

Overview of Appendix 1

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A1.0 Introduction

This appendix provides various tables of values needed to determine default closure levels under RISC. A short narrative describing each table is provided below; the tables are provided following the text.

Table A

Table A is divided into two main sections, Residential and Commercial/ Industrial. Each of these is further divided into two subsections, Soil and Ground Water. Each section presents applicable closure levels and footnotes.

Both the Industrial and Residential Soil Closure Level sections provide concentrations for soil saturation (C_{sat}); soil attenuation capacity (SAC); and construction worker, direct, and migration to ground water pathways. A final column presents the Default Closure Level, as determined by the lowest of C_{sat} ; SAC; and construction worker, direct, or migration to ground water closure levels for a given chemical. Default closure levels are considered protective of human health.

The ground water section provides concentrations for water solubility limits, maximum contaminant levels (MCL), and the respective ground water pathway closure levels. The default closure level for residential settings is the MCL, if the MCL has been established; if not, the default closure level is the lowest of either the ground water pathway or the solubility limit. The ground water default closure level for the commercial/industrial setting is the solubility limit if it is lower than any other level; if not, the default closure level is the highest of either the MCL or the ground water pathway level.

The default closure levels for all compounds, except beryllium and mercury, are used over a default soil pH range of 6.0 to 8.0. If site soils have a pH within this range, the default closure levels can be applied. If not, a site-specific, pH-dependent closure level must be developed for any ionizing organics and metals at the site. The K_d -dependent pH range applies only to metals and ionizing organics. These compounds are identified in the default closure level tables by footnote 6. In general, carboxylic acids, phenols, and amines are considered “ionizing organics.” For those metals or ionizing organics not included in the table, a pH-specific K_{oc} or K_d will need to be determined. Guidance for determining the K_d or K_{oc} is presented in the 1996 EPA Soil Screening Guidance (EPA 540/R-95/128). K_d values for beryllium and mercury are very sensitive to slight changes

in pH; therefore, a site-specific pH must be established and used to determine the K_d for these compounds. This value can be calculated by using Table C-4, Metal K_d Values as a Function of pH, as presented in the EPA 1996 Soil Screening Guidance Users Guide (EPA/540/R-96-018).

Table B

Table B presents values for the following chemical and physical properties used to derive the values listed in Table A:

- Volatilization Factor
 - Diffusivity in air
 - Diffusivity in water
- K_{oc}/K_d
- Henry's Law Constant
- Dermal absorbance
- Water solubility
- Maximum contaminant level (MCL)
- Melting point
- Boiling point
- Molecular weight

The chemical and physical parameter values were taken from the following references (in order of preference):

1. EPA. 1996. Soil Screening Guidance Document, Users Guide, 9355.4-23, EPA/540/R-96/018, April; Technical Background Document, 9355.4-17A, EPA/540/R-95/128, May.
2. Agency for Toxic Substances and Disease Registry
Toxicological Profiles
3. EPA Region 9, Region 6, and Region 3 Preliminary Remediation Goals, Physical and Chemical Parameters; available online at:
<http://www.epa.gov/reg3hwmd/risk/riskmenu.htm>
<http://www.epa.gov/region09/waste/sfund/prg/index.htm> and
http://www.epa.gov/earth1r6/6pd/cra_c/pd-n/screen.htm
4. Other EPA sources, including the Superfund Chemical Data Matrix
5. Other State agency sources
6. Other published literature

Table C

Table C presents mathematical equations used to derive closure levels. The RISC default process considers three media of exposure or pathways for commercial/industrial and residential land uses: surface soil, subsurface soil, and ground water. Subsurface soil is considered a medium because it presents a mechanism for contaminant transport to ground water when rain infiltrates and leaches material out of the soil. For this reason, the equations describing calculation of subsurface soil default closure levels are titled *Migration to Groundwater*; they are often referred to as “indirect” exposure pathway equations. The total exposure associated with each medium is the sum of the exposures from each significant absorption route (ingestion, dermal absorption, and inhalation) associated with that medium. The construction worker occupational exposure considers only soil exposure.

Residential and industrial direct soil exposure is determined by summing the intake from the ingestion, inhalation, and dermal absorption routes. Values listed for exposure resulting from soil contaminants migrating to ground water are protective for the ground water consumption pathway. Residential ground water exposure is determined by summing the intake from the inhalation and ingestion routes. Certain exposure routes in a given pathway were eliminated after considering potential exposure and dosage. The dermal route for residential ground water was assessed as an insignificant contributor to risk and was therefore eliminated from the calculation. Similarly, the inhalation route for industrial ground water was eliminated because industrial settings are typically well ventilated, and it is unlikely that most workers have any significant exposure.

Construction closure levels consider the intake from ingestion, dermal, and inhalation routes for direct soil contact. Water exposure was not considered because most utility or other construction work does not involve workers standing in water for long periods of time.

Separate equations are needed to determine carcinogenic and noncarcinogenic closure levels. Many compounds have both a carcinogenic and noncarcinogenic dose response. In such cases, each value was calculated separately, and the lowest result is used in the table.

Exposure to residential soil presents more significant exposure risks in children 6 years and younger. Children in this age group generally spend more time outdoors and ingest more soil than adults. To account for this special case, a “weighted approach” was used to calculate residential surface soil values. The body weight, exposure duration, skin-surface area, ingestion amounts, and inhalation rates were age-adjusted or “weighted” for each of the three principle soil absorption routes.

Five supporting models were used to account for the following factors: volatilization factor/particulate emissions, soil saturation, age adjustments for soil ingestion, skin contact, and vapor inhalation. The volatilization and particulate emission models account for exposure potential for emission of vapors and particulates from surface soils. The models and equations are taken from the EPA Soil Screening Guidance (1996). Similarly, the models used for soil saturation levels were also taken from the Soil Screening Guidance. The equations (models) used to adjust values based on age were mathematically derived using exposure duration, body weight, skin surface area, and ingestion and inhalation rates of children and adults.

Tables D and E

Table D presents the Default Exposure Assumptions used in the equations presented in Table C. Quantification of exposure variables (such as exposure frequency, exposure duration, and exposed surface area) will change depending on land use, application, and whether the receptors are adults or children. Table E lists a reference source verifying each default value.

Generally speaking, the default assumption values are set at the 90 to 95th percentile of available and reliable data. This approach is more protective than using the average value and it is generally accepted as a reasonable working boundary on the population of sampled measurements (see EPA Risk Assessment Guidance for Superfund, EPA/540/1-89/002).

Table F

Table F presents the reference doses and slope factors for all of the chemicals listed in the closure tables. These values were taken from the following references (in order of preference):

1. EPA Integrated Risk Information System (IRIS) — Certain route-to-route extrapolations are acceptable. Guidance is presented below.

2. Health Effects Assessment Summary Tables (HEAST) — Assuming HEAST continues to be updated (if not, then this source moves to “Other Literature Sources”).
3. Agency for Toxic Substances and Disease Registry (ATSDR), National Center for Environmental Assessment, and EPA Regions 9 and 3 PRG Toxicity Values
4. Other literature sources — This may include derivations from literature sources.
5. Predictive Models — Predictive models such as Quantitative Structure and Activity Relationship (QSARS)

In general, the organic chemicals in the default tables have both an inhalation and an oral reference dose (RfD) or slope factor (SF). These values are taken directly from experimentally derived animal or human data (when available). When sufficient data on the route was not available, IDEM used a route-to-route extrapolation. This approach assumes that toxicity is similar for both routes. While it is unlikely that there is a direct 1-to-1 correlation between the inhalation and oral routes, extrapolation of inhalation RfDs from oral RfDs for the more volatile chemicals tends to be reasonably close when compared to experimentally derived inhalation RfDs (EPA Soil Screening Guidance 1996).

IDEM considers such extrapolations of values for the more volatile compounds to compare reasonably well and will use route-to-route extrapolations. As the volatility of the compounds decreases, route-to-route extrapolations become less certain (EPA Soil Screening Guidance 1996). However, these extrapolations do provide some assurance that the pathways are being addressed, and IDEM will also use route-to-route extrapolations for these compounds.

Route-to-route extrapolations do not work as well for inorganics. For the carcinogenic metals, specifically beryllium, chromium, nickel, and cadmium, the experimental evidence involving increased cancer risk appears to be limited to the respiratory pathway, and it is unlikely that ingestion would contribute to the carcinogenic response. Therefore, a route-to-route extrapolation has not been performed.

With respect to noncarcinogenic inorganics, considerable difference exists in the absorption and toxicity dynamics between routes. The differences are significant enough to eliminate them from consideration for route-to-route extrapolation. In addition, IDEM's

analysis of these compounds at default particulate exposure levels indicates that the particulate inhalation pathway is insignificant. IRIS and EPA Regions 3, 6, and 9 do not perform route-to-route extrapolations for inorganics. IDEM agrees with EPA and will not include the route-to-route extrapolation as a pathway for inorganic compounds. Therefore, route-to-route extrapolations were not performed for noncarcinogenic inorganic compounds.

Table G

The RISC default approach uses the “critical effect” of a noncarcinogenic chemical to establish the target organ. The critical effect is the first adverse effect, or its known precursor, that occurs to the most sensitive species as the dose is increased during toxicity testing. Therefore, it is a toxic effect on a target organ or tissue (for example, an increase in liver weight or nephrotoxicity). Each critical effect will be categorized into one or more “critical effects categories.” A critical effects category is a group of target organs or tissues subject to common absorption or a group of organs with similar or common functions. In certain cases, an effect occurring in one system may indirectly affect another system, and it will be necessary to consider effects as additive within both systems. In other cases, a chemical at the RfD dose may affect more than one critical effects category. Many chemicals have both a carcinogenic and a noncarcinogenic toxic effect. If the default value in the closure table is based on the carcinogenic response, then the additivity of the chemical is assessed only as a carcinogen.

The box on the following page lists the 10 critical effects categories and examples of the target organs or effects considered in that category. The list of critical effects and categories for each chemical is given in Table G.

Critical Effects Categories and Target Organs	
1.	Systemic: Liver, kidney, urinary tract
2.	Circulatory: Arteries, veins, heart, and blood
3.	Gastrointestinal: Buccal cavity, esophagus, stomach, intestines, and gall bladder
4.	Musculoskeletal: Muscles, bone, and connective tissues
5.	Respiratory: Lungs, trachea, and nasal passageway
6.	Immunological: Lymph and tissue fluid, spleen, and lymph nodes

7. Neurological: Brain, spinal cord, and neurons
8. Reproductive/Endocrine: Testes, ovaries, thyroid, adrenal, pituitary, pancreas, and parathyroid
9. Developmental: Teratology, growth retardation, structural malformations, and abnormal development
10. Dermal/ Ocular: Skin and eyes

The primary critical effect and target organ for each chemical was obtained using the following sources (in order of preference):

1. IRIS (EPA 2000)
2. HEAST (EPA 1997)
3. ATSDR Toxicological Profiles
4. Hazardous Substance Databank (<http://toxnet.nlm.nih.gov>)

Exceptions include the following critical effects and target organs:

- Some compounds have an RfD based on the No Observed Adverse Effects Level (NOAEL), and information on toxic effects at higher doses was not available. In these cases, the critical effect of a surrogate compound (similar in structure and type) was used.
- Some compounds have an RfD established with the NOAEL and some toxic effects information. The toxic effects information was used to establish the critical effect.
- Some compounds have experimentally derived oral and inhalation reference doses. Where these values were within an order of magnitude of each other, critical effects from both routes were listed. These compounds should be considered as additive in both categories.
- Some compounds did not have an easily identified target organ within the critical effects category. These compounds were classified within a category as “nonspecific.”

Table A

Residential Closure Levels
Commercial/Industrial Closure Levels

Table A Default Closure Table - Residential

July 24, 2001

Constituent	Soil								Ground Water					
	Soil Attenuation Capacity mg/kg	Soil Saturation mg/kg	Construction (mg/kg)		Direct (mg/kg)		Migration to G W (mg/kg)		Default Closure Level (mg/kg)	Solubility (mg/l)	MCL (mg/l)	Residential (mg/l)	Default Closure Level (mg/l)	
Acenaphthene	6000/2000		50,000	NC	9,500	NC	130	NC	130	4.2		0.46	NC	0.46
Acetone (2-Propanone)	6000/2000	100,000	25,000	NC	3,900	NC	3.1	NC	3.1	1,000,000		0.77	NC	0.77
Acrolein ⁵	6000/2000	28,000	1.2	NC	0.18	NC	0.00023	NC	0.00023	260,000		0.000055	NC	0.000055
Aldrin	6000/2000		27	NC	0.25	C	4.9	C	0.25	0.13		0.000050	C	0.000050
Anthracene	6000/2000		250,000	NC	47,000	NC	51	NC	51	0.043		2.3	NC	0.043
Antimony	10,000		460	NC	140	NC	5.4	NC	5.4		0.0060	0.015	NC	0.0060
Arsenic ^{3,6}	10,000		320	NC	3.9	C	29	C	3.9		0.050	0.00057	C	0.050
Barium ⁶	10,000		79,000	NC	23,000	NC	1,600	NC	1,600		2.0	2.6	NC	2.0
Benz(a)anthracene	6000/2000		790	C	5.0	C	19	C	5.0	0.0094		0.0012	C	0.0012
Benzene ¹⁰	6000/2000	870	120	NC	8.2	C	0.034	C	0.034	1,800	0.0050	0.0062	C	0.0050
Benzo(b)fluoranthene	6000/2000		790	C	5.0	C	57	C	5.0	0.0015		0.0012	C	0.0012
Benzo(k)fluoranthene	6000/2000		7,900	C	50	C	39	C	39	0.00080		0.012	C	0.00080
Benzoic acid ⁶	6000/2000		1,000,000	NC	730,000	NC	590	NC	590	3,500		150	NC	150
Benzo(a)pyrene	6000/2000		79	C	0.50	C	8.2	C	0.50	0.0016	0.00020	0.00012	C	0.00020
Benzyl Alcohol	6000/2000	6,400	270,000	NC	55,000	NC	48	NC	48	40,000		11	NC	11
Beryllium ⁹	10,000		2,300	NC	680	NC	63	C	63		0.0040	0.073	NC	0.0040
Bis(2-Chloroethyl)ether	6000/2000	3,300	280	C	1.6	C	0.00070	C	0.00070	17,000		0.00015	C	0.00015
Bis(2-chloroisopropyl)ether ⁵	6000/2000	790	5,200	C	30	C	0.027	C	0.027	1,700		0.0042	C	0.0042
Bis(2-ethylhexyl)phthalate	6000/2000	31,000	18,000	NC	300	C	3,600	C	300	0.34	0.0060	0.061	C	0.0060
Bromodichloromethane ⁷	6000/2000	3,000	2,100	C	10	C	0.63	C	0.63	6,700	0.100	0.0029	C	0.100
Bromoform(tribromomethane)	6000/2000	1,900	7,700	NC	280	C	0.75	C	0.75	3,100	0.100	0.11	C	0.100
N-Butanol	6000/2000	10,000	48,000	NC	8,200	NC	16	NC	16	74,000		3.7	NC	3.7
Butylbenzylphthalate	6000/2000	930	180,000	NC	37,000	NC	6,200	NC	930	2.7		7.3	NC	2.7
Cadmium ^{3,6}	10,000		570	NC	12	NC	7.5	C	7.5		0.0050	0.018	NC	0.0050
Carbazole	6000/2000		31,000	C	210	C	5.9	C	5.9	7.5		0.043	C	0.043
Carbon disulfide	6000/2000	720	6,200	NC	900	NC	10	NC	10	1,200		1.3	NC	1.3
Carbon tetrachloride	6000/2000	1,100	31	NC	3.3	C	0.066	C	0.066	790	0.0050	0.0026	C	0.0050

