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ECF-HANFORD-10-0442
Revision 2

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

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P.O. Box 1600
Richland, Washington 99352

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K. M. Singleton
Washington River Protection Solutions

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ENVIRONMENTAL CALCULATION COVER PAGE

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Project: 100 Areas, 200 Areas, and 300 Area Remedial Investigation/Feasibility Study Reports

Date:

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

(Provides soil concentrations protective of groundwater for target analytes calculatated in accordance with formulas in 2007 MTCA regulations (WAC 173-340-747)

RELEASE / ISSUE

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0	Initial issue	09/29/2012	All
1	Added new analytes; updated arsenic using revised Kd; updated fluoride using revised GW CUL; corrected CAS # Hg, sulfide	03/05/2012	Tables 4-1, 4-3, and 7-1 ☒
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ENVIRONMENTAL CALCULATION COVER PAGE (CONTINUED)

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Contents

1 Purpose **1**

2 Background **1**

3 Methodology **2**

3.1 Equation 747-1—Fixed Parameter Three-Phase Partitioning Model 2

3.2 Equation 747-2—Distribution Coefficient 3

4 Assumptions and Inputs **3**

5 Software Applications **4**

6 Calculation **4**

7 Results/Conclusions **5**

8 References **6**

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
RCRA	*Resource Conservation and Recovery Act of 1976*
RFI/CMS	RCRA Facility Investigation/ Corrective Measures Study
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 2007 Washington Administrative Code (WAC) Section 173-340-747, "Deriving Soil Concentrations for Ground Water Protection." Under the 2007 WAC 173-340-747 the fixed parameter three-phase equation is used to derive soil concentrations protective of groundwater. 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 preliminary remediation goals (PRGs) in the Remedial Investigation/Feasibility Study (RI/FS) process under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Resource Conservation and Recovery Act (RCRA) Facility Investigation/ Corrective Measures Study (RFI/CMS) process under RCRA. 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 and RFI/CMS processes. State of Washington requirements in the 2007 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.

The 2007 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 the 2007 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.

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 2007 WAC 173-340-747 to derive soil concentrations for groundwater protection.
2. Identify the input parameters within Equation 747-1 from 2007 WAC 173-340-747(4) to calculate soil concentrations for groundwater protection.
3. Identify the lower of the Federal or State MCL or the Standard Method B groundwater cleanup level calculated in accordance with 2007 WAC 173-340-720, "Ground Water Cleanup Standards," for each analyte.
4. For inorganic contaminants, identify the chemical-specific K_d values.
5. For organic contaminants, identify the chemical-specific soil organic carbon-water partitioning coefficients for use as an input parameter within Equation 747-2.
6. Identify the chemical-specific Henry's law constant for each analyte.
7. Calculate soil concentrations for groundwater protection.
8. 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_d values 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 the 2007 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_d values are calculated using Equation 747-2 from the 2007 WAC 173-340-747 as follows.

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

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.
- No chemical or biological degradation occurs 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.
- No attenuation (i.e., adsorption or degradation) of contaminants occurs 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 (θ_a), water-filled soil porosity (θ_w), dry bulk density (ρ_b), and the dilution factor (DF) are default values defined in Equation 747-1 and are listed in Table 3-1.
- The groundwater cleanup level for protectiveness (C_w) used in Equation 747-1 is the lower of the Federal or State MCL or the 2007 WAC 173-340-720 Standard Method B groundwater cleanup level (Method A groundwater cleanup levels are used for total petroleum hydrocarbons [diesel range, gasoline range, and motor oil]).
- 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 the 2007 WAC 173-340-720 as documented in ECF-100NPL-10-0462, *Calculation of Standard Method B Groundwater Cleanup Levels for Potable Groundwater for the 100 Areas and 300 Area Remedial Investigation/Feasibility Study Reports*. These values are listed in Table 4-1.
- Chemical-specific values for soil organic carbon-water partitioning coefficient (K_{oc}), distribution coefficient (K_d), and Henry's law constant (H_{cc}) are obtained from the following sources, in order of preference. The K_{oc} and K_d values are listed in Table 4-2; the H_{cc} values are listed in Table 4-3.
    - Washington State Department of Ecology's "Cleanup Levels and Risk Calculation (CLARC)" online data tables (Ecology, 2014) (https://fortress.wa.gov/ecy/clarc/CLARCOverview.aspx)
    - EPA's "Regional Screening Levels for Chemical Contaminants at Superfund Sites" web site (EPA, 2012) (http://www.epa.gov/reg3hscd/risk/human/rb-concentration_table/)
    - Oak Ridge National Laboratory's (ORNL) Risk Assessment Information System (RAIS) (ORNL, 2014) (http://rais.ornl.gov/cgi-bin/tools/TOX_search?select=chem)
- The K_d value for hexavalent chromium is identified in ECF-HANFORD-11-0165, *Evaluation of Hexavalent Chromium Leach Test Data Conducted on Vadose Zone Sediment Samples from the 100 Area*. This value is listed in Table 4-2.
- For consistency with the assumptions used for the River Corridor RI/FS process, calculations of soil concentrations protective of groundwater for chloride, sulfate, nitrate, nitrite, nitrogen in nitrate, nitrogen in nitrite, and nitrogen in nitrite and nitrate assume a value of zero for the k_d and Henry's Law constant.
- Soil concentrations protective of groundwater for total petroleum hydrocarbons are default residual saturation screening levels specified in the 2007 WAC 173-340-747(10)(d), Table 747-5, "Residual Saturation Screening Levels for TPH" rather than values calculated using the fixed parameter three-phase model. These values are listed in Table 7-1.

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

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® Microsoft Excel is a registered product of the Microsoft Corporation.

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 the 2007 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.

8 References

40 CFR 141, "National Primary Drinking Water Regulations," *Code of Federal Regulations*. Available at: http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&tpl=/ecfrbrowse/Title40/40cfr141_main_02.tpl*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*, 42 USC 9601, et seq. Available at: http://uscode.house.gov/download/pls/42C103.txt.

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Resource Conservation and Recovery Act of 1976, 42 USC 6901, et seq.

Safe Drinking Water Act of 1974, 42 USC 300, et seq. Available at: http://www.epa.gov/ogwdw/sdwa/.

WAC 173-340, "Model Toxics Control Act—Cleanup," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-340.

