ECF-HANFORD-10-0442
Revision 1

Calculation of Nonradiological Soil Concentrations Protective of Groundwater Using the Fixed Parameter 3-Phase Equilibrium Partitioning Equation for the 100 Areas and 300 Area

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract DE-AC06-08RL14788

CH2MHILL
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P.O. Box 1600
Richland, Washington 99352

Approved for Public Release;
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Document Type: ENV Program/Project: EP&SP

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INTERA

Date Published
March 2012

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Release Approval Date

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Environmental Calculation Cover Page

Part 1: Completed by the Responsible Manager

Project: 100 and 300 Areas RI/FS **Date:** 7 March 2012

Calculation Title & Description: Calculation of Nonradiological Soil Concentrations Protective of Groundwater Using the Fixed Parameter 3-Phase Equilibrium Partitioning Equation for the 100 Areas and 300 Area

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Part 2: Completed by Preparer

Calculation No.: ECF-HANFORD-10-0442 **Revision No.:** 1

Revision History:

Revision No.	Description	Date	Affected Pages
1	Added new analytes. Updated arsenic calculation using revised Kd value. Updated fluoride calculation using revised surface water cleanup level. Corrected CAS Nos. for mercury and sulfide	3-5-2012	Tables 4-1, 4-3, and 7-1
0	Initial issue.	9-29-2012	all

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Terms

CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CLARC	Cleanup Levels and Risk Calculations
DF	dilution factor
DOE	U.S. Department of Energy
ECF	environmental calculation file
EPA	U.S. Environmental Protection Agency
K_d	distribution coefficient
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
MRDL	maximum residual disinfectant level
NAPL	non-aqueous phase liquid
ORNL	Oak Ridge National Laboratory
PRG	Preliminary Remediation Goal
RAIS	Risk Assessment Information System
RI/FS	Remedial Investigation/Feasibility Study
WAC	Washington Administrative Code

1 Purpose

This Environmental Calculation documents the methods, assumptions, and results obtained with the fixed parameter three-phase partitioning model as described in the Washington Administrative Code (WAC) Section 173-340-747, "Deriving Soil Concentrations for Ground Water Protection."

Under WAC 173-340-747 the fixed parameter three-phase equation is used to derive soil concentrations protective of groundwater. This Environmental Calculation documents the results from using the equation to derive soil concentrations protective of groundwater. Soil concentrations protective of groundwater are developed in this Environmental Calculation by using the fixed parameter three-phase equation with groundwater cleanup levels rather than surface cleanup levels as specified in WAC 173-340-747. Further details on the calculation methodology are provided in Section 3.

2 Background

Vadose zone transport modeling is performed to estimate concentrations in soil protective of groundwater. Modeling used to develop concentrations in soil for groundwater protection will be developed using a graded approach. In simple terms, the graded approach calls for building models that are only as complex as needed to avoid overly conservative results. The fixed parameter three-phase equation is a highly simplified model with limited data needs, which reflects an initial step in the graded approach. The fixed parameter three-phase equation is drawn from U.S. Environmental Protection Agency (EPA) guidance presented in EPA/540/R-96/018, *Soil Screening Guidance: User's Guide*," and is based on conservative, simplifying assumptions about the release and transport of contaminants in the subsurface.

The concentrations protective of groundwater developed with the fixed parameter three-phase equation may be used as screening levels for data evaluation or as PRGs in the CERCLA RI/FS processes. According to EPA guidance presented in EPA/540/R-92/003, *Risk Assessment Guidance for Superfund, Volume I – Human Health Evaluation Manual, Part B, Development of Risk-Based Preliminary Remediation Goals,* PRGs should be modified, as necessary, as more information becomes available during the RI/FS. State of Washington requirements in WAC 173-340-747(3), "Overview of Methods" provide for a range of methods to calculate concentrations in soil protective of groundwater, and acknowledge that certain methods are tailored for particular types of hazardous substances or sites, which reflect a graded approach.

WAC 173-340-747(3) lists seven methods for deriving soil concentrations. Several of these methods, highlighted in bold below, reflect the graded approach for calculating concentrations in soil protective of groundwater:

- **Fixed parameter three-phase partitioning model** (described in this Environmental Calculation)
- **Variable parameter three-phase partitioning model**
- Four-phase partitioning model (addresses non-aqueous phase liquids or NAPL)
- **Leaching tests**
- **Alternate Fate-and-Transport Model(s)**
- **Empirical demonstration**
- Residual saturation (NAPL)

Depending on site-specific conditions, a more rigorous and detailed modeling approach beyond the fixed parameter three-phase equation may be needed to refine PRGs to support development of final remediation levels or remedial design.

3 Methodology

Soil concentrations for groundwater protection are calculated for nonradiological constituents using Equation 747-1 from WAC 173-340-747(4), "Fixed Parameter Three-Phase Partitioning Model." Default input parameters that are intended to be protective under most circumstances are defined within the equation. In this methodology, soil concentrations protective of groundwater are back calculated from a protective groundwater concentration. The protective groundwater concentration is multiplied by a dilution factor (DF) that represents the reduction in soil leachate concentration caused by mixing in the aquifer, and then a standard linear equilibrium soil/water partitioning equation is used to calculate a soil concentration corresponding to the adjusted groundwater concentration.

Chemical-specific distribution coefficients (K_ds) presented in DOE/RL-96-17, *Remedial Design Report/Remedial Action Work Plan for the 100 Area* are used preferentially in the calculations, and Equation 747-2 from WAC 173-340-747 is used to calculate K_d values for organic constituents if one is not published.

The specific steps taken to calculate soil concentrations protective of groundwater for nonradioactive contaminants using the fixed parameter three-phase equation are as follows:

1. Identify Equation 747-1 and Equation 747-2 from WAC 173-340-747 to derive soil concentrations for groundwater protection.
2. Identify the chemical-specific K_d values from DOE/RL-96-17.
3. For organic contaminants not listed in DOE/RL-96-17, identify the chemical-specific soil organic carbon-water partitioning coefficients for use as an input parameter within Equation 747-2.
4. Identify the input parameters within Equation 747-1 from WAC 173-340-747(4) to calculate soil concentrations for groundwater protection.
5. Identify the lower of the Federal or State MCL or the Standard Method B groundwater cleanup level calculated in accordance with WAC 173-340-720, "Ground Water Cleanup Standards," for each analyte.
6. Calculate soil concentrations for groundwater protection.
7. Document default and chemical-specific input parameters, chemical-specific groundwater cleanup levels, and the primary source in a summary table.

The following sections present the fixed parameter three-phase equation used to derive soil concentrations for groundwater protection and the equation used to calculate chemical-specific K_ds for organic constituents. Definitions of variables and input values for the equations are presented in Table 3-1.

3.1 Equation 747-1—Fixed Parameter Three-Phase Partitioning Model

For nonradiological constituents, soil concentrations for groundwater protection are calculated using Equation 747-1 from WAC 173-340-747 as follows.

$$C_s = C_w(UCF)DF\left[K_d + \frac{(\theta_w + \theta_a H_{cc})}{\rho_b}\right]$$

3.2 Equation 747-2—Distribution Coefficient

For organic constituents, K_ds are calculated using Equation 747-2 from WAC 173-340-747 as follows.

$$K_d = K_{oc} \times f_{oc}$$

Table 3-1. Summary of Parameters Used to Calculate Soil Concentrations for Groundwater Protection

Parameter	Symbol	Value	Units	Source
Contaminant concentration in soil	Cs	Calculated	mg/kg	See Table 4-3
Contaminant concentration in groundwater	Cw	Calculated	µg/L	See Table 4-1
Dilution factor	DF	20	dimensionless	WAC 173-340-747(4) Equation 747-1
Soil fraction of organic carbon	foc	0.001	g/g	WAC 173-340-747(4) Equation 747-2
Henry's law constant	Hcc	Chemical-specific	dimensionless	See Table 4-3
Distribution coefficient	Kd	Chemical-specific	L/kg	DOE/RL-96-17 Rev. 6 Appendix E
Soil organic carbon-water partitioning coefficient	Koc	Chemical-specific	ml/g	See Table 4-3
Dry soil bulk density	ρ_b	1.5	kg/L	WAC 173-340-747(4) Equation 747-1
Unit conversion factor	UCF	0.001	mg/µg	WAC 173-340-747(4) Equation 747-1
Air-filled soil porosity	θ_a	0.13	ml air/ml soil	WAC 173-340-747(4) Equation 747-1
Water-filled soil porosity	θ_w	0.3	ml water/ml soil	WAC 173-340-747(4) Equation 747-1

Notes:

DOE/RL-96-17, *Remedial Design Report/Remedial Action Work Plan for the 100 Area*.

WAC 173-340-747(4), "Model Toxics Control Act—Cleanup, Deriving Soil Concentrations for Groundwater Protection, Fixed Parameter Three-Phase Partitioning Model."

4 Assumptions and Inputs

The fixed-parameter three-phase model involves several simplifying assumptions (EPA/540/R-96/018), which are listed below:

- The source is infinite (i.e., steady-state concentrations will be maintained in ground water over the exposure period of interest).
- Contaminants are uniformly distributed throughout the zone of contamination.
- Soil contamination extends from the surface to the water table.
- There is no chemical or biological degradation in the unsaturated zone.
- Equilibrium soil/water partitioning is instantaneous and linear in the contaminated soil.
- The receptor well is at the edge of the source (i.e., there is no dilution from recharge downgradient of the site) and is screened within the plume.
- The aquifer is unconsolidated and unconfined (surficial).
- Aquifer properties are homogeneous and isotropic.
- There is no attenuation (i.e., adsorption or degradation) of contaminants in the aquifer.
- Non-aqueous phase liquids (NAPLs) are not present at the site.

The default input parameters and chemical-specific parameters used to calculate soil concentrations for groundwater protection are presented in Table 3-1 and Tables 4-1 through 4-3. The key assumptions and inputs for the calculations are as follows:

- Default and chemical-specific parameters are used to calculate soil concentrations for groundwater protection. The sources of the input parameters are listed in Table 3-1.
- Air-filled soil porosity, water-filled soil porosity, dry bulk density, and the dilution factor are default values defined in Equation 747-1 and are listed in Table 3-1.
- The protective groundwater concentration used in Equation 747-1 is the lower of the Federal or State MCL or WAC 173-340-720 Standard Method B groundwater cleanup level.
- Federal MCLs represent MCLs, secondary MCLs, and non-zero maximum contaminant level goals (MCLGs) established under the *Safe Drinking Water Act of 1974* and are listed in Table 4-1.
- State MCLs are published under WAC 246-290-310, “Maximum Contaminant Levels (MCLs) and Maximum Residual Disinfectant Levels (MRDLs)” and are listed in Table 4-1.
- Standard Method B groundwater cleanup levels are calculated in accordance with WAC 173-340-720 as documented in ECF-100NPL-10-0462, *Environmental Calculation of WAC 173-374-720 Method B Groundwater Cleanup Levels for Potable Groundwater in the 100 Areas and 300 Area*. These values are listed in Table 4-1.
- With the exception of arsenic, K_d values are obtained preferentially from Appendix E of DOE/RL-96-17 and are listed in Table 4-2. The arsenic K_d value is obtained from the Ecology CLARC database (Ecology, 2010). For organic constituents not identified in DOE/RL-96-17, K_d values are calculated using Equation 747-2. For inorganic constituents not identified in the DOE/RL-96-17, K_d values are obtained directly from tabulated sources (see next bullet).

- Chemical-specific values for Henry's law constant, soil organic carbon-water partitioning coefficient, and K_d for inorganic constituents not identified in DOE/RL-96-17 are obtained from the following sources, in order of preference, and are listed in Table 4-3:
    - Washington State Department of Ecology's "Cleanup Levels and Risk Calculations (CLARC)" web site (Ecology, 2010) (https://fortress.wa.gov/ecy/clarc/CLARCOverview.aspx)
    - EPA's "Regional Screening Levels for Chemical Contaminants at Superfund Sites" web site (EPA, 2010) (http://www.epa.gov/reg3hscd/risk/human/rb-concentration_table/)
    - Oak Ridge National Laboratory's (ORNL) Risk Assessment Information System (RAIS) (ORNL, 2010) (http://rais.ornl.gov/cgi-bin/tools/TOX_search?select=chem)

Table 4-1. Summary of Groundwater Cleanup Levels Used to Calculate Soil Concentrations Protective of Groundwater

CAS #	Constituent Name	Alternate Constituent Name	Units	Basis for Exclusion	WAC 173-340-720[a,b]		National Recommended Water Quality Criteria[c,d,e]		WAC 246-290-310[f]	Final Groundwater Cleanup Level	Final Groundwater Cleanup Level Basis
					Groundwater Method B Unrestricted Land Use	Groundwater Method A Cleanup Levels	Ground Water ARAR - Federal Maximum Contaminant Level Goal (MCLG)	Ground Water ARAR - Federal Primary Maximum Contaminant Level (MCL)	Ground Water ARAR - State Primary Maximum Contaminant Level (MCL)		
71-55-6	1,1,1-Trichloroethane	Trichloroethane;1,1,1-	µg/L	--	16,000	--	200	200	--	200	Federal MCLG
79-34-5	1,1,2,2-Tetrachloroethane	tetrachloroethane;1,1,2,2-	µg/L	--	0.22	--	--	--	--	0.22	WAC 173-340-720(4)(b)(iii)
79-00-5	1,1,2-Trichloroethane	trichloroethane;1,1,2-	µg/L	--	0.77	--	3.0	5.0	--	0.77	WAC 173-340-720(4)(b)(iii)
75-34-3	1,1-Dichloroethane	dichloroethane;1,1-	µg/L	--	1,600	--	--	--	--	1,600	WAC 173-340-720(4)(b)(iii)
75-35-4	1,1-Dichloroethene	Dichloroethene;1,1-	µg/L	--	400	--	7.0	7.0	--	7.0	Federal MCLG
120-82-1	1,2,4-Trichlorobenzene	trichlorobenzene;1,2,4-	µg/L	--	1.5	--	70	70	--	1.5	WAC 173-340-720(4)(b)(iii)
95-50-1	1,2-Dichlorobenzene	dichlorobenzene;1,2- (ortho-Dichlorobenzene)	µg/L	--	720	--	600	600	--	600	Federal MCLG
107-06-2	1,2-Dichloroethane	dichloroethane;1,2-	µg/L	--	0.48	--	--	5.0	--	0.48	WAC 173-340-720(4)(b)(iii)
540-59-0	1,2-Dichloroethene (Total)	dichloroethylene,1,2- (mixed isomers)	µg/L	--	72	--	--	--	--	72	WAC 173-340-720(4)(b)(iii)
78-87-5	1,2-Dichloropropane	dichloropropane;1,2-	µg/L	--	1.2	--	--	5.0	--	1.2	WAC 173-340-720(4)(b)(iii)
541-73-1	1,3-Dichlorobenzene	dichlorobenzene;1,3	µg/L	No Cleanup Level	--	--	--	--	--	--	--
106-46-7	1,4-Dichlorobenzene	dichlorobenzene;1,4- (para-Dichlorobenzene)	µg/L	--	8.1	--	75	75	--	8.1	WAC 173-340-720(4)(b)(iii)
93-76-5	2,4,5-T(2,4,5-Trichlorophenoxyacetic acid)	Trichlorophenoxyacetic Acid, 2,4,5-	µg/L	--	160	--	--	--	--	160	WAC 173-340-720(4)(b)(iii)
93-72-1	2,4,5-TP(2-(2,4,5-Trichlorophenoxy)propionic acid)Silvex	Trichlorophenoxypropionic acid, -2,4,5	µg/L	--	128	--	50	50	--	50	Federal MCLG
95-95-4	2,4,5-Trichlorophenol	Trichlorophenol;2,4,5-	µg/L	--	800	--	--	--	--	800	WAC 173-340-720(4)(b)(iii)
88-06-2	2,4,6-Trichlorophenol	Trichlorophenol2,4,6-	µg/L	--	4.0	--	--	--	--	4.0	WAC 173-340-720(4)(b)(iii)
94-82-6	2,4-DB(4-(2,4-Dichlorophenoxy)butanoic acid)	Dichlorophenoxy)butyric Acid, 4-(2,4-	µg/L	--	128	--	--	--	--	128	WAC 173-340-720(4)(b)(iii)
120-83-2	2,4-Dichlorophenol	dichlorophenol;2,4-	µg/L	--	24	--	--	--	--	24	WAC 173-340-720(4)(b)(iii)

Table 4-1. Summary of Groundwater Cleanup Levels Used to Calculate Soil Concentrations Protective of Groundwater