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Default Closure Tables

Table A Default Closure Table - Residential

July 24, 2001

Constituent	Soil								Ground Water					
	Soil Attenuation Capacity mg/kg	Soil Saturation mg/kg	Construction (mg/kg)		Direct (mg/kg)		Migration to G W (mg/kg)		Default Closure Level (mg/kg)	Solubility (mg/l)	MCL (mg/l)	Residential (mg/l)	Default Closure Level (mg/l)	
Chlordane	6000/2000		510	NC	17	C	9.6	C	9.6	0.056	0.0020	0.0024	C	0.0020
p-Chloroaniline ⁶	6000/2000		3,600	NC	730	NC	0.97	NC	0.97	5,300		0.15	NC	0.15
Chlorobenzene	6000/2000	680	2,600	NC	380	NC	1.3	NC	1.3	470	0.100	0.13	NC	0.100
Chloroethane	6000/2000	1500	9,600	C	46	C	0.32	C	0.32	5,700		0.062	C	0.062
Chloroform	6000/2000	2,900	6.4	NC	0.91	NC	0.59	C	0.59	7,900	0.100	0.00084	NC	0.100
2-Chlorophenol ⁶	6000/2000	53,000	2,200	NC	360	NC	0.75	NC	0.75	22,000		0.038	NC	0.038
Chromium III ⁶	10,000		1,000,000	NC	520,000	NC	1,000,000	NC	10,000		0.100	55	NC	0.1
Chromium VI ^{6,12}	10,000		3,400	NC	430	C	38	C	38		0.100	0.11	NC	0.100
Chrysene	6000/2000		79,000	C	500	C	25	C	25	0.0016		0.12	C	0.0016
Copper ⁶	10,000		42,000	NC	13,000	NC	580	NC	580	0	1.3	1.4	NC	1.3
Cyanide, Free ¹³	10,000		18,000	NC	3,700	NC	150	NC	150	1,000,000	0.2	0.73	NC	0.2
DDD	6000/2000		3,100	C	28	C	140	C	28	0.090		0.0035	C	0.0035
DDE	6000/2000		2,200	C	20	C	450	C	20	0.12		0.0025	C	0.0025
DDT	6000/2000		540	NC	20	C	260	C	20	0.025		0.0025	C	0.0025
Dibenzo(a,h)anthracene	6000/2000		79	C	0.50	C	18	C	0.50	0.0025		0.00012	C	0.00012
Di-n-butyl phthalate	6000/2000	2,300	89,000	NC	18,000	NC	5,000	NC	2,000	11		3.7	NC	3.7
1,2-Dichlorobenzene	6000/2000	600	18,000	NC	2,800	NC	17	NC	17	160	0.60	0.48	NC	0.60
1,3-Dichlorobenzene	6000/2000	310	180	NC	27	NC	0.13	NC	0.13	130		0.0069	NC	0.0069
1,4-Dichlorobenzene	6000/2000		8,000	C	42	C	2.2	C	2.2	74	0.075	0.0080	C	0.075
3,3-Dichlorobenzidine	6000/2000		1,400	C	9.5	C	0.062	C	0.062	3.1		0.0019	C	0.0019
1,1-Dichloroethane	6000/2000	1,700	8,600	NC	1,300	NC	5.6	NC	5.6	5,100		0.99	NC	0.99
1,2-Dichloroethane	6000/2000	1,800	150	NC	3.7	C	0.024	C	0.024	8,500	0.0050	0.0020	C	0.0050
1,1-Dichloroethylene	6000/2000	1,500	140	C	0.67	C	0.058	C	0.058	2,300	0.0070	0.00067	C	0.0070
cis-1,2-Dichloroethylene	6000/2000	1,200	750	NC	110	NC	0.40	NC	0.40	3,500	0.070	0.077	NC	0.070
trans-1,2-Dichloroethylene	6000/2000	3,100	1,200	NC	180	NC	0.68	NC	0.68	6,300	0.100	0.15	NC	0.100
2,4-Dichlorophenol ⁶	6000/2000		2,700	NC	550	NC	1.1	NC	1.1	4,500		0.11	NC	0.11
1,2-Dichloropropane	6000/2000	1,100	100	NC	4.5	C	0.030	C	0.030	2,800	0.0050	0.0026	C	0.0050
1,3-Dichloropropene	6000/2000	1,400	290	NC	9.5	C	0.040	C	0.040	2,800		0.0056	C	0.0056
Dieldrin	6000/2000		39	C	0.27	C	0.046	C	0.046	0.20		0.000053	C	0.000053
Diethylphthalate	6000/2000	2,000	710,000	NC	150,000	NC	450	NC	450	1,100		29	NC	29
Dimethyl phthalate	6000/2000	1400	1,000,000	NC	1,000,000	NC	2000	NC	1400	4300		370	NC	370
2,4-Dimethylphenol ⁶	6000/2000		18,000	NC	3,700	NC	9.0	NC	9.0	7,900		0.73	NC	0.73
2,4-Dinitrophenol ⁶	6000/2000		1,800	NC	370	NC	0.29	NC	0.29	2,800		0.073	NC	0.073
Dinitrotoluene mixture	6000/2000		890	NC	6.3	C	0.0085	C	0.0085	180		0.0013	C	0.0013
Di-n-octyl phthalate	6000/2000	10,000	18,000	NC	3,700	NC	67,000	NC	2,000	0.020		0.73	NC	0.020

Appendix 1
Default Closure Tables

Table A Default Closure Table - Residential July 24, 2001

Constituent	Soil								Ground Water				
	Soil Attenuation Capacity mg/kg	Soil Saturation mg/kg	Construction (mg/kg)		Direct (mg/kg)		Migration to G W (mg/kg)	Default Closure Level (mg/kg)	Solubility (mg/l)	MCL (mg/l)	Residential (mg/l)		Default Closure Level (mg/l)
Endosulfan	6000/2000		5,300	NC	1,100	NC	20	NC 20	0.51		0.22	NC	0.22
Endrin	6000/2000		270	NC	55	NC	0.99	NC 0.99	0.25	0.0020	0.011	NC	0.0020
Ethylbenzene	6000/2000	400	29,000	NC	4,600	NC	13	NC 13	170	0.70	1.6	NC	0.70
Fluoranthene	6000/2000		33,000	NC	6,300	NC	880	NC 880	0.21		1.5	NC	0.21
Fluorene	6000/2000		33,000	NC	6,300	NC	170	NC 170	2.0		0.31	NC	0.31
Heptachlor	6000/2000		91	C	0.54	C	23	C 0.54	0.18	0.00040	0.00019	C	0.00040
Heptachlor epoxide	6000/2000		12	NC	0.47	C	0.67	C 0.47	0.20	0.00020	0.000094	C	0.00020
Hexachlorobenzene	6000/2000		390	C	2.7	C	2.2	C 2.2	6.2	0.00100	0.00053	C	0.00100
Hexachloro-1,3-butadiene	6000/2000	1,000	180	NC	37	NC	16	C 16	3.2		0.0073	NC	0.0073
alpha-HCH(alpha-BHC)	6000/2000		120	C	0.99	C	0.0072	C 0.0072	2.0		0.00014	C	0.00014
beta-HCH(beta-BHC)	6000/2000		410	C	3.5	C	0.026	C 0.026	0.24		0.00047	C	0.00047
gamma-HCH(Lindane)	6000/2000		310	NC	4.8	C	0.0094	C 0.0094	6.8	0.00020	0.00066	C	0.00020
Hexachlorocyclopentadiene	6000/2000	2,200	6,200	NC	1,300	NC	400	NC 400	1.8	0.050	0.26	NC	0.050
Hexachloroethane	6000/2000		660	NC	120	NC	2.8	C 2.8	50		0.037	NC	0.037
Indeno(1,2,3-cd)pyrene	6000/2000		790	C	5.0	C	3.1	C 3.1	0.000022		0.0012	C	0.000022
Isophorone	6000/2000	4,600	180,000	NC	4,500	C	5.3	C 5.3	12,000		0.90	C	0.90
Lead ⁸	10,000		970		400		81	81			0.015		0.015
Mercury ⁹	10,000		270	NC	55	NC	2.1	NC 2.1		0.0020	0.011	NC	0.0020
Methoxychlor	6000/2000		4,400	NC	910	NC	160	NC 160	0.045	0.040	0.18	NC	0.040
Methyl bromide	6000/2000	3,200	69	NC	9.9	NC	0.052	NC 0.052	15,000		0.011	NC	0.011
Methylene chloride	6000/2000	2,400	22,000	C	120	C	0.023	C 0.023	13,000	0.0050	0.063	C	0.0050
Methyl ethyl ketone (MEK)	6000/2000	35,000	130,000	NC	20,000	NC	11	NC 11	270,000		2.5	NC	2.5
4-methyl-2-pentanone (MIBK)	6000/2000	4,100	7,200	NC	1,000	NC	0.99	NC 0.99	19,000		0.21	NC	0.21
2-Methylphenol(o-cresol) ⁶	6000/2000		39,000	NC	7,500	NC	14	NC 14	26,000		1.8	NC	1.8
3-methylphenol (m-cresol) ⁶	6000/2000	8,900	44,000	NC	9,100	NC	11	NC 11	23,000		1.8	NC	1.8
4-methylphenol (p-cresol) ⁶	6000/2000		4,400	NC	910	NC	1.1	NC 1.1	22,000		0.18	NC	0.18
Methyl tertiary butyl ether (MTBE)	6000/2000	32,000	38,000	C	190	C	0.35	C 0.35	48,000		0.045	C	0.045
Naphthalene	6000/2000		17,000	NC	3,200	NC	0.70	NC 0.70	31		0.0083	NC	0.0083
Nickel ⁶	10,000		23,000	NC	6,900	NC	950	C 950			0.73	NC	0.73
2-nitroaniline	6000/2000		51	NC	10	NC	0.011	NC 0.011	290		0.0021	NC	0.0021
Nitrobenzene	6000/2000	1,000	440	NC	91	NC	0.028	NC 0.028	2,100		0.0043	NC	0.0043
N-Nitrosodiphenylamine ⁶	6000/2000		130,000	C	870	C	9.7	C 9.7	35		0.17	C	0.17
N-Nitrosodi-n-propylamine ^{5,6}	6000/2000		89	C	0.61	C	0.00060	C 0.00060	9,900		0.00012	C	0.00012
PCBs ¹¹	6000/2000		16	NC	1.8	C	6.2	C 1.8	0.70	0.00050	0.00043	C	0.00050
Pentachlorophenol ⁶	6000/2000		3,800	C	20	C	0.028	C 0.028	2,000	0.00100	0.0071	C	0.00100

Appendix 1
Default Closure Tables

Table A Default Closure Table - Residential July 24, 2001

Constituent	Soil								Ground Water					
	Soil Attenuation Capacity mg/kg	Soil Saturation mg/kg	Construction (mg/kg)		Direct (mg/kg)		Migration to G W (mg/kg)		Default Closure Level (mg/kg)	Solubility (mg/l)	MCL (mg/l)	Residential (mg/l)		Default Closure Level (mg/l)
Phenol ^b	6000/2000		460,000	NC	88,000	NC	110	NC	110	83,000		22	NC	22
Pyrene	6000/2000		27,000	NC	5,500	NC	570	NC	570	0.14		1.1	NC	0.14
Selenium ^b	10,000		5,700	NC	1,700	NC	5.2	NC	5.2		0.050	0.18	NC	0.050
Silver ^b	10,000		5,700	NC	1,700	NC	31	NC	31			0.18	NC	0.18
Styrene	6000/2000	1,500	68,000	NC	11,000	NC	3.5	NC	3.5	310	0.100	2.0	NC	0.100
1,1,2,2-Tetrachloroethane	6000/2000	2,000	960	C	5.0	C	0.0070	C	0.0070	3,000		0.00090	C	0.00090
1,1,1,2-Tetrachloroethane	6000/2000	640	7,900	C	37	C	0.05	C	0.05	1,100		0.0069	C	0.0069
Tetrachloroethylene (PCE)	6000/2000	230	4,200	NC	48	C	0.058	C	0.058	200	0.0050	0.014	C	0.0050
Thallium ^b	10,000		100	NC	31	NC	2.8	NC	2.8		0.0020	0.0033	NC	0.0020
Toluene	6000/2000	650	11,000	NC	1,700	NC	12	NC	12	530	1.0	0.93	NC	1.0
Toxaphene	6000/2000		560	C	3.9	C	31	C	3.9	0.74	0.0030	0.00077	C	0.0030
1,2,4-Trichlorobenzene	6000/2000	3,200	8,900	NC	1,800	NC	5.3	NC	5.3	300	0.070	0.22	NC	0.070
1,1,1-Trichloroethane	6000/2000	1,200	11,000	NC	1,800	NC	1.9	NC	1.9	1,300	0.20	0.88	NC	0.20
1,1,2-Trichloroethane	6000/2000	1,800	600	NC	9.4	C	0.030	C	0.030	4,400	0.0050	0.0032	C	0.0050
Trichloroethylene (TCE)	6000/2000	1,300	500	NC	45	C	0.057	C	0.057	1,100	0.0050	0.025	C	0.0050
2,4,5-Trichlorophenol ^b	6000/2000		89,000	NC	18,000	NC	250	NC	250	1,200		3.7	NC	3.7
2,4,6-Trichlorophenol ^b	6000/2000		57,000	C	390	C	1.5	C	1.5	800		0.077	C	0.077
Vinyl acetate	6000/2000	2,700	7,600	NC	1,100	NC	2.3	NC	2.3	20,000		0.55	NC	0.55
Vinyl chloride (chloroethene)	6000/2000	1,200	56	C	0.28	C	0.013	C	0.013	2,800	0.0020	0.00028	C	0.0020
Xylene mixed	6000/2000	410	34,000	NC	4,800	NC	190	NC	190	180	10	1.9	NC	10
Zinc ^b	10,000		340,000	NC	100,000	NC	14,000	NC	10,000			11	NC	11