173-340-720, "Ground Water Cleanup Standards"

173-340-747, "Deriving Soil Concentrations for Ground Water Protection"

173-340-900, "Tables"

WAC 246-290-310, "Group A Public Water Supplies," "Maximum Contaminant Levels (MCLs) and Maximum Residual Disinfectant Levels (MRDLs)," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=246-290-310.

FIGURES

ECF-Hanford-10-0442
1/19/2015
D. Evans

1,1,1-Trichloroethane (71-55-6)

$k_d = K_{oc} \times f_{oc}$ [Eq. 747-2]
$= 135\ L/kg \times 0.001\ g/g$
$= 0.14\ L/kg$ ✓

$C_s = C_w (OCF) DF \left[k_d + \frac{(\theta_w + \theta_a H_{cc})}{\rho_b} \right]$ [Eq. 747-1]
$= 200\ mg/L \times 0.001\ mg/mg \times 20 \left[0.14\ L/kg + \frac{0.3 + 0.13 \times 0.71}{1.5\ kg/L} \right]$
$= 200\ mg/L \times 0.001\ mg/mg \times 20 \left[0.40\ L/kg \right]$
$= 1.6\ mg/kg$ ✓

Figure 6-1. Hand Calculation

TABLES

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

Parameter	Symbol	Value	Units	Source
Contaminant concentration in soil	C_s	Calculated	mg/kg	2007 WAC 173-340-747(4) Equation 747-1
Contaminant concentration in groundwater	C_w	Chemical-specific	µg/L	See Table 4-1
Dilution factor	DF	20	dimensionless	2007 WAC 173-340-747(4) Equation 747-1
Soil fraction of organic carbon	f_{oc}	0.001	g/g	2007 WAC 173-340-747(4) Equation 747-2
Henry's law constant	H_{cc}	Chemical-specific	dimensionless	See Table 4-3
Distribution coefficient	K_d	Chemical-specific	L/kg	See Table 4-2
Soil organic carbon-water partitioning coefficient	K_{oc}	Chemical-specific	ml/g	See Table 4-2
Dry soil bulk density	ρ_b	1.5	kg/L	2007 WAC 173-340-747(4) Equation 747-1
Unit conversion factor	UCF	0.001	mg/µg	2007 WAC 173-340-747(4) Equation 747-1
Air-filled soil porosity	θ_a	0.13	ml air/ml soil	2007 WAC 173-340-747(4) Equation 747-1
Water-filled soil porosity	θ_w	0.3	ml water/ml soil	2007 WAC 173-340-747(4) Equation 747-1

Notes:

2007 WAC 173-340-747(4), "Model Toxics Control Act—Cleanup, Deriving Soil Concentrations for Groundwater Protection, Fixed Parameter Three-Phase Partitioning Model."