CAS #	Constituent Name	Alternate Constituent Name	Units	Basis for Exclusion	WAC 173-340-720[a,b]		National Recommended Water Quality Criteria[c,d,e]		WAC 246-290-310[f]	Final Groundwater Cleanup Level	Final Groundwater Cleanup Level Basis
					Groundwater Method B Unrestricted Land Use	Groundwater Method A Cleanup Levels	Ground Water ARAR - Federal Maximum Contaminant Level Goal (MCLG)	Ground Water ARAR - Federal Primary Maximum Contaminant Level (MCL)	Ground Water ARAR - State Primary Maximum Contaminant Level (MCL)		
94-75-7	2,4-Dichlorophenoxyacetic acid	Dichlorophenoxy Acetic Acid, 2,4-	µg/L	--	160	--	70	70	--	70	Federal MCLG
105-67-9	2,4-Dimethylphenol	dimethylphenol;2,4-	µg/L	--	160	--	--	--	--	160	WAC 173-340-720(4)(b)(iii)
51-28-5	2,4-Dinitrophenol	dinitrophenol;2,4-	µg/L	--	32	--	--	--	--	32	WAC 173-340-720(4)(b)(iii)
121-14-2	2,4-Dinitrotoluene	dinitrotoluene;2,4-	µg/L	--	0.28	--	--	--	--	0.28	WAC 173-340-720(4)(b)(iii)
606-20-2	2,6-Dinitrotoluene	dinitrotoluene;2,6-	µg/L	--	16	--	--	--	--	16	WAC 173-340-720(4)(b)(iii)
78-93-3	2-Butanone	methyl ethyl ketone (MEK; 2-butanone)	µg/L	--	4,800	--	--	--	--	4,800	WAC 173-340-720(4)(b)(iii)
111-76-2	2-Butoxyethanol	ethylene glycol monobutyl ether (EGBE)	µg/L	--	800	--	--	--	--	800	WAC 173-340-720(4)(b)(iii)
91-58-7	2-Chloronaphthalene	beta-chloronaphthalene	µg/L	--	640	--	--	--	--	640	WAC 173-340-720(4)(b)(iii)
95-57-8	2-Chlorophenol	Chlorophenol;2-	µg/L	--	40	--	--	--	--	40	WAC 173-340-720(4)(b)(iii)
591-78-6	2-Hexanone	HEXANONE;2- [MBK, methyl butyl ketone]	µg/L	--	40	--	--	--	--	40	WAC 173-340-720(4)(b)(iii)
91-57-6	2-Methylnaphthalene	methylnapthalene;2-	µg/L	--	32	--	--	--	--	32	WAC 173-340-720(4)(b)(iii)
95-48-7	2-Methylphenol (cresol, o-)	cresol;o-	µg/L	--	400	--	--	--	--	400	WAC 173-340-720(4)(b)(iii)
88-74-4	2-Nitroaniline	nitroaniline, 2-	µg/L	--	160	--	--	--	--	160	WAC 173-340-720(4)(b)(iii)
88-75-5	2-Nitrophenol	nitrophenol;2-	µg/L	No Cleanup Level	--	--	--	--	--	--	--
91-94-1	3,3'-Dichlorobenzidine	dichlorobenzidine;3,3'-	µg/L	--	0.19	--	--	--	--	0.19	WAC 173-340-720(4)(b)(iii)
65794-96-9	3+4 Methylphenol (cresol, m+p)	methylphenol,3+4 (cresol, m+p)	µg/L	No Cleanup Level	--	--	--	--	--	--	--
99-09-2	3-Nitroaniline	nitroaniline, 3-	µg/L	--	4.2	--	--	--	--	4.2	WAC 173-340-720(4)(b)(iii)

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					Groundwater Method B Unrestricted Land Use	Groundwater Method A Cleanup Levels	Ground Water ARAR - Federal Maximum Contaminant Level Goal (MCLG)	Ground Water ARAR - Federal Primary Maximum Contaminant Level (MCL)	Ground Water ARAR - State Primary Maximum Contaminant Level (MCL)		
72-54-8	4,4'-DDD (Dichlorodiphenyldichloroethane)	ddd	µg/L	--	0.36	--	--	--	--	0.36	WAC 173-340-720(4)(b)(iii)
72-55-9	4,4'-DDE (Dichlorodiphenyldichloroethylene)	dde	µg/L	--	0.26	--	--	--	--	0.26	WAC 173-340-720(4)(b)(iii)
50-29-3	4,4'-DDT (Dichlorodiphenyltrichloroethane)	ddt	µg/L	--	0.26	--	--	--	--	0.26	WAC 173-340-720(4)(b)(iii)
534-52-1	4,6-Dinitro-2-methylphenol	dinitro-2-methylphenol;4,6-	µg/L	--	1.3	--	--	--	--	1.3	WAC 173-340-720(4)(b)(iii)
1918-02-1	4-Amino-3,5,6-trichloropicolinic acid	picloram	µg/L	--	1,120	--	500	500	500	500	Federal MCLG
101-55-3	4-Bromophenylphenyl ether	bromodiphenyl ether;4-	µg/L	No Cleanup Level	--	--	--	--	--	--	--
59-50-7	4-Chloro-3-methylphenol	chloro-3-methylphenol;4-	µg/L	--	1,600	--	--	--	--	1,600	WAC 173-340-720(4)(b)(iii)
106-47-8	4-Chloroaniline	chloroaniline;p-	µg/L	--	0.22	--	--	--	--	0.22	WAC 173-340-720(4)(b)(iii)
7005-72-3	4-Chlorophenylphenyl ether	chlorodiphenyl ether;4-	µg/L	No Cleanup Level	--	--	--	--	--	--	--
108-10-1	4-Methyl-2-pentanone	methyl isobutyl ketone	µg/L	--	640	--	--	--	--	640	WAC 173-340-720(4)(b)(iii)
106-44-5	4-Methylphenol (cresol, p-)	cresol;p-	µg/L	--	40	--	--	--	--	40	WAC 173-340-720(4)(b)(iii)
100-01-6	4-Nitroaniline	nitroaniline, 4-	µg/L	--	4.4	--	--	--	--	4.4	WAC 173-340-720(4)(b)(iii)
100-02-7	4-Nitrophenol	nitrophenol;4-	µg/L	--	128	--	--	--	--	128	WAC 173-340-720(4)(b)(iii)
83-32-9	Acenaphthene	acenaphthene	µg/L	--	960	--	--	--	--	960	WAC 173-340-720(4)(b)(iii)
208-96-8	Acenaphthylene	acenaphthylene (Not in CLARC database tables; use acenaphthene as surrogate)	µg/L	No Cleanup Level	--	--	--	--	--	--	--
67-64-1	Acetone	Acetone	µg/L	--	7,200	--	--	--	--	7,200	WAC 173-340-720(4)(b)(iii)

Table 4-1. Summary of Groundwater Cleanup Levels Used to Calculate Soil Concentrations Protective of Groundwater

CAS #	Constituent Name	Alternate Constituent Name	Units	Basis for Exclusion	WAC 173-340-720[a,b]		National Recommended Water Quality Criteria[c,d,e]		WAC 246-290-310[f]	Final Groundwater Cleanup Level	Final Groundwater Cleanup Level Basis
					Groundwater Method B Unrestricted Land Use	Groundwater Method A Cleanup Levels	Ground Water ARAR - Federal Maximum Contaminant Level Goal (MCLG)	Ground Water ARAR - Federal Primary Maximum Contaminant Level (MCL)	Ground Water ARAR - State Primary Maximum Contaminant Level (MCL)		
107-13-1	Acrylonitrile	Acrylonitrile	µg/L	--	0.081	--	--	--	--	0.081	WAC 173-340-720(4)(b)(iii)
309-00-2	Aldrin	aldrin	µg/L	--	0.0026	--	--	--	--	0.0026	WAC 173-340-720(4)(b)(iii)
319-84-6	Alpha-BHC	hexachlorocyclohexane;alpha (alpha-BHC, HCH)	µg/L	--	0.014	--	--	--	--	0.014	WAC 173-340-720(4)(b)(iii)
5103-71-9	Alpha-Chlordane	Alpha-Chlordane	µg/L	--	0.25	--	--	2.0	--	0.25	WAC 173-340-720(4)(b)(iii)
7429-90-5	Aluminum	Aluminum (soluable)	µg/L	--	16,000	--	--	50	--	50	Federal MCL
120-12-7	Anthracene	anthracene	µg/L	--	4,800	--	--	--	--	4,800	WAC 173-340-720(4)(b)(iii)
7440-36-0	Antimony	antimony	µg/L	--	6.4	--	6.0	6.0	6.0	6.0	Federal MCLG
12674-11-2	Aroclor-1016	aroclor 1016 (PCB)	µg/L	--	1.1	--	--	0.50		0.50	Federal MCL
11104-28-2	Aroclor-1221	aroclor 1221 [PCB]	µg/L	--	0.044	--	--	0.50		0.044	WAC 173-340-720(4)(b)(iii)
11141-16-5	Aroclor-1232	aroclor 1232 [PCB]	µg/L	--	0.044	--	--	0.50		0.044	WAC 173-340-720(4)(b)(iii)
53469-21-9	Aroclor-1242	aroclor 1242 [PCB]	µg/L	--	0.044	--	--	0.50		0.044	WAC 173-340-720(4)(b)(iii)
12672-29-6	Aroclor-1248	aroclor 1248 [PCB]	µg/L	--	0.044	--	--	0.50		0.044	WAC 173-340-720(4)(b)(iii)
11097-69-1	Aroclor-1254	aroclor 1254 (PCB)	µg/L	--	0.044	--	--	0.50		0.044	WAC 173-340-720(4)(b)(iii)
11096-82-5	Aroclor-1260	aroclor 1260 (PCB)	µg/L	--	0.044	--	--	0.50		0.044	WAC 173-340-720(4)(b)(iii)
7440-38-2	Arsenic	arsenic, inorganic	µg/L	--	0.058	--	--	10	10	0.058	WAC 173-340-720(4)(b)(iii)
7440-39-3	Barium, compounds	Barium	µg/L	--	3,200	--	2,000	2,000	2,000	2,000	Federal MCLG
71-43-2	Benzene	Benzene	µg/L	--	0.80	--	--	5.0	--	0.80	WAC 173-340-720(4)(b)(iii)
56-55-3	Benzo(a)anthracene	Benzo(a)anthracene	µg/L	--	0.12	--	--	--	--	0.12	WAC 173-340-720(4)(b)(iii)
50-32-8	Benzo(a)pyrene	Benzo(a)pyrene	µg/L	--	0.012	--	--	0.20	--	0.012	WAC 173-340-720(4)(b)(iii)
205-99-2	Benzo(b)fluoranthene	Benzo(b)fluoranthene	µg/L	--	0.12	--	--	--	--	0.12	WAC 173-340-720(4)(b)(iii)

Table 4-1. Summary of Groundwater Cleanup Levels Used to Calculate Soil Concentrations Protective of Groundwater

CAS #	Constituent Name	Alternate Constituent Name	Units	Basis for Exclusion	WAC 173-340-720[a,b]		National Recommended Water Quality Criteria[c,d,e]		WAC 246-290-310[f]	Final Groundwater Cleanup Level	Final Groundwater Cleanup Level Basis
					Groundwater Method B Unrestricted Land Use	Groundwater Method A Cleanup Levels	Ground Water ARAR - Federal Maximum Contaminant Level Goal (MCLG)	Ground Water ARAR - Federal Primary Maximum Contaminant Level (MCL)	Ground Water ARAR - State Primary Maximum Contaminant Level (MCL)		
191-24-2	Benzo(ghi)perylene	BENZO(g,h,i)PERYLENE (using pyrene as a surrogate)	µg/L	No Cleanup Level	--	--	--	--	--	--	--
207-08-9	Benzo(k)fluoranthene	Benzo(k)fluoranthene	µg/L	--	0.12	--	--	--	--	0.12	WAC 173-340-720(4)(b)(iii)
7440-41-7	Beryllium	beryllium	µg/L	--	32	--	4.0	4.0	4.0	4.0	Federal MCLG
319-85-7	beta-1,2,3,4,5,6-Hexachlorocyclohexane (beta-BHC)	hexachlorocyclohexane;beta-	µg/L	--	0.049	--	--	--	--	0.049	WAC 173-340-720(4)(b)(iii)
108-60-1	Bis(2-chloro-1-methylethyl)ether	bis(2-chloro-1-methyl-ethyl)ether	µg/L	--	0.63	--	--	--	--	0.63	WAC 173-340-720(4)(b)(iii)
111-91-1	Bis(2-Chloroethoxy)methane	bis(2-chloroethoxyl)methane	µg/L	--	48	--	--	--	--	48	WAC 173-340-720(4)(b)(iii)
111-44-4	Bis(2-chloroethyl) ether	bis(2-chloroethyl)ether	µg/L	--	0.040	--	--	--	--	0.040	WAC 173-340-720(4)(b)(iii)
117-81-7	Bis(2-ethylhexyl) phthalate	bis(2-ethylhexyl) phthalate	µg/L	--	6.3	--	--	6.0	--	6.0	Federal MCL
7440-69-9	Bismuth	Bismuth	µg/L	No Cleanup Level	--	--	--	--	--	--	--
7440-42-8	Boron	Boron	µg/L	--	3,200	--	--	--	--	3,200	WAC 173-340-720(4)(b)(iii)
24959-67-9	Bromide	Bromide	µg/L	No Cleanup Level	--	--	--	--	--	--	--
75-27-4	Bromodichloromethane	bromodichloromethane	µg/L	--	0.71	--	--	80	--	0.71	WAC 173-340-720(4)(b)(iii)
75-25-2	Bromoform	bromoform	µg/L	--	5.5	--	80	--	--	5.5	WAC 173-340-720(4)(b)(iii)
74-83-9	Bromomethane	bromomethane	µg/L	--	11	--	--	--	--	11	WAC 173-340-720(4)(b)(iii)
85-68-7	Butylbenzylphthalate	butyl benzyl phthalate	µg/L	--	46	--	--	--	--	46	WAC 173-340-720(4)(b)(iii)
7440-43-9	Cadmium	cadmium	µg/L	--	8.0	--	5.0	5.0	5.0	5.0	Federal MCLG
7440-70-2	Calcium	Calcium	µg/L	Essential Nutrient	--	--	--	--	--	--	--
86-74-8	Carbazole	carbazole	µg/L	--	4.4	--	--	--	--	4.4	WAC 173-340-

Table 4-1. Summary of Groundwater Cleanup Levels Used to Calculate Soil Concentrations Protective of Groundwater

CAS #	Constituent Name	Alternate Constituent Name	Units	Basis for Exclusion	WAC 173-340-720[a,b]		National Recommended Water Quality Criteria[c,d,e]		WAC 246-290-310[f]	Final Groundwater Cleanup Level	Final Groundwater Cleanup Level Basis
					Groundwater Method B Unrestricted Land Use	Groundwater Method A Cleanup Levels	Ground Water ARAR - Federal Maximum Contaminant Level Goal (MCLG)	Ground Water ARAR - Federal Primary Maximum Contaminant Level (MCL)	Ground Water ARAR - State Primary Maximum Contaminant Level (MCL)		
											720(4)(b)(iii)
75-15-0	Carbon disulfide	carbon disulfide	µg/L	--	800	--	--	--	--	800	WAC 173-340-720(4)(b)(iii)
56-23-5	Carbon tetrachloride	carbon tetrachloride	µg/L	--	0.34	--	--	5.0	--	0.34	WAC 173-340-720(4)(b)(iii)
57-74-9	Chlordane	chlordane	µg/L	--	0.25	--	--	2.0	--	0.25	WAC 173-340-720(4)(b)(iii)
16887-00-6	Chloride	chloride	µg/L	--	--	--	--	--	250,000	250,000	State MCL
108-90-7	Chlorobenzene	chlorobenzene	µg/L	--	160	--	100	100	--	100	Federal MCLG
75-00-3	Chloroethane	ethyl chloride	µg/L	No Cleanup Level	--	--	--	--	--	--	--
67-66-3	Chloroform	chloroform	µg/L	--	1.4	--	--	70	--	1.4	WAC 173-340-720(4)(b)(iii)
74-87-3	Chloromethane	chloromethane	µg/L	No Cleanup Level	--	--	--	--	--	--	--
7440-47-3	Chromium	chromium (total)	µg/L	--	24,000	--	100	100	100	100	Federal MCLG
218-01-9	Chrysene	Chrysene	µg/L	--	1.2	--	--	--	--	1.2	WAC 173-340-720(4)(b)(iii)
156-59-2	cis-1,2-Dichloroethylene	dichloroethylene;1,2-,cis	µg/L	--	80	--	70	70	--	70	Federal MCLG
10061-01-5	cis-1,3-Dichloropropene	dichloropropene;1,2-,cis	µg/L	--	0.44	--	--	--	--	0.44	WAC 173-340-720(4)(b)(iii)
7440-48-4	Cobalt	Cobalt	µg/L	--	4.8	--	--	--	--	4.8	WAC 173-340-720(4)(b)(iii)
PCB1242/1016	Co-elution of Aroclor 1242 and Aroclor 1016	Co-elution of Aroclor 1242 and Aroclor 1017	µg/L	No Cleanup Level	--	--	--	--	--	--	--
7440-50-8	Copper	copper	µg/L	--	640	--	1,300	1,300	1,300	640	WAC 173-340-720(4)(b)(iii)
57-12-5	Cyanide	cyanide	µg/L	--	320	--	200	200	200	200	Federal MCLG
75-99-0	Dalapon	Dalapon	µg/L	--	240	--	200	200	--	200	Federal MCLG
319-86-8	Delta-BHC	hexachlorocyclohexane;delta-	µg/L	No Cleanup Level	--	--	--	--	--	--	--
53-70-3	Dibenz[a,h]anthracene	Dibenz[a,h]anthracene	µg/L	--	0.12	--	--	--	--	0.12	WAC 173-340-