Appendix 1
Default Closure Tables

Table A Default Closure Table - Industrial July 24, 2001

Constituent	Soil								Ground Water					
	Soil Attenuation Capacity mg/kg	Soil Saturation mg/kg	Construction (mg/kg)		Direct (mg/kg)		Migration to G W (mg/kg)		Default Closure Level (mg/kg)	Solubility (mg/l)	MCL (mg/l)	Industrial (mg/l)		Default Closure Level (mg/l)
Acenaphthene	6000/2000		50,000	NC	24,000	NC	1,200	NC	1,200	4.2		6.1	NC	4.2
Acetone (2-Propanone)	6000/2000	100,000	25,000	NC	5,600	NC	41	NC	41	1,000,000		10	NC	10
Acrolein ⁵	6000/2000	28,000	1.2	NC	0.22	NC	8.3	NC	0.22	260,000		2.0	NC	2.0
Aldrin	6000/2000		27	NC	0.80	C	16	C	0.80	0.13		0.00017	C	0.00017
Anthracene	6000/2000		250,000	NC	120,000	NC	51	NC	51	0.043		31	NC	0.043
Antimony	10,000		460	NC	620	NC	37	NC	37		0.0060	0.041	NC	0.041
Arsenic ⁶	10,000		320	NC	20	C	29	C	20		.050	0.0019	C	0.050
Barium ⁶	10,000		79,000	NC	98,000	NC	5,900	NC	5,900		2.0	7.2	NC	7.2
Benz(a)anthracene	6000/2000		790	C	15	C	62	C	15	0.0094		0.0039	C	0.0039
Benzene ¹⁰	6000/2000	870	120	NC	13	C	0.67	C	0.67	1,800	0.0050	0.099	C	0.099
Benzo(b)fluoranthene	6000/2000		790	C	15	C	74	C	15	0.0015		0.0039	C	0.0015
Benzo(k)fluoranthene	6000/2000		7,900	C	150	C	39	C	39	0.00080		0.039	C	0.00080
Benzoic acid ⁶	6000/2000		1,000,000	NC	1,000,000	NC	1,600	NC	1,600	3,500		410	NC	410
Benzo(a)pyrene	6000/2000		79	C	1.5	C	16	C	1.5	0.0016	0.00020	0.00039	C	0.00039
Benzyl Alcohol	6000/2000	6,400	270,000	NC	150,000	NC	140	NC	140	40,000		31	NC	31
Beryllium ⁹	10,000		2,300	NC	2,900	NC	3,200	C	2,300		0.0040	0.20	NC	0.20
Bis(2-Chloroethyl)ether	6000/2000	3,300	280	C	3.0	C	0.012	C	0.012	17,000		0.0026	C	0.0026
Bis(2-chloroisopropyl)ether ⁵	6000/2000	790	5,200	C	61	C	0.26	C	0.26	1,700		0.041	C	0.041
Bis(2-ethylhexyl)phthalate	6000/2000	31,000	18,000	NC	980	C	120,000	C	980	0.34	0.0060	0.20	C	0.20
Bromodichloromethane ⁷	6000/2000	3,000	2,100	C	17	C	0.63	C	0.63	6,700	0.100	0.046	C	0.100
Bromoform(tribromomethane)	6000/2000	1,900	7,700	NC	580	C	2.7	C	2.7	3,100	0.100	0.36	C	0.36
N-Butanol	6000/2000	10,000	48,000	NC	14,000	NC	44	NC	44	74,000		10	NC	10
Butylbenzylphthalate	6000/2000	930	180,000	NC	98,000	NC	6,200	NC	930	2.7		20	NC	2.7
Cadmium ⁶	10,000		570	NC	780	NC	77	C	77		0.0050	0.051	NC	0.051
Carbazole	6000/2000		31,000	C	690	C	20	C	20	7.5		0.14	C	0.14
Carbon disulfide	6000/2000	720	6,200	NC	1,200	NC	82	NC	82	1,200		10	NC	10
Carbon tetrachloride	6000/2000	1,100	31	NC	5.2	C	0.29	C	0.29	790	0.0050	0.022	C	0.022
Chlordane	6000/2000		510	NC	68	C	39	C	39	0.056	0.0020	0.0082	C	0.0082
p-Chloroaniline ⁶	6000/2000		3,600	NC	2,000	NC	2.7	NC	2.7	5,300		0.41	NC	0.41
Chlorobenzene	6000/2000	680	2,600	NC	510	NC	27	NC	27	470	0.100	2.0	NC	2.0
Chloroethane	6000/2000	1,500	9,600	C	71	C	5.2	C	5.2	5,700		0.99	C	0.99
Chloroform	6000/2000	2,900	6.4	NC	1.2	NC	2.7	C	1.2	7,900	0.100	0.47	C	0.47
2-Chlorophenol ⁶	6000/2000	53,000	2,200	NC	580	NC	10.0	NC	10.0	22,000		0.51	NC	0.51
Chromium III ⁶	10,000		1,000,000	NC	1,000,000	NC	1,000,000	NC	10,000		0.100	150	NC	150

Appendix 1
Default Closure Tables

Table A Default Closure Table - Industrial July 24, 2001

Constituent	Soil								Ground Water					
	Soil Attenuation Capacity mg/kg	Soil Saturation mg/kg	Construction (mg/kg)		Direct (mg/kg)		Migration to G W (mg/kg)		Default Closure Level (mg/kg)	Solubility (mg/l)	MCL (mg/l)	Industrial (mg/l)		Default Closure Level (mg/l)
Chromium VI ^{12, 6}	10,000		3,400	NC	650	C	120	C	120		0.100	0.31	NC	0.31
Chrysene	6000/2000		79,000	C	1,500	C	25	C	25	0.0016		0.39	C	0.0016
Copper ⁶	10,000		42,000	NC	57,000	NC	1,700	NC	1,700		1.3	3.8	NC	3.8
Cyanide, Free ¹³	10,000		18,000	NC	9,800	NC	410	NC	410	1,000,000	0.2	2.0	NC	2.0
DDD	6000/2000		3,100	C	120	C	480	C	120	0.090		0.012	C	0.012
DDE	6000/2000		2,200	C	86	C	1,500	C	86	0.12		0.0084	C	0.0084
DDT	6000/2000		540	NC	86	C	890	C	86	0.025		0.0084	C	0.0084
Dibenzo(a,h)anthracene	6000/2000		79	C	1.5	C	60	C	1.5	0.0025		0.00039	C	0.00039
Di-n-butyl phthalate	6000/2000	2,300	89,000	NC	49,000	NC	14,000	NC	2,000	11		10	NC	10
1,2-Dichlorobenzene	6000/2000	600	18,000	NC	3,900	NC	270	NC	270	160	0.60	9.2	NC	9.2
1,3-Dichlorobenzene	6000/2000	310	180	NC	38	NC	1.8	NC	1.8	130		0.092	NC	0.092
1,4-Dichlorobenzene	6000/2000		8,000	C	73	C	3.4	C	3.4	74	0.075	0.12	C	0.12
3,3-Dichlorobenzidine	6000/2000		1,400	C	31	C	0.21	C	0.21	3.1		0.0064	C	0.0064
1,1-Dichloroethane	6000/2000	1,700	8,600	NC	1,700	NC	58	NC	58	5,100		10	NC	10
1,2-Dichloroethane	6000/2000	1,800	150	NC	5.8	C	0.15	C	0.15	8,500	0.0050	0.031	C	0.031
1,1-Dichloroethylene	6000/2000	1,500	140	C	1.1	C	0.058	C	0.058	2,300	0.0070	0.0048	C	0.0070
cis-1,2-Dichloroethylene	6000/2000	1,200	750	NC	140	NC	5.8	NC	5.8	3,500	0.070	1.0	NC	1.0
trans-1,2-Dichloroethylene	6000/2000	3,100	1,200	NC	230	NC	14	NC	14	6,300	0.100	2.0	NC	2.0
2,4-Dichlorophenol ⁶	6000/2000		2,700	NC	1,500	NC	3.0	NC	3.0	4,500		0.31	NC	0.31
1,2-Dichloropropane	6000/2000	1,100	100	NC	7.2	C	0.25	C	0.25	2,800	0.0050	0.042	C	0.042
1,3-Dichloropropene	6000/2000	1,400	290	NC	16	C	0.20	C	0.20	2,800		0.029	C	0.029
Dieldrin	6000/2000		39	C	0.86	C	0.15	C	0.15	0.20		0.00018	C	0.00018
Diethylphthalate	6000/2000	2,000	710,000	NC	390,000	NC	1,300	NC	1,300	1,100		82	NC	82
Dimethyl phthalate	6000/2000	1400	1,000,000	NC	1,000,000	NC	5,600	NC	1400	4300		1,000	NC	1000
2,4-Dimethylphenol ⁶	6000/2000		18,000	NC	9,800	NC	25	NC	25	7,900		2.0	NC	2.0
2,4-Dinitrophenol ⁶	6000/2000		1,800	NC	980	NC	0.82	NC	0.82	2,800		0.20	NC	0.20
Dinitrotoluene mixture	6000/2000		890	NC	20	C	0.028	C	0.028	180		0.0042	C	0.0042
Di-n-octyl phthalate	6000/2000	10,000	18,000	NC	9,800	NC	67,000	NC	2,000	0.020		2.0	NC	0.020
Endosulfan	6000/2000		5,300	NC	2,900	NC	46	NC	46	0.51		0.61	NC	0.51
Endrin	6000/2000		270	NC	150	NC	15	NC	15	0.25	0.0020	0.031	NC	0.031
Ethylbenzene	6000/2000	400	29,000	NC	6,800	NC	200	NC	200	170	0.70	10	NC	10
Fluoranthene	6000/2000		33,000	NC	16,000	NC	880	NC	880	0.21		4.1	NC	0.21
Fluorene	6000/2000		33,000	NC	16,000	NC	1,100	NC	1,100	2.0		4.1	NC	2.0
Heptachlor	6000/2000		91	C	1.2	C	36	C	1.2	0.18	0.00040	0.00064	C	0.00064
Heptachlor epoxide	6000/2000		12	NC	1.5	C	1.0	C	1.0	0.20	0.00020	0.00031	C	0.00031

Appendix 1
Default Closure Tables

Table A Default Closure Table - Industrial July 24, 2001

Constituent	Soil							Ground Water				
	Soil Attenuation Capacity mg/kg	Soil Saturation mg/kg	Construction (mg/kg)		Direct (mg/kg)		Migration to G W (mg/kg)	Default Closure Level (mg/kg)	Solubility (mg/l)	MCL (mg/l)	Industrial (mg/l)	Default Closure Level (mg/l)
Hexachlorobenzene	6000/2000		390	C	8.6	C	3.9	C 3.9	6.2	0.00100	0.0018	C 0.0018
Hexachloro-1,3-butadiene	6000/2000	1,000	180	NC	98	NC	44	C 44	3.2		0.020	NC 0.020
alpha-HCH(alpha-BHC)	6000/2000		120	C	4.0	C	0.024	C 0.024	2.0		0.00045	C 0.00045
beta-HCH(beta-BHC)	6000/2000		410	C	14	C	0.086	C 0.086	0.24		0.0016	C 0.0016
gamma-HCH(Lindane)	6000/2000		310	NC	19	C	0.10	C 0.10	6.8	0.00020	0.0022	C 0.0022
Hexachlorocyclopentadiene	6000/2000	2,200	6,200	NC	3,400	NC	5,700	NC 2,000	1.8	0.050	0.72	NC 0.72
Hexachloroethane	6000/2000		660	NC	240	NC	7.7	C 7.7	50		0.10	NC 0.10
Indeno(1,2,3-cd)pyrene	6000/2000		790	C	15	C	3.1	C 3.1	0.000022		0.0039	C 0.000022
Isophorone	6000/2000	4,600	180,000	NC	14,000	C	18	C 18	12,000		3.0	C 3.0
Lead ^{8,6}	10,000		970		1,300		230				0.042	
Mercury ⁹	10,000		270	NC	150	NC	32	NC 32		0.0020	0.031	NC 0.031
Methoxychlor	6000/2000		4,400	NC	2,500	NC	180	NC 180	0.045	0.040	0.51	NC 0.045
Methyl bromide	6000/2000	3,200	69	NC	13	NC	0.70	NC 0.70	15,000		0.14	NC 0.14
Methylene chloride	6000/2000	2,400	22,000	C	200	C	1.8	C 1.8	13,000	0.0050	0.38	C 0.38
Methyl ethyl ketone (MEK)	6000/2000	35,000	130,000	NC	28,000	NC	260	NC 260	270,000		61	NC 61
4-methyl-2-pentanone (MIBK)	6000/2000	4,100	7,200	NC	1,400	NC	39	NC 39	19,000		8.2	NC 8.2
2-Methylphenol(o-cresol) ⁶	6000/2000		39,000	NC	17,000	NC	39	NC 39	26,000		5.1	NC 5.1
3-methylphenol (m-cresol) ⁶	6000/2000	8,900	44,000	NC	25,000	NC	30	NC 30	23,000		5.1	NC 5.1
4-methylphenol (p-cresol) ⁶	6000/2000		4,400	NC	2,500	NC	3.0	NC 3.0	22,000		0.51	NC 0.51
Methyl tertiary butyl ether (MTBE)	6000/2000	32,000	38,000	C	330	C	5.6	C 5.6	48,000		0.72	C 0.72
Naphthalene	6000/2000		17,000	NC	8,000	NC	170	NC 170	31		2.0	NC 2.0
Nickel ⁶	10,000		23,000	NC	31,000	NC	2,700	C 2,700			2.0	NC 2.0
2-nitroaniline	6000/2000		51	NC	28	NC	0.029	NC 0.029	290		0.0058	NC 0.0058
Nitrobenzene	6000/2000	1,000	440	NC	250	NC	0.34	NC 0.34	2,100		0.051	NC 0.051
N-Nitrosodiphenylamine ⁶	6000/2000		130,000	C	2,800	C	32	C 32	35		0.58	C 0.58
N-Nitrosodi-n-propylamine ^{5,6}	6000/2000		89	C	2.0	C	0.0020	C 0.0020	9,900		0.00041	C 0.00041
PCBs ¹¹	6000/2000		16	NC	5.3	C	18	C 5.3	0.70	0.00050	0.0014	C 0.0014
Pentachlorophenol ⁶	6000/2000		3,800	C	54	C	0.66	C 0.66	2,000	0.00100	0.024	C 0.024
Phenol ⁶	6000/2000		460,000	NC	190,000	NC	320	NC 320	83,000		61	NC 61
Pyrene	6000/2000		27,000	NC	15,000	NC	570	NC 570	0.14		3.1	NC 0.14
Selenium ⁶	10,000		5,700	NC	7,800	NC	53	NC 53		0.050	0.51	NC 0.51
Silver ⁶	10,000		5,700	NC	7,800	NC	87	NC 87			0.51	NC 0.51
Styrene	6000/2000	1,500	68,000	NC	16,000	NC	720	NC 720	310	0.100	20	NC 20
1,1,2,2-Tetrachloroethane	6000/2000	2,000	960	C	8.7	C	0.11	C 0.11	3,000		0.014	C 0.014