Table 4-1. Nonradiological Analyte Groundwater Action Levels

CAS #	Analyte Name	Units	2007 WAC 173-340-720[a,b]		National Primary Dinking Water Regulations[c,d,e] (40 CFR 141)		WAC 246-290-310[f]	Groundwater Action Level	Groundwater Action Level Basis
			Method B Groundwater Cleanup Level	Method A Groundwater Cleanup Level	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	µg/L	16,000	--	200	200	--	200	Primary Federal MCL
79-34-5	1,1,2,2-Tetrachloroethane	µg/L	0.22	--	--	--	--	0.22	Method B Groundwater Cleanup Level
79-00-5	1,1,2-Trichloroethane	µg/L	0.77	--	3.0	5.0	--	0.77	Method B Groundwater Cleanup Level
75-34-3	1,1-Dichloroethane	µg/L	7.68	--	--	--	--	7.68	Method B Groundwater Cleanup Level
75-35-4	1,1-Dichloroethene	µg/L	400	--	7.0	7.0	--	7.0	Primary Federal MCL
120-82-1	1,2,4-Trichlorobenzene	µg/L	1.5	--	70	70	--	1.5	Method B Groundwater Cleanup Level
95-50-1	1,2-Dichlorobenzene	µg/L	720	--	600	600	--	600	Primary Federal MCL
107-06-2	1,2-Dichloroethane	µg/L	0.48	--	--	5.0	--	0.48	Method B Groundwater Cleanup Level
540-59-0	1,2-Dichloroethene (Total)	µg/L	72	--	--	--	--	72	Method B Groundwater Cleanup Level
78-87-5	1,2-Dichloropropane	µg/L	1.2	--	--	5.0	--	1.2	Method B Groundwater Cleanup Level
541-73-1	1,3-Dichlorobenzene	µg/L	--	--	--	--	--	--	--
106-46-7	1,4-Dichlorobenzene	µg/L	8.1	--	75	75	--	8.1	Method B Groundwater Cleanup Level
93-65-2	2-(2-methyl-4-chlorophenoxy) propionic acid	µg/L	16	--	--	--	--	16	Method B Groundwater Cleanup Level
93-76-5	2,4,5-T(2,4,5-Trichlorophenoxyacetic acid)	µg/L	160	--	--	--	--	160	Method B Groundwater Cleanup Level
93-72-1	2,4,5-TP(2-(2,4,5-Trichlorophenoxy)propionic acid)Silvex	µg/L	128	--	50	50	--	50	Primary Federal MCL
95-95-4	2,4,5-Trichlorophenol	µg/L	800	--	--	--	--	800	Method B Groundwater Cleanup Level
88-06-2	2,4,6-Trichlorophenol	µg/L	4.0	--	--	--	--	4.0	Method B Groundwater Cleanup Level
94-82-6	2,4-DB(4-(2,4-Dichlorophenoxy)butanoic acid)	µg/L	128	--	--	--	--	128	Method B Groundwater Cleanup Level
120-83-2	2,4-Dichlorophenol	µg/L	24	--	--	--	--	24	Method B Groundwater Cleanup Level
94-75-7	2,4-Dichlorophenoxyacetic acid	µg/L	160	--	70	70	--	70	Primary Federal MCL
105-67-9	2,4-Dimethylphenol	µg/L	160	--	--	--	--	160	Method B Groundwater Cleanup Level
51-28-5	2,4-Dinitrophenol	µg/L	32	--	--	--	--	32	Method B Groundwater Cleanup Level
121-14-2	2,4-Dinitrotoluene	µg/L	0.28	--	--	--	--	0.28	Method B Groundwater Cleanup Level
606-20-2	2,6-Dinitrotoluene	µg/L	16	--	--	--	--	16	Method B Groundwater Cleanup Level
78-93-3	2-Butanone	µg/L	4,800	--	--	--	--	4,800	Method B Groundwater Cleanup Level
111-76-2	2-Butoxyethanol	µg/L	800	--	--	--	--	800	Method B Groundwater Cleanup Level
91-58-7	2-Chloronaphthalene	µg/L	640	--	--	--	--	640	Method B Groundwater Cleanup Level
95-57-8	2-Chlorophenol	µg/L	40	--	--	--	--	40	Method B Groundwater Cleanup Level
591-78-6	2-Hexanone	µg/L	40	--	--	--	--	40	Method B Groundwater Cleanup Level
91-57-6	2-Methylnaphthalene	µg/L	32	--	--	--	--	32	Method B Groundwater Cleanup Level
95-48-7	2-Methylphenol (cresol, o-)	µg/L	400	--	--	--	--	400	Method B Groundwater Cleanup Level
88-74-4	2-Nitroaniline	µg/L	160	--	--	--	--	160	Method B Groundwater Cleanup Level
88-75-5	2-Nitrophenol	µg/L	--	--	--	--	--	--	--
91-94-1	3,3'-Dichlorobenzidine	µg/L	0.19	--	--	--	--	0.19	Method B Groundwater Cleanup Level
65794-96-9	3+4 Methylphenol (cresol, m+p)	µg/L	--	--	--	--	--	--	--
108-39-4	3-Methylphenol (cresol, m-)	µg/L	400	--	--	--	--	400	Method B Groundwater Cleanup Level
99-09-2	3-Nitroaniline	µg/L	4.2	--	--	--	--	4.2	Method B Groundwater Cleanup Level
72-54-8	4,4'-DDD (Dichlorodiphenyldichloroethane)	µg/L	0.36	--	--	--	--	0.36	Method B Groundwater Cleanup Level
72-55-9	4,4'-DDE (Dichlorodiphenyldichloroethylene)	µg/L	0.26	--	--	--	--	0.26	Method B Groundwater Cleanup Level
50-29-3	4,4'-DDT (Dichlorodiphenyltrichloroethane)	µg/L	0.26	--	--	--	--	0.26	Method B Groundwater Cleanup Level
534-52-1	4,6-Dinitro-2-methylphenol	µg/L	1.3	--	--	--	--	1.3	Method B Groundwater Cleanup Level
1918-02-1	4-Amino-3,5,6-trichloropicolinic acid	µg/L	1,120	--	500	500	500	500	Primary Federal MCL
101-55-3	4-Bromophenylphenyl ether	µg/L	--	--	--	--	--	--	--
59-50-7	4-Chloro-3-methylphenol	µg/L	1,600	--	--	--	--	1,600	Method B Groundwater Cleanup Level
106-47-8	4-Chloroaniline	µg/L	0.22	--	--	--	--	0.22	Method B Groundwater Cleanup Level
7005-72-3	4-Chlorophenylphenyl ether	µg/L	--	--	--	--	--	--	--
108-10-1	4-Methyl-2-pentanone	µg/L	640	--	--	--	--	640	Method B Groundwater Cleanup Level
106-44-5	4-Methylphenol (cresol, p-)	µg/L	800	--	--	--	--	800	Method B Groundwater Cleanup Level
100-01-6	4-Nitroaniline	µg/L	4.4	--	--	--	--	4.4	Method B Groundwater Cleanup Level
100-02-7	4-Nitrophenol	µg/L	--	--	--	--	--	--	--
83-32-9	Acenaphthene	µg/L	960	--	--	--	--	960	Method B Groundwater Cleanup Level
208-96-8	Acenaphthylene	µg/L	--	--	--	--	--	--	--
67-64-1	Acetone	µg/L	7,200	--	--	--	--	7,200	Method B Groundwater Cleanup Level
79-06-1	Acrylamide	µg/L	0.058	--	--	1,000	--	0.058	Method B Groundwater Cleanup Level
107-13-1	Acrylonitrile	µg/L	0.081	--	--	--	--	0.081	Method B Groundwater Cleanup Level
309-00-2	Aldrin	µg/L	0.0026	--	--	--	--	0.0026	Method B Groundwater Cleanup Level
319-84-6	Alpha-BHC	µg/L	0.014	--	--	--	--	0.014	Method B Groundwater Cleanup Level

