	extrapolated	decreased body weight
dichloroethane, 1,1-	0.8	RV	1.0E-01	HEAST	1.0E-01	extrapolated*	8.0E-02	extrapolated	central nervous system, kidney
					RfC 5.0E-01(IRIS)				
dichloroethene, cis-1,2-	0.8	RV	1.0E-02	HEAST	8.0E-03	extrapolated	8.0E-03	extrapolated	blood, liver
dichloroethene, trans-1,2-	0.8	RV	2.0E-02	IRIS	2.0E-02	extrapolated	2.0E-02	extrapolated	blood, liver
dichlorophenol, 2,3-	0.5	RS	3.0E-03	SURROGATE (c	2.0E-03	extrapolated	2.0E-03	extrapolated	immune system
dichlorophenol, 2,4-	0.5	RS	3.0E-03	IRIS	2.0E-03	extrapolated	2.0E-03	extrapolated	immune system
dichlorophenol, 2,5-	0.5	RS	3.0E-03	SURROGATE (c	2.0E-03	extrapolated	2.0E-03	extrapolated	immune system

Table 4b
Sources and Derivation of Toxicity Values Used in Calculations for Noncarcinogens

Chemical Name	GI Abs	GI Ref	RfDo (mg/kg/day)	Tox Value Source	RfDi (mg/kg/day)	Tox Value Source	RfDd (mg/kg/day)	Tox Value Source	Target Organ or Effect
dichlorophenol, 2,6-	0.5	RS	3.0E-03	SURROGATE (c	2.0E-03	extrapolated	2.0E-03	extrapolated	immune system
dichlorophenol, 3,4-	0.5	RS	3.0E-03	SURROGATE (c	2.0E-03	extrapolated	2.0E-03	extrapolated	immune system
dichlorophenoxy acetic acid, 2,4-	1.0	HS	1.0E-02	IRIS	1.0E-02	extrapolated	1.0E-02	extrapolated	blood, kidney, liver
dichlorprop	0.8	RV	5.0E-03	OPP	4.0E-03	extrapolated	4.0E-03	extrapolated	OPP RfD
diethylene glycol, monoethyl ether	0.5	RS	2.0E+00	HEAST	1.0E+00	extrapolated	1.0E+00	extrapolated	kidney
diethylphthalate	1.0	HS	8.0E-01	IRIS	8.0E-01	extrapolated	8.0E-01	extrapolated	brain, decreased growth rate, kidney, liver
diisopropyl methylphosphonate	0.5	RS	8.0E-02	IRIS	4.0E-02	extrapolated	4.0E-02	extrapolated	none observed
dimethoate	0.5	RS	2.0E-04	IRIS	1.0E-04	extrapolated	1.0E-04	extrapolated	brain
dimethrin	0.5	RS	3.0E-01	HAL	2.0E-01	extrapolated	2.0E-01	extrapolated	HAL RfD
dimethylformamide, N,N-	0.5	RS	1.0E-01	IRIS	7.0E-03	extrapolated*	5.0E-02	extrapolated	liver
					RfC 3.0E-2 (IRIS)				
dimethylphenol, 2,4-	0.5	RS	2.0E-02	IRIS	1.0E-02	extrapolated	1.0E-02	extrapolated	central nervous system, blood
dimethylphenol, 2,6-	0.5	RS	6.0E-04	IRIS	3.0E-04	extrapolated	3.0E-04	extrapolated	body weight changes, kidney, liver, spleen
dimethylphenol, 3,4-	0.5	RS	1.0E-03	IRIS	5.0E-04	extrapolated	5.0E-04	extrapolated	body weight changes, blood pressure, kidney, liver, spleen
dimethylphthalate	1.0	HS	1.0E+01	HEAST	1.0E+01	extrapolated	1.0E+01	extrapolated	kidney
dinitrobenzene, 1,2- (o)	0.5	RS	4.0E-04	IRIS	2.0E-04	extrapolated	2.0E-04	extrapolated	spleen
dinitrobenzene, 1,3- (m)	0.5	RS	1.0E-04	IRIS	5.0E-05	extrapolated	5.0E-05	extrapolated	spleen
dinitrophenol, 2,4-	0.5	RS	2.0E-03	IRIS	1.0E-03	extrapolated	1.0E-03	extrapolated	eye
dinoseb	1.0	HS	1.0E-03	IRIS	1.0E-03	extrapolated	1.0E-03	extrapolated	fetus
diphenamid	0.5	RS	3.0E-02	IRIS	2.0E-02	extrapolated	2.0E-02	extrapolated	liver
disulfoton	0.939	A	4.0E-05	IRIS	4.0E-05	extrapolated	4.0E-05	extrapolated	blood, eye
diuron	0.9	HS	2.0E-03	IRIS	2.0E-03	extrapolated	2.0E-03	extrapolated	blood
endosulfan	0.815	A	6.0E-03	IRIS	5.0E-03	extrapolated	5.0E-03	extrapolated	blood vessels, decreased weight gain, kidney
endothall	0.5	RS	2.0E-02	IRIS	1.0E-02	extrapolated	1.0E-02	extrapolated	small intestine, stomach
endrin	0.5	RS	3.0E-04	IRIS	2.0E-04	extrapolated	2.0E-04	extrapolated	central nervous system, liver
ethion	1.0	HS	5.0E-04	IRIS	5.0E-04	extrapolated	5.0E-04	extrapolated	blood
ethoprop	0.5	RS	1.0E-04	OPP	5.0E-05	extrapolated	5.0E-05	extrapolated	blood
ethoxyethanol acetate, 2-	0.5	RS	3.0E-01	IRIS	2.0E-01	extrapolated	2.0E-01	extrapolated	fetus
ethoxyethanol, 2-	0.5	RS	4.0E-01	HEAST	2.0E-01	extrapolated	2.0E-01	extrapolated	blood, male reproductive
ethyl acetate	0.8	RV	9.0E-01	HEAST	7.0E-01	extrapolated	7.0E-01	extrapolated	body weight loss, increased mortality

Chemical Name	GI Abs	GI Ref.	RfDo (mg/kg/day)	Tox Value Source	RfDi (mg/kg/day)	Tox Value Source	RfDd (mg/kg/day)	Tox Value Source	Target Organ or Effect
ethyl dipropylthiocarbamate, S-(EPTC)	0.96	HS	2.5E-02	IRIS	2.0E-02	extrapolated	2.0E-02	extrapolated	heart
ethyl ether	0.8	RV	2.0E-01	IRIS	2.0E-01	extrapolated	2.0E-01	extrapolated	decreased body weight
ethyl methacrylate	0.8	RV	9.0E-02	HEAST	7.0E-02	extrapolated	7.0E-02	extrapolated	kidney
ethyl p-nitrophenyl phenylphosphorothioate	1.0	HS	1.0E-05	IRIS	1.0E-05	extrapolated	1.0E-05	extrapolated	nerve damage
ethylbenzene	0.8	RV	1.0E-01	IRIS	3.0E-01	extrapolated*	8.0E-02	extrapolated	central nervous system, kidney, liver
					RfC 1.0E+0 (HEAST)				
ethylene diamine	0.5	RS	2.0E-02	HEAST	1.0E-02	extrapolated	1.0E-02	extrapolated	blood, heart
ethylene glycol	0.5	RS	2.0E+00	IRIS	1.0E+00	extrapolated	1.0E+00	extrapolated	kidney
fenamiphos	0.5	RS	2.5E-04	IRIS	1.0E-04	extrapolated	1.0E-04	extrapolated	blood, central nervous system
fenamiphos metabolites	0.5	RS	1.3E-04	IRIS	6.0E-05	extrapolated	6.0E-05	extrapolated	blood, central nervous system
fensulfothion	0.5	RS	2.5E-04	OPP	1.0E-04	extrapolated	1.0E-04	extrapolated	blood
fluometuron	0.5	RS	1.3E-02	IRIS	6.0E-03	extrapolated	6.0E-03	extrapolated	none observed
fluoranthene	0.5	A	4.0E-02	IRIS	2.0E-02	extrapolated	2.0E-02	extrapolated	blood, kidney, liver
fluorene	0.5	A	4.0E-02	IRIS	2.0E-02	extrapolated	2.0E-02	extrapolated	blood
fluoride	0.97	A	6.0E-02	IRIS	6.0E-02	extrapolated	6.0E-02	extrapolated	dental
fonofos	0.815	HS	2.0E-03	IRIS	2.0E-03	extrapolated	2.0E-03	extrapolated	central nervous system, liver
furan	0.8	RV	1.0E-03	IRIS	8.0E-04	extrapolated	8.0E-04	extrapolated	liver
furfural	0.5	RS	3.0E-03	IRIS	1.0E-02	REG III	2.0E-03	extrapolated	liver
glycidaldehyde	0.5	RS	4.0E-04	IRIS	3.0E-04	REG III	2.0E-04	extrapolated	adrenals, altered weight gain, hematopoeisis, kidney
guthion (azinphos-methyl)	1.0	HS	2.0E-03	OPP	2.0E-03	extrapolated	2.0E-03	extrapolated	blood
hexachlorocyclohexane, delta-	0.919	A	3.0E-04	Surrogate (d)	3.0E-04	extrapolated	3.0E-04	extrapolated	kidney, liver
hexachlorocyclopentadiene	0.9	HS	7.0E-03	IRIS	2.0E-05	extrapolated*	6.0E-03	extrapolated	nasal cavity, stomach
					RfC 7.0E-05(IRIS)				
hexane, n-	0.8	RV	6.0E-02	HEAST	6.0E-02	extrapolated*	5.0E-02	extrapolated	central nervous system, male reproductive
					RfC 2.0E-01(IRIS)				
hexanone, 2- (methyl butyl ketone)	0.98	A	4.0E-02	REG III	4.0E-02	extrapolated	4.0E-02	extrapolated	kidney, liver, whole body
hexazinone	0.5	RS	3.3E-02	IRIS	2.0E-02	extrapolated	2.0E-02	extrapolated	decreased body weight
hydroquinone	0.5	RS	4.0E-02	HEAST	2.0E-02	extrapolated	2.0E-02	extrapolated	blood
iron	0.085	CD	3.0E-01	REG III	3.0E-02	extrapolated	3.0E-02	extrapolated	
isobutyl alcohol	0.8	RV	3.0E-01	IRIS	2.0E-01	extrapolated	2.0E-01	extrapolated	central nervous system
lead	0.8	A	NA	NA	NA	NA	NA	NA	blood

Table 4b
Sources and Derivation of Toxicity Values Used in Calculations for Noncarcinogens