Table 4-1. Summary of Groundwater Cleanup Levels Used to Calculate Soil Concentrations Protective of Groundwater

CAS #	Constituent Name	Alternate Constituent Name	Units	Basis for Exclusion	WAC 173-340-720[a,b]		National Recommended Water Quality Criteria[c,d,e]		WAC 246-290-310[f]	Final Groundwater Cleanup Level	Final Groundwater Cleanup Level Basis
					Groundwater Method B Unrestricted Land Use	Groundwater Method A Cleanup Levels	Ground Water ARAR - Federal Maximum Contaminant Level Goal (MCLG)	Ground Water ARAR - Federal Primary Maximum Contaminant Level (MCL)	Ground Water ARAR - State Primary Maximum Contaminant Level (MCL)		
											720(4)(b)(iii)
132-64-9	Dibenzofuran	dibenzofuran	µg/L	--	16	--	--	--	--	16	WAC 173-340-720(4)(b)(iii)
124-48-1	Dibromochloromethane	chlorodibromomethane [dibromochloromethane]	µg/L	--	0.52	--	60	60	--	0.52	WAC 173-340-720(4)(b)(iii)
1918-00-9	Dicamba	Dicamba	µg/L	--	480	--	--	--	--	480	WAC 173-340-720(4)(b)(iii)
120-36-5	Dichloroprop	Dichloroprop	--	No Cleanup Level	--	--	--	--	--	--	--
60-57-1	Dieldrin	dieldrin	µg/L	--	0.0055	--	--	--	--	0.0055	WAC 173-340-720(4)(b)(iii)
60-29-7	Diethyl ether	ethyl ether	µg/L	--	1,600	--	--	--	--	1,600	WAC 173-340-720(4)(b)(iii)
84-66-2	Diethylphthalate	diethyl phthalate	µg/L	--	12,800	--	--	--	--	12,800	WAC 173-340-720(4)(b)(iii)
131-11-3	Dimethyl phthalate	dimethyl phthalate	µg/L	No Cleanup Level	--	--	--	--	--	--	--
84-74-2	Di-n-butylphthalate	di-butyl phthalate	µg/L	--	1,600	--	--	--	--	1,600	WAC 173-340-720(4)(b)(iii)
117-84-0	Di-n-octylphthalate	di-n-octyl phthalate	µg/L	No Cleanup Level	--	--	--	--	--	--	--
88-85-7	Dinoseb(2-secButyl-4,6-dinitrophenol)	Dinoseb	µg/L	--	16	--	7.0	7.0	--	7.0	Federal MCLG
959-98-8	Endosulfan I	Endosulfan I	µg/L	--	96	--	--	--	--	96	WAC 173-340-720(4)(b)(iii)
33213-65-9	Endosulfan II	Endosulfan II	µg/L	--	96	--	--	--	--	96	WAC 173-340-720(4)(b)(iii)
1031-07-8	Endosulfan sulfate	Endosulfan sulfate	µg/L	No Cleanup Level	--	--	--	--	--	--	--
72-20-8	Endrin	endrin	µg/L	--	4.8	--	2.0	2.0	--	2.0	Federal MCLG
7421-93-4	Endrin aldehyde	Endrin aldehyde	µg/L	No Cleanup	--	--	--	--	--	--	--

Table 4-1. Summary of Groundwater Cleanup Levels Used to Calculate Soil Concentrations Protective of Groundwater

CAS #	Constituent Name	Alternate Constituent Name	Units	Basis for Exclusion Level	WAC 173-340-720[a,b]		National Recommended Water Quality Criteria[c,d,e]		WAC 246-290-310[f]	Final Groundwater Cleanup Level	Final Groundwater Cleanup Level Basis
					Groundwater Method B Unrestricted Land Use	Groundwater Method A Cleanup Levels	Ground Water ARAR - Federal Maximum Contaminant Level Goal (MCLG)	Ground Water ARAR - Federal Primary Maximum Contaminant Level (MCL)	Ground Water ARAR - State Primary Maximum Contaminant Level (MCL)		
53494-70-5	Endrin ketone	Endrin ketone	µg/L	No Cleanup Level	--	--	--	--	--	--	--
141-78-6	Ethyl acetate	Ethyl acetate	µg/L	--	7,200	--	--	--	--	7,200	WAC 173-340-720(4)(b)(iii)
107-21-1	Ethylene glycol	Ethelyne glycol	µg/L	--	16,000	--	--	--	--	16,000	WAC 173-340-720(4)(b)(iii)
100-41-4	Ethylbenzene	ethylbenzene	µg/L	--	4.0	--	700	700	--	4.0	WAC 173-340-720(4)(b)(iii)
206-44-0	Fluoranthene	fluoranthene	µg/L	--	640	--	--	--	--	640	WAC 173-340-720(4)(b)(iii)
86-73-7	Fluorene	fluorene	µg/L	--	640	--	--	--	--	640	WAC 173-340-720(4)(b)(iii)
16984-48-8	Fluoride	fluoride (using fluorine)	µg/L	--	960	--	4,000	4,000	4,000	960	WAC 173-340-720(4)(b)(iii)
58-89-9	Gamma-BHC (Lindane)	lindane [gamma-BHC] (see hexachlorocyclohexane)	µg/L	--	0.080	--	0.20	0.20	--	0.080	WAC 173-340-720(4)(b)(iii)
76-44-8	Heptachlor	heptachlor	µg/L	--	0.019	--	--	0.40	--	0.019	WAC 173-340-720(4)(b)(iii)
1024-57-3	Heptachlor epoxide	Heptachlor epoxide	µg/L	--	0.0048	--	--	0.20	--	0.0048	WAC 173-340-720(4)(b)(iii)
118-74-1	Hexachlorobenzene	hexachlorobenzene	µg/L	--	0.055	--	--	1.0	--	0.055	WAC 173-340-720(4)(b)(iii)
87-68-3	Hexachlorobutadiene	hexachlorobutadiene	µg/L	--	0.56	--	--	--	--	0.56	WAC 173-340-720(4)(b)(iii)
77-47-4	Hexachlorocyclopentadiene	hexachlorocyclopentadiene	µg/L	--	48	--	50	50	--	48	WAC 173-340-720(4)(b)(iii)
67-72-1	Hexachloroethane	hexachloroethane	µg/L	--	3.1	--	--	--	--	3.1	WAC 173-340-720(4)(b)(iii)
18540-29-9	Hexavalent Chromium	chromium(VI)	µg/L	--	48	--	--	--	--	48	WAC 173-340-720(4)(b)(iii)
193-39-5	Indeno(1,2,3-cd)pyrene	Indeno(1,2,3-cd)pyrene	µg/L	--	0.12	--	--	--	--	0.12	WAC 173-340-720(4)(b)(iii)
7439-89-6	Iron	Iron	µg/L	--	11,200	--	--	300	300	300	Federal MCL
78-59-1	Isophorone	isophorone	µg/L	--	46	--	--	--	--	46	WAC 173-340-

Table 4-1. Summary of Groundwater Cleanup Levels Used to Calculate Soil Concentrations Protective of Groundwater

CAS #	Constituent Name	Alternate Constituent Name	Units	Basis for Exclusion	WAC 173-340-720[a,b]		National Recommended Water Quality Criteria[c,d,e]		WAC 246-290-310[f]	Final Groundwater Cleanup Level	Final Groundwater Cleanup Level Basis
					Groundwater Method B Unrestricted Land Use	Groundwater Method A Cleanup Levels	Ground Water ARAR - Federal Maximum Contaminant Level Goal (MCLG)	Ground Water ARAR - Federal Primary Maximum Contaminant Level (MCL)	Ground Water ARAR - State Primary Maximum Contaminant Level (MCL)		
											720(4)(b)(iii)
7439-92-1	Lead	lead	µg/L	--	--	15	--	15	15	15	Federal MCL
7439-93-2	Lithium	Lithium	µg/L	--	32	--	--	--	--	32	WAC 173-340-720(4)(b)(iii)
7439-95-4	Magnesium	Magnesium (Not in CLARC database Tables)	µg/L	Essential Nutrient	--	--	--	--	--	--	--
7439-96-5	Manganese	manganese	µg/L	--	2,240	--	--	50	50	50	Federal MCL
7487-94-7	Mercury	Mercury (using mercuric chloride)	µg/L	--	4.8	--	2.0	2.0	2.0	2.0	Federal MCLG
72-43-5	Methoxychlor	methoxychlor	µg/L	--	80	--	40	40	--	40	Federal MCLG
75-09-2	Methylene chloride	methylene chloride	µg/L	--	5.8	--	--	5.0	--	5.0	Federal MCL
7439-98-7	Molybdenum	molybdenum	µg/L	--	80	--	--	--	--	80	WAC 173-340-720(4)(b)(iii)
108-38-3	m-Xylene	Xylene, m-	µg/L	--	1,600	--	--	--	--	1,600	WAC 173-340-720(4)(b)(iii)
91-20-3	Naphthalene	naphthalene	µg/L	--	160	--	--	--	--	160	WAC 173-340-720(4)(b)(iii)
7440-02-0	Nickel	nickel soluble salts	µg/L	--	320	--	--	--	100	100	State MCL
14797-55-8	Nitrate	Nitrate	µg/L	--	113,600	--	45,000	45,000	45,000	45,000	Federal MCL
14797-65-0	Nitrite	Nitrite	µg/L	--	4,800	--	3,300	3,300	3,300	3,300	Federal MCL
98-95-3	Nitrobenzene	Nitrobenzene	µg/L	--	16	--	--	--	--	16	WAC 173-340-720(4)(b)(iii)
NO3-N	Nitrogen in Nitrate	Nitrogen in Nitrate	µg/L	--	25,600	--	10,000	10,000	10,000	10,000	Federal MCL
NO2-N	Nitrogen in Nitrite	Nitrogen in Nitrite	µg/L	--	1,600	--	1,000	1,000	1,000	1,000	Federal MCL
NO2+NO3-N	Nitrogen in Nitrite and Nitrate	Nitrogen in Nitrite and Nitrate	µg/L	--	25,600	--	10,000	10,000	10,000	10,000	Federal MCL
621-64-7	n-Nitrosodi-n-dipropylamine	nitroso-di-n-propylamine;N-	µg/L	--	0.013	--	--	--	--	0.013	WAC 173-340-720(4)(b)(iii)
86-30-6	n-Nitrosodiphenylamine	nitrosodiphenylamine;N-	µg/L	--	18	--	--	--	--	18	WAC 173-340-720(4)(b)(iii)
95-47-6	o-Xylene	xylene,o-	µg/L	--	1,600	--	--	--	--	1,600	WAC 173-340-720(4)(b)(iii)
87-86-5	Pentachlorophenol	pentachlorophenol	µg/L	--	0.73	--	--	1.0	--	0.73	WAC 173-340-720(4)(b)(iii)
%MOISTURE	Percent moisture (wet sample)	Percent moisture (wet	µg/L	No	--	--	--	--	--	--	--

Table 4-1. Summary of Groundwater Cleanup Levels Used to Calculate Soil Concentrations Protective of Groundwater

CAS #	Constituent Name	Alternate Constituent Name	Units	Basis for Exclusion	WAC 173-340-720[a,b]		National Recommended Water Quality Criteria[c,d,e]		WAC 246-290-310[f]	Final Groundwater Cleanup Level	Final Groundwater Cleanup Level Basis
					Groundwater Method B Unrestricted Land Use	Groundwater Method A Cleanup Levels	Ground Water ARAR - Federal Maximum Contaminant Level Goal (MCLG)	Ground Water ARAR - Federal Primary Maximum Contaminant Level (MCL)	Ground Water ARAR - State Primary Maximum Contaminant Level (MCL)		
		sample)		Cleanup Level							
PH	pH Measurement	pH Measurement	µg/L	No Cleanup Level	--	--	--	--	--	--	--
85-01-8	Phenanthrene	Phenanthrene	µg/L	No Cleanup Level	--	--	--	--	--	--	--
108-95-2	Phenol	Phenol	µg/L	--	2,400	--	--	--	--	2,400	WAC 173-340-720(4)(b)(iii)
14265-44-2	Phosphate	Phosphate	µg/L	No Cleanup Level	--	--	--	--	--	--	--
7723-14-0	Phosphorus	phosphorus	µg/L	--	0.16	--	--	--	--	0.16	WAC 173-340-720(4)(b)(iii)
PO4-P	Phosphorus in phosphate	Phosphorus in phosphate	µg/L	No Cleanup Level	--	--	--	--	--	--	--
7440-09-7	Potassium	Potassium	µg/L	Essential Nutrient	--	--	--	--	--	--	--
129-00-0	Pyrene	pyrene	µg/L	--	480	--	--	--	--	480	WAC 173-340-720(4)(b)(iii)
7782-49-2	Selenium	selenium and compounds	µg/L	--	80	--	50	50	50	50	Federal MCLG
7440-21-3	Silicon	Silicon	µg/L	No Cleanup Level	--	--	--	--	--	--	--
7440-22-4	Silver	silver	µg/L	--	80	--	--	100	100	80	WAC 173-340-720(4)(b)(iii)
7440-23-5	Sodium	Sodium	µg/L	Essential Nutrient	--	--	--	--	--	--	--
7440-24-6	Strontium	strontium	µg/L	--	9,600	--	--	--	--	9,600	WAC 173-340-720(4)(b)(iii)
100-42-5	Styrene	styrene	µg/L	--	1,600	--	100	100	--	100	Federal MCLG
14808-79-8	Sulfate	sulfate	µg/L	--	--	--	--	250,000	250,000	250,000	Federal MCL
18496-25-8	Sulfide	Sulfide	--	No Cleanup	--	--	--	--	--	--	--

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CAS #	Constituent Name	Alternate Constituent Name	Units	Basis for Exclusion Level	WAC 173-340-720[a,b] Groundwater Method B Unrestricted Land Use	WAC 173-340-720[a,b] Groundwater Method A Cleanup Levels	National Recommended Water Quality Criteria[c,d,e] Ground Water ARAR - Federal Maximum Contaminant Level Goal (MCLG)	National Recommended Water Quality Criteria[c,d,e] Ground Water ARAR - Federal Primary Maximum Contaminant Level (MCL)	WAC 246-290-310[f] Ground Water ARAR - State Primary Maximum Contaminant Level (MCL)	Final Groundwater Cleanup Level	Final Groundwater Cleanup Level Basis
127-18-4	Tetrachloroethene	tetrachloroethylene	µg/L	--	0.081	--	--	5.0	--	0.081	WAC 173-340-720(4)(b)(iii)
7440-28-0	Thallium	Thallium, soluable salts	µg/L	--	--	--	0.50	2.0	2.0	0.50	Federal MCLG
7440-31-5	Tin	tin	µg/L	--	9,600	--	--	--	--	9,600	WAC 173-340-720(4)(b)(iii)
108-88-3	Toluene	Toluene	µg/L	--	640	--	1,000	1,000	--	640	WAC 173-340-720(4)(b)(iii)
TPH	Total petroleum hydrocarbons	Total petroleum hydrocarbons	--		--	500	--	--	--	500	WAC 173-340-720(3)(b)
TPHDIESEL	Total petroleum hydrocarbons - diesel range	Total petroleum hydrocarbons - diesel range	µg/L	--	--	500	--	--	--	500	WAC 173-340-720(3)(b)
TPH/OILH	Total petroleum hydrocarbons - motor oil (high boiling)	Total petroleum hydrocarbons - motor oil (high boiling)	µg/L	--	--	500	--	--	--	500	WAC 173-340-720(3)(b)
8001-35-2	Toxaphene	toxaphene	µg/L	--	0.080	--	--	3.0	--	0.080	WAC 173-340-720(4)(b)(iii)
156-60-5	trans-1,2-Dichloroethylene	dichloroethylene;1,2-,trans	µg/L	--	160	--	100	100	--	100	Federal MCLG
10061-02-6	trans-1,3-Dichloropropene	dichloropropene;1,3-,trans	µg/L	--	0.44	--	--	--	--	0.44	WAC 173-340-720(4)(b)(iii)
126-73-8	Tributyl phosphate	Tributyl phosphate	µg/L	--	9.7	--	--	--	--	9.7	WAC 173-340-720(4)(b)(iii)
79-01-6	Trichloroethene	trichloroethylene (TCE)	µg/L	--	0.49	--	--	5.0	--	0.49	WAC 173-340-720(4)(b)(iii)
75-69-4	Trichloromonofluoromethane	trichlorofluoromethane	µg/L	--	2,400	--	--	--	--	2,400	WAC 173-340-720(4)(b)(iii)
7440-61-1	Uranium	Uranium	µg/L	--	48	--	--	30	--	30	Federal MCL
7440-62-2	Vanadium	vanadium	µg/L	--	80	--	--	--	--	80	WAC 173-340-720(4)(b)(iii)
75-01-4	Vinyl chloride	vinyl chloride [chloroethene; 1-]	µg/L	--	0.061	--	--	2.0	--	0.061	WAC 173-340-720(4)(b)(iii)
1330-20-7	Xylenes (total)	Xylenes (total)	µg/L	--	1,600	--	10,000	10,000	--	1,600	WAC 173-340-720(4)(b)(iii)
7440-66-6	Zinc	zinc	µg/L	--	4,800	--	--	5,000	5,000	4,800	WAC 173-340-720(4)(b)(iii)

Notes:

Table 4-1. Summary of Groundwater Cleanup Levels Used to Calculate Soil Concentrations Protective of Groundwater

CAS #	Constituent Name	Alternate Constituent Name	Units	Basis for Exclusion	WAC 173-340-720[a,b]		National Recommended Water Quality Criteria[c,d,e]		WAC 246-290-310[f]	Final Groundwater Cleanup Level	Final Groundwater Cleanup Level Basis
					Groundwater Method B Unrestricted Land Use	Groundwater Method A Cleanup Levels	Ground Water ARAR - Federal Maximum Contaminant Level Goal (MCLG)	Ground Water ARAR - Federal Primary Maximum Contaminant Level (MCL)	Ground Water ARAR - State Primary Maximum Contaminant Level (MCL)		

a. Standard Method B groundwater cleanup levels calculated per requirements in WAC 173-340-720, "Ground Water Cleanup Standards," as documented in ECF-100NPL-10-0462.
b. WAC 173-340-720(3)(b) Table 720-1, Method A cleanup Levles for Groundwater
c. 40 CFR 141.61, “National Primary Drinking Water Regulations,” “Maximum Contaminant Levels for Organic Contaminants."
d. 40 CFR 141.62, “National Primary Drinking Water Regulations,” “Maximum Contaminant Levels for Inorganic Contaminants."
e. 40 CFR 143.3, “National Secondary Drinking Water Regulations,” “Secondary Maximum Contaminant Levels."
f. WAC 246-290-310, “Group A Public Water Supplies,” “Maximum Contaminant Levels (MCLs) and Maximum Residual Disinfectant Levels (MRDLs)."