Table 4-1. Nonradiological Analyte Groundwater Action Levels

CAS #	Analyte Name	Units	2007 WAC 173-340-720[a,b]		National Primary Dinking Water Regulations[c,d,e] (40 CFR 141)		WAC 246-290-310[f]	Groundwater Action Level	Groundwater Action Level Basis
			Method B Groundwater Cleanup Level	Method A Groundwater Cleanup Level	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)		
5103-71-9	Alpha-Chlordane	µg/L	0.25	--	--	2.0	--	0.25	Method B Groundwater Cleanup Level
7429-90-5	Aluminum	µg/L	16,000	--	--	--	--	16000	Method B Groundwater Cleanup Level
120-12-7	Anthracene	µg/L	4,800	--	--	--	--	4,800	Method B Groundwater Cleanup Level
7440-36-0	Antimony	µg/L	6.4	--	6.0	6.0	6.0	6.0	Primary Federal MCL
12674-11-2	Aroclor-1016	µg/L	1.1	--	--	0.50	--	0.50	Primary Federal MCL
11104-28-2	Aroclor-1221	µg/L	0.022	--	--	0.50	--	0.022	Method B Groundwater Cleanup Level
11141-16-5	Aroclor-1232	µg/L	0.022	--	--	0.50	--	0.022	Method B Groundwater Cleanup Level
53469-21-9	Aroclor-1242	µg/L	0.044	--	--	0.50	--	0.044	Method B Groundwater Cleanup Level
12672-29-6	Aroclor-1248	µg/L	0.044	--	--	0.50	--	0.044	Method B Groundwater Cleanup Level
11097-69-1	Aroclor-1254	µg/L	0.044	--	--	0.50	--	0.044	Method B Groundwater Cleanup Level
11096-82-5	Aroclor-1260	µg/L	0.044	--	--	0.50	--	0.044	Method B Groundwater Cleanup Level
7440-38-2	Arsenic	µg/L	0.058	--	--	10	10	0.058	Method B Groundwater Cleanup Level
7440-39-3	Barium	µg/L	3,200	--	2,000	2,000	2,000	2,000	Primary Federal MCL
71-43-2	Benzene	µg/L	0.80	--	--	5.0	--	0.80	Method B Groundwater Cleanup Level
56-55-3	Benzo(a)anthracene	µg/L	0.12	--	--	--	--	0.12	Method B Groundwater Cleanup Level
50-32-8	Benzo(a)pyrene	µg/L	0.012	--	--	0.20	--	0.012	Method B Groundwater Cleanup Level
205-99-2	Benzo(b)fluoranthene	µg/L	0.12	--	--	--	--	0.12	Method B Groundwater Cleanup Level
191-24-2	Benzo(ghi)perylene	µg/L	--	--	--	--	--	--	--
207-08-9	Benzo(k)fluoranthene	µg/L	0.12	--	--	--	--	0.12	Method B Groundwater Cleanup Level
7440-41-7	Beryllium	µg/L	32	--	4.0	4.0	4.0	4.0	Primary Federal MCL
319-85-7	beta-1,2,3,4,5,6-Hexachlorocyclohexane (beta-BHC)	µg/L	0.049	--	--	--	--	0.049	Method B Groundwater Cleanup Level
108-60-1	Bis(2-chloro-1-methylethyl)ether	µg/L	0.63	--	--	--	--	0.63	Method B Groundwater Cleanup Level
111-91-1	Bis(2-Chloroethoxy)methane	µg/L	48	--	--	--	--	48	Method B Groundwater Cleanup Level
111-44-4	Bis(2-chloroethyl) ether	µg/L	0.040	--	--	--	--	0.040	Method B Groundwater Cleanup Level
117-81-7	Bis(2-ethylhexyl) phthalate	µg/L	6.3	--	--	6.0	--	6.0	Primary Federal MCL
7440-69-9	Bismuth	µg/L	--	--	--	--	--	--	--
7440-42-8	Boron	µg/L	3,200	--	--	--	--	3,200	Method B Groundwater Cleanup Level
24959-67-9	Bromide	µg/L	--	--	--	--	--	--	--
75-27-4	Bromodichloromethane	µg/L	0.71	--	--	80	--	0.71	Method B Groundwater Cleanup Level
75-25-2	Bromoform	µg/L	5.5	--	80	--	--	5.5	Method B Groundwater Cleanup Level
74-83-9	Bromomethane	µg/L	11	--	--	--	--	11	Method B Groundwater Cleanup Level
85-68-7	Butylbenzylphthalate	µg/L	46	--	--	--	--	46	Method B Groundwater Cleanup Level
7440-43-9	Cadmium	µg/L	8.0	--	5.0	5.0	5.0	5.0	Primary Federal MCL
7440-70-2	Calcium	µg/L	--	--	--	--	--	--	--
86-74-8	Carbazole	µg/L	4.4	--	--	--	--	4.4	Method B Groundwater Cleanup Level
75-15-0	Carbon disulfide	µg/L	800	--	--	--	--	800	Method B Groundwater Cleanup Level
56-23-5	Carbon tetrachloride	µg/L	0.63	--	--	5.0	--	0.63	Method B Groundwater Cleanup Level
57-74-9	Chlordane	µg/L	0.25	--	--	2.0	--	0.25	Method B Groundwater Cleanup Level
16887-00-6	Chloride	µg/L	--	--	--	250,000	250,000	250,000	Secondary Federal MCL
108-90-7	Chlorobenzene	µg/L	160	--	100	100	--	100	Primary Federal MCL
75-00-3	Chloroethane	µg/L	--	--	--	--	--	--	--
67-66-3	Chloroform	µg/L	1.4	--	--	80	--	1.4	Method B Groundwater Cleanup Level
74-87-3	Chloromethane	µg/L	--	--	--	--	--	--	--
7440-47-3	Chromium	µg/L	24,000	--	100	100	100	100	Primary Federal MCL
218-01-9	chrysene	µg/L	1.2	--	--	--	--	1.2	Method B Groundwater Cleanup Level
156-59-2	cis-1,2-Dichloroethylene	µg/L	16	--	70	70	--	16	Method B Groundwater Cleanup Level
10061-01-5	cis-1,3-Dichloropropene	µg/L	0.44	--	--	--	--	0.44	Method B Groundwater Cleanup Level
7440-48-4	cobalt	µg/L	4.8	--	--	--	--	4.8	Method B Groundwater Cleanup Level
PCB1242/1016	Co-elution of Aroclor 1242 and Aroclor 1016	µg/L	--	--	--	--	--	--	--
7440-50-8	Copper	µg/L	640	--	1,300	1,300	1,300	640	Method B Groundwater Cleanup Level
57-12-5	Cyanide	µg/L	4.8	--	200	200	200	5	Method B Groundwater Cleanup Level
75-99-0	Dalapon	µg/L	240	--	200	200	--	200	Primary Federal MCL
319-86-8	Delta-BHC	µg/L	--	--	--	--	--	--	--
53-70-3	Dibenz[a,h]anthracene	µg/L	0.12	--	--	--	--	0.12	Method B Groundwater Cleanup Level
132-64-9	Dibenzofuran	µg/L	16	--	--	--	--	16	Method B Groundwater Cleanup Level
124-48-1	Dibromochloromethane	µg/L	0.52	--	60	60	--	0.52	Method B Groundwater Cleanup Level
1918-00-9	Dicamba	µg/L	480	--	--	--	--	480	Method B Groundwater Cleanup Level