Chemical Name	GI Abs	GI Ref.	RfDo (mg/kg/day)	Tox Value Source	RfDi (mg/kg/day)	Tox Value Source	RfDd (mg/kg/day)	Tox Value Source	Target Organ or Effect
linuron	0.5	RS	2.0E-03	IRIS	1.0E-03	extrapolated	1.0E-03	extrapolated	blood
lithium	0.2	RI	2.0E-02	REG III	4.0E-03	extrapolated	4.0E-03	extrapolated	NA
malathion	0.47	HS	2.0E-02	IRIS	9.0E-03	extrapolated	9.0E-03	extrapolated	blood
maleic hydrazide	0.8	RV	5.0E-01	IRIS	4.0E-01	extrapolated	4.0E-01	extrapolated	kidney
malonitrile	0.05	RS	2.0E-05	HEAST	1.0E-06	extrapolated	1.0E-06	extrapolated	liver, spleen
maneb	0.5	RS	5.0E-03	IRIS	3.0E-03	extrapolated	3.0E-03	extrapolated	thyroid
manganese	0.04	A	2.3E-02	IRIS	1.0E-05	extrapolated*	9.0E-04	extrapolated	central nervous system
					RfC 5.0E-05(IRIS)				
mercury, inorganic	0.1	A	3.0E-04	REG III	9.0E-05	extrapolated*	3.0E-05	extrapolated	central nervous system
					RfC 3.0E-04 (IRIS)				
mercury, methyl	0.95	A	1.0E-04	IRIS	1.0E-04	extrapolated*	1.0E-04	extrapolated	central nervous system
merphos	0.8	RV	3.0E-05	IRIS	9.0E-05	extrapolated	2.0E-05	extrapolated	central nervous system, decreased body weight
merphos oxide	0.5	RS	3.0E-03	IRIS	2.0E-03	extrapolated	2.0E-03	extrapolated	central nervous system, decreased body weight
methacrylonitrile	0.8	RV	1.0E-04	IRIS	2.0E-04	REG III	8.0E-05	extrapolated	liver
methamidophos	0.5	RS	5.0E-05	IRIS	3.0E-05	extrapolated	3.0E-05	extrapolated	central nervous system
methanol	0.5	RS	5.0E-01	IRIS	3.0E-01	extrapolated	3.0E-01	extrapolated	brain, liver
methidathion	0.5	RS	1.0E-03	IRIS	5.0E-04	extrapolated	5.0E-04	extrapolated	liver
methomyl	0.8	RV	2.5E-02	IRIS	2.0E-02	extrapolated	2.0E-02	extrapolated	kidney
methoxychlor	0.9	A	5.0E-03	IRIS	5.0E-03	extrapolated	5.0E-03	extrapolated	reproductive system
methyl acetate	0.8	RV	1.0E+00	HEAST	8.0E-01	extrapolated	8.0E-01	extrapolated	liver
methyl acrylate	0.5	RS	3.0E-02	REG III	2.0E-02	extrapolated	2.0E-02	extrapolated	none observed
methyl isobutyl ketone	0.8	RV	8.0E-02	HEAST	2.0E-02	extrapolated*	6.4E-02	extrapolated	kidney, liver, whole body
					RfC 8.0E-02(HEAST)				
methyl methylacrylate	0.8	RV	1.4E+00	HEAST	1.1E+00	extrapolated	1.1E+00	extrapolated	NOAEL
methyl parathion	0.8	A	2.5E-04	IRIS	2.0E-04	extrapolated	2.0E-04	extrapolated	blood
methyl styrene (mixed)	0.8	RV	6.0E-03	HEAST	1.0E-02	REG III	5.0E-03	extrapolated	nasal cavity
methyl styrene, alpha	0.8	RV	7.0E-02	HEAST	7.0E-02	extrapolated	6.0E-02	extrapolated	kidney, liver
methyl tert-butyl ether	0.8	RV	5.0E-03	REG III	9.0E-01	extrapolated*	4.0E-03	extrapolated	eye, increased prostration, kidney, liver
					RfC 3.0E+00(IRIS)				
methyl-4-chlorophenoxy acetic acid, 2-	0.932	HS	5.0E-04	IRIS	9.0E-01	REG III	5.0E-04	extrapolated	kidney, liver
methylene bromide	0.8	RV	1.0E-02	HEAST	8.0E-03	extrapolated	8.0E-03	extrapolated	blood
methylnaphthalene, 1-	0.8	RV	4.0E-02	Surrogate (e)	3.0E-02	extrapolated	3.0E-02	extrapolated	blood
methylnaphthalene, 2	0.8	RV	4.0E-02	REG III	3.0E-02	extrapolated	3.0E-02	extrapolated	

Table 4b
Sources and Derivation of Toxicity Values Used in Calculations for Noncarcinogens

Chemical Name	GI Abs	GI Ref.	RfDo (mg/kg/day)	Tox Value Source	RfDi (mg/kg/day)	Tox Value Source	RfDd (mg/kg/day)	Tox Value Source	Target Organ or Effect
methylphenol, 2-	0.745	A	5.0E-02	IRIS	4.0E-02	extrapolated	4.0E-02	extrapolated	blood, central nervous system, decreased body weight, kidney, liver
methylphenol, 3-	0.745	A	5.0E-02	IRIS	4.0E-02	extrapolated	4.0E-02	extrapolated	central nervous system, decreased body weight
methylphenol, 4-	0.745	A	5.0E-03	HEAST	4.0E-03	extrapolated	4.0E-03	extrapolated	blood, central nervous system, kidney, liver, respiratory
metolachlor	0.5	RS	1.5E-01	IRIS	8.0E-02	extrapolated	8.0E-02	extrapolated	decreased body weight gain
metribuzin	0.8	RV	3.0E-02	IRIS	2.0E-02	extrapolated	2.0E-02	extrapolated	decreased body weight, kidney, liver, mortality
mevinphos	1.0	HS	3.0E-04	OPP	3.0E-04	extrapolated	3.0E-04	extrapolated	blood
molinate	0.865	HS	2.0E-03	IRIS	2.0E-03	extrapolated	2.0E-03	extrapolated	reproductive system
molybdenum	0.45	HS	5.0E-03	IRIS	2.0E-03	extrapolated	2.0E-03	extrapolated	increased uric acid levels
naled	1.0	HS	2.0E-03	IRIS	2.0E-03	extrapolated	2.0E-03	extrapolated	central nervous system
naphthalene	1.0	A	4.0E-02	HEAST (WD)	4.0E-02	extrapolated	4.0E-02	extrapolated	blood
nickel	0.05	A	2.0E-02	IRIS	1.0E-03	extrapolated	1.0E-03	extrapolated	decreased body weight, female reproductive, kidney, liver, skin
nitrate	0.2	RI	1.6E+00	IRIS	3.0E-01	extrapolated	3.0E-01	extrapolated	blood
nitrite	0.2	RI	1.0E-01	IRIS	2.0E-02	extrapolated	2.0E-02	extrapolated	blood
nitroaniline, o-	0.5	RS	6.0E-05	REG III	6.0E-05	extrapolated*	3.0E-05	extrapolated	blood
			RfC 2.0E-04 (HEAST)						
nitroaniline, p-	0.5	RS	3.0E-03	REG III	6.0E-05	REG III	1.5E-03	extrapolated	NA
nitrobenzene	0.8	RV	5.0E-04	IRIS	6.0E-04	extrapolated*	4.0E-04	extrapolated	adrenal, blood, kidney, liver
			RfC 2.0E-03(HEAST)						
nitrophenol, 4-	0.5	RS	8.0E-03	REG III	4.0E-03	extrapolated	4.0E-03	extrapolated	
nitrotoluene, m-	0.8	RV	1.0E-02	HEAST	8.0E-03	extrapolated	8.0E-03	extrapolated	spleen
nitrotoluene, o-	0.8	RV	1.0E-02	HEAST	8.0E-03	extrapolated	8.0E-03	extrapolated	spleen
nitrotoluene, p-	0.8	RV	1.0E-02	HEAST	8.0E-03	extrapolated	8.0E-03	extrapolated	spleen
octamethylpyrophosphoramide	0.5	RS	2.0E-03	HEAST	1.0E-03	extrapolated	1.0E-03	extrapolated	blood
oxamyl	0.5	RS	2.5E-02	IRIS	1.0E-02	extrapolated	1.0E-02	extrapolated	decreased body weight gain and food consumption
paraquat	0.2	HS	4.5E-03	IRIS	9.0E-04	extrapolated	9.0E-04	extrapolated	respiratory
parathion	1.0	HS	6.0E-03	HEAST	6.0E-03	extrapolated	6.0E-03	extrapolated	blood
pebulate	0.95	HS	5.0E-02	HEAST	5.0E-02	extrapolated	5.0E-02	extrapolated	blood
pendimethalin	0.5	RS	4.0E-02	IRIS	2.0E-02	extrapolated	2.0E-02	extrapolated	blood, liver
pentachlorobenzene	0.5	RS	8.0E-04	IRIS	4.0E-04	extrapolated	4.0E-04	extrapolated	kidney, liver
permethrin	0.5	RS	5.0E-02	IRIS	3.0E-02	extrapolated	3.0E-02	extrapolated	liver
phenanthrene	0.5	A	3.0E-02	Surrogate (a)	2.0E-02	extrapolated	2.0E-02	extrapolated	central nervous system, decreased body weight, liver

Table 4b
Sources and Derivation of Toxicity Values Used in Calculations for Noncarcinogens