Table 4-2. Summary of Soil/Water Distribution Coefficients, DOE/RL-96-17, Rev. 6.

Contaminant	K_d Value (mL/g)	Source
Ag (silver)-108m	90	ANL 1993
Americium-241	200	Hanford Site-specific K_d value: Ames and Serne 1991
Carbon-14	200	Hanford Site-specific K_d value: BHI 2002a
Cesium-137	50	Hanford Site-specific K_d value: Ames and Serne 1991
Cobalt-60	50	Hanford Site-specific K_d value: Ames and Serne 1991
Curium-243	200	Hanford Site-specific K_d value: Kincaid et al. 1998
Europium-152	200	Hanford Site-specific K_d value: Ames and Serne 1991
Europium-154	200	Hanford Site-specific K_d value: Ames and Serne 1991
Europium-155	200	Hanford Site-specific K_d value: Ames and Serne 1991
Iodine-129	1	Hanford Site-specific K_d value: Kincaid et al. 1998
Neptunium-237	15	Hanford Site-specific K_d value: Kincaid et al. 1998
Nickel-63	30	Hanford Site-specific K_d value: Ames and Serne 1991
Niobium-94	200	Hanford Site-specific K_d value: Kincaid et al. 1998
Plutonium-238	200	Hanford Site-specific K_d value: Serne and Wood 1990
Plutonium-239/240	200	Hanford Site-specific K_d value: Serne and Wood 1990
Potassium-40	5.5	Hanford Site-specific K_d value: Kincaid et al. 1998
Sodium-22	10	Hanford Site-specific K_d value: Kincaid et al. 1998
Strontium-90	25	Hanford Site-specific K_d value: Ames and Serne 1991
Technetium-99	0	Hanford Site-specific K_d value: Serne and Wood 1990
Thorium-228	200	Hanford Site-specific K_d value: Ames and Rai 1978
Thorium-232	200	Hanford Site-specific K_d value: Ames and Rai 1978
Tritium (H-3)	0	Hanford Site-specific K_d value: Serne and Wood 1990
Uranium-233/234	2	Hanford Site-specific K_d value: Serne and Wood 1990
Uranium-235	2	Hanford Site-specific K_d value: Serne and Wood 1990
Uranium-238	2	Hanford Site-specific K_d value: Serne and Wood 1990
Metals		
Antimony	3.76	Krupka and Serne 2002
Arsenic	3	Baes and Sharp 1983
Barium	25	Hanford Site-specific K_d value: Ames and Serne 1991
Beryllium	790	Ecology 2009
Boron	3	ORNL 2009
Cadmium	30	Hanford Site-specific K_d value: Ames and Serne 1991

Table 4-2. Summary of Soil/Water Distribution Coefficients, DOE/RL-96-17, Rev. 6.

Contaminant	K_d Value (mL/g)	Source
Chromium, Total	200	EPA 2002
Hexavalent Chromium	0	Hanford Site-specific K_d value: Ames and Serne 1991
Cobalt	50	Hanford Site-specific K_d value: Ames and Serne 1991
Copper	22	Ecology 2009
Lead	30	Hanford Site-specific K_d value: Ames and Serne 1991
Lithium	50	ORNL 2009 (see explanation in text, above)
Manganese	50	Hanford Site-specific K_d value: Ames and Serne 1991
Mercury	30	Hanford Site-specific K_d value: Ames and Serne 1991
Methyl Mercury	0.014	ORNL 2009
Molybdenum	20	ORNL 2009
Nickel	65	Hanford Site-specific K_d value: Ames and Serne 1991
Selenium	5	Ecology 2009
Silver	90	ANL 1993
Strontium	25	Hanford Site-specific K_d value: Ames and Serne 1991
Tin	130	ORNL 2009
Uranium	2	Hanford Site-specific K_d value: Serne and Wood 1990
Vanadium	1,000	Ecology 2009
Zinc	30	Hanford Site-specific K_d value: Ames and Serne 1991
Inorganic Anions and TPH		
Chloride	0	Hanford Site-specific K_d value: Kincaid et al. 1998
Cyanide	9.9	ORNL 2009
Fluoride	150	ORNL 2009
Nitrate	0	(Conservative assumption)
Nitrite	0	(Conservative assumption)
Sulfate	0	(Conservative assumption)
Sulfide	0	(Conservative assumption)
TPH	50	(Conservative assumption)
Volatiles		
Acetone	0.0006	Ecology 2009 (Using K_d = Koc/1000)
Carbon Tetrachloride	0.152	Ecology 2009 (Using K_d = Koc/1000)
Methylene Chloride	0.01	Ecology 2009 (Using K_d = Koc/1000)
Toluene	0.14	Ecology 2009 (Using K_d = Koc/1000)
Xylene	0.233	Ecology 2009 (Using K_d = Koc/1000)
Semivolatiles		
Acenapthene	4.9	Ecology 2009 (Using K_d = Koc/1000)
Acenaphthene	6.12	ORNL 2009 (Using K_d = Koc/1000)
Anthracene	23.5	Ecology 2009 (Using K_d = Koc/1000)

Table 4-2. Summary of Soil/Water Distribution Coefficients, DOE/RL-96-17, Rev. 6.

Contaminant	K_d Value (mL/g)	Source
Benzo(a)anthracene	360	Ecology 2009 (Using K_d = Koc/1000)
Benzo(a)pyrene	5,500	Ecology 2009 (Using K_d = Koc/1000)
Benzo(b)fluoranthene	803	ORNL 2009 (Using K_d = Koc/1000)
Benzo(k)fluoranthene	1,230	Ecology 2009 (Using K_d = Koc/1000)
Benzo(g,h,i)perylene	2,680	ORNL 2009 (Using K_d = Koc/1000)
Bis(2-chloro-1-methylethyl)ether	0.0392	ORNL 2009 (Using K_d = Koc/1000)
Bis(2-chloroethoxy)methane	0.00277	ORNL 2009 (Using K_d = Koc/1000)
Bis(2-chloroethyl) ether	0.076	Ecology 2009 (Using K_d = Koc/1000)
Bis(2-ethylhexyl) phthalate	110	Ecology 2009 (Using K_d = Koc/1000)
Bromophenylphenyl ether; 4-	4.16	ORNL 2009 (Using K_d = Koc/1000)
Butylbenzylphthalate	13.8	Ecology 2009 (Using K_d = Koc/1000)
Carbazole	3.39	Ecology 2009 (Using K_d = Koc/1000)
4-Chloro-3-methylphenol	--	Not available
4-Chloroaniline	0.0725	ORNL 2009 (Using K_d = Koc/1000)
2-Chloronaphthalene	2.98	ORNL 2009 (Using K_d = Koc/1000)
2-Chlorophenol	0.388	Ecology 2009 (Using K_d = Koc/1000)
Chlorophenylphenyl ether; 4-	--	Not available
Chrysene	200	Ecology 2009 (Using K_d = Koc/1000)
Dibenz[a,h]anthracene	1,790	Ecology 2009 (Using K_d = Koc/1000)
Dibenzofuran	11.3	ORNL 2009 (Using K_d = Koc/1000)
1,2-Dichlorobenzene	0.379	Ecology 2009 (Using K_d = Koc/1000)
1,3-Dichlorobenzene	0.434	ORNL 2009 (Using K_d = Koc/1000)
1,4-Dichlorobenzene	0.616	Ecology 2009 (Using K_d = Koc/1000)
3,3'-Dichlorobenzidine	0.724	Ecology 2009 (Using K_d = Koc/1000)
2,4-Dichlorophenol	0.147	Ecology 2009 (Using K_d = Koc/1000)
Diethylphthalate	0.082	Ecology 2009 (Using K_d = Koc/1000)
Dimethylphthalate	0.0371	ORNL 2009 (Using K_d = Koc/1000)
2,4-Dimethylphenol	0.209	Ecology 2009 (Using K_d = Koc/1000)
Di-n-butylphthalate	1.57	Ecology 2009 (Using K_d = Koc/1000)
Di-n-octylphthalate	83,200	Ecology 2009 (Using K_d = Koc/1000)
4,6-Dinitro-2-methylphenol	0.6015	ORNL 2009 (Using K_d = Koc/1000)
2,4-Dinitrophenol	0.00001	Ecology 2009 (Using K_d = Koc/1000)
2,4-Dinitrotoluene	0.0955	Ecology 2009 (Using K_d = Koc/1000)
2,6-Dinitrotoluene	0.0692	Ecology 2009 (Using K_d = Koc/1000)
Ethylene glycol	0.001	ORNL 2009 (Using K_d = Koc/1000)
Fluoranthene	49.1	Ecology 2009 (Using K_d = Koc/1000)

Table 4-2. Summary of Soil/Water Distribution Coefficients, DOE/RL-96-17, Rev. 6.

Contaminant	K_d Value (mL/g)	Source
Fluorene	7.71	Ecology 2009 (Using K_d = Koc/1000)
Hexachlorobenzene	80	Ecology 2009 (Using K_d = Koc/1000)
Hexachlorobutadiene	53.7	Ecology 2009 (Using K_d = Koc/1000)
Hexachlorocyclopentadiene	200	Ecology 2009 (Using K_d = Koc/1000)
Hexachloroethane	1.78	Ecology 2009 (Using K_d = Koc/1000)
Hydrazine	0.0143	ORNL 2009 (Using K_d = Koc/1000)
Indeno(1,2,3-cd)pyrene	3,470	Ecology 2009 (Using K_d = Koc/1000)
Isophorone	0.0468	Ecology 2009 (Using K_d = Koc/1000)
2-Methylnaphthalene	2.98	ORNL 2009 (Using K_d = Koc/1000)
2-Methylphenol (cresol, o-)	0.434	ORNL 2009 (Using K_d = Koc/1000)
4-Methylphenol (cresol, p-)	0.434	ORNL 2009 (Using K_d = Koc/1000)
Naphthalene	1.19	Ecology 2009 (Using K_d = Koc/1000)
2-Nitroaniline	0.0527	ORNL 2009 (Using K_d = Koc/1000)
3-Nitroaniline	0.0516	ORNL 2009 (Using K_d = Koc/1000)
4-Nitroaniline	0.0516	ORNL 2009 (Using K_d = Koc/1000)
Nitrobenzene	0.119	Ecology 2009 (Using K_d = Koc/1000)
2-Nitrophenol	0.309	ORNL 2009 (Using K_d = Koc/1000)
4-Nitrophenol	0.309	ORNL 2009 (Using K_d = Koc/1000)
Nitroso-di-n-propylamine;N-	0.024	Ecology 2009 (Using K_d = Koc/1000)
Nitrosodiphenylamine;N-	1.29	Ecology 2009 (Using K_d = Koc/1000)
Pentachlorophenol	0.592	Ecology 2009 (Using K_d = Koc/1000)
Phenanthrene	23.5	Ecology 2009 (Using K_d = Koc/1000)
Phenol	0.0288	Ecology 2009 (Using K_d = Koc/1000)
Pyrene	68	Ecology 2009 (Using K_d = Koc/1000)
Tributyl Phosphate	1.89	ORNL 2009 (Using K_d = Koc/1000)
1,2,4-Trichlorobenzene	1.66	Ecology 2009 (Using K_d = Koc/1000)
2,4,5-Trichlorophenol	1.6	Ecology 2009 (Using K_d = Koc/1000)
2,4,6-Trichlorophenol	0.381	Ecology 2009 (Using K_d = Koc/1000)
Pesticides and PCBs		
Aldrin	48.7	Ecology 2009 (Using K_d = Koc/1000)
Alpha-BHC	1.76	Ecology 2009 (Using K_d = Koc/1000)
beta-1,2,3,4,5,6-Hexachlorocyclohexane (beta-BHC)	2.14	Ecology 2009 (Using K_d = Koc/1000)
Delta-BHC	3.38	ORNL 2009 (Using K_d = Koc/1000)
BHC, gamma (Lindane)	1.35	Ecology 2009 (Using K_d = Koc/1000)
Chlordane	51	Ecology 2009 (Using K_d = Koc/1000)

Table 4-2. Summary of Soil/Water Distribution Coefficients, DOE/RL-96-17, Rev. 6.

Contaminant	K_d Value (mL/g)	Source
Dalapon	0.00274	ORNL 2009 (Using K_d = Koc/1000)
Db; 2,4-	0.1	ORNL 2009 (Using K_d = Koc/1000)
4,4'-DDD (Dichlorodiphenyldichloroethane)	45.8	Ecology 2009 (Using K_d = Koc/1000)
4,4'-DDE (Dichlorodiphenyldichloroethylene)	86.4	Ecology 2009 (Using K_d = Koc/1000)
4,4'-DDT (Dichlorodiphenyltrichloroethane)	678	Ecology 2009 (Using K_d = Koc/1000)
Dicambra	0.0288	ORNL 2009 (Using K_d = Koc/1000)
Dichlorophenoxyacetic acid; 2,4-	0.0294	ORNL 2009 (Using K_d = Koc/1000)
Dichloroprop	0.0294	ORNL 2009 (Using K_d = Koc/1000)
Dieldrin	25.6	Ecology 2009 (Using K_d = Koc/1000)
Dinoseb (DNBP)	3.54	ORNL 2009 (Using K_d = Koc/1000)
Endosulfan I	2.04	Ecology 2009 (Using K_d = Koc/1000)
Endosulfan II	3.04	Ecology 2009 (Using K_d = Koc/1000)
Endrin	10.8	Ecology 2009 (Using K_d = Koc/1000)
Endrin aldehyde	11.8	Ecology 2009 (Using K_d = Koc/1000)
Heptachlor	9.53	Ecology 2009 (Using K_d = Koc/1000)
Heptachlor epoxide	83.2	Ecology 2009 (Using K_d = Koc/1000)
Methoxychlor	80	Ecology 2009 (Using K_d = Koc/1000)
Polychlorinated Biphenyls	309	Ecology 2009 (Using K_d = Koc/1000)
Aroclor-1016	107	Ecology 2009 (Using K_d = Koc/1000)
Aroclor-1221	10.3	ORNL 2009 (Using K_d = Koc/1000)
Aroclor-1232	10.3	ORNL 2009 (Using K_d = Koc/1000)
Aroclor-1242	44.8	ORNL 2009 (Using K_d = Koc/1000)
Aroclor-1248	43.9	ORNL 2009 (Using K_d = Koc/1000)
Aroclor-1254	75.6	ORNL 2009 (Using K_d = Koc/1000)
Aroclor-1260	822	Ecology 2009 (Using K_d = Koc/1000)
Silvex (tp;2,4,5-)	0.08	ORNL 2009 (Using K_d = Koc/1000)
Toxaphene	95.8	Ecology 2009 (Using K_d = Koc/1000)
Trichlorophenoxyacetic acid;2,4,5-	0.049	ORNL 2009 (Using K_d = Koc/1000)

Notes:

K_d = distribution coefficient

Koc = carbon-water partitioning coefficient

Table 4-2. Summary of Soil/Water Distribution Coefficients, DOE/RL-96-17, Rev. 6.