Table 4-1. Nonradiological Analyte Groundwater Action Levels

CAS #	Analyte Name	Units	2007 WAC 173-340-720[a,b]		National Primary Dinking Water Regulations[1,4,5] (40 CFR 141)		WAC 246-290-310[7]	Groundwater Action Level	Groundwater Action Level Basis
			Method B Groundwater Cleanup Level	Method A Groundwater Cleanup Level	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)		
120-36-5	Dichloroprop	µg/L	--	--	--	--	--	--	--
60-57-1	Dieldrin	µg/L	0.0055	--	--	--	--	0.0055	Method B Groundwater Cleanup Level
60-29-7	Diethyl ether	µg/L	1,600	--	--	--	--	1,600	Method B Groundwater Cleanup Level
84-66-2	Diethylphthalate	µg/L	12,800	--	--	--	--	12,800	Method B Groundwater Cleanup Level
131-11-3	Dimethyl phthalate	µg/L	--	--	--	--	--	--	--
84-74-2	Di-n-butylphthalate	µg/L	1,600	--	--	--	--	1,600	Method B Groundwater Cleanup Level
117-84-0	Di-n-octylphthalate	µg/L	192	--	--	--	--	192	Method B Groundwater Cleanup Level
88-85-7	Dinoseb(2-secButyl-4,6-dinitrophenol)	µg/L	16	--	7.0	7.0	--	7.0	Primary Federal MCL
959-98-8	Endosulfan I	µg/L	96	--	--	--	--	96	Method B Groundwater Cleanup Level
33213-65-9	Endosulfan II	µg/L	96	--	--	--	--	96	Method B Groundwater Cleanup Level
1031-07-8	Endosulfan sulfate	µg/L	--	--	--	--	--	--	--
72-20-8	Endrin	µg/L	4.8	--	2.0	2.0	--	2.0	Primary Federal MCL
7421-93-4	Endrin aldehyde	µg/L	--	--	--	--	--	--	--
53494-70-5	Endrin ketone	µg/L	--	--	--	--	--	--	--
141-78-6	Ethyl acetate	µg/L	7,200	--	--	--	--	7,200	Method B Groundwater Cleanup Level
100-41-4	Ethylbenzene	µg/L	4.0	--	700	700	--	4.0	Method B Groundwater Cleanup Level
107-21-1	Ethylene glycol	µg/L	16,000	--	--	--	--	16,000	Method B Groundwater Cleanup Level
206-44-0	Fluoranthene	µg/L	640	--	--	--	--	640	Method B Groundwater Cleanup Level
86-73-7	Fluorene	µg/L	320	--	--	--	--	320	Method B Groundwater Cleanup Level
16984-48-8	Fluoride	µg/L	960	--	4,000	4,000	4,000	960	Method B Groundwater Cleanup Level
58-89-9	Gamma-BHC (Lindane)	µg/L	0.080	--	0.20	0.20	--	0.080	Method B Groundwater Cleanup Level
76-44-8	Heptachlor	µg/L	0.019	--	--	0.40	--	0.019	Method B Groundwater Cleanup Level
1024-57-3	Heptachlor epoxide	µg/L	0.0048	--	--	0.20	--	0.0048	Method B Groundwater Cleanup Level
118-74-1	Hexachlorobenzene	µg/L	0.055	--	--	1.0	--	0.055	Method B Groundwater Cleanup Level
87-68-3	Hexachlorobutadiene	µg/L	0.56	--	--	--	--	0.56	Method B Groundwater Cleanup Level
77-47-4	Hexachlorocyclopentadiene	µg/L	48	--	50	50	--	48	Method B Groundwater Cleanup Level
67-72-1	Hexachloroethane	µg/L	1.1	--	--	--	--	1.1	Method B Groundwater Cleanup Level
18540-29-9	Hexavalent Chromium	µg/L	48	--	--	--	--	48	Method B Groundwater Cleanup Level
193-39-5	Indeno(1,2,3-cd)pyrene	µg/L	0.12	--	--	--	--	0.12	Method B Groundwater Cleanup Level
7439-89-6	Iron	µg/L	11,200	--	--	--	--	11200	Method B Groundwater Cleanup Level
78-59-1	Isophorone	µg/L	46	--	--	--	--	46	Method B Groundwater Cleanup Level
98-82-8	Isopropylbenzene	µg/L	800	--	--	--	--	800	Method B Groundwater Cleanup Level
7439-92-1	Lead	µg/L	--	15	--	15	15	15	Primary Federal MCL
7439-93-2	Lithium	µg/L	32	--	--	--	--	32	Method B Groundwater Cleanup Level
7439-95-4	Magnesium	µg/L	--	--	--	--	--	--	--
7439-96-5	Manganese	µg/L	384	--	--	--	--	384	Method B Groundwater Cleanup Level
7439-97-6	Mercury	µg/L	4.8	--	2.0	2.0	2.0	2.0	Primary Federal MCL
67-56-1	Methanol	µg/L	4,000	--	--	--	--	4,000	Method B Groundwater Cleanup Level
72-43-5	Methoxychlor	µg/L	80	--	40	40	--	40	Primary Federal MCL
75-09-2	Methylene chloride	µg/L	21.9	--	--	5.0	--	5.0	Primary Federal MCL
7439-98-7	Molybdenum	µg/L	80	--	--	--	--	80	Method B Groundwater Cleanup Level
108-38-3	m-Xylene	µg/L	1,600	--	--	--	--	1,600	Method B Groundwater Cleanup Level
91-20-3	Naphthalene	µg/L	160	--	--	--	--	160	Method B Groundwater Cleanup Level
7440-02-0	Nickel	µg/L	320	--	--	--	100	100	State MCL
14797-55-8	Nitrate	µg/L	113,600	--	45,000	45,000	45,000	45,000	Primary Federal MCL
14797-65-0	Nitrite	µg/L	4,800	--	3,300	3,300	3,300	3,300	Primary Federal MCL
98-95-3	Nitrobenzene	µg/L	16	--	--	--	--	16	Method B Groundwater Cleanup Level
NO3-N	Nitrogen in Nitrate	µg/L	25,600	--	10,000	10,000	10,000	10,000	Primary Federal MCL
NO2-N	Nitrogen in Nitrite	µg/L	1,600	--	1,000	1,000	1,000	1,000	Primary Federal MCL
NO2+NO3-N	Nitrogen in Nitrite and Nitrate	µg/L	25,600	--	10,000	10,000	10,000	10,000	Primary Federal MCL
621-64-7	n-Nitrosodi-n-dipropylamine	µg/L	0.013	--	--	--	--	0.013	Method B Groundwater Cleanup Level
86-30-6	n-Nitrosodiphenylamine	µg/L	18	--	--	--	--	18	Method B Groundwater Cleanup Level
95-47-6	o-Xylene	µg/L	1,600	--	--	--	--	1,600	Method B Groundwater Cleanup Level
87-86-5	Pentachlorophenol	µg/L	0.22	--	--	1.0	--	0.22	Method B Groundwater Cleanup Level
85-01-8	Phenanthrene	µg/L	--	--	--	--	--	--	--
108-95-2	Phenol	µg/L	2,400	--	--	--	--	2,400	Method B Groundwater Cleanup Level
14265-44-2	Phosphate	µg/L	--	--	--	--	--	--	--