Chemical Name	GI Abs	GI Ref	RfDo (mg/kg/day)	Tox Value Source	RfDi (mg/kg/day)	Tox Value Source	RfDd (mg/kg/day)	Tox Value Source	Target Organ or Effect
phenmedipham (betanal)	0.5	RS	2.5E-01	IRIS	1.0E-01	extrapolated	1.0E-01	extrapolated	none observed
phenol	1.0	A	6.0E-01	IRIS	6.0E-01	extrapolated	6.0E-01	extrapolated	central nervous system, female reproductive, fetus, lung
phenylenediamine, m-	0.5	RS	6.0E-03	IRIS	3.0E-03	extrapolated	3.0E-03	extrapolated	liver
phenylenediamine, p-	0.5	RS	1.9E-01	HEAST	1.0E-01	extrapolated	1.0E-01	extrapolated	whole body
phorate	1.0	HS	2.0E-04	HEAST	2.0E-04	extrapolated	2.0E-04	extrapolated	central nervous system
phosmet	0.5	RS	2.0E-02	IRIS	1.0E-02	extrapolated	1.0E-02	extrapolated	blood, decreased body weight, liver
phthalic acid, p-	0.8	RV	1.0E+00	HEAST	8.0E-01	extrapolated	8.0E-01	extrapolated	bladder
phthalic anhydride	0.5	RS	2.0E+00	IRIS	1.0E+00	extrapolated	1.0E+00	extrapolated	kidney, lung
prometon	0.5	RS	1.5E-02	IRIS	8.0E-03	extrapolated	8.0E-03	extrapolated	none observed
prometryn	0.5	RS	4.0E-03	IRIS	2.0E-03	extrapolated	2.0E-03	extrapolated	bone marrow, kidney, liver
propachlor	0.5	RS	1.3E-02	IRIS	7.0E-03	extrapolated	7.0E-03	extrapolated	decreased body weight
propanil	0.5	RS	5.0E-03	IRIS	3.0E-03	extrapolated	3.0E-03	extrapolated	spleen
propazine	0.5	RS	2.0E-02	IRIS	1.0E-02	extrapolated	1.0E-02	extrapolated	decreased body weight
propylene glycol	0.5	RS	2.0E+01	HEAST	1.0E+01	extrapolated	1.0E+01	extrapolated	blood
propylene glycol monomethyl ether	0.5	RS	7.0E-01	HEAST	6.0E-01	REG III	4.0E-01	extrapolated	kidney, liver
pydrin	0.5	RS	2.5E-02	IRIS	1.0E-02	extrapolated	1.0E-02	extrapolated	central nervous system
pyrene	0.5	A	3.0E-02	IRIS	2.0E-02	extrapolated	2.0E-02	extrapolated	central nervous system, decreased body weight, kidney
pyridine	0.67	A	1.0E-03	IRIS	7.0E-04	extrapolated	7.0E-04	extrapolated	liver
resmethrin	0.5	RS	3.0E-02	IRIS	2.0E-02	extrapolated	2.0E-02	extrapolated	reproductive system
ronnel	0.5	RS	5.0E-02	HEAST	3.0E-02	extrapolated	3.0E-02	extrapolated	blood, central nervous system, liver
selenium	0.97	A	5.0E-03	IRIS	5.0E-03	extrapolated	5.0E-03	extrapolated	central nervous system, gastrointestinal, skin
silver	0.2	RI	5.0E-03	IRIS	1.0E-03	extrapolated	1.0E-03	extrapolated	heart, liver, skin
strontium	0.2	RI	6.0E-01	IRIS	1.0E-01	extrapolated	1.0E-01	extrapolated	bone
strychnine	0.5	RS	3.0E-04	IRIS	2.0E-04	extrapolated	2.0E-04	extrapolated	increased mortality
styrene	1.0	A	2.0E-01	IRIS	3.0E-01	extrapolated*	3.0E-01	extrapolated	blood, liver
					RfC 1.0E+00(IRIS)				
terbacil	0.5	RS	1.3E-02	IRIS	3.0E-01	calc-IRIS	6.5E-03	extrapolated	liver, thyroid
terbufos	0.5	RS	2.5E-05	HEAST	1.0E-05	extrapolated	1.0E-05	extrapolated	blood
tetrachlorobenzene, 1,2,4,5-	0.5	RS	3.0E-04	IRIS	2.0E-04	extrapolated	2.0E-04	extrapolated	kidney
tetrachlorophenol, 2,3,4,6-	0.5	RS	3.0E-02	IRIS	2.0E-02	extrapolated	2.0E-02	extrapolated	liver
tetraethyl dithiopyrophosphate	0.5	RS	5.0E-04	IRIS	3.0E-04	extrapolated	3.0E-04	extrapolated	blood

Chemical Name	GI Abs	GI Ref.	RfDo (mg/kg/day)	Tox Value Source	RfDi (mg/kg/day)	Tox Value Source	RfDd (mg/kg/day)	Tox Value Source	Target Organ or Effect
thiobencarb	0.5	RS	1.0E-02	IRIS	5.0E-03	extrapolated	5.0E-03	extrapolated	decreased body weight, kidney
thiram	0.5	RS	5.0E-03	IRIS	3.0E-03	extrapolated	3.0E-03	extrapolated	central nervous system
tin	0.028	A	6.0E-01	HEAST	2.0E-02	extrapolated	2.0E-02	extrapolated	kidney, liver
toluene	0.8	RV	2.0E-01	IRIS	1.0E-01	extrapolated*	2.0E-01	extrapolated	kidney, liver
					RfC 4.0E-01(IRIS)				
triallate	0.5	RS	1.3E-02	IRIS	1.00E-01	extrapolated*	7.0E-03	extrapolated	liver, spleen
					RfC 4.0E-01(HEAST)				
tributyltin oxide	0.5	RS	3.0E-05	IRIS	2.00E-05	extrapolated	2.00E-05	extrapolated	immune system
trichloro-1,2,2-trifluoroethane, 1,1,2-	0.2	HE	3.0E+01	IRIS	9.0E+00	extrapolated*	6.0E+00	extrapolated	psychomotor impairment
					RfC 3.0E+01(HEAST)				
trichloroacetic acid	0.5	RS	1.0E-01	HAL	9.0E+00	calc-IRIS	5.0E-02	extrapolated	developmental effects to offspring, kidney, liver, spleen
trichlorobenzene, 1,2,3-	0.8	RV	1.0E-02	IRIS	6.0E-02	extrapolated*	8.0E-03	extrapolated	central nervous system, increased adrenal weights
					RfC 2.0E-02(IRIS)				
trichlorobenzene, 1,2,4-	0.9	HS	1.0E-02	IRIS	6.0E-02	extrapolated*	9.0E-03	extrapolated	central nervous system, increased adrenal weights
					RfC 2.0E-01(HEAST)				
trichlorobenzene, 1,3,5-	0.8	RS	6.0E-03	HAL	6.0E-02	calc-IRIS	5.0E-03	extrapolated	HAL RfD
trichloroethane, 1,1,1-	1.0	HS	2.0E-02	REG III	3.0E-01	REG III	2.0E-02	extrapolated	NA
trichlorofluoromethane	0.8	RV	3.0E-01	IRIS	2.0E-01	extrapolated*	2.0E-01	extrapolated	central nervous system, heart, liver, lung
					RfC 7.0E-01(HEAST)				
trichlorophenol, 2,4,5-	0.5	RS	1.0E-01	IRIS	2.0E-01	REG III	5.0E-02	extrapolated	kidney, liver
trichlorophenoxy acetic acid, 2,4,5-	0.95	HS	1.0E-02	IRIS	1.0E-02	extrapolated	1.0E-02	extrapolated	proteinuria
trichlorophenoxy propionic acid, 2(2,4,5)-	1.0	HS	8.0E-03	HEAST	8.0E-03	extrapolated	8.0E-03	extrapolated	liver
trichloropropane, 1,1,2-	0.8	RV	5.0E-03	IRIS	4.0E-03	extrapolated	4.0E-03	extrapolated	kidney, liver, thyroid
trichloropropene, 1,2,3-	0.8	RV	5.0E-03	HEAST	4.0E-03	extrapolated	4.0E-03	extrapolated	eye
trimethylbenzene, 1,2,3-	0.8	RV	5.0E-02	REG III	4.0E-02	extrapolated	4.0E-02	extrapolated	NA
trimethylbenzene, 1,2,4-	0.8	RV	5.0E-02	REG III	2.0E-03	REG III	4.0E-02	extrapolated	NA
trimethylbenzene, 1,3,5-	0.8	RV	5.0E-02	REG III	2.0E-03	REG III	4.0E-02	extrapolated	NA
trinitrobenzene, 1,3,5-	0.5	RS	3.0E-02	REG III	2.0E-02	extrapolated	2.0E-02	extrapolated	spleen
trinitrophenylmethylnitramine	0.5	RS	1.0E-02	HEAST	5.0E-03	extrapolated	5.0E-03	extrapolated	kidney, liver, spleen
uranium	0.002	A	3.0E-03	IRIS	6.0E-06	extrapolated	6.0E-06	extrapolated	NA
vanadium	0.03	A	7.0E-03	HEAST	2.0E-04	extrapolated	2.0E-04	extrapolated	none observed
vanadium pentoxide	0.20	RI	9.0E-03	IRIS	2.0E-03	extrapolated	2.0E-03	extrapolated	decreased hair cystine
vernam	0.5	RS	1.0E-03	IRIS	5.0E-04	extrapolated	5.0E-04	extrapolated	decreased body weight

Table 4b
Sources and Derivation of Toxicity Values Used in Calculations for Noncarcinogens

Chemical Name	GI Abs	GI Rel.	RfDo (mg/kg/day)	Tox Value Source	RfDi (mg/kg/day)	Tox Value Source	RfDd (mg/kg/day)	Tox Value Source	Target Organ or Effect
vinyl acetate	0.8	RV	1.0E+00	HEAST	6.0E-02	extrapolated*	8.0E-01	extrapolated	nasal epithelial lesions
					RfC 2.0E-01(IRIS)				
white phosphorus	0.2	RI	2.0E-05	IRIS	4.0E-06	extrapolated	4.0E-06	extrapolated	hair loss, increased maternal death at parturition
xylenes, total	0.895	A	2.0E+00	IRIS	2.0E+00	extrapolated	2.0E+00	extrapolated	central nervous system, kidney, whole body
zinc	0.25	A	3.0E-01	IRIS	8.0E-02	calc-IRIS	8.0E-02	extrapolated	blood
zinc phosphide	0.2	RI	3.0E-04	IRIS	6.0E-05	extrapolated	6.0E-05	extrapolated	decreased body weight
zineb	0.5	RS	5.0E-02	IRIS	3.00E-02	extrapolated	3.00E-02	extrapolated	thyroid

HEAST (& HE): Health Effects Assessment Summary Tables.
IRIS: Integrated Risk Information System.
REG III: USEPA Region III Risk-Based Concentration Table.
OPP: Office of Pesticide Programs
HAL: Health Advisory Level

Surrogate (a): Surrogate RfD based on other non-carcinogenic PAHs (e.g., pyrene).
Surrogate (b): Surrogate RfD based on oral RfD for 2-chlorophenol.
Surrogate (c): Surrogate RfD based oral RfD for 2,4-dichlorophenol.
Surrogate (d): Surrogate RfD based on oral RfD for HCH-gamme (lindane).
Surrogate (e): Surrogate RfD based on other non-carcinogenic PAHs (e.g., naphthalene).