Contaminant	K_d Value (mL/g)	Source

PCB = polychlorinated biphenyl
TPH = total petroleum hydrocarbons

Table 4-3. Summary of Input Parameters Used for the Fixed Parameter 3-Phse Partitioning Model Calculation

CAS #	Constituent Name	Alternate Constituent Name	Groundwater CUL for Protectiveness (µg/L)	Groundwater CUL for Protectiveness Source	Henry's Law Constant (Dimensionless)	Henry's Law[b,d] Constant Source	RDR/RAWP K_d (DOE/RL-96-17)[a]	K_{oc} (L/kg)	Organic K_d (L/kg) = K_{oc} x f_{oc}	Organic K_d Source[b]	Inorganic K_d (L/kg)	Inorganic K_d Source[b]	Selected K_d (L/kg)	Source of Selected K_d[c]
71-55-6	1,1,1-Trichloroethane	Trichloroethane;1,1,1-	200	Federal MCLG	0.71	CLARC 2010	--	140	0.14	CLARC 2010	--	--	0.14	CLARC 2010
79-34-5	1,1,2,2-Tetrachloroethane	tetrachloroethane;1,1,2,2-	0.22	WAC 173-340-720(4)(b)(iii)	0.014	CLARC 2010	--	79	0.079	CLARC 2010	--	--	0.079	CLARC 2010
79-00-5	1,1,2-Trichloroethane	trichloroethane;1,1,2-	0.77	WAC 173-340-720(4)(b)(iii)	0.037	CLARC 2010	--	75	0.075	CLARC 2010	--	--	0.075	CLARC 2010
75-34-3	1,1-Dichloroethane	dichloroethane;1,1-	1,600	WAC 173-340-720(4)(b)(iii)	0.23	CLARC 2010	--	53	0.053	CLARC 2010	--	--	0.053	CLARC 2010
75-35-4	1,1-Dichloroethene	Dichloroethene;1,1-	7.0	Federal MCLG	1.1	CLARC 2010	--	65	0.065	CLARC 2010	--	--	0.065	CLARC 2010
120-82-1	1,2,4-Trichlorobenzene	trichlorobenzene;1,2,4-	1.5	WAC 173-340-720(4)(b)(iii)	0.058	CLARC 2010	1.7	1,700	1.7	CLARC 2010	--	--	1.7	DOE/RL-96-17
95-50-1	1,2-Dichlorobenzene	dichlorobenzene;1,2- (ortho-Dichlorobenzene)	600	Federal MCLG	0.078	CLARC 2010	0.38	380	0.38	CLARC 2010	--	--	0.38	DOE/RL-96-17
107-06-2	1,2-Dichloroethane	dichloroethane;1,2-	0.48	WAC 173-340-720(4)(b)(iii)	0.040	CLARC 2010	--	38	0.038	CLARC 2010	--	--	0.038	CLARC 2010
540-59-0	1,2-Dichloroethene (Total)	dichloroethylene,1,2- (mixed isomers)	72	WAC 173-340-720(4)(b)(iii)	0.17	EPA 2010	--	40	0.040	EPA 2010	--	--	0.040	EPA 2010
78-87-5	1,2-Dichloropropane	dichloropropane;1,2-	1.2	WAC 173-340-720(4)(b)(iii)	0.12	CLARC 2010	--	47	0.047	CLARC 2010	--	--	0.047	CLARC 2010
541-73-1	1,3-Dichlorobenzene	dichlorobenzene;1,3	--	--	0.11	ORNL 2010	0.43	375	0.38	ORNL 2010	--	--	0.43	DOE/RL-96-17
106-46-7	1,4-Dichlorobenzene	dichlorobenzene;1,4- (para-Dichlorobenzene)	8.1	WAC 173-340-720(4)(b)(iii)	0.10	CLARC 2010	0.62	620	0.62	CLARC 2010	--	--	0.62	DOE/RL-96-17
93-76-5	2,4,5-T(2,4,5-Trichlorophenoxyacetic acid)	Trichlorophenoxyacetic Acid, 2,4,5-	160	WAC 173-340-720(4)(b)(iii)	1.9E-06	EPA 2010	0.049	107	0.11	EPA 2010	--	--	0.049	DOE/RL-96-17
93-72-1	2,4,5-TP(2-(2,4,5-Trichlorophenoxy)propionic acid)Silvex	Trichlorophenoxypropionic acid, -2,4,5	50	Federal MCLG	3.7E-07	EPA 2010	0.080	175.3	0.18	EPA 2010	--	--	0.080	DOE/RL-96-17
95-95-4	2,4,5-Trichlorophenol	Trichlorophenol;2,4,5-	800	WAC 173-340-720(4)(b)(iii)	1.80E-04	CLARC 2010	1.6	1,600	1.6	CLARC 2010	--	--	1.6	DOE/RL-96-17
88-06-2	2,4,6-Trichlorophenol	Trichlorophenol2,4,6-	4.0	WAC 173-340-720(4)(b)(iii)	3.20E-04	CLARC 2010	0.38	380	0.38	CLARC 2010	--	--	0.38	DOE/RL-96-17
94-82-6	2,4-DB(4-(2,4-Dichlorophenoxy)butanoic acid)	Dichlorophenoxy)butyric Acid, 4-(2,4-	128	WAC 173-340-720(4)(b)(iii)	2.4E-07	EPA 2010	0.10	98.4	0.098	EPA 2010	--	--	0.10	DOE/RL-96-17
120-83-2	2,4-Dichlorophenol	dichlorophenol;2,4-	24	WAC 173-340-720(4)(b)(iii)	1.30E-04	CLARC 2010	0.15	150	0.15	CLARC 2010	--	--	0.15	DOE/RL-96-17
94-75-7	2,4-Dichlorophenoxyacetic acid	Dichlorophenoxy Acetic Acid, 2,4-	70	Federal MCLG	1.4E-06	EPA 2010	0.029	29.63	0.030	EPA 2010	--	--	0.029	DOE/RL-96-17
105-67-9	2,4-Dimethylphenol	dimethylphenol;2,4-	160	WAC 173-340-720(4)(b)(iii)	8.20E-05	CLARC 2010	0.21	210	0.21	CLARC 2010	--	--	0.21	DOE/RL-96-17
51-28-5	2,4-Dinitrophenol	dinitrophenol;2,4-	32	WAC 173-340-720(4)(b)(iii)	1.80E-05	CLARC 2010	1.00E-05	0.010	1.00E-05	CLARC 2010	--	--	1.00E-05	DOE/RL-96-17
121-14-2	2,4-Dinitrotoluene	dinitrotoluene;2,4-	0.28	WAC 173-340-720(4)(b)(iii)	3.80E-06	CLARC 2010	0.096	96	0.096	CLARC 2010	--	--	0.096	DOE/RL-96-17
606-20-2	2,6-Dinitrotoluene	dinitrotoluene;2,6-	16	WAC 173-340-720(4)(b)(iii)	3.10E-05	CLARC 2010	0.069	69	0.069	CLARC 2010	--	--	0.069	DOE/RL-96-17
78-93-3	2-Butanone	methyl ethyl ketone (MEK; 2-butanone)	4,800	WAC 173-340-720(4)(b)(iii)	0.0023	EPA 2010	--	4.5	0.0045	EPA 2010	--	--	0.0045	EPA 2010

Table 4-3. Summary of Input Parameters Used for the Fixed Parameter 3-Phse Partitioning Model Calculation

CAS #	Constituent Name	Alternate Constituent Name	Groundwater CUL for Protectiveness (µg/L)	Groundwater CUL for Protectiveness Source	Henry's Law Constant (Dimensionless)	Henry's Law[b,d] Constant Source	RDR/RAWP K_d (DOE/RL-96-17)[a]	K_{oc} (L/kg)	Organic K_d (L/kg) = K_{oc} x f_{oc}	Organic K_d Source[b]	Inorganic K_d (L/kg)	Inorganic K_d Source[b]	Selected K_d (L/kg)	Source of Selected K_d[c]
111-76-2	2-Butoxyethanol	ethylene glycol monobutyl ether (EGBE)	800	WAC 173-340-720(4)(b)(iii)	6.54E-05	EPA 2010	--	2.8	0.0028	EPA 2010	--	--	0.0028	EPA 2010
91-58-7	2-Chloronaphthalene	beta-chloronaphthalene	640	WAC 173-340-720(4)(b)(iii)	0.013	EPA 2010	3.0	2,478	2.5	EPA 2010	--	--	3.0	DOE/RL-96-17
95-57-8	2-Chlorophenol	Chlorophenol;2-	40	WAC 173-340-720(4)(b)(iii)	0.016	CLARC 2010	0.39	390	0.39	CLARC 2010	--	--	0.39	DOE/RL-96-17
591-78-6	2-Hexanone	HEXANONE;2- [MBK, methyl butyl ketone]	40	WAC 173-340-720(4)(b)(iii)	0.0038	ORNL 2010	--	15	0.015	EPA 2010	--	--	0.015	EPA 2010
91-57-6	2-Methylnaphthalene	methylnapthalene;2-	32	WAC 173-340-720(4)(b)(iii)	0.021	ORNL 2010	3.0	2,480	2.5	ORNL 2010	--	--	3.0	DOE/RL-96-17
95-48-7	2-Methylphenol (cresol, o-)	cresol;o-	400	WAC 173-340-720(4)(b)(iii)	4.90E-05	CLARC 2010	0.43	91	0.091	CLARC 2010	--	--	0.43	DOE/RL-96-17
88-74-4	2-Nitroaniline	nitroaniline, 2-	160	WAC 173-340-720(4)(b)(iii)	2.40E-06	EPA 2010	0.053	111	0.11	EPA 2010	--	--	0.053	DOE/RL-96-17
88-75-5	2-Nitrophenol	nitrophenol;2-	--	--	5.23E-04	ORNL 2010	0.31	297	0.30	ORNL 2010	--	--	0.31	DOE/RL-96-17
91-94-1	3,3'-Dichlorobenzidine	dichlorobenzidine;3,3'-	0.19	WAC 173-340-720(4)(b)(iii)	1.60E-07	CLARC 2010	0.72	720	0.72	CLARC 2010	--	--	0.72	DOE/RL-96-17
65794-96-9	3+4 Methylphenol (cresol, m+p)	methylphenol,3+4 (cresol, m+p)	--	--	--	--	--	--	--	--	--	--	--	--
99-09-2	3-Nitroaniline	nitroaniline, 3-	4.2	WAC 173-340-720(4)(b)(iii)	3.23E-07	ORNL 2010	0.052	109	0.11	ORNL 2010	--	--	0.052	DOE/RL-96-17
72-54-8	4,4'-DDD (Dichlorodiphenyldichloroethane)	ddd	0.36	WAC 173-340-720(4)(b)(iii)	1.60E-04	CLARC 2010	46	46,000	46	CLARC 2010	--	--	46	DOE/RL-96-17
72-55-9	4,4'-DDE (Dichlorodiphenyldichloroethylene)	dde	0.26	WAC 173-340-720(4)(b)(iii)	8.60E-04	CLARC 2010	86	86,000	86	CLARC 2010	--	--	86	DOE/RL-96-17
50-29-3	4,4'-DDT (Dichlorodiphenyltrichloroethane)	ddt	0.26	WAC 173-340-720(4)(b)(iii)	3.30E-04	CLARC 2010	678	680,000	680	CLARC 2010	--	--	678	DOE/RL-96-17
534-52-1	4,6-Dinitro-2-methylphenol	dinitro-2-methylphenol;4,6-	1.3	WAC 173-340-720(4)(b)(iii)	5.70E-05	EPA 2010	0.60	754	0.75	EPA 2010	--	--	0.60	DOE/RL-96-17
1918-02-1	4-Amino-3,5,6-trichloropicolinic acid	picloram	500	Federal MCLG	2.18E-12	EPA 2010	--	39	0.039	EPA 2010	--	--	0.039	EPA 2010
101-55-3	4-Bromophenylphenyl ether	bromodiphenyl ether;4-	--	--	--	--	--	--	--	--	--	--	--	--
59-50-7	4-Chloro-3-methylphenol	chloro-3-methylphenol;4-	1,600	WAC 173-340-720(4)(b)(iii)	1.0E-04	EPA 2010	--	491.8	0.49	EPA 2010	--	--	0.49	EPA 2010
106-47-8	4-Chloroaniline	chloroaniline;p-	0.22	WAC 173-340-720(4)(b)(iii)	1.40E-05	CLARC 2010	0.073	66	0.066	CLARC 2010	--	--	0.073	DOE/RL-96-17
7005-72-3	4-Chlorophenylphenyl ether	chlorodiphenyl ether;4-	--	--	0.0098	ORNL 2010	--	3,080	3.1	ORNL 2010	--	--	3.1	ORNL 2010
108-10-1	4-Methyl-2-pentanone	methyl isobutyl ketone	640	WAC 173-340-720(4)(b)(iii)	0.0056	EPA 2010	--	13	0.013	EPA 2010	--	--	0.013	EPA 2010
106-44-5	4-Methylphenol (cresol, p-)	cresol;p-	40	WAC 173-340-720(4)(b)(iii)	4.10E-05	EPA 2010	0.43	300	0.30	EPA 2010	--	--	0.43	DOE/RL-96-17
100-01-6	4-Nitroaniline	nitroaniline, 4-	4.4	WAC 173-340-720(4)(b)(iii)	5.20E-08	EPA 2010	0.052	109	0.11	EPA 2010	--	--	0.052	DOE/RL-96-17
100-02-7	4-Nitrophenol	nitrophenol;4-	128	WAC 173-340-720(4)(b)(iii)	1.70E-08	ORNL 2010	0.31	291	0.29	ORNL 2010	--	--	0.31	DOE/RL-96-17
83-32-9	Acenaphthene	acenaphthene	960	WAC 173-340-720(4)(b)(iii)	0.0064	CLARC 2010	6.1	4,900	4.9	CLARC 2010	--	--	6.1	DOE/RL-96-17

Table 4-3. Summary of Input Parameters Used for the Fixed Parameter 3-Phse Partitioning Model Calculation

CAS #	Constituent Name	Alternate Constituent Name	Groundwater CUL for Protectiveness (µg/L)	Groundwater CUL for Protectiveness Source	Henry's Law Constant (Dimensionless)	Henry's Law[b,d] Constant Source	RDR/RAWP K_d (DOE/RL-96-17)[a]	K_{oc} (L/kg)	Organic K_d (L/kg) = K_{oc} x f_{oc}	Organic K_d Source[b]	Inorganic K_d (L/kg)	Inorganic K_d Source[b]	Selected K_d (L/kg)	Source of Selected K_d[c]
208-96-8	Acenaphthylene	acenaphthylene (Not in CLARC database tables; use acenaphthene as surrogate)	--	--	0.0047	ORNL 2010	--	5,030	5.0	ORNL 2010	--	--	5.0	ORNL 2010
67-64-1	Acetone	Acetone	7,200	WAC 173-340-720(4)(b)(iii)	0.0016	CLARC 2010	6.00E-04	0.58	5.80E-04	CLARC 2010	--	--	6.00E-04	DOE/RL-96-17
107-13-1	Acrylonitrile	Acrylonitrile	0.081	WAC 173-340-720(4)(b)(iii)	0.0056	EPA 2010	--	8.5	0.0085	EPA 2010	--	--	0.0085	EPA 2010
309-00-2	Aldrin	aldrin	0.0026	WAC 173-340-720(4)(b)(iii)	0.0070	CLARC 2010	49	49,000	49	CLARC 2010	--	--	49	DOE/RL-96-17
319-84-6	Alpha-BHC	hexachlorocyclohexane;alpha (alpha-BHC, HCH)	0.014	WAC 173-340-720(4)(b)(iii)	4.40E-04	CLARC 2010	1.8	1,800	1.8	CLARC 2010	--	--	1.8	DOE/RL-96-17
5103-71-9	Alpha-Chlordane	Alpha-Chlordane	0.25	WAC 173-340-720(4)(b)(iii)	0.0020	ORNL 2010	51	67,500	68	ORNL 2010	--	--	51	DOE/RL-96-17
7429-90-5	Aluminum	Aluminum (soluble)	50	Federal MCL	0	CLARC 2010	--	--	--	--	1,500	EPA 2010	1,500	EPA 2010
120-12-7	Anthracene	anthracene	4,800	WAC 173-340-720(4)(b)(iii)	0.0027	CLARC 2010	24	23,000	23	CLARC 2010	--	--	24	DOE/RL-96-17
7440-36-0	Antimony	antimony	6.0	Federal MCLG	0	CLARC 2010	3.8	--	--	--	45	CLARC 2010	3.8	DOE/RL-96-17
12674-11-2	Aroclor-1016	aroclor 1016 (PCB)	0.50	Federal MCL	0.0082	EPA 2010	107	110,000	110	CLARC 2010	--	--	107	DOE/RL-96-17
11104-28-2	Aroclor-1221	aroclor 1221 [PCB]	0.044	WAC 173-340-720(4)(b)(iii)	0.030	EPA 2010	10	8,397	8.4	EPA 2010	--	--	10	DOE/RL-96-17
11141-16-5	Aroclor-1232	aroclor 1232 [PCB]	0.044	WAC 173-340-720(4)(b)(iii)	0.030	EPA 2010	10	8,397	8.4	EPA 2010	--	--	10	DOE/RL-96-17
53469-21-9	Aroclor-1242	aroclor 1242 [PCB]	0.044	WAC 173-340-720(4)(b)(iii)	0.0078	EPA 2010	45	78,100	78	EPA 2010	--	--	45	DOE/RL-96-17
12672-29-6	Aroclor-1248	aroclor 1248 [PCB]	0.044	WAC 173-340-720(4)(b)(iii)	0.018	EPA 2010	44	76,530	77	EPA 2010	--	--	44	DOE/RL-96-17
11097-69-1	Aroclor-1254	aroclor 1254 (PCB)	0.044	WAC 173-340-720(4)(b)(iii)	0.012	EPA 2010	76	130,500	131	EPA 2010	--	--	76	DOE/RL-96-17
11096-82-5	Aroclor-1260	aroclor 1260 (PCB)	0.044	WAC 173-340-720(4)(b)(iii)	0.014	EPA 2010	822	820,000	820	CLARC 2010	--	--	822	DOE/RL-96-17
7440-38-2	Arsenic	arsenic, inorganic	0.058	WAC 173-340-720(4)(b)(iii)	0	CLARC 2010	3.0	--	--	--	29	CLARC 2010	29	CLARC 2010
7440-39-3	Barium, compounds	Barium	2,000	Federal MCLG	0	CLARC 2010	25	--	--	--	41	CLARC 2010	25	DOE/RL-96-17
71-43-2	Benzene	Benzene	0.80	WAC 173-340-720(4)(b)(iii)	0.23	CLARC 2010	--	62	0.062	CLARC 2010	--	--	0.062	CLARC 2010
56-55-3	Benzo(a)anthracene	Benzo(a)anthracene	0.12	WAC 173-340-720(4)(b)(iii)	1.40E-04	CLARC 2010	360	360,000	360	CLARC 2010	--	--	360	DOE/RL-96-17
50-32-8	Benzo(a)pyrene	Benzo(a)pyrene	0.012	WAC 173-340-720(4)(b)(iii)	4.60E-05	CLARC 2010	5,500	970,000	970	CLARC 2010	--	--	5,500	DOE/RL-96-17
205-99-2	Benzo(b)fluoranthene	Benzo(b)fluoranthene	0.12	WAC 173-340-720(4)(b)(iii)	0.0046	CLARC 2010	803	1.20E+06	1,200	CLARC 2010	--	--	803	DOE/RL-96-17
191-24-2	Benzo(ghi)perylene	BENZO(g,h,i)PERYLENE (using pyrene as a surrogate)	--	--	1.35E-05	ORNL 2010	--	1.95E+06	1,950	ORNL 2010	--	--	1,950	ORNL 2010
207-08-9	Benzo(k)fluoranthene	Benzo(k)fluoranthene	0.12	WAC 173-340-720(4)(b)(iii)	3.40E-05	CLARC 2010	1,230	1.20E+06	1,200	CLARC 2010	--	--	1,230	DOE/RL-96-17