Appendix 1
Default Closure Tables

Table A Default Closure Table - Industrial July 24, 2001

Constituent	Soil								Ground Water					
	Soil Attenuation Capacity mg/kg	Soil Saturation mg/kg	Construction (mg/kg)		Direct (mg/kg)		Migration to G W (mg/kg)		Default Closure Level (mg/kg)	Solubility (mg/l)	MCL (mg/l)	Industrial (mg/l)		Default Closure Level (mg/l)
1,1,1,2-Tetrachloroethane	6000/2000	640	7900	C	63	C	0.79	C	0.79	1,100		0.11	C	0.11
Tetrachloroethylene (PCE)	6000/2000	230	4,200	NC	110	C	0.64	C	0.64	200	0.0050	0.055	C	0.055
Thallium ⁶	10,000		100	NC	140	NC	13	NC	13		0.0020	0.0092	NC	0.0092
Toluene	6000/2000	650	11,000	NC	2,200	NC	240	NC	240	530	1.0	20	NC	20
Toxaphene	6000/2000		560	C	12	C	31	C	12	0.74	0.0030	0.0026	C	0.0030
1,2,4-Trichlorobenzene	6000/2000	3,200	8,900	NC	4,900	NC	77	NC	77	300	0.070	1.0	NC	1.0
1,1,1-Trichloroethane	6000/2000	1,200	11,000	NC	2,700	NC	35	NC	35	1,300	0.20	3.6	NC	3.6
1,1,2-Trichloroethane	6000/2000	1,800	600	NC	15	C	0.30	C	0.30	4,400	0.0050	0.050	C	0.050
Trichloroethylene (TCE)	6000/2000	1,300	500	NC	72	C	3.0	C	3.0	1,100	0.0050	0.26	C	0.26
2,4,5-Trichlorophenol ⁶	6000/2000		89,000	NC	49,000	NC	690	NC	690	1,200		10	NC	10
2,4,6-Trichlorophenol ⁶	6000/2000		57,000	C	1,300	C	5.0	C	5.0	800		0.26	C	0.26
Vinyl acetate	6000/2000	2,700	7,600	NC	1,400	NC	430	NC	430	20,000		100	NC	100
Vinyl chloride (chloroethene)	6000/2000	1,200	56	C	0.46	C	0.013	C	0.013	2,800	0.0020	0.0015	C	0.0020
Xylene mixed	6000/2000	410	34,000	NC	6,200	NC	3,400	NC	410	180	10	200	NC	180
Zinc ⁶	10,000		340,000	NC	470,000	NC	38,000	NC	10,000			31	NC	31

Table A Footnotes

1. The default values for certain compounds may be listed as a carcinogen in one column and a non carcinogen in another column. This is the result of calculating both a carcinogenic and noncarcinogenic response for a given chemical and taking the lowest of the two. If a compound has a “C” next to the concentration, then the closure level is evaluated from a carcinogen endpoint, and the compound should be treated as a carcinogen when considering additivity. If a compound does not have a “C” next to the concentration, then the closure level is evaluated from a non-carcinogen endpoint, and the compound should be treated as noncarcinogenic when considering additivity.
2. Certain chemicals that are not liquid at normal soil temperature will not have C_{sat} values.
3. Soil direct contact values are based on the potential for soil-plant-human uptake.
4. Construction values are listed as the raw calculated values. When applying construction values to closures, care should be taken to recognize that values will be capped at the SAC value (defaulted at 6000 mg/kg and 10,000 mg/kg for organics and metals, respectively) or the C_{sat} whichever is less. Direct contact and Migration to ground water closure levels are listed as the raw calculated values. When applying these values separately to closure care should be taken to recognize that these values may be capped at the SAC (defaulted at 6000/2000 or 10,000 for organics and metals, respectively), the C_{sat} , or the construction value, whichever is less. Site specific values for SAC and C_{sat} may be determined. The lesser of these values may then be used up to the raw calculated Construction or Direct/Migration values in these three columns. (note that non-default options also exist for changing the Direct/Migration columns See Chapter 7).
5. Acrolein, Bis(2-chloroethyl)ether, and N-Nitroso-di-n-propylamine may not have an analytical method available with a detection or quantitation limit able to meet the closure level for the matrix without modification. Appendix 2 should be consulted to verify analytical procedures.
6. Ionizing organics and metals Koc and Kd values will vary depending on pH. If the source area pH is outside of the range of 6.0-8.0 then see the discussion in Section A1.0, under “Table A”, pages A.1-1 and A.1-2.
7. Under certain circumstances a “trihalomethane” standard may apply to bromoform, chloroform, and bromodichloromethane. The composite standard may reduce the closure level.
8. Lead values were calculated using the:

1994 Integrated Exposure Uptake Biokinetic Model (see EPA/540/R-93/081, PB-963510) for residential exposures;

The Methodology for Assessing Risks Associated with Adult Exposures to Lead

in Soil, SRC-GLD-FO162-209-DRAFT-7/21/96, and;

Review of A Methodology for Establishing Risk-Based Soil Remediation Goals for Commercial Areas of the California Gultch Site, USEPA, Technical Review Workgroup for Lead, October 26, 1995 for industrial and construction exposures, and;

The Drinking Water Regulation and Health Advisories EPA 822-R-96-001, February, 1996 action levels for residential ground water, and an extrapolation to determine industrial ground water levels.

The Kd value for lead was taken from Sheppard and Thibault (Default Soil Solid Liquid Partition Coefficients , Kds for Four Major Soil Types: A Compendium, Health Physics Vol 59, No. 4, pp 471-482, 1990) for sandy soils and is considered to be applicable anywhere in the state. IDEM recommends site specific determinations and/or use of the Synthetic Precipitation Leaching Procedure (SPLP) for lead (see section 7.1.1).

9. Closure levels for beryllium and mercury must be determined with a site specific pH. See discussion in section A1.0 under Table A, pages A.1-1 and A.1-2.
10. Benzene values may soon change. IRIS has listed the slope factor for this compound as a range and IDEM is currently determining the application to closure levels
11. PCBs are assumed to be a mixture and that Aroclor 1016 and 1254 are present.
12. Chromium VI should be used to represent total chromium unless a species specific ratio evaluation is made.
13. Cyanide values apply to free cyanide only. The closure levels are not applicable to copper cyanide or other complexed cyanides. Total cyanides may not be representative of free cyanide.
14. The SAC value of 10,000 mg/kg for metals is a ceiling value that addresses the potential for a high level of one chemical to impact multiple chemical exposure in such a way that the combined effect is likely to be greater than the sum of the individual effects.
15. Table A lists default closure levels for individual chemicals only. Additivity or the potential for combined effects of multiple chemical exposure should be evaluated when there is more than one chemical present (see section 6.1 Chemical of Concern Additivity)

TABLE B

Chemical/Physical Properties

Appendix 1
Default Closure Tables

Contaminant	Di,a cm ² /s	Di,w cm ² /s	Koc l/kg	K _D (Inorganic) l/kg	H' unitless	ABS unitless	S mg/l	MCL mg/l	MP °C	BP °C	MW g/mol
Acenaphthene	4.21e-02	7.69e-06	7.08e+03		6.36e-03	1.30e-01	4.24e+00		93	279	154
Acetone (2-Propanone)	1.24e-01	1.14e-05	5.75e-01		1.59e-03	1.00e-01	1.00e+06		-95	56.5	58.1
Acrolein	1.10e-01	1.20e-05	1.18e+00		4.90e-03	1.00e-01	2.60e+05		-88	53	56.1
Aldrin	1.32e-02	4.86e-06	2.45e+06		6.97e-03	1.00e-01	1.30e-01		104	145	364.9
Anthracene	3.24e-02	7.74e-06	2.95e+04		2.67e-03	1.30e-01	4.34e-02		215	340	178
Antimony				4.50e+01		1.00e-02		6.00e-03	630	1750	121.8
Arsenic				2.90e+01		3.00e-02		5.00e-02	818	613	74.9
Barium				4.10e+01		1.00e-02		2.00e+00	725	1640	182.2
Benz(a)anthracene	5.10e-02	9.00e-06	3.98e+05		1.37e-04	1.30e-01	9.40e-03		84	438	228.3
Benzene	8.80e-02	9.80e-06	5.89e+01		2.28e-01	1.00e-01	1.75e+03	5.00e-03	5.5	80.1	78.1
Benzo(b)fluoranthene	2.26e-02	5.56e-06	1.23e+06		4.55e-03	1.30e-01	1.50e-03		168	357	252.3
Benzo(k)fluoranthene	2.26e-02	5.56e-06	1.23e+06		3.40e-05	1.30e-01	8.00e-04		217	480	252.3
Benzoic acid	5.36e-02	7.97e-06	6.00e-01		6.31e-05	1.00e-01	3.50e+03		122	249.2	122
Benzo(a)pyrene	4.30e-02	9.00e-06	1.02e+06		4.63e-05	1.30e-01	1.62e-03	2.00e-04	177	495	252.3
Benzyl Alcohol	8.00e-02	8.00e-06	1.02e+01		1.38e-05	1.00e-01	4.00e+04		-15.2	205.3	108.1
Beryllium				7.90e+02		1.00e-02		4.00e-03	1278	2970	9
Bis(2-Chloroethyl)ether	6.92e-02	7.53e-06	1.55e+01		7.38e-04	1.00e-01	1.72e+04		-52	178	143.01
Bis(2-chloroisopropyl)ether	6.30e-02	6.40e-06	6.10e+01		4.60e-03	1.00e-01	1.70e+03		-97	187	171
Bis(2-ethylhexyl)phthalate	3.51e-02	3.66e-06	1.51e+07		4.18e-06	1.00e-01	3.40e-01	6.00e-03	-55	384	390.6

Appendix 1
Default Closure Tables

Contaminant	Di,a cm ² /s	Di,w cm ² /s	Koc l/kg	K _D (Inorganic) l/kg	H' unitless	ABS unitless	S mg/l	MCL mg/l	MP °C	BP °C	MW g/mol
Bromodichloromethane	2.98e-02	1.06e-05	5.50e+01		6.56e-02	1.00e-01	6.74e+03	1.00e-01	-57	90	163.8
Bromoform(tribromomethane)	1.49e-02	1.03e-05	8.71e+01		2.19e-02	1.00e-01	3.10e+03	1.00e-01	8	149	252.8
Butanol	8.00e-02	9.30e-06	6.92e+00		3.61e-04	1.00e-01	7.40e+04		-89.8	115	74.1
Butylbenzylphthalate	1.74e-02	4.83e-06	5.75e+04		5.17e-05	1.00e-01	2.69e+00		-35	370	312.4
Cadmium				7.50e+01		1.00e-02		5.00e-03	321	765	112.4
Carbazole	3.90e-02	7.03e-06	3.39e+03		6.26e-07	1.00e-01	7.48e+00		246.2	355	167.2
Carbon disulfide	1.04e-01	1.00e-05	4.57e+01		1.24e+00	1.00e-01	1.19e+03		-115	46.5	76.1
Carbon tetrachloride	7.80e-02	8.80e-06	1.74e+02		1.25e+00	1.00e-01	7.93e+02	5.00e-03	-23	76.7	153.9
Chlordane	1.18e-02	4.37e-06	1.20e+05		1.99e-03	4.00e-02	5.60e-02	2.00e-03	106	175	409.8
p-Chloroaniline	4.83e-02	1.01e-05	6.61e+01		1.36e-05	1.00e-01	5.30e+03		72.5	232	
Chlorobenzene	7.30e-02	8.70e-06	2.19e+02		1.52e-01	1.00e-01	4.72e+02	1.00e-01	-45.2	131.5	112.6
Chloroethane	1.00e-01	1.00e-05	1.54e+01		3.60e-01	1.00e-01	5.70e+03		-138.7	12.3	64.5
Chloroform	1.04e-01	1.00e-05	3.98e+01		1.50e-01	1.00e-01	7.92e+03	1.00e-01	-63.6	61.5	119.4
2-Chlorophenol	5.01e-02	9.46e-06	3.88e+02		1.60e-02	1.00e-01	2.20e+04		9.8	175	128.6
Chromium III				1.80e+06	---	1.00e-02		1.00e-01	1900	2642	52
Chromium VI				1.90e+01		1.00e-02		1.00e-01	1900	2642	52
Chrysene	2.48e-02	6.21e-06	3.98e+05		3.88e-03	1.30e-01	1.60e-03		258.2	448	228.3
Copper				2.22e+01		1.00e-02		1.30e+00	1083	2595	79.5
Cyanide, Free ¹	1.80e-01	2.00e-05		9.90e+00	5.31e-06	1.00e-01	1.00e+06		-13.4	+201	27