*These values were extrapolated from inhalation reference concentrations.
NA: Not available
WD = withdrawn

A: Agency for Toxic Substances and Disease Registry Toxicological Profiles (ATSDR)

RI: USEPA Region IV Supplemental Guidance to RAGS: Human Health Bulletin, 1996. Absorption factor for inorganic chemicals
RS: USEPA Region IV Supplemental Guidance to RAGS: Human Health Bulletin, 1996. Absorption factor for semi-volatile organic chemicals
RV: USEPA Region IV Supplemental Guidance to RAGS: Human Health Bulletin, 1996. Absorption factor for volatile organic chemicals

HS: Hazardous Substances Database
US: USEPA Health Effects Assessment for Methyl Ethyl Ketone (PB90-142456)
CD: Casarett and Doull's Toxicology, 4th Edition

Chapter 62-785, F.A.C. Chemicals Sorted by Target Organ

Chemical Name	Target Organ/Effect
ADRENALS	
glycidaldehyde	adrenals, hematopoeisis, kidney, altered weight gain
nitrobenzene	adrenal, blood, kidney, liver
trichlorobenzene, 1,2,3-	central nervous system, increased adrenal weights
trichlorobenzene, 1,2,4-	central nervous system, increased adrenal weights
BLOOD	
acetonitrile	blood, liver
antimony	blood, increased mortality
antimony pentoxide (as Sb)	blood, increased mortality
antimony potassium tartrate (as Sb)	blood, increased mortality
antimony tetroxide (as Sb)	blood, increased mortality
antimony trioxide (as Sb)	blood, increased mortality
bayleton	blood, decreased body weight gain
bentazon	blood
carbofuran	blood, reproductive
carbophenothion	blood, central nervous system
chlorobutane, 1-	blood, central nervous system, increased mortality
chlorpyrifos	blood
coumaphos	blood
diazinon	blood
dichloroethene, cis-1,2-	blood, liver
dichloroethene, trans-1,2-	blood, liver
dichlorophenoxy acetic acid, 2,4-	blood, kidney, liver
dimethylphenol, 2,4-	blood, central nervous system
disulfoton	blood, eye
diuron	blood
ethion	blood
ethoprop	blood
ethoxyethanol, 2-	blood, male reproductive
ethylene diamine	blood, heart
fenamiphos	blood, central nervous system
fenamiphos metabolites	blood, central nervous system
fensulfothion	blood
fluoranthene	blood, kidney, liver
fluorene	blood
glycidaldehyde	adrenals, altered weight gain, kidney, hematopoeisis
guthion	blood
hydroquinone	blood
linuron	blood
malathion	blood
methyl parathion	blood
methylene bromide	blood
methylnaphthalene, 1-	blood
methylnaphthalene, 2-	blood
methylphenol, 2- (o-cresol)	blood, central nervous system, decreased body weight, kidney, liver
methylphenol, 4- (p-cresol)	blood, central nervous system, kidney, liver, respiratory
mevinphos	blood

Chemical Name	Target Organ/ Effect
naphthalene	blood
nitrate	blood
nitrite	blood
nitroaniline, o-	blood
nitrobenzene	adrenal, blood, kidney, liver
octamethylpyrophosphoramide	blood
parathion	blood
pebulate	blood
pendimethalin	blood, liver
phosmet	blood, decreased body weight, liver
propylene glycol	blood
ronnel	blood, central nervous system, liver
styrene	blood, liver
terbufos	blood
tetraethyl dithiopyrophosphate	blood
zinc	blood

BODY WEIGHT

acenaphthylene	decreased body weight, liver
aluminum	altered body weight
aluminum phosphide	altered body weight
ammonium sulfamate	decreased body weight
bayleton	blood, decreased body weight gain
bisphenol A	decreased body weight
bromacil	decreased body weight
chlorotoluene, o-	decreased body weight gain
copper cyanide	decreased body and organ weights, kidney, liver
cyanide	decreased body weight, thyroid, nerve damage
cyclohexanone	body weight depression
cyhalothrin, lambda (karate)	decreased body weight, decreased body weight gain in offspring
dichlorodifluoromethane	decreased body weight
dimethylphenol, 2,6-	body weight changes, kidney, liver, spleen
dimethylphenol, 3,4-	body weight changes, blood pressure, kidney, liver, spleen
endosulfan	blood vessels, decreased weight gain, kidney
ethyl acetate	body weight loss, increased mortality
ethyl ether	decreased body weight
glycidaldehyde	adrenals, altered weight gain, hematopoeisis, kidney
hexazinone	decreased body weight
merphos	central nervous system, decreased body weight
merphos oxide	central nervous system, decreased body weight
methylphenol, 2- (o-cresol)	blood, central nervous system, decreased body weight, kidney, liver
metolachlor	decreased body weight gain
metribuzin	decreased body weight, kidney, liver, mortality
nickel	decreased body wt, kidney, liver, female repro, skin
oxamyl	decreased body weight gain and food consumption
phenanthrene	central nervous system, decreased body weight, liver
phosmet	blood, decreased body weight, liver

Chemical Name	Target Organ/Effect
propachlor	decreased body weight, liver
propazine	decreased body weight
pyrene	central nervous system, decreased body weight, kidney
thiobencarb	decreased body weight, kidney
TRPH	decreased body weight
vernam	decreased body weight
zinc phosphide	decreased body weight

CENTRAL NERVOUS SYSTEM

acetone	central nervous system, kidney, liver
aldicarb	central nervous system
benzo(g,h,i)perylene	central nervous system
butanol, 1-	central nervous system
carbophenothion	blood, central nervous system
chlorite	neurobehavioral
chlorobutane, 1-	blood, central nervous system, increased mortality
dichloroacetic acid	cerebellum, cerebrum, liver, testes
dichloroethane, 1,1-	central nervous system, kidney
dimethylphenol, 2,4-	blood, central nervous system
endrin	central nervous system, liver
ethylbenzene	central nervous system, kidney, liver
fenamiphos	blood, central nervous system
fenamiphos metabolites	blood, central nervous system
fonofos	central nervous system, liver
hexane, n-	central nervous system, male reproductive
isobutyl alcohol	central nervous system
manganese	central nervous system
mercury, inorganic	central nervous system
mercury, methyl	developmental neurologic effects in human infants
merphos	central nervous system, decreased body weight
merphos oxide	central nervous system, decreased body weight
methamidophos	central nervous system
methylphenol, 2- (o-cresol)	blood, central nervous system, decreased body weight, kidney, liver
methylphenol, 3- (m-cresol)	central nervous system, decreased body weights
methylphenol, 4- (p-cresol)	blood, central nervous system, kidney, liver, respiratory
naled	central nervous system
phenanthrene	central nervous system, decreased body weight, liver
phenol	central nervous system, female reproductive, fetus, lung
phorate	central nervous system
pydrin	central nervous system
pyrene	central nervous system, decreased body weight, kidney
ronnel	blood, central nervous system, liver
selenium	central nervous system, gastrointestinal, skin
thiram	central nervous system
trichloro-1,2,2-trifluoroethane, 1,1,2-	psychomotor impairment
trichlorobenzene, 1,2,3-	central nervous system, increased adrenal weights
trichlorobenzene, 1,2,4-	central nervous system, increased adrenal weights
trichlorofluoromethane	central nervous system, heart, liver, lung
xylenes, total	central nervous system, kidney, whole body

Chemical Name	Target Organ/Effect
EYE	
benzyl alcohol	eye, stomach
dinitrophenol, 2,4-	eye
disulfoton	blood, eye
methyl tert-butyl ether	eye, increased prostration, kidney, liver
trichloropropene, 1,2,3-	eye
FETUS	
butanone, 2- (MEK)	fetus
carbon disulfide	fetus
dicamba	fetus
dinoseb	fetus
ethoxyethanol acetate, 2-	fetus
mercury, methyl	developmental neurologic effects in human infants
phenol	central nervous system, lung, female reproductive, fetus
trichloroacetic acid	developmental effects to offspring, kidney, liver, spleen
HEART	
chloroacetic acid	heart
ethyl dipropylthiocarbamate, S- (EPTC)	heart
ethylene diamine	blood, heart
silver	heart, liver, skin
trichlorofluoromethane	central nervous system, heart, liver, lung
IMMUNE SYSTEM	
dichlorophenol, 2, 3-	immune system
dichlorophenol, 2, 4-	immune system
dichlorophenol, 2, 5-	immune system
dichlorophenol, 2, 6-	immune system
dichlorophenol, 3, 4-	immune system
tributyltin oxide (as Sn) (TBTO)	immune system
KIDNEY	
acetone	central nervous system, kidney, liver
allyl alcohol	kidney, liver
benzaldehyde	kidney, stomach
biphenyl, 1,1- (diphenyl)	kidney
cadmium	kidney, liver/carcinogen
carbaryl	kidney, liver
chlorobenzene	kidney, liver
chlorobenzotrifluoride, 4-	kidney
chlorpropham	bone marrow, kidney, liver, spleen
copper cyanide	decreased body and organ weights, kidney, liver
cumene (isopropyl benzene)	kidney
di-n-octylphthalate	kidney, liver
dichloroethane, 1,1-	central nervous system, kidney
dichlorophenoxy acetic acid, 2,4-	blood, kidney, liver
diethylene glycol, monoethyl ether	kidney

Chemical Name	Target Organ/ Effect
diethylphthalate	brain, decreased growth rate, kidney, liver
dimethylphenol, 2,6-	body weight changes, kidney, liver, spleen
dimethylphenol, 3,4-	body weight changes, blood pressure, kidney, liver, spleen
dimethylphthalate	kidney
endosulfan	blood vessels, decreased weight gain, kidney
ethyl methacrylate	kidney
ethylbenzene	central nervous system, kidney, liver
ethylene glycol	kidney
fluoranthene	blood, kidney, liver
glycidaldehyde	adrenals, altered weight gain, hematopoeisis, kidney
hexachlorocyclohexane, delta- (δ-BHC)(δ-HCH)	kidney, liver
hexanone, 2- (methyl butyl ketone)	kidney, liver, whole body
maleic hydrazide	kidney
methomyl	kidney
methyl isobutyl ketone	kidney, liver, whole body
methyl styrene, alpha	kidney, liver
methyl tert-butyl ether	eye, increased prostration, kidney, liver
methyl-4-chlorophenoxy acetic acid, 2-	kidney, liver
methylphenol, 2- (o-cresol)	blood, central nervous system, decreased body weight, kidney, liver
methylphenol, 4- (p-cresol)	blood, central nervous system, kidney, liver, respiratory
metribuzin	decreased weight, kidney, liver, mortality
nickel	decreased body wt, kidney, liver, female repro, skin
nitrobenzene	adrenal, blood, kidney, liver
pentachlorobenzene	kidney, liver
phthalic anhydride	kidney, lung
phthalic anhydride	kidney, lung
prometryn	bone marrow, kidney, liver,
propylene glycol monomethyl ether	kidney, liver
pyrene	central nervous system, decreased body weight, kidney
tetrachlorobenzene, 1,2,4,5-	kidney
thiobencarb	decreased body weight, kidney
tin	kidney, liver
toluene	kidney, liver
trichloroacetic acid	developmental effects to offspring, kidney, liver, spleen
trichlorophenol, 2,4,5-	kidney, liver
trichloropropane, 1,1,2-	kidney, liver, thyroid
trinitrophenylmethylnitramine	kidney, liver, spleen
xylenes, total	central nervous system, kidney, whole body

LIVER

acenaphthene	liver
acenaphthylene	decreased body weight, liver
acetone	central nervous system, kidney, liver
acetonitrile	blood, liver
allyl alcohol	kidney, liver
ametryn	liver
benzenethiol	liver