Table 4-3. Summary of Input Parameters Used for the Fixed Parameter 3-Phse Partitioning Model Calculation

CAS #	Constituent Name	Alternate Constituent Name	Groundwater CUL for Protectiveness (µg/L)	Groundwater CUL for Protectiveness Source	Henry's Law Constant (Dimensionless)	Henry's Law[b,d] Constant Source	RDR/RAWP K_d (DOE/RL-96-17)[a]	K_{oc} (L/kg)	Organic K_d (L/kg) = K_{oc} x f_{oc}	Organic K_d Source[b]	Inorganic K_d (L/kg)	Inorganic K_d Source[b]	Selected K_d (L/kg)	Source of Selected K_d[c]
7440-41-7	Beryllium	beryllium	4.0	Federal MCLG	0	CLARC 2010	790	--	--	--	790	CLARC 2010	790	DOE/RL-96-17
319-85-7	beta-1,2,3,4,5,6-Hexachlorocyclohexane (beta-BHC)	hexachlorocyclohexane;beta-	0.049	WAC 173-340-720(4)(b)(iii)	3.10E-05	CLARC 2010	2.1	2,100	2.1	CLARC 2010	--	--	2.1	DOE/RL-96-17
108-60-1	Bis(2-chloro-1-methylethyl)ether	bis(2-chloro-1-methyl-ethyl)ether	0.63	WAC 173-340-720(4)(b)(iii)	0.0030	EPA 2010	0.039	83	0.083	EPA 2010	--	--	0.039	DOE/RL-96-17
111-91-1	Bis(2-Chloroethoxy)methane	bis(2-chloroethoxyl)methane	48	WAC 173-340-720(4)(b)(iii)	1.60E-04	EPA 2010	0.0028	14	0.014	EPA 2010	--	--	0.0028	DOE/RL-96-17
111-44-4	Bis(2-chloroethyl) ether	bis(2-chloroethyl)ether	0.040	WAC 173-340-720(4)(b)(iii)	7.40E-04	CLARC 2010	0.076	76	0.076	CLARC 2010	--	--	0.076	DOE/RL-96-17
117-81-7	Bis(2-ethylhexyl) phthalate	bis(2-ethylhexyl) phthalate	6.0	Federal MCL	4.20E-06	CLARC 2010	110	110,000	110	CLARC 2010	--	--	110	DOE/RL-96-17
7440-69-9	Bismuth	Bismuth	--	--	--	--	--	--	--	--	--	--	--	--
7440-42-8	Boron	Boron	3,200	WAC 173-340-720(4)(b)(iii)	0	CLARC 2010	--	--	--	--	3.0	EPA 2010	3.0	EPA 2010
24959-67-9	Bromide	Bromide	--	--	--	--	--	--	--	--	--	--	--	--
75-27-4	Bromodichloromethane	bromodichloromethane	0.71	WAC 173-340-720(4)(b)(iii)	0.066	CLARC 2010	--	55	0.055	CLARC 2010	--	--	0.055	CLARC 2010
75-25-2	Bromoform	bromoform	5.5	WAC 173-340-720(4)(b)(iii)	0.022	CLARC 2010	--	130	0.13	CLARC 2010	--	--	0.13	CLARC 2010
74-83-9	Bromomethane	bromomethane	11	WAC 173-340-720(4)(b)(iii)	0.26	CLARC 2010	--	9.0	0.0090	CLARC 2010	--	--	0.0090	CLARC 2010
85-68-7	Butylbenzylphthalate	butyl benzyl phthalate	46	WAC 173-340-720(4)(b)(iii)	5.20E-05	CLARC 2010	14	14,000	14	CLARC 2010	--	--	14	DOE/RL-96-17
7440-43-9	Cadmium	cadmium	5.0	Federal MCLG	0	CLARC 2010	30	--	--	--	75	EPA 2010	30	DOE/RL-96-17
7440-70-2	Calcium	Calcium	--	--	--	--	--	--	--	--	--	--	--	--
86-74-8	Carbazole	carbazole	4.4	WAC 173-340-720(4)(b)(iii)	6.30E-07	CLARC 2010	3.4	3,400	3.4	CLARC 2010	--	--	3.4	DOE/RL-96-17
75-15-0	Carbon disulfide	carbon disulfide	800	WAC 173-340-720(4)(b)(iii)	1.2	CLARC 2010	--	46	0.046	CLARC 2010	--	--	0.046	CLARC 2010
56-23-5	Carbon tetrachloride	carbon tetrachloride	0.34	WAC 173-340-720(4)(b)(iii)	1.3	CLARC 2010	0.15	150	0.15	CLARC 2010	--	--	0.15	DOE/RL-96-17
57-74-9	Chlordane	chlordane	0.25	WAC 173-340-720(4)(b)(iii)	0.0020	CLARC 2010	51	51,000	51	CLARC 2010	--	--	51	DOE/RL-96-17
16887-00-6	Chloride	chloride	250,000	State MCL	0	ORNL 2010	0	--	--	--	--	--	0	DOE/RL-96-17
108-90-7	Chlorobenzene	chlorobenzene	100	Federal MCLG	0.15	CLARC 2010	--	220	0.22	CLARC 2010	--	--	0.22	CLARC 2010
75-00-3	Chloroethane	ethyl chloride	--	--	4.5E-01	EPA 2010	--	22	0.022	ORNL 2010	--	--	0.022	ORNL 2010
67-66-3	Chloroform	chloroform	1.4	WAC 173-340-720(4)(b)(iii)	0.15	CLARC 2010	--	53	0.053	CLARC 2010	--	--	0.053	CLARC 2010
74-87-3	Chloromethane	chloromethane	--	--	3.6E-01	ORNL 2010	--	6.0	0.0060	CLARC 2010	--	--	0.0060	CLARC 2010
7440-47-3	Chromium	chromium (total)	100	Federal MCLG	0	CLARC 2010	200	--	--	--	1,000	CLARC 2010	200	DOE/RL-96-17
218-01-9	chrysene	Chrysene	1.2	WAC 173-340-	0.0039	CLARC 2010	200	400,000	400	CLARC 2010	--	--	200	DOE/RL-

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				720(4)(b)(iii)										96-17
156-59-2	cis-1,2-Dichloroethylene	dichloroethylene;1,2-,cis	70	Federal MCLG	0.17	CLARC 2010	--	36	0.036	CLARC 2010	--	--	0.036	CLARC 2010
10061-01-5	cis-1,3-Dichloropropene	dichloropropene;1,2-,cis	0.44	WAC 173-340-720(4)(b)(iii)	0.73	CLARC 2010	--	27	0.027	CLARC 2010	--	--	0.027	CLARC 2010
7440-48-4	cobalt	Cobalt	4.8	WAC 173-340-720(4)(b)(iii)	0	ORNL 2010	50	--	--	--	45	EPA 2010	50	DOE/RL-96-17
PCB1242/1016	Co-elution of Aroclor 1242 and Aroclor 1016	Co-elution of Aroclor 1242 and Aroclor 1017	--	--	--	--	--	--	--	--	--	--	--	--
7440-50-8	Copper	copper	640	WAC 173-340-720(4)(b)(iii)	0	CLARC 2010	22	--	--	--	22	CLARC 2010	22	DOE/RL-96-17
57-12-5	Cyanide	cyanide	200	Federal MCLG	0.0054	EPA 2010	9.9	--	--	--	9.9	EPA 2010	9.9	DOE/RL-96-17
75-99-0	Dalapon	Dalapon	200	Federal MCLG	2.3E-06	EPA 2010	0.0027	3.231	0.0032	EPA 2010	--	--	0.0027	DOE/RL-96-17
319-86-8	Delta-BHC	hexachlorocyclohexane;delta-	--	--	2.10E-04	ORNL 2010	--	2,810	2.8	ORNL 2010	--	--	2.8	ORNL 2010
53-70-3	Dibenz[a,h]anthracene	Dibenz[a,h]anthracene	0.12	WAC 173-340-720(4)(b)(iii)	6.00E-07	CLARC 2010	1,790	1.80E+06	1,800	CLARC 2010	--	--	1,790	DOE/RL-96-17
132-64-9	Dibenzofuran	dibenzofuran	16	WAC 173-340-720(4)(b)(iii)	0.0087	EPA 2010	11	9,161	9.2	EPA 2010	--	--	11	DOE/RL-96-17
124-48-1	Dibromochloromethane	chlorodibromomethane [dibromochloromethane]	0.52	WAC 173-340-720(4)(b)(iii)	0.032	CLARC 2010	--	63	0.063	CLARC 2010	--	--	0.063	CLARC 2010
1918-00-9	Dicamba	Dicamba	480	WAC 173-340-720(4)(b)(iii)	8.9E-08	EPA 2010	0.029	29.01	0.029	EPA 2010	--	--	0.029	DOE/RL-96-17
120-36-5	Dichloroprop	Dichloroprop	--	--	--	--	0.029	--	--	--	--	--	0.029	DOE/RL-96-17
60-57-1	Dieldrin	dieldrin	0.0055	WAC 173-340-720(4)(b)(iii)	6.20E-04	CLARC 2010	26	26,000	26	CLARC 2010	--	--	26	DOE/RL-96-17
60-29-7	Diethyl ether	ethyl ether	1,600	Method B GW CUL	0.050	EPA 2010	--	9.7	0.0097	EPA 2010	--	--	0.0097	EPA 2010
84-66-2	Diethylphthalate	diethyl phthalate	12,800	WAC 173-340-720(4)(b)(iii)	1.90E-05	CLARC 2010	0.082	82	0.082	CLARC 2010	--	--	0.082	DOE/RL-96-17
131-11-3	Dimethyl phthalate	dimethyl phthalate	--	--	8.05E-06	CLARC 2010	--	32	0.032	ORNL 2010	--	--	0.032	ORNL 2010
84-74-2	Di-n-butylphthalate	di-butyl phthalate	1,600	WAC 173-340-720(4)(b)(iii)	3.90E-08	CLARC 2010	1.6	1,600	1.6	CLARC 2010	--	--	1.6	DOE/RL-96-17
117-84-0	Di-n-octylphthalate	di-n-octyl phthalate	--	--	0.0027	CLARC 2010	--	8.30E+07	83,000	CLARC 2010	--	--	83,000	CLARC 2010
88-85-7	Dinoseb(2-secButyl-4,6-dinitrophenol)	Dinoseb	7.0	Federal MCLG	1.9E-05	EPA 2010	3.5	4294	4.3	EPA 2010	--	--	3.5	DOE/RL-96-17
959-98-8	Endosulfan I	Endosulfan I	96	WAC 173-340-720(4)(b)(iii)	4.60E-04	CLARC 2010	2.0	2,000	2.0	CLARC 2010	--	--	2.0	DOE/RL-96-17
33213-65-9	Endosulfan II	Endosulfan II	96	WAC 173-340-720(4)(b)(iii)	4.60E-04	CLARC 2010	2.0	2,000	2.0	CLARC 2010	--	--	2.0	DOE/RL-96-17
1031-07-8	Endosulfan sulfate	Endosulfan sulfate	--	--	1.33E-05	ORNL 2010	2.0	9,850	9.9	ORNL 2010	--	--	2.0	DOE/RL-96-17
72-20-8	Endrin	endrin	2.0	Federal MCLG	3.10E-04	CLARC 2010	11	11,000	11	CLARC 2010	--	--	11	DOE/RL-96-17

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7421-93-4	Endrin aldehyde	Endrin aldehyde	--	--	1.71E-04	ORNL 2010	11	3,270	3.3	ORNL 2010	--	--	11	DOE/RL-96-17
53494-70-5	Endrin ketone	Endrin ketone	--	--	8.26E-07	ORNL 2010	--	9,720	9.7	ORNL 2010	--	--	9.7	ORNL 2010
141-78-6	Ethyl acetate	Ethyl acetate	7,200	WAC 173-340-720(4)(b)(iii)	0.0055	EPA 2010	--	5.6	0.0056	EPA 2010	--	--	0.0056	EPA 2010
107-21-1	Ethylene glycol	Ethylene glycol	16,000	WAC 173-340-720(4)(b)(iii)	2.45E-06	EPA 2010	0.0010	1.0	0.0010	ORNL 2010	--	--	0.0010	DOE/RL-96-17
100-41-4	Ethylbenzene	ethylbenzene	4.0	WAC 173-340-720(4)(b)(iii)	0.32	CLARC 2010	--	200	0.20	CLARC 2010	--	--	0.20	CLARC 2010
206-44-0	Fluoranthene	fluoranthene	640	WAC 173-340-720(4)(b)(iii)	6.60E-04	CLARC 2010	49	49,000	49	CLARC 2010	--	--	49	DOE/RL-96-17
86-73-7	Fluorene	fluorene	640	WAC 173-340-720(4)(b)(iii)	0.0026	CLARC 2010	7.7	7,700	7.7	CLARC 2010	--	--	7.7	DOE/RL-96-17
16984-48-8	Fluoride	fluoride (using fluorine)	960	WAC 173-340-720(4)(b)(iii)	0	(Conservative assumption)	150	--	--	--	150	EPA 2010	150	DOE/RL-96-17
58-89-9	Gamma-BHC (Lindane)	lindane [gamma-BHC] (see hexachlorocyclohexane)	0.080	WAC 173-340-720(4)(b)(iii)	5.70E-04	CLARC 2010	1.4	1,400	1.4	CLARC 2010	--	--	1.4	DOE/RL-96-17
76-44-8	Heptachlor	heptachlor	0.019	WAC 173-340-720(4)(b)(iii)	0.045	CLARC 2010	9.5	9,500	9.5	CLARC 2010	--	--	9.5	DOE/RL-96-17
1024-57-3	Heptachlor epoxide	Heptachlor epoxide	0.0048	WAC 173-340-720(4)(b)(iii)	3.90E-04	CLARC 2010	83	83,000	83	CLARC 2010	--	--	83	DOE/RL-96-17
118-74-1	Hexachlorobenzene	hexachlorobenzene	0.055	WAC 173-340-720(4)(b)(iii)	0.054	CLARC 2010	80	80,000	80	CLARC 2010	--	--	80	DOE/RL-96-17
87-68-3	Hexachlorobutadiene	hexachlorobutadiene	0.56	WAC 173-340-720(4)(b)(iii)	0.33	CLARC 2010	54	54,000	54	CLARC 2010	--	--	54	DOE/RL-96-17
77-47-4	Hexachlorocyclopentadiene	hexachlorocyclopentadiene	48	WAC 173-340-720(4)(b)(iii)	1.1	CLARC 2010	200	200,000	200	CLARC 2010	--	--	200	DOE/RL-96-17
67-72-1	Hexachloroethane	hexachloroethane	3.1	WAC 173-340-720(4)(b)(iii)	0.16	CLARC 2010	1.8	1,800	1.8	CLARC 2010	--	--	1.8	DOE/RL-96-17
18540-29-9	Hexavalent Chromium	chromium(VI)	48	WAC 173-340-720(4)(b)(iii)	0	CLARC 2010	0	--	--	--	19	CLARC 2010	0	DOE/RL-96-17
193-39-5	Indeno(1,2,3-cd)pyrene	Indeno(1,2,3-cd)pyrene	0.12	WAC 173-340-720(4)(b)(iii)	6.60E-05	CLARC 2010	3,470	3.50E+06	3,500	CLARC 2010	--	--	3,470	DOE/RL-96-17
7439-89-6	Iron	Iron	300	Federal MCL	0	CLARC 2010	--	--	--	--	25	EPA 2010	25	EPA 2010
78-59-1	Isophorone	isophorone	46	WAC 173-340-720(4)(b)(iii)	2.70E-04	CLARC 2010	0.047	47	0.047	CLARC 2010	--	--	0.047	DOE/RL-96-17
7439-92-1	Lead	lead	15	Federal MCL	0	CLARC 2010	30	--	--	--	10,000	CLARC 2010	30	DOE/RL-96-17
7439-93-2	Lithium	Lithium	32	WAC 173-340-720(4)(b)(iii)	0	ORNL 2010	50	--	--	--	300	EPA 2010	50	DOE/RL-96-17
7439-95-4	Magnesium	Magnesium (Not in CLARC database Tables)	--	--	--	--	--	--	--	--	--	--	--	--
7439-96-5	Manganese	manganese	50	Federal MCL	0	CLARC 2010	50	--	--	--	65	EPA 2010	50	DOE/RL-96-17
7487-94-7	Mercury	Mercury (using mercuric chloride)	2.0	Federal MCLG	0.47	CLARC 2010	30	--	--	--	52	CLARC 2010	30	DOE/RL-96-17
72-43-5	Methoxychlor	methoxychlor	40	Federal MCLG	6.50E-04	CLARC 2010	80	80,000	80	CLARC 2010	--	--	80	DOE/RL-96-17