Appendix 1
Default Closure Tables

Contaminant	Di,a cm ² /s	Di,w cm ² /s	Koc l/kg	K _D (Inorganic) l/kg	H' unitless	ABS unitless	S mg/l	MCL mg/l	MP °C	BP °C	MW g/mol
Cyclohexane	8.00e-02	9.00e-06	1.60e+02		8.20e+00	1.00e-01	5.50e+01		6.6	80.7	84.2
DDD	1.69e-02	4.76e-06	1.00e+06		1.64e-04	3.00e-02	9.00e-02		109.5	193	320
DDE	1.44e-02	5.87e-06	4.47e+06		8.61e-04	3.00e-02	1.20e-01		89	316	518
DDT	1.37e-02	4.95e-06	2.63e+06		3.32e-04	3.00e-02	2.50e-02		108.5	260	354.5
Dibenzo(a,h)anthracene	2.02e-02	5.18e-06	3.80e+06		6.03e-07	1.30e-01	2.49e-03		269.5	524	278.4
Di-n-butylphthalate	4.38e-02	7.86e-06	3.39e+04		3.85e-08	1.00e-01	1.12e+01		-35	340	278.3
1,2-Dichlorobenzene	6.90e-02	7.90e-06	6.17e+02		7.79e-02	1.00e-01	1.56e+02	6.00e-01	-16.7	180.5	147
1,3-Dichlorobenzene	6.90e-02	7.90e-06	3.80e+02		1.29e-01	1.00e-01	1.30e+02		-25	173	147
1,4-Dichlorobenzene	6.90e-02	7.90e-06	6.17e+02		9.96e-02	1.00e-01	7.38e+01	7.50e-02	52.7	174	147
3,3-Dichlorobenzidine	1.94e-02	6.74e-06	7.24e+02		1.64e-07	1.00e-01	3.11e+00		132.5	368	253.1
1,1-Dichloroethane	7.42e-02	1.05e-05	3.16e+01		2.30e-01	1.00e-01	5.06e+03		-96.9	57.3	99
1,2-Dichloroethane	1.04e-01	9.90e-06	1.74e+01		4.01e-02	1.00e-01	8.52e+03	5.00e-03	-35.5	83.5	99
1,1-Dichloroethylene	9.00e-02	1.04e-05	5.89e+01		1.07e+00	1.00e-01	2.25e+03	7.00e-03	-122.5	31.7	97
cis-1,2-Dichloroethylene	7.36e-02	1.13e-05	3.55e+01		1.67e-01	1.00e-01	3.50e+03	7.00e-02	-80	60	97
trans-1,2-Dichloroethylene	7.07e-02	1.19e-05	5.25e+01		3.85e-01	1.00e-01	6.30e+03	1.00e-01	-49.8	49	97
2,4-Dichlorophenol	3.46e-02	8.77e-06	1.47e+02		1.30e-04	1.00e-01	4.50e+03		45	210	163
1,2-Dichloropropane	7.82e-02	8.73e-06	4.37e+01		1.15e-01	1.00e-01	2.80e+03	5.00e-03	-70	96.37	111
1,3-Dichloropropene	6.26e-02	1.00e-05	4.57e+01		7.26e-01	1.00e-01	2.80e+03		-60	108	110
Dieldrin	1.25e-02	4.74e-06	2.14e+04		6.19e-04	1.00e-01	1.95e-01		175.5	385	380.9

Appendix 1
Default Closure Tables

Contaminant	Di,a cm ² /s	Di,w cm ² /s	Koc l/kg	K _D (Inorganic) l/kg	H' unitless	ABS unitless	S mg/l	MCL mg/l	MP °C	BP °C	MW g/mol
Diethylphthalate	2.56e-02	6.35e-06	2.88e+02		1.85e-05	1.00e-01	1.08e+03		-40.5	295	222.3
Dimethylphthalate	6.70e-02	6.30e-06	3.74e+01		2.40e-05	1.00e-01	4.30e+03		5.5	283.7	194.2
2,4-Dimethylphenol	5.84e-02	8.69e-06	2.09e+02		8.20e-05	1.00e-01	7.87e+03		24.5	211	122.2
2,4-Dinitrophenol	2.73e-02	9.06e-06	1.00e-02		1.82e-05	1.00e-01	2.79e+03		116	>200	184
Dinitrotoluene mixture	1.18e-01	7.26e-06	6.92e+01		3.06e-05	1.00e-01	1.82e+02		71	300	182.2
Di-n-octyl phthalate	1.51e-02	3.58e-06	8.32e+07		2.74e-03	1.00e-01	2.00e-02		-30	220	390
Endosulfan	1.15e-02	4.55e-06	2.14e+03		4.59e-04	1.00e-01	5.10e-01		106	>200	406.9
Endrin	1.25e-02	4.74e-06	1.23e+04		3.08e-04	1.00e-01	2.50e-01	2.00e-03	200	245	380.9
Ethylbenzene	7.50e-02	7.80e-06	3.63e+02		3.23e-01	1.00e-01	1.69e+02	7.00e-01	-94.9	136.5	106.2
Fluoranthene	3.02e-02	6.35e-06	1.07e+05		6.60e-04	1.30e-01	2.06e-01		107.8	384	202.4
Fluorene	3.63e-02	7.88e-06	1.38e+04		2.61e-03	1.30e-01	1.98e+00		114.8	295	166.2
Heptachlor	1.12e-02	5.69e-06	1.41e+06		6.07e+01	1.00e-01	1.80e-01	4.00e-04	95.5	135	373.4
Heptachlor epoxide	1.32e-02	4.23e-06	8.32e+04		3.90e-04	1.00e-01	2.00e-01	2.00e-04	160	200	389.3
Hexachlorobenzene	5.42e-02	5.91e-06	5.50e+04		5.41e-02	1.00e-01	6.20e+00	1.00e-03	231.8	325	284.7
Hexachloro-1,3-butadiene	5.61e-02	6.16e-06	5.37e+04		3.34e-01	1.00e-01	3.23e+00		-21	215	260.7
alpha-HCH(alpha-BHC)	1.42e-02	7.34e-06	1.23e+03		4.35e-04	4.00e-02	2.00e+00		160	288	290.8
beta-HCH(beta-BHC)	1.42e-02	7.34e-06	1.26e+03		3.05e-05	4.00e-02	2.40e-01		315	600	290.8
gamma-HCH(Lindane)	1.42e-02	7.34e-06	1.07e+03		5.74e-04	4.00e-02	6.80e+00	2.00e-04	112.5	323	290.4
Hexachlorocyclopentadiene	1.61e-02	7.21e-06	2.00e+05		1.11e+00	1.00e-01	1.80e+00	5.00e-02	-9	239	272.8

Appendix 1
Default Closure Tables

Contaminant	Di,a cm ² /s	Di,w cm ² /s	Koc l/kg	K _D (Inorganic) l/kg	H' unitless	ABS unitless	S mg/l	MCL mg/l	MP °C	BP °C	MW g/mol
Hexachloroethane	2.50e-03	6.80e-06	1.78e+03		1.59e-01	1.00e-01	5.00e+01		187	189	236.7
Indeno(1,2,3-cd)pyrene	1.90e-02	5.66e-06	3.47e+06		6.56e-05	1.30e-01	2.20e-05		161.5	536	236.7
Isophorone	6.23e-02	6.76e-06	4.68e+01		2.72e-04	1.00e-01	1.20e+04		-8.1	215.3	138.2
Lead	See note #2										
Mercury	3.07e-02	6.30e-06		5.20e+01	4.5e-01	1.00e-01		2.00e-03	-38.87	357	200.6
Methoxychlor	1.56e-02	4.46e-06	9.77e+04		6.48e-04	1.00e-01	4.50e-02	4.00e-02	87	346	345.7
Methyl bromide	7.28e-02	1.21e-05	1.05e+01		2.56e-01	1.00e-01	1.52e+04		-93.7	3.56	95
Methylene chloride	1.01e-01	1.17e-05	1.17e+01		8.98e-02	1.00e-01	1.30e+04	5.00e-03	-95.1	39.75	84.9
Methyl ethyl ketone (MEK)	9.00e-02	9.80e-06	5.00e+00		1.00e-03	1.00e-01	2.70e+05		-86	80	72
4-methyl-2-pentanone	7.50e-02	7.80e-06	1.90e+01		5.64e-03	1.00e-01	1.90e+04		-80	117.4	100.2
2-methylphenol(o-cresol)	7.40e-02	8.30e-06	9.12e+01		4.92e-05	1.00e-01	2.60e+04		29.8	191	108.1
3-methylphenol	7.40e-02	1.00e-05	4.78e+01		3.52e-05	1.00e-01	2.30e+04		11.8	202.2	108.1
4-methylphenol	7.40e-02	1.00e-05	4.61e+01		3.23e-05	1.00e-01	2.20e+04		35.5	201.9	108.1
MTBE	0.08	0.000008	94.4		0.0241	0.1	48000		-109	55.2	88.15
Naphthalene	5.90e-02	7.50e-06	2.00e+03		1.98e-02	1.30e-01	3.10e+01		80.2	218	128.2
Nickel				6.50e+01		1.00e-02			1455	2730	58.7
2-nitroaniline	7.40e-02	1.00e-05	2.66e+01		2.41e-06	1.00e-01	2.90e+02		71.2	284	138.1
Nitrobenzene	7.60e-02	8.60e-06	6.46e+01		9.84e-04	1.00e-01	2.09e+03		5.7	211	123.1
N-Nitrosodiphenylamine	3.12e-02	6.35e-06	1.29e+03		2.05e-04	1.00e-01	3.51e+01		66.5	268	74.1

Appendix 1
Default Closure Tables

Contaminant	Di,a cm ² /s	Di,w cm ² /s	Koc l/kg	K _D (Inorganic) l/kg	H' unitless	ABS unitless	S mg/l	MCL mg/l	MP °C	BP °C	MW g/mol
N-Nitrosodi-n-propylamine	5.45e-02	8.17e-06	2.40e+01		9.23e-05	1.00e-01	9.89e+03		>24	206	130.22
PCBs	8.00e-02	8.00e-06	3.09e+05		1.06e-01	1.40e-01	7.00e-01	5.00e-04	>24	>200	268.4
Pentachlorophenol	5.60e-02	6.10e-06	5.92e+02		1.00e-06	2.50e-01	1.95e+03	1.00e-03	174	310	266.4
Phenol	8.20e-02	9.10e-06	2.88e+01		1.63e-05	1.00e-01	8.28e+04		40.9	182	94.1
Pyrene	2.72e-02	7.24e-06	1.05e+05		4.51e-04	1.00e-01	1.35e-01		151.2	404	202.3
Selenium				5.00e+00		1.00e-02		5.00e-02	217	684	79
Silver				8.30e+00		1.00e-02			962	2212	107.9
Styrene	7.10e-02	8.00e-06	7.76e+02		1.13e-01	1.00e-01	3.10e+02	1.00e-01	-31	146	104.2
1,1,1,2-Tetrachloroethane	7.10e-02	7.90e-06	8.00e+01		1.41e-02	1.00e-01	1.10e+03		-70	130.5	167.9
1,1,2,2-Tetrachloroethane	7.10e-02	7.90e-06	9.33e+01		1.41e-02	1.00e-01	2.97e+03		-43.8	146.5	167.9
Tetrachloroethylene (PCE)	7.20e-02	8.20e-06	1.55e+02		7.54e-01	1.00e-01	2.00e+02	5.00e-03	-22.3	121	165.8
Thallium				7.10e+01		1.00e-02		2.00e-03	303.5	1457	204.4
Toluene	8.70e-02	8.60e-06	1.82e+02		2.72e-01	1.00e-01	5.26e+02	1.00e+00	-94.9	110.6	92.1
Toxaphene	1.16e-02	4.34e-06	2.57e+05		2.46e-04	1.00e-01	7.40e-01	3.00e-03	78	NA	181.4
1,2,4-Trichlorobenzene	3.00e-02	8.23e-06	1.78e+03		5.82e-02	1.00e-01	3.00e+02	7.00e-02	17	213	181.4
1,1,1-Trichloroethane	7.80e-02	8.80e-06	1.10e+02		7.05e-01	1.00e-01	1.33e+03	2.00e-01	-30.4	74.1	133.4
1,1,2-Trichloroethane	7.80e-02	8.80e-06	5.01e+01		3.74e-02	1.00e-01	4.42e+03	5.00e-03	-36.6	114	133.4
Trichloroethylene (TCE)	7.90e-02	9.10e-06	1.66e+02		4.22e-01	1.00e-01	1.10e+03	5.00e-03	-84.7	86.7	131.4
2,4,5-Trichlorophenol	2.91e-02	7.03e-06	1.60e+03		1.78e-04	1.00e-01	1.20e+03		69	253	197.5

Contaminant	Di,a cm ² /s	Di,w cm ² /s	Koc l/kg	K _D (Inorganic) l/kg	H' unitless	ABS unitless	S mg/l	MCL mg/l	MP °C	BP °C	MW g/mol
2,4,6-Trichlorophenol	3.18e-02	6.25e-06	3.81e+02		3.19e-04	1.00e-01	8.00e+02		69	247	197.5
Vinyl acetate	8.50e-02	9.20e-06	5.25e+00		2.10e-02	1.00e-01	2.00e+04		-93.2	72.7	86.1
Vinyl chloride (chloroethene)	1.06e-01	1.23e-06	1.86e+01		1.11e+00	1.00e-01	2.76e+03	2.00e-03	-153.7	-13	62.5
Xylene mixed	8.70e-02	1.00e-05	3.63e+02		2.13e-01	1.00e-01	1.78e+02	1.00e+01	-37	141	106.2
Zinc				6.20e+01		1.00e-02			419.5	908	65.4

Above parameters are listed for 25° C and 760 mm Hg.