Chemical Name	Target Organ/Effect
bromochloromethane	liver
butyl benzyl phthalate, N-	liver
butylate	liver
cadmium	kidney, liver/carcinogen
carbaryl	kidney, liver
chlorobenzene	kidney, liver
chloronaphthalene, beta	liver, respiratory
chloropropane, 2-	liver
chlorpropham	bone marrow, kidney, liver, spleen
copper	GI irritation/liver damage
copper cyanide	decreased body and organ weights, kidney, liver
decabromodiphenyl ether	liver
di-n-octylphthalate	kidney, liver
dibromobenzene, 1,4-	liver
dichloroacetic acid	cerebellum, cerebrum, liver, testes
dichloroethene, cis-1,2-	blood, liver
dichloroethene, trans-1,2-	blood, liver
dichlorophenoxy acetic acid, 2,4-	blood, kidney, liver
diethylphthalate	brain, decreased growth rate, kidney, liver
dimethylformamide, N,N-	liver
dimethylphenol, 2,6-	body weight changes, kidney, liver, spleen
dimethylphenol, 3,4-	body weight changes, blood pressure, kidney, liver, spleen
diphenamid	liver
endrin	central nervous system, liver
ethylbenzene	central nervous system, kidney, liver
fluoranthene	blood, kidney, liver
fonofos	central nervous system, liver
furan	liver
furfural	liver
hexachlorocyclohexane, delta- (δ-BHC)(δ-HCH)	kidney, liver
hexanone, 2- (methyl butyl ketone)	kidney, liver, whole body
malonitrile	liver, spleen
methacrylonitrile	liver
methidathion	liver
methyl acetate	liver
methyl isobutyl ketone (MIBK)	kidney, liver, whole body
methyl styrene, alpha	kidney, liver
methyl tert-butyl ether	eye, increased prostration, kidney, liver
methyl-4-chlorophenoxy acetic acid, 2-	kidney, liver
methylphenol, 2- (o-cresol)	blood, central nervous system, decreased body weight, kidney, liver
methylphenol, 4- (p-cresol)	blood, central nervous system, kidney, liver, respiratory
metribuzin	decreased weight, kidney, liver, mortality
nickel	decreased body wt, kidney, liver, female repro, skin
nitrobenzene	adrenal, blood, kidney, liver
pendimethalin	blood, liver
pentachlorobenzene	kidney, liver
permethrin	liver

Chemical Name	Target Organ/ Effect
phenanthrene	central nervous system, decreased body weight, liver
phenylenediamine, m-	liver
phosmet	blood, decreased body weight, liver
prometryn	bone marrow, kidney, liver,
propachlor	decreased body weight, liver
propylene glycol monomethyl ether	kidney, liver
pyridine	liver
ronnel	blood, central nervous system, liver
silver	heart, liver, skin
styrene	blood, liver
terbacil	liver, thyroid
tetrachlorophenol, 2,3,4,6-	liver
tin	kidney, liver
toluene	kidney, liver
triallate	liver, spleen
trichloroacetic acid	developmental effects to offspring, kidney, liver, spleen
trichlorofluoromethane	central nervous system, heart, liver, lung
trichlorophenol, 2,4,5-	kidney, liver
trichlorophenoxy propionic acid, 2(2,4,5)-(silvex)	liver
trichloropropane, 1,1,2-	kidney, liver, thyroid
trinitrophenylmethylnitramine	kidney, liver, spleen

MORTALITY

antimony	blood, increased mortality
antimony pentoxide (as Sb)	blood, increased mortality
antimony potassium tartrate (as Sb)	blood, increased mortality
antimony tetroxide (as Sb)	blood, increased mortality
antimony trioxide (as Sb)	blood, increased mortality
chlorobutane, 1-	blood, central nervous system, increased mortality
di-n-butylphthalate	increased mortality
ethyl acetate	body weight loss, increased mortality
metribuzin	decreased body weight, kidney, liver, mortality
strychnine	increased mortality

NASAL CAVITY (ALSO CHECK RESPIRATORY)

acrolein	nasal epithelium
chloro-1,3-butadiene (chloroprene)	nasal epithelium
hexachlorocyclopentadiene	nasal cavity, stomach
methyl styrene (mixed)	nasal cavity
vinyl acetate	nasal epithelial lesions

NERVE DAMAGE

chlorine dioxide	no effect level on neurological develpoment in offspring
cyanide	decreased body weight, nerve damage, thyroid
cycloate	nerve damage
ethyl p-nitrophenyl phenylphosphorothioate (EPN)	nerve damage
trichloro-1,2,2-trifluoroethane, 1,1,2-	psychomotor impairment

Chemical Name	Target Organ/ Effect
REPRODUCTIVE SYSTEM	
boron	male reproductive, respiratory
carbofuran	blood, reproductive
chlorophenol, 2-	reproductive system
chlorophenol, 3-	reproductive system
chlorophenol, 4-	reproductive system
dichloroacetic acid	cerebellum, cerebrum, liver, testes
ethoxyethanol, 2-	male reproductive, blood
hexane, n-	male reproductive, nervous system
methoxychlor	reproductive system
molinate	reproductive system
nickel	decreased body wt, kidney, liver, female repro, skin
phenol	central nervous system, lung, female reproductive, fetus
resmethrin	reproductive system
white phosphorous	hair loss, increased maternal death at parturition
RESPIRATORY (ALSO CHECK NASAL CAVITY)	
acrolein	nasal epithelium
boron	male reproductive, respiratory
chloronaphthalene, beta	liver, respiratory
methylphenol, 4- (p-cresol)	blood, central nervous system, kidney, liver, respiratory
paraquat	respiratory
phenol	central nervous system, lung, female reproductive, fetus
phthalic anhydride	kidney, lung
trichlorofluoromethane	central nervous system, heart, liver, lung
SKIN	
nickel	decreased body wt, kidney, liver, female repro, skin
selenium	central nervous system, gastrointestinal, skin
silver	heart, liver, skin
SPLEEN	
chloroaniline, 4-	spleen
trichloroacetic acid	developmental effects to offspring, kidney, liver, spleen
chlorpropham	bone marrow, kidney, liver, spleen
dimethylphenol, 2,6-	body weight changes, kidney, liver, spleen
dimethylphenol, 3,4-	body weight changes, blood pressure, kidney, liver, spleen
dinitrobenzene, 1,2- (o-)	spleen
dinitrobenzene, 1,3- (m-)	spleen
malonitrile	liver, spleen
nitrotoluene, m-	spleen
nitrotoluene, o-	spleen
nitrotoluene, p-	spleen
propanil	spleen
triallate	liver, spleen
trinitrobenzene, 1,3,5-	spleen
trinitrophenylmethylnitramine	kidney, liver, spleen

Chemical Name	Target Organ/ Effect
STOMACH	
benzaldehyde	kidney, stomach
beryllium	gastrointestinal lesions
copper	gastrointestinal irritation/liver damage
benzyl alcohol	eye, stomach
bromomethane (methyl bromide)	stomach
cypermethrin	gastrointestinal tract
endothall	small intestine, stomach
hexachlorocyclopentadiene	nasal cavity, stomach
selenium	central nervous system, gastrointestinal, skin
THYROID	
cyanide	decreased body weight, nerve damage, thyroid
maneb	thyroid
terbacil	liver, thyroid
trichloropropane, 1,1,2-	kidney, liver, thyroid
zineb	thyroid
NOEL/NOAEL	
anthracene	none observed
benzoic acid	none observed
butylphthalyl butylglycolate	none observed
calcium cyanide	none observed
chlorine	none observed
chlorine cyanide	none observed
chlorobenzoic acid, p-	none observed
cyanogen	none observed
dichlorobenzene, 1,2-	no adverse effects observed
diisopropyl methylphosphonate (DIMP)	none observed
fluometuron	none observed
methyl acrylate	none observed
methyl methylacrylate	none observed
phenmedipham (betanal)	none observed
prometon	none observed
vanadium	no adverse effects observed
OTHER	
ammonia	systemic effects
chloroethylvinylether, 2-	NA
chlorotoluene, p-	HAL RfD
cobalt	NA
dibenzofuran	NA
dichloroacetonitrile	HAL RfD
dichlorobenzene, 1,3-	NA
dichlorprop	OPP RfD
dimethrin	HAL RfD
iron	NHANES Study
lead	NA
lithium	NA

Chemical Name	Target Organ/Effect
nitroaniline, p-	NA
nitrophenol, 4-	HAL RfD
trichlorobenzene, 1,3,5-	HAL RfD
trichloroethane, 1,1,1-	NA
trimethylbenzene, 1,2,3-	NA
trimethylbenzene, 1,2,4-	NA
trimethylbenzene, 1,3,5-	NA
uranium, natural	NA
CARCINOGENS	
acephate	carcinogen
acrylamide	carcinogen
acrylonitrile	carcinogen
alachlor	carcinogen
aldrin	carcinogen
aniline	carcinogen
Aroclor (PCBs) (polychlorinated biphenyls)	carcinogen
arsenic	carcinogen
atrazine	carcinogen
azobenzene	carcinogen
benzene	carcinogen
benzo(a)anthracene	carcinogen
benzo(a)pyrene	carcinogen
benzo(b)fluoranthene	carcinogen
benzo(k)fluoranthene	carcinogen
benzotrichloride	carcinogen
benzyl chloride	carcinogen
beryllium	carcinogen
bis (2-chloro-1-methylethyl) ether	carcinogen
bis (2-chloroethyl) ether	carcinogen
bis (2-chloroisopropyl) ether	carcinogen
bis (2-ethylhexyl) phthalate	carcinogen
bromodichloromethane	carcinogen
bromoform	carcinogen
captan	carcinogen
carbazole	carcinogen
carbon tetrachloride	carcinogen
chlordane	carcinogen
chlorobenzilate	carcinogen
chloroform	carcinogen
chloromethane	carcinogen
chloronitrobenzene, o-	carcinogen
chloronitrobenzene, p-	carcinogen
chlorothalonil	carcinogen
chromium (hexavalent)	carcinogen
chrysene	carcinogen
crotonaldehyde	carcinogen
DDD, 4,4'-	carcinogen
DDE, 4,4'-	carcinogen
DDT, 4,4'-	carcinogen

Chemical Name	Target Organ/ Effect
diallate	carcinogen
dibenz(a,h)anthracene	carcinogen
dibromo-3-chloropropane, 1-2- (DBCP)	carcinogen
dibromochloromethane	carcinogen
dibromoethane, 1,2- (EDB)	carcinogen
dichlorobenzene, 1,4-	carcinogen
dichlorobenzidine, 3,3-	carcinogen
dichloroethane, 1,2- (EDC)	carcinogen
dichloroethene, 1,1-	carcinogen
dichloropropane, 1,2-	carcinogen
dichloropropene, 1,3-	carcinogen
dichlorvos	carcinogen
dicofol	carcinogen
dieldrin	carcinogen
dimethylaniline, 2,4-	carcinogen
dinitrotoluene, 2,4-	carcinogen
dinitrotoluene, 2,6-	carcinogen
dioxane, 1,4-	carcinogen
diphenylhydrazine, 1,2-	carcinogen
epichlorohydrin	carcinogen
ethyl acrylate	carcinogen
ethyl chloride (chloroethane)	carcinogen
ethylene oxide	carcinogen
formaldehyde	carcinogen
heptachlor	carcinogen
heptachlor epoxide	carcinogen
hexachloro-1,3-butadiene	carcinogen
hexachlorobenzene	carcinogen
hexachlorocyclohexane, alpha- (a-BHC) (a-HCH)	carcinogen
hexachlorocyclohexane, beta- (b-BHC) (b-HCH)	carcinogen
hexachlorocyclohexane, gamma- (g-BHC) (g-HCH) (lindane)	carcinogen
hexachloroethane	carcinogen
hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	carcinogen
indeno(1,2,3-cd)pyrene	carcinogen
isophorone	carcinogen
lindane (hexachlorocyclohexane, gamma-) (g-BHC) (g-HCH)	carcinogen
methoxy-5-nitroaniline, 2-	carcinogen
methylaniline, 2-	carcinogen
methylene bis(2-chloroaniline), 4,4'-	carcinogen
methylene chloride	carcinogen
nickel subsulfide	carcinogen
nitroso-di-ethylamine, N-	carcinogen
nitroso-di-n-butylamine, N-	carcinogen
nitroso-di-n-propylamine, N-	carcinogen
nitroso-N-methylethylamine, N-	carcinogen
nitrosodimethylamine, N-	carcinogen