Table 4-3. Summary of Input Parameters Used for the Fixed Parameter 3-Phse Partitioning Model Calculation

CAS #	Constituent Name	Alternate Constituent Name	Groundwater CUL for Protectiveness (µg/L)	Groundwater CUL for Protectiveness Source	Henry's Law Constant (Dimensionless)	Henry's Law[b,d] Constant Source	RDR/RAWP K_d (DOE/RL-96-17)[a]	K_{oc} (L/kg)	Organic K_d (L/kg) = K_{oc} x f_{oc}	Organic K_d Source[b]	Inorganic K_d (L/kg)	Inorganic K_d Source[b]	Selected K_d (L/kg)	Source of Selected K_d[c]
75-09-2	Methylene chloride	methylene chloride	5.0	Federal MCL	0.090	CLARC 2010	0.010	10	0.010	CLARC 2010	--	--	0.010	DOE/RL-96-17
7439-98-7	Molybdenum	molybdenum	80	WAC 173-340-720(4)(b)(iii)	0	CLARC 2010	20	--	--	--	20	EPA 2010	20	DOE/RL-96-17
108-38-3	m-Xylene	Xylene, m-	1,600	WAC 173-340-720(4)(b)(iii)	0.30	CLARC 2010	--	200	0.20	CLARC 2010	--	--	0.20	CLARC 2010
91-20-3	Naphthalene	naphthalene	160	WAC 173-340-720(4)(b)(iii)	0.020	CLARC 2010	1.2	1,200	1.2	CLARC 2010	--	--	1.2	DOE/RL-96-17
7440-02-0	Nickel	nickel soluble salts	100	State MCL	0	CLARC 2010	65	--	--	--	65	CLARC 2010	65	DOE/RL-96-17
14797-55-8	Nitrate	Nitrate	45,000	Federal MCL	0	(Conservative assumption)	0	--	--	--	--	--	0	DOE/RL-96-17
14797-65-0	Nitrite	Nitrite	3,300	Federal MCL	0	(Conservative assumption)	0	--	--	--	--	--	0	DOE/RL-96-17
98-95-3	Nitrobenzene	Nitrobenzene	16	WAC 173-340-720(4)(b)(iii)	9.80E-04	CLARC 2010	0.12	120	0.12	CLARC 2010	--	--	0.12	DOE/RL-96-17
NO3-N	Nitrogen in Nitrate	Nitrogen in Nitrate	10,000	Federal MCL	0	(Conservative assumption)	0	--	--	--	--	--	0	DOE/RL-96-17
NO2-N	Nitrogen in Nitrite	Nitrogen in Nitrite	1,000	Federal MCL	0	(Conservative assumption)	0	--	--	--	--	--	0	DOE/RL-96-17
NO2+NO3-N	Nitrogen in Nitrite and Nitrate	Nitrogen in Nitrite and Nitrate	10,000	Federal MCL	0	(Conservative assumption)	0	--	--	--	--	--	0	DOE/RL-96-17
621-64-7	n-Nitrosodi-n-dipropylamine	nitroso-di-n-propylamine;N-	0.013	WAC 173-340-720(4)(b)(iii)	9.20E-05	CLARC 2010	0.024	24	0.024	CLARC 2010	--	--	0.024	DOE/RL-96-17
86-30-6	n-Nitrosodiphenylamine	nitrosodiphenylamine;N-	18	WAC 173-340-720(4)(b)(iii)	2.10E-04	CLARC 2010	1.3	1,300	1.3	CLARC 2010	--	--	1.3	DOE/RL-96-17
95-47-6	o-Xylene	xylene,o-	1,600	WAC 173-340-720(4)(b)(iii)	2.1E-01	CLARC 2010	--	240	0.24	CLARC 2010	--	--	0.24	CLARC 2010
87-86-5	Pentachlorophenol	pentachlorophenol	0.73	WAC 173-340-720(4)(b)(iii)	1.00E-06	CLARC 2010	0.59	590	0.59	CLARC 2010	--	--	0.59	DOE/RL-96-17
%MOISTURE	Percent moisture (wet sample)	Percent moisture (wet sample)	--	--	--	--	--	--	--	--	--	--	--	--
PH	pH Measurement	pH Measurement	--	--	--	--	--	--	--	--	--	--	--	--
85-01-8	Phenanthrene	Phenanthrene	--	--	0.0017	ORNL 2010	24	16,700	17	ORNL 2010	--	--	24	DOE/RL-96-17
108-95-2	Phenol	Phenol	2,400	WAC 173-340-720(4)(b)(iii)	1.60E-05	CLARC 2010	0.029	29	0.029	CLARC 2010	--	--	0.029	DOE/RL-96-17
14265-44-2	Phosphate	Phosphate	--	--	--	--	--	--	--	--	--	--	--	--
7723-14-0	Phosphorus	phosphorus	0.16	WAC 173-340-720(4)(b)(iii)	0	(Conservative assumption)	--	--	--	--	3.5	EPA 2010	3.5	EPA 2010
PO4-P	Phosphorus in phosphate	Phosphorus in phosphate	--	--	--	--	--	--	--	--	--	--	--	--
7440-09-7	Potassium	Potassium	--	--	--	--	--	--	--	--	--	--	--	--
129-00-0	Pyrene	pyrene	480	WAC 173-340-720(4)(b)(iii)	4.50E-04	CLARC 2010	68	68,000	68	CLARC 2010	--	--	68	DOE/RL-96-17
7782-49-2	Selenium	selenium and compounds	50	Federal MCLG	0	CLARC 2010	5.0	--	--	--	5.0	CLARC 2010	5.0	DOE/RL-96-17
7440-21-3	Silicon	Silicon	--	--	--	--	--	--	--	--	--	--	--	--
7440-22-4	Silver	silver	80	WAC 173-340-	0	CLARC 2010	90	--	--	--	8.3	CLARC	90	DOE/RL-

Table 4-3. Summary of Input Parameters Used for the Fixed Parameter 3-Phse Partitioning Model Calculation

CAS #	Constituent Name	Alternate Constituent Name	Groundwater CUL for Protectiveness (µg/L)	Groundwater CUL for Protectiveness Source	Henry's Law Constant (Dimensionless)	Henry's Law[b,d] Constant Source	RDR/RAWP K_d (DOE/RL-96-17)[a]	K_{oc} (L/kg)	Organic K_d (L/kg) = K_{oc} x f_{oc}	Organic K_d Source[b]	Inorganic K_d (L/kg)	Inorganic K_d Source[b]	Selected K_d (L/kg)	Source of Selected K_d[c]
				720(4)(b)(iii)								2010		96-17
7440-23-5	Sodium	Sodium	--	--	--	--	--	--	--	--	--	--	--	--
7440-24-6	Strontium	strontium	9,600	WAC 173-340-720(4)(b)(iii)	0	CLARC 2010	25	--	--	--	35	EPA 2010	25	DOE/RL-96-17
100-42-5	Styrene	styrene	100	Federal MCLG	0.11	CLARC 2010	--	910	0.91	CLARC 2010	--	--	0.91	CLARC 2010
14808-79-8	Sulfate	sulfate	250,000	Federal MCL	0	(Conservative assumption)	0	--	--	--	--	--	0	DOE/RL-96-17
18496-25-8	Sulfide	Sulfide	--	--	--	--	0	--	--	--	--	--	0	DOE/RL-96-17
127-18-4	Tetrachloroethene	tetrachloroethylene	0.081	WAC 173-340-720(4)(b)(iii)	0.75	CLARC 2010	--	270	0.27	CLARC 2010	--	--	0.27	CLARC 2010
7440-28-0	Thallium	Thallium, soluable salts	0.50	Federal MCLG	0	CLARC 2010	--	--	--	--	71	CLARC 2010	71	EPA 2010
7440-31-5	Tin	tin	9,600	WAC 173-340-720(4)(b)(iii)	0	CLARC 2010	130	--	--	--	250	EPA 2010	130	DOE/RL-96-17
108-88-3	Toluene	Toluene	640	WAC 173-340-720(4)(b)(iii)	0.27	CLARC 2010	0.14	140	0.14	CLARC 2010	--	--	0.14	DOE/RL-96-17
TPH	Total petroleum hydrocarbons	Total petroleum hydrocarbons	500	WAC 173-340-720(3)(b)	--	--	--	--	--	--	--	--	--	--
TPHDIESEL	Total petroleum hydrocarbons - diesel range	Total petroleum hydrocarbons - diesel range	500	WAC 173-340-720(3)(b)	--	--	--	--	--	--	--	--	--	--
TPH/OILH	Total petroleum hydrocarbons - motor oil (high boiling)	Total petroleum hydrocarbons - motor oil (high boiling)	500	WAC 173-340-720(3)(b)	--	--	--	--	--	--	--	--	--	--
8001-35-2	Toxaphene	toxaphene	0.080	WAC 173-340-720(4)(b)(iii)	2.50E-04	CLARC 2010	96	96,000	96	CLARC 2010	--	--	96	DOE/RL-96-17
156-60-5	trans-1,2-Dichloroethylene	dichloroethylene;1,2-,trans	100	Federal MCLG	0.39	CLARC 2010	--	38	0.038	CLARC 2010	--	--	0.038	CLARC 2010
10061-02-6	trans-1,3-Dichloropropene	dichloropropene;1,3-,trans	0.44	WAC 173-340-720(4)(b)(iii)	0.73	CLARC 2010	--	27	0.027	CLARC 2010	--	--	0.027	CLARC 2010
126-73-8	Tributyl phosphate	Tributyl phosphate	9.7	WAC 173-340-720(4)(b)(iii)	5.76E-05	EPA 2010	1.9	2,350	2.4	EPA 2010	--	--	1.9	DOE/RL-96-17
79-01-6	Trichloroethene	trichloroethylene (TCE)	0.49	WAC 173-340-720(4)(b)(iii)	0.42	CLARC 2010	--	94	0.094	CLARC 2010	--	--	0.094	CLARC 2010
75-69-4	Trichloromonofluoromethane	trichlorofluoromethane	2,400	WAC 173-340-720(4)(b)(iii)	4.0	EPA 2010	--	44	0.044	EPA 2010	--	--	0.044	EPA 2010
7440-61-1	Uranium	Uranium	30	Federal MCL	0	CLARC 2010	2.0	--	--	--	450	EPA 2010	2.0	DOE/RL-96-17
7440-62-2	Vanadium	vanadium	80	WAC 173-340-720(4)(b)(iii)	0	CLARC 2010	1,000	--	--	--	1,000	CLARC 2010	1,000	DOE/RL-96-17
75-01-4	Vinyl chloride	vinyl chloride [chloroethene; 1-]	0.061	WAC 173-340-720(4)(b)(iii)	1.1	CLARC 2010	--	19	0.019	CLARC 2010	--	--	0.019	CLARC 2010
1330-20-7	Xylenes (total)	Xylenes (total)	1,600	WAC 173-340-720(4)(b)(iii)	0.28	CLARC 2010	0.23	230	0.23	CLARC 2010	--	--	0.23	DOE/RL-96-17
7440-66-6	Zinc	zinc	4,800	WAC 173-340-720(4)(b)(iii)	0	CLARC 2010	30	--	--	--	62	CLARC 2010	30	DOE/RL-96-17

Notes:

a. Table E-2, DOE/RL-96-17 Rev. 6, Remedial Design Report/Remedial Action Work Plan

Table 4-3. Summary of Input Parameters Used for the Fixed Parameter 3-Phse Partitioning Model Calculation

CAS #	Constituent Name	Alternate Constituent Name	Groundwater CUL for Protectiveness (µg/L)	Groundwater CUL for Protectiveness Source	Henry's Law Constant (Dimensionless)	Henry's Law[b,d] Constant Source	RDR/RAWP K_d (DOE/RL-96-17)[a]	K_{oc} (L/kg)	Organic K_d (L/kg) = K_{oc} x f_{oc}	Organic K_d Source[b]	Inorganic K_d (L/kg)	Inorganic K_d Source[b]	Selected K_d (L/kg)	Source of Selected K_d[c]

(RDR/RAWP) for the 100 Area

b. Chemical-specific parameters (H_{cc}, K_d, and K_{oc}) were obtained from the following sources, in order of preference:

1. Ecology, 2010, Cleanup Levels and Risk Calculations (CLARC) Database, Washington State Department of Ecology, Olympia, Washington, available on the internet at <https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx>.
2. EPA, 2010, "Regional Screening Levels for Chemical Contaminants at Superfund Sites", screening level/preliminary remediation goal website, updated May 27, 2010
3. ORNL, 2010, Risk Assessment Information System, Oak Ridge National Laboratory, Oak Ridge, Tennessee, available on the internet at < http://rais.ornl.gov/ >.

c. The final selected soil/water distribution coefficinets (Kd) were obtained from the RDR/RAWP. If a kd is not identified in the RDR/RAWP, a Kd is calculated using the method described in Section 4 of this environmental calculation.

d. A Henry's Law Constant was not identified in the three tabulated sources for fluoride, nitrate, nitrite, nitrogen as nitrate, nitrogen as nitrite, nitrogen as nitrite and nitrate, phosphorous, and sulfate. A value of zero was use as a conservative assumption for these constituents.

K_d = distribution coefficient

K_{oc} = carbon-water partitioning coefficient

5 Software Applications

All supporting calculations are performed on electronic spreadsheets using Microsoft Excel®.

6 Calculation

Soil concentrations for groundwater protection are calculated using the methodology and equations presented in Section 3 and the assumptions and inputs presented in Section 4. Results of the calculations are discussed in Section 7. The spreadsheet calculations are validated by comparison with hand calculations. The hand calculations are provided in Figure 6-1.

7 Results/Conclusions

Results of the fixed parameter three-phase partitioning model calculations are presented in Table 7-1. The concentrations in soil calculated with this equation are highly conservative values that are calculated with assumptions which potentially overstate the potential impacts to groundwater from contaminants in soil under actual waste site conditions. These conservative assumptions are listed in Section 4, and are discussed in further detail in EPA/540/R-96/018. The dilution factor is also a default value; site-specific values for dilution factors can be calculated according to the variable parameter three-phase partitioning model, as described in WAC-173-340-747(5), "Variable Parameter Three-Phase Partitioning Model." As described in EPA/540/R-96/018, the concentrations in soil calculated with this equation are most useful as screening levels for identifying sites and locations where further evaluation of potential impacts to groundwater from contaminants in soil may be warranted. Therefore, the concentrations in soil calculated with the fixed parameter three-phase model may be useful in identifying contaminants of potential concern which should be evaluated further using more refined modeling within a graded approach.