Table 4-1. Nonradiological Analyte Groundwater Action Levels

CAS #	Analyte Name	Units	2007 WAC 173-340-720[a,b]		National Primary Dinking Water Regulations[c,d,e] (40 CFR 141)		WAC 246-290-310[f]	Groundwater Action Level	Groundwater Action Level Basis
			Method B Groundwater Cleanup Level	Method A Groundwater Cleanup Level	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)		
7723-14-0	Phosphorus	µg/L	--	--	--	--	--	--	--
PO4-P	Phosphorus in phosphate	µg/L	--	--	--	--	--	--	--
7440-09-7	Potassium	µg/L	--	--	--	--	--	--	--
129-00-0	Pyrene	µg/L	480	--	--	--	--	480	Method B Groundwater Cleanup Level
7782-49-2	Selenium	µg/L	80	--	50	50	50	50	Primary Federal MCL
7440-21-3	Silicon	µg/L	--	--	--	--	--	--	--
7440-22-4	Silver	µg/L	80	--	--	100	100	80	Method B Groundwater Cleanup Level
7440-23-5	Sodium	µg/L	--	--	--	--	--	--	--
7440-24-6	Strontium	µg/L	9,600	--	--	--	--	9,600	Method B Groundwater Cleanup Level
100-42-5	Styrene	µg/L	1,600	--	100	100	--	100	Primary Federal MCL
14808-79-8	Sulfate	µg/L	--	--	--	250,000	250,000	250,000	Secondary Federal MCL
18496-25-8	Sulfide	µg/L	--	--	--	--	--	--	--
127-18-4	Tetrachloroethene	µg/L	20.8	--	--	5.0	--	5.000	Primary Federal MCL
7440-28-0	Thallium	µg/L	--	--	0.50	2.0	2.0	0.50	Federal MCLG
7440-31-5	Tin	µg/L	9,600	--	--	--	--	9,600	Method B Groundwater Cleanup Level
108-88-3	Toluene	µg/L	640	--	1,000	1,000	--	640	Method B Groundwater Cleanup Level
TPH	Total petroleum hydrocarbons	µg/L	--	500	--	--	--	500	Method A Groundwater Cleanup Level
TPHDIESEL	Total petroleum hydrocarbons - diesel range	µg/L	--	500	--	--	--	500	Method A Groundwater Cleanup Level
TPHGASOLINE	Total petroleum hydrocarbons - gasoline range	µg/L	--	800	--	--	--	800	Method A Groundwater Cleanup Level
TPHOILH	Total petroleum hydrocarbons - motor oil (high boiling)	µg/L	--	500	--	--	--	500	Method A Groundwater Cleanup Level
8001-35-2	Toxaphene	µg/L	0.080	--	--	3.0	--	0.080	Method B Groundwater Cleanup Level
156-60-5	trans-1,2-Dichloroethylene	µg/L	160	--	100	100	--	100	Primary Federal MCL
10061-02-6	trans-1,3-Dichloropropene	µg/L	0.44	--	--	--	--	0.44	Method B Groundwater Cleanup Level
126-73-8	Tributyl phosphate	µg/L	9.7	--	--	--	--	9.7	Method B Groundwater Cleanup Level
79-01-6	Trichloroethene	µg/L	0.54	--	--	5.0	--	0.54	Method B Groundwater Cleanup Level
75-69-4	Trichloromonofluoromethane	µg/L	2,400	--	--	--	--	2,400	Method B Groundwater Cleanup Level
7440-61-1	Uranium	µg/L	48	--	--	30	--	30	Primary Federal MCL
7440-62-2	Vanadium	µg/L	80	--	--	--	--	80	Method B Groundwater Cleanup Level
75-01-4	Vinyl chloride	µg/L	0.061	--	--	2.0	--	0.061	Method B Groundwater Cleanup Level
1330-20-7	Xylenes (total)	µg/L	1,600	--	10,000	10,000	--	1,600	Method B Groundwater Cleanup Level
7440-66-6	Zinc	µg/L	4,800	--	--	5,000	5,000	4,800	Method B Groundwater Cleanup Level

Notes:

a. 2007 WAC 173-340-720, "Ground Water Cleanup Standards."

b. 2007 WAC 173-340-720(3)(b), Table 720-1, "Method A Cleanup Levels 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)."

MCL = maximum contaminant level.

MCLG = maximum contaminant level goal.