Notes:

1. Cyanide as CN⁻ is assumed to be non-volatile as it is in pH 6.8 soil and nonacidic water.
2. **Lead is regulated using two different models: a media-specific ingestion and absorption model for industrial exposure and a pharmacokinetic model for children in residential exposure. See also footnote 8 on page A-15.**

Key of terms:

Di,a-diffusivity in air

Di,w-diffusivity in water

Koc-soil organic carbon-water partitioning coefficient

Kd-soil-water partition coefficient

H'-Dimensionless Henry's Law constant (a measure of the affinity of a compound to volatilize from water)

ABS-fraction absorbed through skin

S-water solubility

MCL-Safe Drinking Water Act maximum contaminat level

MP-melting point

BP- boiling point

MW- molecular weight

Table C

Exposure Equations

Equation Number	Equation Name	Table C - Exposure Equations
A1-1	Residential Groundwater (Carcinogens)	$C_{gwrc} = \frac{TR \times BW_a \times AT_c \times 365 \text{ day/year}}{EF_r \times ED_r \times \left[(SF_o \times IngR_{raw}) + (SF_i \times InhR_{raa} \times K) \right]}$
A1-2	Residential Groundwater (Non-carcinogens)	$C_{gwm} = \frac{THQ \times BW_a \times AT_n \times 365 \text{ days/year}}{EF_r \times ED_r \times \left[\left(\frac{IngR_{raw}}{RFD_o} \right) + \left(\frac{InhR_{raa}}{RFD_i} \times K \right) \right]}$
A1-3	Residential Soil Direct Contact (Carcinogens)	$C_{ssrc} = \frac{TR \times AT_c \times 365 \text{ days/year}}{EF_r \times \left[\frac{SF_o \left(IngF_{adj} + \left(\frac{SFS_{adj}}{10^6 \text{ mg/kg}} \times ABS \right) \right)}{10^6 \text{ mg/kg}} + InhF_{adj} \times SF_i \left(\frac{1}{VF} + \frac{1}{PEF} \right) \right]}$
A 1-4	Residential Direct Contact (Non-carcinogens)	$C_{ssrn} = \frac{THQ \times AT_n \times 365 \text{ days/year}}{EF_r \times \left[\left(\frac{IngF_{adj} + (SFS_{adj} \times ABS)}{RFD_o \times 10^6 \text{ mg/kg}} \right) + \frac{InhF_{adj}}{RFD_i} \left(\frac{1}{VF} + \frac{1}{PEF} \right) \right]}$
A 1-5	Residential Soil Migration to GW (Carcinogens)	$C_{sbsrc} = C_{gwrc} \times 20 \left[K_d + \frac{\theta_{w\rho} + (\theta_{a\rho} \times H')}{\rho_b} \right]$

Equation Number	Equation Name	Table C - Exposure Equations
A 1-6	Residential Soil Migration to GW (Non-carcinogens)	$C_{\text{sbsrn}} = C_{\text{gwrn}} \times 20 \left[K_d + \frac{\theta_{w\rho} + (\theta_{a\rho} \times H')}{\rho_b} \right]$
A 1-7	Commercial / Industrial Groundwater (Carcinogens)	$C_{\text{gwic}} = \frac{TR \times BW_a \times AT_c \times 365 \text{ days/year}}{EF_i \times ED_i \times (SF_o \times \text{IngR}_{\text{iaw}})}$
A 1-8	Commercial/ Industrial Groundwater (Non-carcinogens)	$C_{\text{gwin}} = \frac{THQ \times BW_a \times AT_n \times 365 \text{ days/year}}{EF_i \times ED_i \left(\frac{\text{IngR}_{\text{iaw}}}{\text{RFD}_o} \right)}$
A 1-9	Commercial/Industrial Soil Direct Contact (Carcinogens)	$C_{\text{ssic}} = \frac{TR \times BW_a \times AT_c \times 365 \text{ days/year}}{EF_i \times ED_i \left[SF_o \times \left(\frac{\text{IngR}_{\text{ias}} + \left(\frac{SA_{\text{ias}} \times M \times \text{ABS}}{10^6 \text{ mg/kg}} \right)}{10^6 \text{ mg/kg}} \right) + SF_i \times \text{InhR}_{\text{iaa}} \left(\frac{1}{VF} + \frac{1}{PEF} \right) \right]}$
A1-10	Commercial/ Industrial Soil Direct Contact (Non-carcinogens)	$C_{\text{ssin}} = \frac{THQ \times BW_a \times AT_n \times 365 \text{ days/year}}{EF_i \times ED_i \left[\left(\frac{\text{IngR}_{\text{ias}} + (SA_{\text{ias}} \times M \times \text{ABS})}{\text{RFD}_o (10^6 \text{ mg/kg})} \right) + \frac{\text{InhR}_{\text{iaa}}}{\text{RFD}_i} \left(\frac{1}{VF} + \frac{1}{PEF} \right) \right]}$

Equation Number	Equation Name	Table C - Exposure Equations
A1-11	Commercial/ Industrial Soil Migration to GW (Carcinogens)	$C_{\text{sbic}} = C_{\text{gwc}} \times 20 \left[K_d + \frac{\theta_{\text{wp}} + (\theta_{\text{ap}} \times H')}{\rho_b} \right]$
A 1-12	Commercial/Industrial Migration to GW Contact (Non-carcinogens)	$C_{\text{sbsin}} = C_{\text{gwin}} \times 20 \left[K_d + \frac{\theta_{\text{wp}} + (\theta_{\text{ap}} \times H')}{\rho_b} \right]$
A 1-13	Construction Soils (Carcinogens)	$C_{\text{sscc}} = \frac{\text{TR} \times \text{BW}_a \times \text{AT}_c \times 365 \frac{\text{days}}{\text{year}}}{\text{EF}_{\text{co}} \times \text{ED}_{\text{co}} \left[\text{SF}_o \times \frac{(\text{IngR}_{\text{cas}} + (\text{SA}_{\text{cas}} \times \text{M} \times \text{ABS}))}{10^6 \frac{\text{mg}}{\text{kg}}} + \text{SF}_i \times \text{InhR}_{\text{caa}} \left[\frac{1}{\text{VF}} + \frac{1}{\text{PEF}} \right] \right]}$
A 1-14	Construction Soils (Non-carcinogens)	$C_{\text{sscn}} = \frac{\text{THQ} \times \text{BW}_a \times \text{AT}_n \times 365 \frac{\text{days}}{\text{year}}}{\text{ED}_{\text{co}} \times \text{EF}_{\text{co}} \left[\frac{(\text{IngR}_{\text{cas}} + (\text{SA}_{\text{cas}} \times \text{M} \times \text{ABS}))}{\text{RFD}_o (10^6 \frac{\text{mg}}{\text{kg}})} + \frac{\text{InhR}_{\text{caa}}}{\text{RFD}_i} \left[\frac{1}{\text{VF}} + \frac{1}{\text{PEF}} \right] \right]}$

Equation Number	Equation Name	Table C - Exposure Equations
A 1-15	Volatilization Factor	$VF = \frac{\frac{Q}{C_{vf}} \times (3.14 \times D_a \times T)^{\frac{1}{2}} \times 10^{-4} \text{ m}^2/\text{cm}^2}{(2 \times \rho_b \times D_a)}$ <p>Where:</p> $D_a = \frac{\left[\frac{\theta_{avf}^{10/3} D_i H' + \theta_{wvf}^{10/3} D_w}{n^2} \right]}{\rho_b K_d + \theta_{wvf} + \theta_{avf} H'}$
A 1-16	Particulate Emission Factor Equation	$PEF = \frac{Q}{C_p} \times \left[\frac{3,600 \text{ s/h}}{0.036 \times (1 - V) \times \left(\frac{U_m}{U_t} \right)^3 \times F(x)} \right]$
A 1-17	Ingestion Soil - Age Adjusted	$\text{IngF}_{\text{adj}} \frac{\text{mg} - \text{yr}}{\text{Kg} - \text{day}} = \frac{ED_{\text{ch}} \times \text{IngR}_{\text{rcs}}}{BW_c} + \frac{(ED_r - ED_{\text{ch}}) \times \text{IngR}_{\text{ras}}}{BW_a}$
A 1-18	Skin Contact - Age Adjusted	$\text{SFS}_{\text{adj}} \frac{\text{mg} - \text{yr}}{\text{Kg} - \text{day}} = \frac{ED_{\text{ch}} \times M \times SA_{\text{rcs}}}{BW_c} + \frac{(ED_r - ED_{\text{ch}}) \times M \times SA_{\text{ras}}}{BW_a}$

Equation Number	Equation Name	Table C - Exposure Equations
A 1-19	Inhalation - Age Adjusted	$\text{InhF}_{\text{adj}} \frac{\text{M}^3 - \text{yr}}{\text{Kg} - \text{day}} = \frac{\text{ED}_{\text{ch}} \times \text{InhR}_{\text{raa}}}{\text{BW}_{\text{c}}} + \frac{(\text{ED}_{\text{r}} - \text{ED}_{\text{ch}}) \times \text{InhR}_{\text{raa}}}{\text{BW}_{\text{a}}}$
7-1	Soil to Groundwater Partitioning Model	$\text{CCL} = C_{\text{w}} \times \text{DAF} \times \left[K_{\text{d}} + \frac{\theta_{\text{w}} + \theta_{\text{a}} H'}{\rho_{\text{b}}} \right]$
7-3	Soil Saturation Limit Equation	$C_{\text{sat}} = \frac{S}{\rho_{\text{b}}} (K_{\text{d}} \rho_{\text{b}} + \theta_{\text{w}} + H' \theta_{\text{a}})$
7-4	Soil Attenuation Capacity	Site Specific Soil Attenuation Capacity = $f_{\text{oc}} \times 10^6$

TABLE D

Equation Parameters/Exposure Assumptions

Symbol	Parameter	Value
2_{ap}	Air Filled Soil Porosity Partitioning model	0.134 l air/l soil
2_{avf}	Air Filled Soil Porosity - volatilization	0.284 l air /l soil
2_{wp}	Water Filled Soil Porosity Partitioning model	0.3 l water/l soil
2_{wvf}	Water Filled Soil Porosity - volatilization	0.15 l water /l soil
ABS	Skin Absorbance Factor (Absorbed fraction)	Chemical Specific (unitless see Table B)
AT _c AT _n	Averaging Time (subscript dictates chemical type)	C = 70 Years carcinogens N = 30 Years residential non-carcinogens 25 years industrial noncarcinogens 1 year construction noncarcinogens
BW _a	Body Weight Adult	70 kg
BW _c	Body Weight Child	15 kg
C	Carcinogen	Chemical Specific
CCL	Carcinogen Closure Level	Chemical Specific
C _{gwrc}	Default Level Groundwater Concentration for Residential Carcinogen	Chemical Specific (mg/l)
C _{gwrn}	Default Level Groundwater Concentration for Residential Non-carcinogen	Chemical Specific (mg/l)
C _{igwc}	Default Level Commercial/Industrial Groundwater Concentration for Carcinogen	Chemical Specific mg/l
C _{igwn}	Default Level Commercial/Industrial Groundwater Concentration for Non-carcinogen	Chemical Specific mg/l
C _{sat}	Soil Saturation Limit	Chemical Specific (mg/kg)
C _{sbrsc}	Subsurface Soil Residential Carcinogen	Chemical Specific (mg/kg)
C _{sbrsn}	Subsurface Soil Residential Non-carcinogen	Chemical Specific (mg/kg)
C _{sbsic}	Default Closure Level Subsurface Soil Commercial/Industrial Carcinogen	Chemical Specific (mg/kg)

Symbol	Parameter	Value
C_{sbsin}	Default Closure Level Subsurface Soil Commercial/Industrial Non-carcinogen	Chemical Specific (mg/kg)
C_{scc}	Default Closure Level Soil Concentration Construction Carcinogenic	Chemical specific (mg/kg)
C_{scn}	Default Closure Level Soil Concentration Construction Non-carcinogenic	Chemical specific (mg/kg)
C_{ssic}	Default Closure Level Surface Soil Commercial/Industrial Carcinogen	Chemical Specific (mg/kg)
C_{ssin}	Default Closure Level Surface Soil Commercial/Industrial Non-carcinogen	Chemical Specific (mg/kg)
C_{ssrc}	Default Closure Level Residential Surface Soil Concentration Carcinogenic (direct contact)	Chemical specific (mg/kg)
C_{ssrn}	Default Closure Level Residential Surface Soil Concentration Non-carcinogenic (direct contact)	Chemical specific (mg/kg)
D_a	Apparent Diffusivity	Chemical Specific cm^2/s
D_i	Diffusivity in Air	Chemical Specific cm^2/s
D_w	Diffusivity in Water	Chemical Specific cm^2/s
ED_{ch}	Exposure Duration Child	6 years
ED_{co}	Exposure Duration Construction	1 year
ED_i	Exposure Duration Commercial/Industrial	25 years
ED_r	Exposure Duration Residential	30 years
EF_{co}	Exposure Frequency Construction	45 days
EF_i	Exposure Frequency Commercial/Industrial	250 days/yr
EF_r	Exposure Frequency Residential	350 days/year
EF_{rs}	Exposure Frequency Residential Soil	250 days/year
$F(x)$	Function dependent on U_m/U_t	0.194 (unitless)
f_{oc}	Fraction Soil Organic Carbon (Fraction)	0.002 for subsurface soil 0.006 for surface soil

Symbol	Parameter	Value
H'	Henry's Law Constant x 4l	Chemical Specific (unitless)
$IngF_{adj}$	Ingestion Factor Soil Age Adjusted	114 mg-yr/kg-day
$IngR_{cas}$	Ingestion Rate Construction Adult Soil	480 mg/day
$IngR_{ias}$	Ingestion Rate Commercial/Industrial Adult Soil	50 mg/day
$IngR_{iaw}$	Ingestion Rate Commercial/Industrial Adult Water	1.0 l/day
$IngR_{ras}$	Ingestion Rate Residential Adult Soil	100 mg/day
$IngR_{raw}$	Ingestion Rate Residential Adult Water	2.0 l/day
$IngR_{rcs}$	Ingestion Rate Residential Child Soil	200 mg/day
$InhF_{adj}$	Inhalation Factor Age Adjusted	10.9 m ³ -yr/kg-day
$InhR_{caa}$	Inhalation Rate Construction Adult Air	20 m ³ /day
$InhR_{iaa}$	Inhalation Rate Commercial/Industrial Adult Air	20 m ³ /day
$InhR_{raa}$	Inhalation Rate Residential Adult Air	15 m ³ /day Indoor 20 m ³ /day Outdoor
$InhR_{rca}$	Inhalation Rate Residential Child Air	10 m ³ /day
K	Indoor Volatilization Factor (Inhalation from volatiles in groundwater)	0.5 (unitless)
K_d	Soil/Water Partition Coefficient(See Table B) K_d = Table Values for Metals(See Table B) $K_d = K_{oc} \times f_{oc}$ for Organics(See Table B)	Chemical Specific (l/kg) Chemical Specific (l/kg) Chemical Specific (l/kg)
K_{oc}	Soil Organic Carbon/Water Partition Coefficient(See Table B)	Chemical Specific (l/kg)
l	Length of sampling interval	site specific
M	Soil to Skin Adherence Factor	0.5 mg/cm ² -day
n	Number of site samples	Chemical Specific
NC	Non-carcinogen	Chemical Specific
NCL	Non-carcinogen Closure Level	Chemical Specific