Chemical Name	Target Organ/ Effect
nitrosodiphenylamine, N-	carcinogen
PCBs (polychlorinated biphenyls) (Aroclor)	carcinogen
pentachloronitrobenzene	carcinogen
pentachlorophenol	carcinogen
phenylenediamine, o-	carcinogen
phenylphenol, 2-	carcinogen
propylene oxide	carcinogen
simazine	carcinogen
tetrachloroethane, 1,1,1,2-	carcinogen
tetrachloroethane, 1,1,2,2-	carcinogen
tetrachloroethene (PCE)	carcinogen
toluidine, p-	carcinogen
toxaphene	carcinogen
trichloroethane, 1,1,2-	carcinogen
trichloroethene (TCE)	carcinogen
trichlorophenol, 2,4,6-	carcinogen
trichloropropane, 1,2,3-	carcinogen
trifluralin	carcinogen
trimethyl phosphate	carcinogen
trinitrotoluene, 2,4,6-	carcinogen
vinyl chloride	carcinogen

Appendix A

Derivation of Inhalation Rates and Dermal Surface Areas

A. Derivation of an Inhalation Rate (m^3/day) for an Aggregate Resident

The Exposure Factors Handbook (USEPA, 1989b) provided inhalation rates (L/min) for all activity levels listed in the following categories: 6, 10, and 13 year old males, an adult female and an adult male (Table A1) and provided the amount of time spent at each activity level (found on pages 3-8 of USEPA, 1989b) (Table A2).

Table A1:
Minute Inhalation (L/min) by Activity Level

Activity Level	Infant	Male 6yr	Male 10yr	Male 13yr	Male Adult	Female Adult
Resting	0.84	6.5	7.1	8.9	12.2	5.7
Light	-	13.9	17.2	16.4	13.8	8.1
Moderate	-	33.3	53.4	32.8	40.9	26.5
Heavy	-	40.3	70.5	57.9	80.0	47.9

Table A2:
Percent Time at Activity Level

	Outdoor		Indoor	
Activity Level	Average	RME	Average	RME
Resting	.28	0	.48	.25
Light	.28	0	.48	.60
Moderate	.37	.50	.03	.10
Heavy	.07	.50	.01	.05

RME = Reasonable Maximum Exposure

Using the values above, minute inhalation rates (L/min) were converted to daily inhalation rates (m^3/day) with the equation below. These values are listed in Table 3.

$$m^3/day = L/min * 60\ min/hr * 24\ hr/day * 1\ cm^3/mL * 1000\ mL/L * 1E\text{-}06\ m^3/cm^3$$

Table A3:
Inhalation Rates (m^3/day)

Activity Level	Infant	Male 6yr	Male 10yr	Male 13yr	Male Adult	Female Adult
Resting	1.21	9.36	10.22	12.82	17.57	8.21
Light	-	20.02	24.77	23.62	19.87	11.66
Moderate	-	47.95	76.90	47.23	58.90	38.16
Heavy	-	58.03	101.52	83.38	115.20	68.98

Indoor and outdoor daily inhalation rates (presented in Table A4) were calculated for each receptor using the average values for percent of time spent at each activity level (Table A2).

Daily Inhalation Rate (m^3/day) = (% of time spent resting*resting inhalation rate) +
+ (% of time spent in light activity*light inhalation rate) +
+ (% of time spent in moderate activity*moderate inhalation rate) +
+ (% of time spent in heavy activity*heavy inhalation rate)

Table A4:
Daily Inhalation Rates (m^3/day) for Each Age Level

	Infant	Male 6yr	Male 10yr	Male 13yr	Male Adult	Female Adult
Average						
Outdoor	0.34	30.03	45.36	33.51	40.34	24.51
Indoor	0.58	16.12	20.12	19.74	20.89	11.37
RME						
Outdoor	0.51*	52.99	89.21	65.30	87.05	53.57
Indoor	1*	22.05	30.18	26.26	27.96	16.32

* Information is not presented in the Exposure Factors Handbook for light, moderate, or heavy inhalation rates for infants. Using only the resting inhalation rate of 1.21 m^3/day (Table A3) to calculate the outdoor and indoor RME inhalation rates results in "worst case" values that are less than "average" values. Therefore, an alternative method was used to calculate the infant indoor and outdoor RME inhalation rates. The ratio between the "average outdoor" and the "RME outdoor" for each of the other age groups was calculated and then the mean of these ratios was multiplied by the infant outdoor "average" inhalation rate to derive an estimated outdoor "RME" inhalation rate. For example, the mean ratio of RME/average for outdoor values is 1.5, so 0.34 x 1.5 = 0.51 is the estimated RME outdoor-infant daily inhalation rate. The same method was used with the indoor values to derive an estimated indoor "RME" inhalation rate.

To calculate an inhalation rate for an aggregate resident, an exposure duration of 30 years was assumed. Due to the limited data, it was assumed that a person spends four years each at the infant, 6 year old, 10 year old, and 13 year old inhalation rates. The remaining 14 years are spent at the adult inhalation rate. Indoor and outdoor average inhalation rates for an aggregate resident (Table A5) were calculated using the following equation:

Indoor or Outdoor Inhalation Rate (m^3/day) =

= [(4 yr * Infant IR (m^3/day)) + (4 yr * 6 yr old IR (m^3/day)) +
+ (4 yr * 10 yr old IR (m^3/day)) + (4 yr * 13 yr old IR (m^3/day)) +
+ (14 yr * {(Adult Male IR (m^3/day) + Adult Female IR (m^3/day))/2})]/30 yrs

The average person is estimated to spend 3.07 hours per week outside (pages 1 – 21, USEPA, 1989b). This value is equal to 0.44 hours per day. Therefore, the average time spent inside is 23.56 hours per day. Using these assumptions, total (includes indoor and outdoor) average inhalation rates for the aggregate resident (Table A5) were calculated using the following equation:

Aggregate Resident Total Inhalation Rate (m^3/day) =

$$= \frac{[(\text{Outdoor IR } m^3/\text{day} * 0.44 \text{ hr/day}) + (\text{Indoor IR } m^3/\text{day} * 23.56 \text{ hr/day})]}{24 \text{ hr/day}}$$

Table A5:
Inhalation Rates for an Aggregate Resident

	Inhalation Rate (m^3/day)
AVERAGE	
Outdoor	29.70
Indoor	15.07
Total (In + Out)	15.34*
RME	
Outdoor	60.54
Indoor	20.93
Total (In + Out)	21.66

*The aggregate resident inhalation rate used to calculate the SCTL is rounded to 15 m^3/day.

B. Derivation of a Dermal Surface Area for the Aggregate Resident

Values presented in the Exposure Factors Handbook (USEPA, 1989b) were used to calculate the surface area available for dermal exposure of an aggregate resident. Median total body surface areas for children, as presented in the Exposure Factors Handbook, are presented in Table A6, with the exception for children under two, for which values are unavailable. The percentage of total body surface area by part for children, as presented in the Exposure Factors Handbook, is presented in Table A7.

Table A6:
Median Total Body Surface Area (cm^2)

Surface Area (cm^2)			
Age (yr)	**Male**	**Female**	**Average**
2 < 3	6030	5790	5910
3 < 6	7280	7110	7195
6 < 9	9310	9190	9250
9 < 12	11600	11600	11600
12 < 15	14900	14800	14850
15 < 18	17500	16000	16750

Table A7:
Percentage of Total Body Surface Area by Part for Children

Percent of Total Body Surface Area (%)						
Age	**Head**	**Trunk**	**Arms**	**Hands**	**Legs**	**Feet**
< 1	18.20	35.70	13.70	5.30	20.60	6.54
1 < 2	16.50	35.50	13.00	5.68	23.10	6.27
2 < 3	14.20	38.50	11.80	5.30	23.20	7.07
3 < 4	13.60	31.90	14.40	6.07	26.80	7.21
4 < 5	13.80	31.50	14.00	5.70	27.80	7.29
6 < 7	13.10	35.10	13.10	4.71	27.10	6.90
9 < 10	12.00	34.20	12.30	5.30	28.70	7.58
12 < 13	8.74	34.70	13.70	5.39	30.50	7.03
13 < 14	9.97	32.70	12.10	5.11	32.00	8.02
16 < 17	7.96	32.70	13.10	5.68	33.60	6.93
17 < 18	7.58	31.70	17.50	5.13	30.80	7.28

Body surface areas by part for children (Table A8) were calculated using the following equation:

Surface Area (cm^2) = Total body surface area (cm^2) x
x % of Total body surface area for the body part

It was assumed that an aggregate resident would have his hands, half of his arms, and half of his legs available for dermal exposure. Using this assumption, a total surface area was calculated for each age group using the following equation (Table A8):

Total Surface Area (cm^2) = Hands SA (cm^2) + [(Arms SA + Legs SA (cm^2))/2]

Table A8:
Body Surface Area by Part for Children

	Body Surface Area (cm^2)						
Age	**Head**	**Trunk**	**Arms**	**Hands**	**Legs**	**Feet**	**Available SA***
2 < 3	839	2275	697	313	1371	418	1347
3 < 4	979	2295	1036	437	1928	519	1919
4 < 5	993	2266	1007	410	2000	525	1914
6 < 7	1212	3247	1212	436	2507	638	2295
9 < 10	1392	3967	1427	615	3329	879	2993
12 < 13	1298	5153	2034	800	4529	1044	4082
13 < 14	1481	4856	1797	759	4752	1191	4034
16 < 17	1333	5477	2194	951	5628	1161	4862
17 < 18	1270	5310	2931	859	5159	1219	4904

*Assume exposed surface area of 1/2 of arms, 1/2 of legs, and hands

Available Child (age 1-6) SA* (cm^2) = 1789 = 1800**

**Child Surface Area rounded to two significant figures

Surface area by body part and total surface areas for adults are presented in Table A9. The adult surface area available for dermal exposure was calculated using the same equation used for the child.