Table 4-2. Nonradiological Analyte Distribution Coefficient (K_d) Selection

CAS #	Analyte Name	K_{oc} (mL/g)	K_{oc} Source[a]	Calculated Organic K_d (mL/g) = K_{oc} x f_{oc}	Inorganic K_d (mL/g)	Inorganic K_d Source[a]	Selected K_d (mL/g)	Source of Selected K_d
71-55-6	1,1,1-Trichloroethane	135	CLARC 2014	0.14	--	--	0.14	CLARC 2014
79-34-5	1,1,2,2-Tetrachloroethane	79	CLARC 2014	0.079	--	--	0.079	CLARC 2014
79-00-5	1,1,2-Trichloroethane	75	CLARC 2014	0.075	--	--	0.075	CLARC 2014
75-34-3	1,1-Dichloroethane	53	CLARC 2014	0.053	--	--	0.053	CLARC 2014
75-35-4	1,1-Dichloroethene	65	CLARC 2014	0.065	--	--	0.065	CLARC 2014
120-82-1	1,2,4-Trichlorobenzene	1,659	CLARC 2014	1.7	--	--	1.7	CLARC 2014
95-50-1	1,2-Dichlorobenzene	379	CLARC 2014	0.38	--	--	0.38	CLARC 2014
107-06-2	1,2-Dichloroethane	38	CLARC 2014	0.038	--	--	0.038	CLARC 2014
540-59-0	1,2-Dichloroethene (Total)	40	EPA 2012	0.040	--	--	0.040	EPA 2012
78-87-5	1,2-Dichloropropane	47	CLARC 2014	0.047	--	--	0.047	CLARC 2014
541-73-1	1,3-Dichlorobenzene	375	ORNL 2014	0.38	--	--	0.38	ORNL 2014
106-46-7	1,4-Dichlorobenzene	616	CLARC 2014	0.62	--	--	0.62	CLARC 2014
93-65-2	2-(2-methyl-4-chlorophenoxy) propionic acid	49	EPA 2012	0.049	--	--	0.049	EPA 2012
93-76-5	2,4,5-T(2,4,5-Trichlorophenoxyacetic acid)	107	EPA 2012	0.11	--	--	0.11	EPA 2012
93-72-1	2,4,5-TP(2-(2,4,5-Trichlorophenoxy)propionic acid)Silvex	175	EPA 2012	0.18	--	--	0.18	EPA 2012
95-95-4	2,4,5-Trichlorophenol	1,597	CLARC 2014	1.6	--	--	1.6	CLARC 2014
88-06-2	2,4,6-Trichlorophenol	381	CLARC 2014	0.38	--	--	0.38	CLARC 2014
94-82-6	2,4-DB(4-(2,4-Dichlorophenoxy)butanoic acid)	98	EPA 2012	0.098	--	--	0.098	EPA 2012
120-83-2	2,4-Dichlorophenol	147	CLARC 2014	0.15	--	--	0.15	CLARC 2014
94-75-7	2,4-Dichlorophenoxyacetic acid	30	EPA 2012	0.030	--	--	0.030	EPA 2012
105-67-9	2,4-Dimethylphenol	209	CLARC 2014	0.21	--	--	0.21	CLARC 2014
51-28-5	2,4-Dinitrophenol	0.010	CLARC 2014	1.00E-05	--	--	1.00E-05	CLARC 2014
121-14-2	2,4-Dinitrotoluene	96	CLARC 2014	0.096	--	--	0.096	CLARC 2014
606-20-2	2,6-Dinitrotoluene	69	CLARC 2014	0.069	--	--	0.069	CLARC 2014
78-93-3	2-Butanone	4.5	EPA 2012	0.0045	--	--	0.0045	EPA 2012
111-76-2	2-Butoxyethanol	2.8	EPA 2012	0.0028	--	--	0.0028	EPA 2012
91-58-7	2-Chloronaphthalene	2,478	EPA 2012	2.5	--	--	2.5	EPA 2012
95-57-8	2-Chlorophenol	388	CLARC 2014	0.39	--	--	0.39	CLARC 2014
591-78-6	2-Hexanone	15	EPA 2012	0.015	--	--	0.015	EPA 2012
91-57-6	2-Methylnaphthalene	2,478	EPA 2012	2.5	--	--	2.5	EPA 2012
95-48-7	2-Methylphenol (cresol, o-)	91	CLARC 2014	0.091	--	--	0.091	CLARC 2014
88-74-4	2-Nitroaniline	111	EPA 2012	0.11	--	--	0.11	EPA 2012
88-75-5	2-Nitrophenol	297	ORNL 2014	0.30	--	--	0.30	ORNL 2014
91-94-1	3,3'-Dichlorobenzidine	724	CLARC 2014	0.72	--	--	0.72	CLARC 2014
65794-96-9	3+4 Methylphenol (cresol, m+p)	--	--	--	--	--	--	--
108-39-4	3-Methylphenol (cresol, m-)	300	EPA 2012	0.30	--	--	0.30	EPA 2012
99-09-2	3-Nitroaniline	109	ORNL 2014	0.11	--	--	0.11	ORNL 2014
72-54-8	4,4'-DDD (Dichlorodiphenyldichloroethane)	45,800	CLARC 2014	46	--	--	46	CLARC 2014
72-55-9	4,4'-DDE (Dichlorodiphenyldichloroethylene)	86,405	CLARC 2014	86	--	--	86	CLARC 2014
50-29-3	4,4'-DDT (Dichlorodiphenyltrichloroethane)	677,934	CLARC 2014	678	--	--	678	CLARC 2014
534-52-1	4,6-Dinitro-2-methylphenol	754	EPA 2012	0.75	--	--	0.75	EPA 2012
1918-02-1	4-Amino-3,5,6-trichloropicolinic acid	39	EPA 2012	0.039	--	--	0.039	EPA 2012
101-55-3	4-Bromophenylphenyl ether	3,080	ORNL 2014	3.1	--	--	3.1	ORNL 2014
59-50-7	4-Chloro-3-methylphenol	492	EPA 2012	0.49	--	--	0.49	EPA 2012
106-47-8	4-Chloroaniline	66	CLARC 2014	0.066	--	--	0.066	CLARC 2014
7005-72-3	4-Chlorophenylphenyl ether	3,080	ORNL 2014	3.1	--	--	3.1	ORNL 2014
108-10-1	4-Methyl-2-pentanone	13	EPA 2012	0.013	--	--	0.013	EPA 2012
106-44-5	4-Methylphenol (cresol, p-)	300	EPA 2012	0.30	--	--	0.30	EPA 2012
100-01-6	4-Nitroaniline	109	EPA 2012	0.11	--	--	0.11	EPA 2012
100-02-7	4-Nitrophenol	291	ORNL 2014	0.29	--	--	0.29	ORNL 2014
83-32-9	Acenaphthene	4,898	CLARC 2014	4.9	--	--	4.9	CLARC 2014
208-96-8	Acenaphthylene	5,030	ORNL 2014	5.0	--	--	5.0	ORNL 2014
67-64-1	Acetone	0.58	CLARC 2014	5.75E-04	--	--	5.75E-04	CLARC 2014
79-06-1	Acrylamide	5.7	EPA 2012	0.0057	--	--	0.0057	EPA 2012
107-13-1	Acrylonitrile	8.5	EPA 2012	0.0085	--	--	0.0085	EPA 2012
309-00-2	Aldrin	48,685	CLARC 2014	49	--	--	49	CLARC 2014
319-84-6	Alpha-BHC	1,762	CLARC 2014	1.8	--	--	1.8	CLARC 2014
5103-71-9	Alpha-Chlordane	51,310	CLARC 2014	51	--	--	51	CLARC 2014
7429-90-5	Aluminum	--	--	--	1,500	EPA 2012	1,500	EPA 2012
120-12-7	Anthracene	23,493	CLARC 2014	23	--	--	23	CLARC 2014
7440-36-0	Antimony	--	--	--	45	CLARC 2014	45	CLARC 2014
12674-11-2	Aroclor-1016	107,285	CLARC 2014	107	--	--	107	CLARC 2014
11104-28-2	Aroclor-1221	8,397	EPA 2012	8.4	--	--	8.4	EPA 2012
11141-16-5	Aroclor-1232	8,397	EPA 2012	8.4	--	--	8.4	EPA 2012
53469-21-9	Aroclor-1242	78,100	EPA 2012	78	--	--	78	EPA 2012
12672-29-6	Aroclor-1248	76,530	EPA 2012	77	--	--	77	EPA 2012
11097-69-1	Aroclor-1254	130,500	EPA 2012	131	--	--	131	EPA 2012
11096-82-5	Aroclor-1260	822,422	CLARC 2014	822	--	--	822	CLARC 2014
7440-38-2	Arsenic	--	--	--	29	CLARC 2014	29	CLARC 2014
7440-39-3	Barium	--	--	--	41	CLARC 2014	41	CLARC 2014
71-43-2	Benzene	62	CLARC 2014	0.062	--	--	0.062	CLARC 2014
56-55-3	Benzo(a)anthracene	357,537	CLARC 2014	358	--	--	358	CLARC 2014
50-32-8	Benzo(a)pyrene	968,774	CLARC 2014	969	--	--	969	CLARC 2014
205-99-2	Benzo(b)fluoranthene	1.23E+06	CLARC 2014	1,230	--	--	1,230	CLARC 2014
191-24-2	Benzo(ghi)perylene	1.95E+06	ORNL 2014	1,950	--	--	1,950	ORNL 2014
207-08-9	Benzo(k)fluoranthene	1.23E+06	CLARC 2014	1,230	--	--	1,230	CLARC 2014
7440-41-7	Beryllium	--	--	--	790	CLARC 2014	790	CLARC 2014
319-85-7	beta-1,2,3,4,5,6-Hexachlorocyclohexane (beta-BHC)	2,139	CLARC 2014	2.1	--	--	2.1	CLARC 2014
108-60-1	Bis(2-chloro-1-methylethyl)ether	83	EPA 2012	0.083	--	--	0.083	EPA 2012
111-91-1	Bis(2-Chloroethoxy)methane	14	EPA 2012	0.014	--	--	0.014	EPA 2012
111-44-4	Bis(2-chloroethyl) ether	76	CLARC 2014	0.076	--	--	0.076	CLARC 2014
117-81-7	Bis(2-ethylhexyl) phthalate	111,123	CLARC 2014	111	--	--	111	CLARC 2014
7440-69-9	Bismuth	--	--	--	--	--	--	--
7440-42-8	Boron	--	--	--	3.0	EPA 2012	3.0	EPA 2012
24959-67-9	Bromide	--	--	--	--	--	--	--
75-27-4	Bromodichloromethane	55	CLARC 2014	0.055	--	--	0.055	CLARC 2014
75-25-2	Bromoform	126	CLARC 2014	0.13	--	--	0.13	CLARC 2014
74-83-9	Bromomethane	9.0	CLARC 2014	0.0090	--	--	0.0090	CLARC 2014
85-68-7	Butylbenzylphthalate	13,746	CLARC 2014	14	--	--	14	CLARC 2014
7440-43-9	Cadmium	--	--	--	6.7	CLARC 2014	6.7	CLARC 2014
7440-70-2	Calcium	--	--	--	--	--	--	--
86-74-8	Carbazole	3,390	CLARC 2014	3.4	--	--	3.4	CLARC 2014
75-15-0	Carbon disulfide	46	CLARC 2014	0.046	--	--	0.046	CLARC 2014
56-23-5	Carbon tetrachloride	152	CLARC 2014	0.15	--	--	0.15	CLARC 2014
57-74-9	Chlordane	51,310	CLARC 2014	51	--	--	51	CLARC 2014
16887-00-6	Chloride	--	--	--	--	--	0	EPA 2012
108-90-7	Chlorobenzene	224	CLARC 2014	0.22	--	--	0.22	CLARC 2014
75-00-3	Chloroethane	22	EPA 2012	0.022	--	--	0.022	EPA 2012
67-66-3	Chloroform	53	CLARC 2014	0.053	--	--	0.053	CLARC 2014
74-87-3	Chloromethane	6.0	CLARC 2014	0.0060	--	--	0.0060	CLARC 2014
7440-47-3	Chromium	--	--	--	1,000	CLARC 2014	1,000	CLARC 2014
218-01-9	chrysene	398,000	CLARC 2014	398	--	--	398	CLARC 2014
156-59-2	cis-1,2-Dichloroethylene	36	CLARC 2014	0.036	--	--	0.036	CLARC 2014
10061-01-5	cis-1,3-Dichloropropene	27	CLARC 2014	0.027	--	--	0.027	CLARC 2014
7440-48-4	cobalt	--	--	--	45	EPA 2012	45	EPA 2012
PCB1242/1016	Co-elution of Aroclor 1242 and Aroclor 1016	--	--	--	--	--	--	--