Symbol	Parameter	Value
P_b	Dry Soil Bulk Density	1.5 kg/l
PEF	Particulate Emission Factor (See Table C)	$1.316 \times 10^9 \text{ m}^3/\text{kg}$
P_s	Soil particle density	2.65 g/cm^3
Q/C_{vf}	Inverse of the mean concentration at the center of a 0.5 acre source - volatilization factor	$68.81 \frac{\text{g/m}^2\text{-s}}{\text{kg/m}^3}$
Q/C_p	Inverse of the mean concentration at the center of a 0.5 acre source - particulates	$90.80 \frac{\text{g/m}^2\text{-Sec}}{\text{kg/m}^3}$
RFD_i	Reference Dose Inhalation	Chemical Specific (mg/Kg - day)
RFD_o	Reference Dose Oral	Chemical Specific (mg/Kg - day)
s	Standard deviation of site sample set	Chemical Specific
S	Solubility in Water	Chemical Specific (mg/l-water)
SA_{cas}	Surface Area Construction Exposed Adult Skin	3160 cm^2
SA_{ias}	Surface Area Commercial/Industrial Exposed Adult Skin	3160 cm^2
SA_{ras}	Surface Area Residential Exposed Adult Skin	5000 cm^2
SA_{rcs}	Surface Area Residential Exposed Child Skin	2000 cm^2
SF_i	Carcinogenic Potency Slope Inhalation	Chemical Specific (mg/Kg - day) $^{-1}$
SF_o	Carcinogenic Potency Slope Oral	Chemical Specific (mg/Kg - day) $^{-1}$
SFS_{adj}	Skin Factor Soil Age Adjusted (See Table C)	1257 mg-yr/kg-day
t	Students' t value corresponding to n at the 95% confidence level (one tailed test)	Chemical Specific
T	Exposure interval Volatilization Equation	$9.5 \times 10^8 \text{ s}$
THQ	Target Hazard Quotient	1 (unitless)
TR	Target Risk	1×10^{-5} (unitless)
U_m	Mean annual wind speed	4.69 m/s
U_t	Equivalent threshold value of wind speed at 7 m	11.32 m/s
V	Fraction of vegetative cover	0.5 (unitless, = 50%)

Symbol	Parameter	Value
VF	Volatilization Factor (See Table C)	Chemical Specific m ³ /kg
— x	Average of site samples	Chemical Specific

TABLE E

Default Exposure Assumption References

Table E DEFAULT EXPOSURE ASSUMPTION REFERENCES		
PARAMETER	VALUE	REFERENCE
Target Risk	10 ⁻⁵ (unitless)	IDEM draft policy
Target Hazard Quotient	1.0	IDEM draft policy
Target Hazard Index	1.0	IDEM draft policy
Cancer Slope Factor	Chemical Specific Oral or Inhalation (mg/kg-day) ⁻¹	IRIS, HEAST, NCEA, Regions 3, 6, 9
Reference Dose Oral or Inhalation	Chemical Specific (mg/kg-day)	IRIS, HEAST, NCEA, Regions 3, 6, 9
Body Weight Adult	70kg	RAGS (Part A) EPA 1989 EPA/540/1-89/002
Averaging Time	Carcinogen-70 yrs Noncarcinogen- Exposure Duration	RAGS (Part A) EPA 1989 EPA/540/1-89/002
Skin Surface Area Adult	5000 cm ² (25%)	Exposure Factors, EPA 1989 OSWER No. 9285.6-03
Skin Surface Area Child	2000 cm ² (25%)	Dermal Assessment, EPA 1992 EPA/600/8-91/011B
Skin Surface Area Adult Construction in Industrial	3160 cm ²	Dermal Assessment 1992, Construction , (heads, hands, forearms)
Adherence Factor	0.5 mg/cm ² -day	Dermal Assessment, EPA 1992
Skin Absorption	0.1 most organics 0.01 most metals (Select compounds have other values)	EPA, Cal-EPA-(DTSC, 1994)
Inhalation Rate Adult Residential Indoor	15 m ³ /day	RAGS Part B
Inhalation Rate Adult Residential Outdoor	20 m ³ / day	OSHWER No. 9285.6-03

Table E DEFAULT EXPOSURE ASSUMPTION REFERENCES		
PARAMETER	VALUE	REFERENCE
Inhalation Rate Adult Occupational	20 m ³ /day	RAGS Part B OSHWER No. 9285.6-03
Inhalation Rate Child	10 m ³ /day	EPA Region 6, 9 (Referencing RAGS Part A, EPA/540/1- 89/002)
Drinking Water Ingestion Adult	2.0 l/day	RAGS Part A
Drinking Water Ingestion Child	1.0 l/day	PEA, Cal-EPA (DTSC, 1994)
Drinking Water Ingestion Occupational	1.0 l/day	IDEM VRP (OER, October 1995)
Soil Ingestion Adult	100 mg/day	OSHWER No. 9285.6-03 RAGS 1989
Soil Ingestion Child	200 mg/day	OSHWER No. 9285.6-03 RAGS 1989
Soil Ingestion Adult Occupational	50 mg/day	OSHWER No. 9285.6-03
Soil Ingestion Adult Construction	480 mg/day	OSWER Directive: 9285.6-03 Attachment B
Exposure Frequency Residential	350 days/yr	OSHWER No. 9285.6-03
Exposure Frequency Occupational	250 days/yr	OSHWER No. 9285.6-03
Exposure Frequency Construction	45 days/yr	IDEM Policy Region V RCRA Correspondence 9/30/96
Exposure Frequency Residential soil	250 days	IDEM Policy EPA 1984, EPA/600/8-84/031
Exposure Duration Residential	30 years	OSWER Directive: 9285.6-03
Exposure Duration Occupational	25 years	OSWER Directive: 9285.6-03

Table E DEFAULT EXPOSURE ASSUMPTION REFERENCES		
PARAMETER	VALUE	REFERENCE
Exposure Duration Construction	1 year	IDEM Policy Region V RCRA Correspondence 9/30/96
Indoor Volatilization Factor	0.5	RAGS Part B
Particulate Emission Factor Model	$1.32 \times 10^9 \text{ m}^3/\text{kg}$	EPA 1996, EPA 540/R-96/18 Defaults as listed in same
Volatilization Factor Outdoor Soil Model	Chemical Specific m^3/kg	EPA 1996, EPA 540/R-96/18 Defaults as listed in same
Soil Partition to Groundwater Model	Chemical Specific mg/kg	EPA 1996, EPA 540/R-96/18 Defaults as listed in same
Soil Saturation Limit	Chemical Specific mg/kg	EPA 1996, EPA 540/R-96/18 Defaults as listed in same
Age Adjusted Factors		
Ingestion soils	$114 \text{ mg}\cdot\text{yr}/\text{kg}\cdot\text{day}$	RAGS Part B
Skin Contact	$1257 \text{ mg}\cdot\text{yr}/\text{kg}\cdot\text{day}$	RAGS Part B by analogy
Inhalation	$10.9 \text{ m}^3 \cdot \text{yr}/\text{kg}\cdot\text{day}$	RAGS Part B by analogy

TABLE F

Human Health Toxicity Parameters

Chemical	CAS	SFo (mg/kg-day) ⁻¹		Rfdo mg/kg-day		SFi (mg/kg-day) ⁻¹		RfDi mg/kg-day	
		Value	Source	Value	Source	Value	Source	Value	Source
Acenaphthene	83-32-9			6.0e-02	I			6.0e-02	6,9 R
Acetone (2-propanone)	67-64-1			1.0e-01	I			1.0e-01	6,9 R
Acrolein	107-02-8			2.0e-02	H			5.7e-06	I
Aldrin	309-00-2	1.7e+01	I	3.0e-05	I	1.7e+01	I	3.0e-05	6,9 R
Anthracene	120-12-7			3.0e-01	I			3.0e-01	6,9 R
Antimony	7440-36-0			4.0e-04	I				
Arsenic	7440-38-2	1.5e+00	I	3.0e-04	I	1.5e+01	I		
Barium	7440-39-3			7.0e-02	I			1.4e-04	H
Benz(a)anthracene	56-55-3	7.3e-01	3,6,9 N			3.1e-01	6,9 N		
Benzene	71-43-2	2.9e-02	9	3.0e-03	3,6,9 (N)	2.9e-02	R	1.7e-03	3,6,9 N
Benzo(b)fluoranthene	205-99-2	7.3e-01	3,6,9 N			3.1e-01	6,9 N		
Benzo(k)fluoranthene	207-08-9	7.3e-02	3,6,9 N			3.1e-02	6,9 N		
Benzoic acid	65-85-0			4.0e+00	I			4.0e+00	6,9 R
Benzo(a)pyrene	50-32-8	7.3e+00	I			3.1e+00	3,6,9 N		
Benzyl alcohol	100-51-6			3.0e-01	H			3.0e-01	6,9 R
Beryllium	7440-41-7			2.0e-03	I	8.4e+00	I	5.7e-06	I
Bis(2-chloroethyl)ether	111-44-4	1.1e+00	I			1.2e+00	I		
Bis(2-chloroisopropyl)ether	108-60-1	7.0e-02	H	4.0e-02	I	3.5e-02	H	4.0e-02	6,9 R
Bis(2-ethylhexyl)phthalate	117-81-7	1.4e-02	I	2.0e-02	I	1.4e-02	3,6,9 R	2.2e-02	6,9 (R)
Bromodichloromethane	75-27-4	6.2e-02	I	2.0e-02	I	6.2e-02	6,9 R	2.0e-02	6,9 R
Bromoform(tribromomethane)	75-25-2	7.9e-03	I	2.0e-02	I	3.9e-03	I	2.0e-02	6,9 R
Butanol	71-36-3			1.0e-01	I			1.0e-01	6,9 R
Butylbenzylphthalate	85-68-7			2.0e-01	I			2.0e-01	6,9 R
Cadmium	7440-43-9			5.0e-04	I	6.3e+00	I	5.7e-05	3 N
Carbazole	86-74-8	2.0e-02	H			2.0e-02	6,9 R		
Carbon disulfide	75-15-0			1.0e-01	I			2.0e-01	I
Carbon tetrachloride	56-23-5	1.3e-01	I	7.0e-04	I	5.3e-02	I	5.7e-04	3 N
Chlordane	12789-03-6	3.5e-01	I	5.0e-04	I	3.5e-01	I	2.0e-04	I
p-Chloroaniline	106-47-8			4.0e-03	I			4.0e-03	6,9 R
Chlorobenzene	108-90-7			2.0e-02	I			1.7e-02	3,9 N

Chemical	CAS	SFo (mg/kg-day) ⁻¹		Rfdo mg/kg-day		SFi (mg/kg-day) ⁻¹		RfDi mg/kg-day	
		Value	Source	Value	Source	Value	Source	Value	Source
Chloroethane	75-00-3	2.9e-03	3,9 N	4.0e-01	3,6,9 N	2.9e-03	9 R	2.9e+00	I
Chloroform	67-66-3	6.1e-03	I	1.0e-02	I	8.1e-02	I	8.6e-05	3,9 N
2-Chlorophenol	95-57-8			5.0e-03	I			5.0e-03	6,9 R
Chromium III	16065-83-1			1.5e+00	I				
Chromium VI	18540-29-9			3.0e-03	I	2.9e+02	I	2.9e-05	I
Chrysene	218-01-9	7.3e-03	3,6,9 N			3.1e-03	6,9 N		
Copper	7440-50-8			3.7e-02	9 (H)				
Cyanide (free)	74-90-8			2.0e-02	I				
Cyclohexane	110-82-7			5.7	9 R			5.7	9 (N)
DDD	72-54-8	2.4e-01	I			2.4e-01	6,9 R		
DDE	72-55-9	3.4e-01	I			3.4e-01	6,9 R		
DDT	50-29-3	3.4e-01	I	5.0e-04	I	3.4e-01	I	5.0e-04	6,9 R
Dibenzo(a,h)anthracene	53-70-3	7.3e+00	3,6,9 N			3.1e+00	6,9 N		
Di-n-butylphthalate	84-74-2			1.0e-01	I			1.0e-01	6,9 R
1,2-Dichlorobenzene	95-50-1			9.0e-02	I			5.7e-02	H
1,3-Dichlorobenzene	541-73-1			9.0e-04	3,9 N			9.0e-04	9 R
1,4-Dichlorobenzene	106-46-7	2.4e-02	H	3.0e-02	3,9 N	2.2e-02	3,9 N	2.3e-01	I
3,3-Dichlorobenzidine	91-94-1	4.5e-01	I			4.5e-01	6,9 R		
1,1-Dichloroethane	75-34-3			1.0e-01	H			1.4e-01	H
1,2-Dichloroethane	107-06-2	9.1e-02	I	3.0e-02	3,9 N	9.1e-02	I	1.4e-03	3,9 N
1,1-Dichloroethylene	75-35-4	6.0e-01	I	9.0e-03	I	1.8e-01	I	9.0e-03	6,9 R
cis-1,2-Dichloroethylene	156-59-2			1.0e-02	H			1.0e-02	6,9 R
trans-1,2-Dichloroethylene	156-60-5			2.0e-02	I			2.0e-02	6,9 R
2,4-Dichlorophenol	120-83-2			3.0e-03	I			3.0e-03	6,9 R
1,2-Dichloropropane	78-87-5	6.8e-02	H	1.1e-03	6,9 R	6.8e-02	6,9 R	1.1e-03	I
1,3-Dichloropropene	542-75-6	1.0e-01	I	3.0e-02	I	1.4e-02	I	5.7e-03	I
Dieldrin	60-57-1	1.6e+01	I	5.0e-05	I	1.6e+01	I	5.0e-05	6,9 R
Diethylphthalate	84-66-2			8.0e-01	I			8.0e-01	6,9 R
2,4-Dimethylphenol	105-67-9			2.0e-02	I			2.0e-02	6,9 R
Dimethyl phthalate	131-11-3			1.0e+01	6,9 (H)			1.0e+01	6,9 R