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Table 7-1. Fixed Parameter 3-Phase Partitioning Model Calculation for Soil Concentrations Protective of Groundwater

CAS #	Constituent Name	Alternate Constituent Name	Soil Concentration Protective of Groundwater (mg/kg)
71-55-6	1,1,1-Trichloroethane	Trichloroethane;1,1,1-	1.6
79-34-5	1,1,2,2-Tetrachloroethane	tetrachloroethane;1,1,2,2-	0.0012
79-00-5	1,1,2-Trichloroethane	trichloroethane;1,1,2-	0.0043
75-34-3	1,1-Dichloroethane	dichloroethane;1,1-	8.7
75-35-4	1,1-Dichloroethene	Dichloroethene;1,1-	0.050
120-82-1	1,2,4-Trichlorobenzene	trichlorobenzene;1,2,4-	0.056
95-50-1	1,2-Dichlorobenzene	dichlorobenzene;1,2- (ortho-Dichlorobenzene)	7.0
107-06-2	1,2-Dichloroethane	dichloroethane;1,2-	0.0023
540-59-0	1,2-Dichloroethene (Total)	dichloroethylene,1,2- (mixed isomers)	0.37
78-87-5	1,2-Dichloropropane	dichloropropane;1,2-	0.0063
541-73-1	1,3-Dichlorobenzene	dichlorobenzene;1,3	--
106-46-7	1,4-Dichlorobenzene	dichlorobenzene;1,4- (para-Dichlorobenzene)	0.13
93-76-5	2,4,5-T(2,4,5-Trichlorophenoxyacetic acid)	Trichlorophenoxyacetic Acid, 2,4,5-	0.80
93-72-1	2,4,5-TP(2-(2,4,5-Trichlorophenoxy)propionic acid)Silvex	Trichlorophenoxypropionic acid, -2,4,5	0.28
95-95-4	2,4,5-Trichlorophenol	Trichlorophenol;2,4,5-	29
88-06-2	2,4,6-Trichlorophenol	Trichlorophenol2,4,6-	0.046
94-82-6	2,4-DB(4-(2,4-Dichlorophenoxy)butanoic acid)	Dichlorophenoxy)butyric Acid, 4-(2,4-	0.77
120-83-2	2,4-Dichlorophenol	dichlorophenol;2,4-	0.17
94-75-7	2,4-Dichlorophenoxyacetic acid	Dichlorophenoxy Acetic Acid, 2,4-	0.32
105-67-9	2,4-Dimethylphenol	dimethylphenol;2,4-	1.3
51-28-5	2,4-Dinitrophenol	dinitrophenol;2,4-	0.13
121-14-2	2,4-Dinitrotoluene	dinitrotoluene;2,4-	0.0017
606-20-2	2,6-Dinitrotoluene	dinitrotoluene;2,6-	0.086
78-93-3	2-Butanone	methyl ethyl ketone (MEK; 2-butanone)	20

Table 7-1. Fixed Parameter 3-Phase Partitioning Model Calculation for Soil Concentrations Protective of Groundwater

CAS #	Constituent Name	Alternate Constituent Name	Soil Concentration Protective of Groundwater (mg/kg)
111-76-2	2-Butoxyethanol	ethylene glycol monobutyl ether (EGBE)	3.2
91-58-7	2-Chloronaphthalene	beta-chloronaphthalene	41
95-57-8	2-Chlorophenol	Chlorophenol;2-	0.47
591-78-6	2-Hexanone	HEXANONE;2- [MBK, methyl butyl ketone]	0.17
91-57-6	2-Methylnaphthalene	methylnapthalene;2-	2.0
95-48-7	2-Methylphenol (cresol, o-)	cresol;o-	5.1
88-74-4	2-Nitroaniline	nitroaniline, 2-	0.81
88-75-5	2-Nitrophenol	nitrophenol;2-	--
91-94-1	3,3'-Dichlorobenzidine	dichlorobenzidine;3,3'-	0.0036
65794-96-9	3+4 Methylphenol (cresol, m+p)	methylphenol,3+4 (cresol, m+p)	--
99-09-2	3-Nitroaniline	nitroaniline, 3-	0.021
72-54-8	4,4'-DDD (Dichlorodiphenyldichloroethane)	ddd	0.34
72-55-9	4,4'-DDE (Dichlorodiphenyldichloroethylene)	dde	0.45
50-29-3	4,4'-DDT (Dichlorodiphenyltrichloroethane)	ddt	3.5
534-52-1	4,6-Dinitro-2-methylphenol	dinitro-2-methylphenol;4,6-	0.021
1918-02-1	4-Amino-3,5,6-trichloropicolinic acid	picloram	2.4
101-55-3	4-Bromophenylphenyl ether	bromodiphenyl ether;4-	--
59-50-7	4-Chloro-3-methylphenol	chloro-3-methylphenol;4-	22
106-47-8	4-Chloroaniline	chloroaniline;p-	0.0012
7005-72-3	4-Chlorophenylphenyl ether	chlorodiphenyl ether;4-	--
108-10-1	4-Methyl-2-pentanone	methyl isobutyl ketone	2.7
106-44-5	4-Methylphenol (cresol, p-)	cresol;p-	0.51
100-01-6	4-Nitroaniline	nitroaniline, 4-	0.022
100-02-7	4-Nitrophenol	nitrophenol;4-	1.3

Table 7-1. Fixed Parameter 3-Phase Partitioning Model Calculation for Soil Concentrations Protective of Groundwater

CAS #	Constituent Name	Alternate Constituent Name	Soil Concentration Protective of Groundwater (mg/kg)
83-32-9	Acenaphthene	acenaphthene	121
208-96-8	Acenaphthylene	acenaphthylene (Not in CLARC database tables; use acenaphthene as surrogate)	--
67-64-1	Acetone	Acetone	29
107-13-1	Acrylonitrile	Acrylonitrile	3.39E-04
309-00-2	Aldrin	aldrin	0.0025
319-84-6	Alpha-BHC	hexachlorocyclohexane;alpha (alpha-BHC, HCH)	5.44E-04
5103-71-9	Alpha-Chlordane	Alpha-Chlordane	0.26
7429-90-5	Aluminum	Aluminum (soluble)	1,500
120-12-7	Anthracene	anthracene	2,275
7440-36-0	Antimony	antimony	0.48
12674-11-2	Aroclor-1016	aroclor 1016 (PCB)	1.1
11104-28-2	Aroclor-1221	aroclor 1221 [PCB]	0.0092
11141-16-5	Aroclor-1232	aroclor 1232 [PCB]	0.0092
53469-21-9	Aroclor-1242	aroclor 1242 [PCB]	0.039
12672-29-6	Aroclor-1248	aroclor 1248 [PCB]	0.039
11097-69-1	Aroclor-1254	aroclor 1254 (PCB)	0.066
11096-82-5	Aroclor-1260	aroclor 1260 (PCB)	0.72
7440-38-2	Arsenic	arsenic, inorganic	0.034
7440-39-3	Barium, compounds	Barium	1,008
71-43-2	Benzene	Benzene	0.0045
56-55-3	Benzo(a)anthracene	Benzo(a)anthracene	0.86
50-32-8	Benzo(a)pyrene	Benzo(a)pyrene	1.3
205-99-2	Benzo(b)fluoranthene	Benzo(b)fluoranthene	1.9

Table 7-1. Fixed Parameter 3-Phase Partitioning Model Calculation for Soil Concentrations Protective of Groundwater

CAS #	Constituent Name	Alternate Constituent Name	Soil Concentration Protective of Groundwater (mg/kg)
191-24-2	Benzo(ghi)perylene	BENZO(g,h,i)PERYLENE (using pyrene as a surrogate)	--
207-08-9	Benzo(k)fluoranthene	Benzo(k)fluoranthene	2.9
7440-41-7	Beryllium	beryllium	63
319-85-7	beta-1,2,3,4,5,6-Hexachlorocyclohexane (beta-BHC)	hexachlorocyclohexane;beta-	0.0023
108-60-1	Bis(2-chloro-1-methylethyl)ether	bis(2-chloro-1-methyl-ethyl)ether	0.0030
111-91-1	Bis(2-Chloroethoxy)methane	bis(2-chloroethoxyl)methane	0.19
111-44-4	Bis(2-chloroethyl) ether	bis(2-chloroethyl)ether	2.20E-04
117-81-7	Bis(2-ethylhexyl) phthalate	bis(2-ethylhexyl) phthalate	13
7440-69-9	Bismuth	Bismuth	--
7440-42-8	Boron	Boron	205
24959-67-9	Bromide	Bromide	--
75-27-4	Bromodichloromethane	bromodichloromethane	0.0037
75-25-2	Bromoform	bromoform	0.037
74-83-9	Bromomethane	bromomethane	0.052
85-68-7	Butylbenzylphthalate	butyl benzyl phthalate	13
7440-43-9	Cadmium	cadmium	3.0
7440-70-2	Calcium	Calcium	--
86-74-8	Carbazole	carbazole	0.31
75-15-0	Carbon disulfide	carbon disulfide	5.6
56-23-5	Carbon tetrachloride	carbon tetrachloride	0.0031
57-74-9	Chlordane	chlordane	0.26
16887-00-6	Chloride	chloride	1,000
108-90-7	Chlorobenzene	chlorobenzene	0.87

Table 7-1. Fixed Parameter 3-Phase Partitioning Model Calculation for Soil Concentrations Protective of Groundwater

CAS #	Constituent Name	Alternate Constituent Name	Soil Concentration Protective of Groundwater (mg/kg)
75-00-3	Chloroethane	ethyl chloride	--
67-66-3	Chloroform	chloroform	0.0075
74-87-3	Chloromethane	chloromethane	--
7440-47-3	Chromium	chromium (total)	400
218-01-9	chrysene	Chrysene	4.8
156-59-2	cis-1,2-Dichloroethylene	dichloroethylene;1,2-,cis	0.35
10061-01-5	cis-1,3-Dichloropropene	dichloropropene;1,2-,cis	0.0025
7440-48-4	cobalt	Cobalt	4.8
PCB1242/1016	Co-elution of Aroclor 1242 and Aroclor 1016	Co-elution of Aroclor 1242 and Aroclor 1017	--
7440-50-8	Copper	copper	284
57-12-5	Cyanide	cyanide	40
75-99-0	Dalapon	Dalapon	0.81
319-86-8	Delta-BHC	hexachlorocyclohexane;delta-	--
53-70-3	Dibenz[a,h]anthracene	Dibenz[a,h]anthracene	4.3
132-64-9	Dibenzofuran	dibenzofuran	3.7
124-48-1	Dibromochloromethane	chlorodibromomethane [dibromochloromethane]	0.0028
1918-00-9	Dicamba	Dicamba	2.2
120-36-5	Dichloroprop	Dichloroprop	--
60-57-1	Dieldrin	dieldrin	0.0028
60-29-7	Diethyl ether	ethyl ether	6.8
84-66-2	Diethylphthalate	diethyl phthalate	72
131-11-3	Dimethyl phthalate	dimethyl phthalate	--
84-74-2	Di-n-butylphthalate	di-butyl phthalate	57
117-84-0	Di-n-octylphthalate	di-n-octyl phthalate	--

Table 7-1. Fixed Parameter 3-Phase Partitioning Model Calculation for Soil Concentrations Protective of Groundwater

CAS #	Constituent Name	Alternate Constituent Name	Soil Concentration Protective of Groundwater (mg/kg)
88-85-7	Dinoseb(2-secButyl-4,6-dinitrophenol)	Dinoseb	0.52
959-98-8	Endosulfan I	Endosulfan I	4.3
33213-65-9	Endosulfan II	Endosulfan II	4.3
1031-07-8	Endosulfan sulfate	Endosulfan sulfate	--
72-20-8	Endrin	endrin	0.44
7421-93-4	Endrin aldehyde	Endrin aldehyde	--
53494-70-5	Endrin ketone	Endrin ketone	--
141-78-6	Ethyl acetate	Ethyl acetate	30
107-21-1	Ethylene glycol	Ethylene glycol	64
100-41-4	Ethylbenzene	ethylbenzene	0.034
206-44-0	Fluoranthene	fluoranthene	631
86-73-7	Fluorene	fluorene	101
16984-48-8	Fluoride	fluoride (using fluorine)	2,884
58-89-9	Gamma-BHC (Lindane)	lindane [gamma-BHC] (see hexachlorocyclohexane)	0.0025
76-44-8	Heptachlor	heptachlor	0.0038
1024-57-3	Heptachlor epoxide	Heptachlor epoxide	0.0080
118-74-1	Hexachlorobenzene	hexachlorobenzene	0.088
87-68-3	Hexachlorobutadiene	hexachlorobutadiene	0.60
77-47-4	Hexachlorocyclopentadiene	hexachlorocyclopentadiene	192
67-72-1	Hexachloroethane	hexachloroethane	0.12
18540-29-9	Hexavalent Chromium	chromium(VI)	0.19
193-39-5	Indeno(1,2,3-cd)pyrene	Indeno(1,2,3-cd)pyrene	8.3
7439-89-6	Iron	Iron	151

Table 7-1. Fixed Parameter 3-Phase Partitioning Model Calculation for Soil Concentrations Protective of Groundwater

CAS #	Constituent Name	Alternate Constituent Name	Soil Concentration Protective of Groundwater (mg/kg)
78-59-1	Isophorone	isophorone	0.23
7439-92-1	Lead	lead	9.1
7439-93-2	Lithium	Lithium	32
7439-95-4	Magnesium	Magnesium (Not in CLARC database Tables)	--
7439-96-5	Manganese	manganese	50
7487-94-7	Mercury	Mercury (using mercuric chloride)	1.2
72-43-5	Methoxychlor	methoxychlor	64
75-09-2	Methylene chloride	methylene chloride	0.022
7439-98-7	Molybdenum	molybdenum	32
108-38-3	m-Xylene	Xylene, m-	14
91-20-3	Naphthalene	naphthalene	4.5
7440-02-0	Nickel	nickel soluble salts	130
14797-55-8	Nitrate	Nitrate	180
14797-65-0	Nitrite	Nitrite	13
98-95-3	Nitrobenzene	Nitrobenzene	0.10
NO3-N	Nitrogen in Nitrate	Nitrogen in Nitrate	40
NO2-N	Nitrogen in Nitrite	Nitrogen in Nitrite	4.0
NO2+NO3-N	Nitrogen in Nitrite and Nitrate	Nitrogen in Nitrite and Nitrate	40
621-64-7	n-Nitrosodi-n-dipropylamine	nitroso-di-n-propylamine;N-	5.60E-05
86-30-6	n-Nitrosodiphenylamine	nitrosodiphenylamine;N-	0.53
95-47-6	o-Xylene	xylene,o-	15
87-86-5	Pentachlorophenol	pentachlorophenol	0.012
%MOISTURE	Percent moisture (wet sample)	Percent moisture (wet sample)	--
PH	pH Measurement	pH Measurement	--

Table 7-1. Fixed Parameter 3-Phase Partitioning Model Calculation for Soil Concentrations Protective of Groundwater

CAS #	Constituent Name	Alternate Constituent Name	Soil Concentration Protective of Groundwater (mg/kg)
85-01-8	Phenanthrene	Phenanthrene	--
108-95-2	Phenol	Phenol	11
14265-44-2	Phosphate	Phosphate	--
7723-14-0	Phosphorus	phosphorus	0.012
PO4-P	Phosphorus in phosphate	Phosphorus in phosphate	--
7440-09-7	Potassium	Potassium	--
129-00-0	Pyrene	pyrene	655
7782-49-2	Selenium	selenium and compounds	5.2
7440-21-3	Silicon	Silicon	--
7440-22-4	Silver	silver	144
7440-23-5	Sodium	Sodium	--
7440-24-6	Strontium	strontium	4,838
100-42-5	Styrene	styrene	2.2
14808-79-8	Sulfate	sulfate	1,000
18496-25-8	Sulfide	Sulfide	--
127-18-4	Tetrachloroethene	tetrachloroethylene	8.67E-04
7440-28-0	Thallium	Thallium, soluable salts	0.71
7440-31-5	Tin	tin	24,998
108-88-3	Toluene	Toluene	4.7
TPH	Total petroleum hydrocarbons	Total petroleum hydrocarbons	--
TPHDIESEL	Total petroleum hydrocarbons - diesel range	Total petroleum hydrocarbons - diesel range	--
TPH/OILH	Total petroleum hydrocarbons - motor oil (high boiling)	Total petroleum hydrocarbons - motor oil (high boiling)	--
8001-35-2	Toxaphene	toxaphene	0.15

Table 7-1. Fixed Parameter 3-Phase Partitioning Model Calculation for Soil Concentrations Protective of Groundwater

CAS #	Constituent Name	Alternate Constituent Name	Soil Concentration Protective of Groundwater (mg/kg)
156-60-5	trans-1,2-Dichloroethylene	dichloroethylene;1,2-,trans	0.54
10061-02-6	trans-1,3-Dichloropropene	dichloropropene;1,3-,trans	0.0025
126-73-8	Tributyl phosphate	Tributyl phosphate	0.41
79-01-6	Trichloroethene	trichloroethylene (TCE)	0.0032
75-69-4	Trichloromonofluoromethane	trichlorofluoromethane	28
7440-61-1	Uranium	Uranium	1.3
7440-62-2	Vanadium	vanadium	1,600
75-01-4	Vinyl chloride	vinyl chloride [chloroethene; 1-]	3.82E-04
1330-20-7	Xylenes (total)	Xylenes (total)	15
7440-66-6	Zinc	zinc	2,899

100+300 area | Soil Concentration protective of Groundwater | IR 11/03/10

1,1-dichloroethane

$C_S = C_w \times UCF \times DF \times [K_d + \frac{Q_w \times Q_a \times H'}{Lab}]$

$K_d = K_{oc} \times f_{oc} = 53 \frac{L}{kg} \times 0.001 = 0.053 \frac{L}{kg}$

$C_S =$

$C_S = 1600 \frac{kg}{L} \times 0.001 \frac{mg}{kg} \times 20 \times [0.053 \frac{L}{kg} + \frac{0.3 + 0.13 + 0.29}{1.5 \frac{L}{kg}}]$

$= 1600 \frac{kg}{L} \times 0.001 \frac{mg}{kg} \times 20 \times [0.2729]$

$= 8.7 \frac{mg}{kg}$

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