Table A9: Average Surface Area by Body Part for Adults

	Surface Area (cm^2)		
Body Part	**Men**	**Women**	Average
Head	1180	1100	1140
Trunk	5690	5420	5555
Upper Extremities	3190	2760	2975
Arms	2280	2100	2190
Upper Arms	1430	-	1430
Forearms	1140	-	1140
Hands	840	746	793
Lower Extremities	6360	6260	6310
Legs	5050	4880	4965
Thighs	1980	2580	2280
Lower Legs	2070	1940	2005
Feet	1120	975	1048
Whole Body	19400	16900	18150

Available Adult SA* (cm^2) = 4371

*Assume exposed surface area of 1/2 of arms, 1/2 of legs, and hands

The aggregate resident surface area available for dermal exposure was calculated using the following equation:

$$\text{Aggregate Resident Surface Area (cm}^2\text{)} =$$
$$= [(2\text{ yr} * 2\text{<}3\text{ yr old SA cm}^2) + (1\text{ yr} * 3\text{<}4\text{ yr old SA cm}^2) +$$
$$+ (2\text{ yr} * 4\text{<}5\text{ yr old SA cm}^2) + (2\text{ yr} * 6\text{<}7\text{ yr old SA cm}^2) +$$
$$+ (3\text{ yr} * 9\text{<}10\text{ yr old SA cm}^2) + (2\text{ yr} * 12\text{<}13\text{ yr old SA cm}^2) +$$
$$+ (2\text{ yr} * 13\text{<}14\text{ yr old SA cm}^2) + (2\text{ yr} * 16\text{<}17\text{ yr old SA cm}^2) +$$
$$+ (2\text{ yr} * 17\text{<}18\text{ yr old SA cm}^2) + (12\text{ yr} * \text{Adult SA cm}^2)] * 1/30\text{ yr}$$

No specific age group data are presented in the Exposure Factors Handbook for children at ages 1, 5, 7, 8, 10, 11, 14, 15, and 18 years. Therefore, the surface area information for these ages was alternately taken from either the next previous or following age group. The age ranges applied as factors in the above equation are shown in the table below. The numbers in parentheses under the "age" column represents the age of a person with a particular surface area. The age range in each group corresponds to years spent with a specific surface area ("years" column), which is then multiplied by the corresponding available surface area. For example, there is no information for 1 yr-olds, so the SA value for 2 yr-olds from the Exposure Factors Handbook is assumed to apply to both 1 and 2 year-olds. Since this value is applicable for two years (out of 30 total), the SA value of 2186 is multiplied by 2. The alternate assignment of ages without SA values to higher and lower age groups is intended to minimize biasing the surface area estimate either high or low.

Table A10:
Aggregate Surface Area

Age	Years	Available SA (cm^2)*
2 < 3 (1-2)	2	1347
3 < 4 (3)	1	1919
4 < 5 (4-5)	2	1914
6 < 7 (6-7)	2	2295
9 < 10 (8-10)	3	2993
12 < 13 (11-12)	2	4082
13 < 14 (13-14)	2	4034
16 < 17 (15-16)	2	4862
17 < 18 (17-18)	2	4904
Adult: 19 < 30 (19 - 30)	12	4371
Aggregate SA =		**3674**

*Assume exposed surface area of 1/2 of arms, 1/2 of legs, and hands

Available On-Site Worker SA (cm^2) = 2000

The value of 2,000 cm^2 for the On-Site Worker Available Surface Area is derived from the USEPA Dermal Exposure Assessment: Principles and Applications, January 1992 (EPA/600/8-91/011B).

Appendix B

Derivation of Inhalation and Dermal Toxicity Values

A. Inhalation Toxicity Values

For evaluating hazard from the inhalation of a chemical of concern, the USEPA develops toxicity values in the form of Reference Doses (RfDs) or Reference Concentrations (RfCs). While the USEPA has recently shown preference for RfCs, the equations for the methods described in this report use RfDs exclusively. The reason for this decision is that it is well recognized that children have much higher ventilation rates relative to body weight than adults. Consequently, they will receive a higher dosage of a chemical of concern from air than an adult at the same air concentration. The use of RfDs allows this difference to be taken into consideration, whereas the use of RfCs involves the implicit assumption that adults and children are equally sensitive to contamination in air. For the same reason, the equation for carcinogenicity utilizes Inhalation Slope Factors (ISFs) rather than Inhalation Unit Risk (IUR) values (which are expressed as recognized air concentrations).

1.) Reference Dose (RfD)

The first choice, when an inhalation RfD was not available, was to develop one from the RfC for that chemical. The conversion from RfC to inhalation RfD assumed a 70 kg individual breathing 20 m^3/day. Thus, the RfC was multiplied by 20 m^3/day and divided by 70 kg to obtain a value with the units mg/kg/day.

e.g., Methyl *tert*-butyl ether: Inhalation RfC = 3 mg/m^3

thus, (3 mg/m^3 x 20 m^3/day) / 70 kg = 8.6×10^{-1} mg/kg/day = RfD_i

When an RfC was not available, the second choice was to develop an inhalation RfD from the oral RfD using route-to-route extrapolation. Such extrapolation was only done when the toxic endpoint being addressed was systemic in nature. Oral RfDs that were known or likely to be route-specific (e.g., where the toxic endpoint involved the gastrointestinal tract) were not extrapolated.

The formula for converting an oral RfD to an inhalation RfD was as follows:

$$RfD_i = RfD_o \times GI\ Absorption$$

e.g., Anthracene: $RfD_o = 3.0 \times 10^{-1}$ mg/kg/day
Chemical Specific GI Abs Factor = 0.5

thus, $(3.0 \times 10^{-1}$ mg/kg/day) x (0.5) = 1.5×10^{-1} mg/kg/day

2.) Slope Factor (SF)

When a carcinogen had an inhalation unit risk (IUR) value, but not an inhalation slope factor (ISF), the IUR value was converted to an ISF for the calculation of a soil target level. The conversion assumes a 70 kg individual breathing 20 m^3/day. Thus, the IUR (Unit Risk/$\mu g/m^3$) is divided by 20 m^3/day and multiplied by 70 kg and a conversion factor of 1000 $\mu g/mg$ to obtain a value with the units $(mg/kg/day)^{-1}$.

e.g., Benzene: IUR = 8.3×10^{-6} UR/µg/m^3

thus, [((8.3×10^{-6} UR/µg/m^3) / 20m^3/day) x 70 kg x 1000 µg/mg] =
= 2.9×10^{-2} $(mg/kg/day)^{-1}$ = ISF

If an IUR was not available and the chemical was regarded as likely producing carcinogenicity via a systemic effect, an ISF was derived from the oral slope factor (OSF), if available. This route-to-route extrapolation was accomplished by using the following formula:

ISF = OSF / GI Absorption

In general, route-to-route extrapolation from the OSF was not performed if the OSF was known or presumed to reflect route-specific toxicity. When a chemical exhibits route-specific toxicity, it exerts its toxic effect (i.e., cancer) only by a specific exposure route. For example, chromium only causes lung cancer if it is inhaled, thus the toxic effect (lung cancer) is route-specific and target organ-specific. No other exposure route for chromium has been shown to cause cancer.

B. Dermal Toxicity Values

1.) Reference Dose (RfD)

Dermal RfDs were derived from either the oral or inhalation RfD (if both were available and suitable, preference was given to the oral RfD). The following formula was used:

$RfD_d = RfD_o \times GI\ Absorption$

If an RfD (either oral or inhalation) was known or presumed to be route-specific, it was not regarded as suitable for route-to-route extrapolation.

2.) Slope Factor (SF)

Dermal slope factors (DSFs) were derived from OSFs using route-to-route extrapolation:

DSF = OSF / GI Absorption

e.g., Benzene: OSF = 2.9×10^{-2} $(mg/kg/day)^{-1}$
Chemical-Specific GI Abs = 0.9

thus, (2.9×10^{-2} $(mg/kg/day)^{-1}$) + (0.9) =
= 3.2×10^{-2} $(mg/kg/day)^{-1}$ = DSF

In general, OSFs were not extrapolated to produce DSFs if they were thought to reflect route-specific toxicity.*

* In the case of carcinogenic PAHs the toxic endpoint (cancer) occurs regardless of the route of exposure. This effect is clearly evidenced by the fact that while the OSF for benzo(a)pyrene is based on data in which oral dosing resulted in GI tract tumors in rodents, arguably a route-specific cancer, benzo(a)pyrene has also been observed to produce other types of cancer in several species when administered by a variety of routes, including inhalation and dermal contact. Although no slope factor has yet been derived for these routes, the rather strong evidence that benzo(a)pyrene (and, by implication, other carcinogenic PAHs) is carcinogenic by a variety of routes, indicates that PAH induced cancer is not wholly route-specific. Because of this property, route-to-route extrapolation was performed to derive both inhalation and dermal slope factors from the OSF for this group of chemicals.

Appendix C

Technical Basis for the TRPH

Soil Cleanup Target Levels

Technical Basis for the TRPH Soil Cleanup Target Levels

The following calculations for total petroleum hydrocarbon (TRPH) values were adopted essentially as described in the Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG, 1997a, 1997b, and 1997c; Volumes III and IV, and the Technical Overview).

The application of a general standard for TRPHs is difficult because of the variation in mobility and toxicity of the chemicals included. To overcome this problem, TPHCWG (1997a) suggests a sub-classification methodology in which aromatics and aliphatics are considered separately because these groups vary considerably in their environmental behavior. Each of these groups was then further subdivided on the basis of equivalent carbon number index (EC). The EC is a function of the molecular weight (MW) and boiling point (BP) of a chemical normalized to the BP of the n-alkanes, or its retention time in a BP gas chromatographic column. This approach is used since it is consistent with methods routinely used in the petroleum industry for separating complex mixtures and is a more appropriate differentiation technique than the actual carbon number of the chemical.

Range of Equivalent Carbon Number, EC	EC	Classification
C_5-C_7	6.5	Aromatic
>C_7-C_8	7.5	Aromatic
>C_8-C_{10}	9.0	Aromatic
>C_{10}-C_{12}	11	Aromatic
>C_{12}-C_{16}	14	Aromatic
>C_{16}-C_{21}	18.5	Aromatic
>C_{21}-C_{35}	28	Aromatic
C_5-C_6	5.5	Aliphatic
>C_6-C_8	7.0	Aliphatic
>C_8-C_{10}	9.0	Aliphatic
>C_{10}- C_{12}	11	Aliphatic
>C_{12}- C_{16}	14	Aliphatic
>C_{16}- C_{35}	18.5	Aliphatic

Calculation of TRPH Fraction-Specific Physical Properties

Several alternatives for estimating representative physical/chemical properties for each fraction were reviewed by the TPHCWG. They included simple averaging of all available property data, composition-based averaging in which a weighted average of the available property data was computed based on the relative mass of each component in gasoline, and correlation to relative boiling point index in which the properties were developed based on EC values. While all of the approaches had similar results, it was determined that the correlations approach was most useful, because if the definition of the fractions change, new properties can be easily computed.