Chemical	CAS	SFo (mg/kg-day) ⁻¹		Rfdo mg/kg-day		SFi (mg/kg-day) ⁻¹		RfDi mg/kg-day	
		Value	Source	Value	Source	Value	Source	Value	Source
2,4-Dinitrophenol	51-28-5			2.0e-03	I			2.0e-03	6,9 R
Dinitrotoluene mixture	25321-14-6	6.8e-01	I	1.0e-03	H	6.8e-01	6,9 R	1.0e-03	R
Di-n-Octyl phthalate	117-84-0			2.0e-02	H			2.0e-02	6,9 R
Endosulfan	115-29-7			6.0e-03	I			6.0e-03	6,9 R
Endrin	72-20-8			3.0e-04	I			3.0e-04	6,9 R
Ethylbenzene	100-41-4			1.0e-01	I			2.9e-01	I
Fluoranthene	206-44-0			4.0e-02	I			4.0e-02	6,9 R
Fluorene	86-73-7			4.0e-02	I			4.0e-02	6,9 R
Heptachlor	76-44-8	4.5e+00	I	5.0e-04	I	4.6e+00	I	5.0e-04	6,9 R
Heptachlor epoxide	1024-57-3	9.1e+00	I	1.3e-05	I	9.1e+00	I	1.3e-05	6,9 R
Hexachlorobenzene	118-74-1	1.6e+00	I	8.0e-04	I	1.6e+00	I	8.0e-04	6,9 R
Hexachloro-1,3-butadiene	87-68-3	7.8e-02	I	2.0e-04	H	7.8e-02	I	2.0e-04	6,9 R
alpha-HCH (alpha-BHC)	319-84-6	6.3e+00	I			6.3e+00	I		
beta-HCH (beta-BHC)	319-85-7	1.8e+00	I			1.8e+00	I		
gamma-HCH (Lindane)	58-89-9	1.3e+00	H	3.0e-04	I	1.3e+00	6,9 R	3.0e-04	6,9 R
Hexachlorocyclopentadiene	77-47-4			7.0e-03	I			2.0e-05	H
Hexachloroethane	67-72-1	1.4e-02	I	1.0e-03	I	1.4e-02	I	1.0e-03	6,9 R
Indeno(1,2,3-cd)pyrene	193-39-5	7.3e-01	3,6,9 N			3.1e-01	6,9 N		
Isophorone	78-59-1	9.5e-04	I	2.0e-01	I	9.5e-04	6,9 R	2.0e-01	6,9 R
Mercury	7439-97-6			3.0e-04	I			8.6e-05	I
Methoxychlor	72-43-5			5.0e-03	I			5.0e-03	6,9 R
Methyl bromide	74-83-9			1.4e-03	I			1.4e-03	I
Methylene chloride	75-09-2	7.5e-03	I	6.0e-02	I	1.6e-03	I	8.6e-01	H
Methyl ethyl ketone (MEK)	78-93-3			6.0e-01	I			2.9e-01	I
4-Methyl-2-pentanone (MIBK)	108-10-1			8.0e-02	H			2.3e-02	H
2-Methylphenol(o-cresol)	95-48-7			5.0e-02	I			5.0e-02	6,9 R
3-Methylphenol (m-cresol)	108-39-4			5.0e-02	I			5.0e-02	6,9 R
4-Methylphenol (p-cresol)	106-44-5			5.0e-03	H			5.0e-03	6,9 R
Methyl tertbutyl ether	1634-04-4	4.0e-03	IDEM	8.6e-01	R	4.0e-03	IDEM	8.6e-01	I
Naphthalene	91-20-3			2.0e-02	I			8.6e-04	I

Chemical	CAS	SFo (mg/kg-day) ⁻¹		Rfdo mg/kg-day		SFi (mg/kg-day) ⁻¹		RfDi mg/kg-day	
		Value	Source	Value	Source	Value	Source	Value	Source
Nickel	7440-02-0			2.0e-02	I	8.4e-01	I		
2-Nitroaniline	88-74-4			5.7e-05	6,9 R			5.7e-05	H
Nitrobenzene	98-95-3			5.0e-04	I			5.7e-04	9 (H)
N-Nitrosodiphenylamine	86-30-6	4.9e-03	I			4.9e-03	6,9 R		
N-Nitrosodi-n-propylamine	621-64-7	7.0e+00	I			7.0e+00	6,9 R		
Polychlorinated biphenyls (PCB)	1336-36-3	2.0e+00	I	2.0e-05	I	2.0e+00	I	2.0e-05	R
Pentachlorophenol	87-86-5	1.2e-01	I	3.0e-02	I	1.2e-01	6,9 R	3.0e-02	6,9 R
Phenol	108-95-2			6.0e-01	I			6.0e-01	6,9 R
Pyrene	129-00-0			3.0e-02	I			3.0e-02	6,9 R
Selenium	7782-49-2			5.0e-03	I				
Silver	7440-22-4			5.0e-03	I				
Styrene	100-42-5			2.0e-01	I			2.9e-01	I
1,1,2,2-Tetrachloroethane	79-34-5	2.0e-01	I	6.0e-02	3,9 N	2.0e-01	I	6.0e-02	9 R
1,1,1,2-Tetrachloroethane	630-20-6	2.6e-02	I	3.0e-02	I	2.6e-02	I	3.0e-02	6,9 R
Tetrachloroethylene (PCE)	127-18-4	5.2e-02	3,6,9 N	1.0e-02	I	2.0e-03	3,6,9 N	1.1e-01	3,6,9 N
Thallium (nitrate)	10102-45-1			9.0e-05	I				
Toluene	108-88-3			2.0e-01	I			1.1e-01	I
Toxaphene	8001-35-2	1.1e+00	I			1.1e+00	I		
1,2,4-Trichlorobenzene	120-82-1			1.0e-02	I			5.7e-02	6,9 (H)
1,1,1-Trichloroethane	71-55-6			3.5e-02	6,9 (N)			2.9e-01	6,9 (N)
1,1,2-Trichloroethane	79-00-5	5.7e-02	I	4.0e-03	I	5.6e-02	I	4.0e-03	6,9 R
Trichloroethylene (TCE)	79-01-6	1.1e-02	3,6,9 N	6.0e-03	reg 6,9	6.0e-03	3,6,9 N	6.0e-03	6,9 R
2,4,5-Trichlorophenol	95-95-4			1.0e-01	I			1.0e-01	6,9 R
2,4,6-Trichlorophenol	88-06-2	1.1e-02	I			1.1e-02	I		
Vinyl acetate	108-05-4			1.0e+00	H			5.7e-02	I
Vinyl chloride (chloroethene)	75-01-4	1.9e+00	H			3.0e-01	H		
Xylene (mixed)	1330-20-7			2.0e+00	I			2.0e-01	reg 9
Zinc	7440-66-6			3.0e-01	I				

CAS = Chemical Abstract Service
H = Heast
I = IRIS
N = NCEA
R = Route to Route Extrapolation
SF_i = Inhalation Slope Factor
SF_o = Oral Slope Factor
RfD_i = Inhalation Reference Dose
RfD_o = Oral Reference Dose

3,6,9 = EPA Regions 3,6,9 Screening Tables

A parenthesis indicates the reference cited by a source. Example: 9 (N) means the value was taken from EPA Region 9 Screening Tables, and Region 9 cited NCEA as its source.

PCB Slope Factor and RfD assume a mixture of PCB congeners including Aroclor 1016 and 1254.

Table G
Critical Effects

TABLE G
CRITICAL EFFECTS

Chemical	Critical EffectsCategory	Source
	Primary Critical Effect	
Acenaphthene	Systemic (Liver)	IRIS
Acenaphthylene	Systemic (Liver)	Similar PAHs
Acetone	Systemic (Kidney, liver)	IRIS
Acrolein	Respiratory (Nasal passageway)	IRIS
Anthracene	Systemic (Liver)	Similar PAHs
Antimony	Circulatory (Heart) Systemic (Nonspecific)	IRIS
Barium	Systemic (Kidney)	IRIS
Benzoic acid	Systemic (Liver, Kidney) Respiratory(Trachea, Lung)	HSDB
Benzyl alcohol	Gastrointestinal (Foreestomach)	HEAST
Butanol	Neurological (Central nervous system)	IRIS
Butylbenzyl phthalate	Systemic (Liver)	IRIS
Cadmium	Systemic (Kidney)	IRIS
Carbon disulfide	Neurological (Peripheral nervous system) Developmental (Nonspecific)	IRIS
4-Chloroaniline	Musculoskeletal (Connective tissue)	IRIS
Chlorobenzene	Systemic (Liver)	IRIS
Chloroethane (Ethyl Chloride)	Developmental (Growth Retardation)	IRIS
2-chloronapthalene	Dermal/Ocular (Skin)	HSDB
2-Chlorophenol	Reproductive (Nonspecific)	IRIS
Chromium III	Respiratory(Lung)	ATSDR
Copper	Systemic (Liver/kidney) Circulatory (Blood)	ATSDR
Cyanide	Endocrine (Thyroid) Neurological (Neurons)	IRIS
Di-n-butyl phthalate	Developmental (Teratology)	IRIS
1,2-Dichlorobenzene	Systemic (Liver)	IRIS
1,3-Dichlorobenzene	Systemic (Liver)	1,2-Dichlorobenzene
1,1-Dichloroethane	Systemic (Liver, kidney) Neurological (Central nervous system)	HSDB HEAST
cis-1,2-Dichloroethene	Circulatory (Blood)	HEAST
trans-1,2-Dichloroethene	Circulatory (Blood)	IRIS
2,4-Dichlorophenol	Immunological (Lymph)	IRIS
Diethyl phthalate	Developmental (Teratology) ²	IRIS
Dimethyl phthalate	Systemic (Kidney, liver)	HSDB
2,4-Dimethylphenol	Neurological (Central nervous system) Circulatory (Blood)	IRIS

Chemical	Critical EffectsCategory	Source
	Primary Critical Effect	
2,4-Dinitrophenol	Dermal/Ocular (eye)	IRIS
Di-n-octyl phthalate	Systemic (Liver) Immunological (Spleen) Developmental (Teratology)	HSDB
Endosulfan	Systemic (Kidney) Circulatory (Blood vessel)	IRIS
Endrin	Systemic (Liver)	IRIS
Ethylbenzene	Systemic (Liver, kidney) Developmental (Teratology)	IRIS
Fluoranthene	Systemic (Liver, kidney) Circulatory (Blood)	IRIS
Fluorene	Circulatory (Blood)	IRIS
Hexachlorocyclopentadiene	Gastrointestinal (Stomach)	IRIS
Lead	Neurological (Central nervous system)	ATSDR
Mercury	Neurological (Central nervous system) Systemic (Kidney)	IRIS
Methoxychlor	Developmental (Nonspecific)	IRIS
Methyl bromide (Bromomethane)	Gastrointestinal (Stomach) Respiratory (Nasal)	IRIS
Methyl ethyl ketone (2- Butanone)	Developmental (Nonspecific)	IRIS
4-Methyl-2-pentanone (Methyl isobutyl ketone)	Systemic (Liver, Kidney)	HEAST
2-Methylphenol	Neurological (Central nervous system)	IRIS
3-Methylphenol	Neurological (Central nervous system)	IRIS
4-Methylphenol	Neurological (Central nervous system) ¹	ATSDR
Naphthalene	Respiratory (Nasal)	IRIS
Nickel	Circulatory (Heart) Systemic (Liver) Immunological (Spleen)	IRIS
2-Nitroaniline	Circulatory (Blood) Systemic (Liver, kidney) Endocrine (Adrenals)	HEAST
Nitrobenzene	Systemic (Liver, kidney) Endocrine (Adrenals) Circulatory (Blood)	IRIS
Phenol	Developmental (Nonspecific)	IRIS
Pyrene	Systemic (Kidney)	IRIS
Selenium	Dermal/Ocular (Skin) Neurological (Central nervous system)	IRIS

Chemical	Critical EffectsCategory	Source
	Primary Critical Effect	
Silver	Dermal/Ocular (Skin)	IRIS
Styrene	Circulatory(Blood) Systemic (Liver) Neurological (Central nervous system)	IRIS
Thallium	Systemic (Liver)	IRIS
Toluene	Systemic (Liver, Kidney) Neurological (Central nervous system)	IRIS
1,2,4-Trichlorobenzene	Endocrine (Adrenal)	IRIS
1,1,1-Trichloroethane	Circulatory (Heart) Neurological (Central nervous system)	ATSDR
2,4,5-Trichlorophenol	Systemic (Liver, kidney)	IRIS
Vinyl acetate	Respiratory (Nasal)	IRIS
Xylenes	Neurological (Central nervous system)	IRIS
Zinc	Circulatory (Blood)	IRIS

Critical Effects Categories and Target Organs

1. Systemic: Liver, kidney, urinary tract
2. Circulatory: Arteries, veins, heart, and blood
3. Gastrointestinal: Buccal cavity, esophagus, stomach, intestines, and gall bladder
4. Musculoskeletal: Muscles, bone, and connective tissues
5. Respiratory: Lungs, trachea, and nasal passageway
6. Immunological: Lymph and tissue fluid, spleen, and lymph nodes
7. Neurological: Brain, spinal cord, neurons, and neuroglia
8. Reproductive/Endocrine: Testes, ovaries, thyroid, adrenal, pituitary, pancreas, and parathyroid
9. Developmental: Teratology, growth retardation, structural malformations, and abnormal development
10. Dermal/ Ocular: Skin and eyes

The primary critical effect and target organ for each chemical was obtained using the following sources (in order of preference):

1. IRIS (EPA 2000)
2. HEAST (EPA 1997)
3. ATSDR Toxicological Profiles
4. Hazardous Substance Databank (<http://toxnet.nlm.nih.gov>)

Exceptions include the following critical effects and target organs:

- Some compounds have an RfD based on the No Observed Adverse Effects Level (NOAEL), and information on toxic effects at higher doses was not available. In these cases, the critical effect of a surrogate compound (similar in structure and type) was used.
- Some compounds have an RfD established with the NOAEL and some toxic effects information. The toxic effects information was used to establish the critical effect.
- Some compounds have experimentally derived oral and inhalation reference doses. Where these values were within an order of magnitude of each other, critical effects from both routes were listed. These compounds should be considered as additive in both categories.
- Some compounds did not have an easily identified target organ within the critical effects category. These compounds were classified within a category as “nonspecific.”

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