Utilizing the values correlations approach, the TRPHs are grouped into EC fractions, a method which allows for the calculation of the fate and transport characteristics of solubility (S), organic carbon partition coefficient (Koc) and vapor pressure (atm). While Henry's Law constant (HLC) could also be estimated from a similar type of equation, TPHCWG determined that using the estimated molecular weights, solubilities and vapor pressures to calculate HLC allowed for internal consistency with the other estimated values. The formulas provided by TPHCWG (1997a) are as follows:

Aromatics:

$$\text{Log S} = (-0.21 \times \text{EC}) + 3.7$$
$$\text{Log Koc} = (0.10 \times \text{EC}) + 2.3$$

Aliphatics:

$$\text{Log S} = (-0.55 \times \text{EC}) + 4.58$$
$$\text{Log Koc} = (0.45 \times \text{EC}) + 0.43$$

Aliphatics and Aromatics

$$\text{Log VP} = (-0.5 \times \text{EC}) + 2.3, \text{ for EC} \leq 12$$
$$\text{Log VP} = (-0.36 \times \text{EC}) + 0.72, \text{ for EC} > 12$$

$$\text{H' (unitless)}^{*} = \frac{\text{Vapor Pressure (atm)} \times \text{Molecular Weight (g/mol)}}{\text{Solubility (mg/L)} \times 8.2\text{x}10^{-5}\ (\text{atm-m}^3/\text{mol-K}) \times 293\text{K}}$$

$$\text{H' (unitless)}/41 = \text{Henry's Law constant (atm-m}^3/\text{mol)}^{*}$$

(*rounded to two significant figures)

When diffusivity in air or water was plotted as a function of equivalent carbon number, TPHCWG found that the values did not vary significantly from compound to compound. Thus, a conservative, reasonable assumption was to set $D_{air} = 10^{-1}$ cm²/sec and $D_{water} = 10^{-5}$ cm²/sec for all fractions.

Using the above models, the following chemical values for the TRPH classes have been assigned:

Table C1:
Assigned chemical properties of TRPH classes based on an Equivalent Carbon Number[a]

TRPH Class	Ave. EC	Proposed Value					
		H(atm-m³/mol)[b]	H'	MW(g)	K_{oc} (mL/g)	S (mg/L)	VP(atm)
C_6-C_7 Aromatic	6.5	5.6E-3	NC	NC	NC	NC	NC
>C_7-C_8 Aromatic	7.5	6.6E-3	NC	NC	NC	NC	NC
>C_8-C_{10} Aromatic	9.0	1.2E-2	4.8E-1	1.2E+2	1.6E+3	6.5E+1	6.3E-3
>C_{10}-C_{12} Aromatic	11	3.3E-3	1.4E-1	1.3E+2	2.5E+3	2.5E+1	6.3E-4
>C_{12}-C_{16} Aromatic	14	1.3E-3	5.2E-2	1.5E+2	5.0E+3	5.8E00	4.8E-5
>C_{16}-C_{21} Aromatic	18.5	3.2E-4	1.3E-2	1.8E+2	1.4E+4	6.5E-1	1.1E-6
>C_{21}-C_{35} Aromatic	28	1.6E-5	6.7E-4	2.4E+2	1.3E+5	6.6E-3	4.4E-10
C_5-C_6 Aliphatic	5.5	8.0E-1	3.3E+1	8.1E+1	8.0E+2	3.6E+1	3.5E-1
>C_6-C_8 Aliphatic	7.0	1.2E00	4.9E+1	1.0E+2	3.8E+3	5.4E00	6.3E-2
>C_8-C_{10} Aliphatic	9.0	1.9E00	7.9E+1	1.3E+2	3.0E+4	4.3E-1	6.3E-3
>C_{10}-C_{12} Aliphatic	11	3.0E00	1.2E+2	1.6E+2	2.4E+5	3.4E-2	6.3E-4
>C_{12}-C_{16} Aliphatic	14	1.3E+1	5.3E+2	2.0E+2	5.4E+6	7.6E-4	4.8E-5
>C_{16}-C_{35} Aliphatic	18.5	1.2E+2	4.9E+3	2.7E+2	5.7E+8	2.5E-6	1.1E-6

NC: Values for the C_5-C_7 and >C_7-C_8 aromatics, which correspond to benzene and toluene, were not calculated according to the TPHCWG methods. Chemical-specific values for these fractions were assumed to be equal to those of benzene and toluene, thus the K_{oc} and H values from Table 3a of the Technical Report were used.

[a] Solubility (mg/L), Vapor Pressure (atm), and K_{oc} (mL/g) values calculated according to formulas in Tables 7, 9, and 12 of TPHCWG 1997a. H' (unitless) was calculated according to the formula presented above.

[b] Henry's Law constant calculated using methods described above. Final values rounded to two significant figures.

Table C2:
Calculated chemical properties of TRPH classes

TRPH Class	Calculated Fraction-Specific Values*		
	D_a (cm^2/sec)	Volatilization Factor** (m^3/kg)	
		Residential	Industrial
C_5-C_7 Aromatic	2.373206E-3	1.427839E+3	2.914565E+3
>C_7-C_8 Aromatic	1.454501E-3	1.823853E+3	3.722925E+3
>C_8-C_{10} Aromatic	2.676664E-4	4.251577E+3	8.678495E+3
>C_{10}-C_{12} Aromatic	4.766102E-5	1.007547E+4	2.056647E+4
>C_{12}-C_{16} Aromatic	9.433057E-6	2.264753E+4	4.622907E+4
>C_{16}-C_{21} Aromatic	8.318777E-7	7.626359E+4	1.556724E+5
>C_{21}-C_{35} Aromatic	4.561537E-9	1.029891E+6	2.102257E+6
C_5-C_6 Aliphatic	1.572995E-2	5.546045E+2	1.132082E+3
>C_6-C_8 Aliphatic	8.136944E-3	7.711100E+2	1.574022E+3
>C_8-C_{10} Aliphatic	2.136944E-3	1.507145E+3	3.076447E+3
>C_{10}-C_{12} Aliphatic	4.478028E-4	3.287029E+3	6.709621E+3
>C_{12}-C_{16} Aliphatic	8.737169E-5	7.441520E+3	1.518994E+4
>C_{16}-C_{35} Aliphatic	7.662332E-6	2.512850E+4	5.129333E+4

*All calculations carried out to 18 decimal places. Values provided have been rounded to seven significant figures for presentation in this table.

**For residential exposure to non-carcinogens, VFs are based on an exposure duration of six years. Industrial exposure duration is 25 years.

Derivation of TRPH Fraction Toxicological Values

The toxicity values for the various TRPH fractions were obtained from TPHCWG (1997c) and are as follows:

Table C3:
Toxicity Values of TRPH Classes[a]

TRPH Class	RfD_o (mg/kg-day)	RfD_d (mg/kg-day)[b]	RfC_i (mg/m^3)	RfD_i (mg/kg-day)[c]
C_5-C_7 Aromatic	0.2	0.1	0.4	0.1
>C_7-C_8 Aromatic	0.2	0.1	0.4	0.1
>C_8-C_{10} Aromatic	0.04	0.02	0.2	0.06
>C_{10}-C_{12}	0.04	0.02	0.2	0.06
>C_{12}-C_{16}	0.04	0.02	0.2	0.06
>C_{16}-C_{21}	0.03	0.02	not available	0.02[d]
>C_{21}-C_{35}	0.03	0.02	not available	0.02[d]
C_5-C_6 Aliphatic	5.0	3.0	18.4	5.0
>C_6-C_8 Aliphatic	5.0	3.0	18.4	5.0
>C_8-C_{10} Aliphatic	0.1	0.05	1.0	0.3
>C_{10}-C_{12} Aliphatic	0.1	0.05	1.0	0.3
>C_{12}-C_{16} Aliphatic	0.1	0.05	1.0	0.3
>C_{16}-C_{35} Aliphatic	2.0	1.0	not available	1.0[d]

[a] Toxicity Values from TPHCWG 1997c.

[b] RfD_d values extrapolated from RfD_o, GI absorption assumed to be 0.5 (see Appendix B).

[c] RfD_i values extrapolated from RfC_i values when available, GI absorption assumed to be 0.5 (see Appendix B).

[d] RfD_i values extrapolated from RfD_o, GI absorption assumed to be 0.5 (see Appendix B).

Derivation of TRPH SCTLs

The Florida TRPH SCTLs will be based on a 2-tiered approach. First, there will be a primary TRPH soil cleanup target level (SCTL). This SCTL is based on the assumption that the TRPHs consist exclusively of aromatic hydrocarbons in the >C_8-C_{10} range. Second, if the primary SCTL is exceeded, then the TRPHs may be sub-classified with each class possessing its own SCTL. Given the potential for the subclassification methodology to yield relatively high SCTLs, it is possible that the human health SCTLs for some constituents, particularly those with relatively low toxicity and low mobility potential (such as TRPHs) could result in staining, odors and /or nuisance conditions.

The primary TRPH SCTL is based on the >C_8-C_{10} carbon range as a result of two factors. First, the analytical method identified by the Florida Department of Environmental Protection for the purpose of measuring petroleum hydrocarbons in water and soil is limited to the detection of products within a carbon chain range of C_8 – C_{40}. This method, the Florida Petroleum Residual Organic (FL-PRO) — Alternative Method to Total Recoverable Petroleum Hydrocarbons, 418.1 or 9073 — combines several of the commonly used methods so that the targeted range of petroleum hydrocarbons can be analyzed in a single step. However, because of its limitations, the smallest detectable C-range using the FL-PRO Method is the >C_8-C_{10} grouping. [This method is available for immediate use and may be obtained by calling the FDEP Quality Assurance Section at (850) 488-2796.] Secondly, the TRPH SCTL value was selected based on the identification of the most conservative values. The calculation of the SCTLs (listed below) using standard FDEP and USEPA protocols results in the most conservative values for the C_5-C_7 aromatics. However, due to the limitations of the TRPH Method of Analysis, and since the most toxic and prevalent COCs within this range are addressed by other analyses and individual cleanup target levels, the values in this group are not used as TRPH SCTLs. The next most conservative values for residential and industrial direct exposure that occur within a carbon range that can be analyzed by FL-PRO are found in the >C_8-C_{10} aromatics grouping. Therefore, the TRPH SCTL values are based on this group of total petroleum hydrocarbons.

Calculation of the SCTLs

With the assignment of the above chemical and toxicological values, the determination of risk-based SCTLs follows the same methodology as that used for individual compounds.

Table C4: Calculated SCTLs for TRPH Classes

TRPH Class	SCTL (mg/kg_{soil})		
	Residential	Industrial	Leachability[a]
C_5-C_7 Aromatic	220	1500	34
>C_7-C_8 Aromatic	280	1900	50
>C_8-C_{10} Aromatic	**350**	**2500**	**340**
>C_{10}-C_{12} Aromatic	720	5700	520
>C_{12}-C_{16} Aromatic	1200	11000	1000
>C_{16}-C_{21} Aromatic	1200	12000	2800
>C_{21}-C_{35} Aromatic	2100	37000	26000
C_5-C_6 Aliphatic	4300	29000	470
>C_6-C_8 Aliphatic	5900	40000	1200
>C_8-C_{10} Aliphatic	650	4600	6700
>C_{10}-C_{12} Aliphatic	1300	9600	49000
>C_{12}-C_{16} Aliphatic	2400	20000	1100000
>C_{16}-C_{35} Aliphatic	31000	240000	110000000

[a]Based on an acceptable groundwater concentration of 5000 µg/L.