Table 4-2. Nonradiological Analyte Distribution Coefficient (K_d) Selection

CAS #	Analyte Name	K_{oc} (mL/g)	K_{oc} Source[a]	Calculated Organic K_d (mL/g) = $K_{oc} \times f_{oc}$	Inorganic K_d (mL/g)	Inorganic K_d Source[a]	Selected K_d (mL/g)	Source of Selected K_d
7440-50-8	Copper	--	--	--	22	CLARC 2014	22	CLARC 2014
57-12-5	Cyanide	--	--	--	9.9	EPA 2012	9.9	EPA 2012
75-99-0	Dalapon	3.2	EPA 2012	0.0032	--	--	0.0032	EPA 2012
319-86-8	Delta-BHC	2,810	ORNL 2014	2.8	--	--	2.8	ORNL 2014
53-70-3	Dibenz[a,h]anthracene	1.79E+06	CLARC 2014	1,789	--	--	1,789	CLARC 2014
132-64-9	Dibenzofuran	9,161	EPA 2012	9.2	--	--	9.2	EPA 2012
124-48-1	Dibromochloromethane	63	CLARC 2014	0.063	--	--	0.063	CLARC 2014
1918-00-9	Dicamba	29	EPA 2012	0.029	--	--	0.029	EPA 2012
120-36-5	Dichloroprop	49	ORNL 2014	0.049	--	--	0.049	ORNL 2014
60-57-1	Dieldrin	25,546	CLARC 2014	26	--	--	26	CLARC 2014
60-29-7	Diethyl ether	9.7	EPA 2012	0.0097	--	--	0.0097	EPA 2012
84-66-2	Diethylphthalate	82	CLARC 2014	0.082	--	--	0.082	CLARC 2014
131-11-3	Dimethyl phthalate	32	ORNL 2014	0.032	--	--	0.032	ORNL 2014
84-74-2	Di-n-butylphthalate	1,567	CLARC 2014	1.6	--	--	1.6	CLARC 2014
117-84-0	Di-n-octylphthalate	8.32E+07	CLARC 2014	83,200	--	--	83,200	CLARC 2014
88-85-7	Dinoseb(2-secButyl-4,6-dinitrophenol)	4,294	EPA 2012	4.3	--	--	4.3	EPA 2012
959-98-8	Endosulfan I	2,040	CLARC 2014	2.0	--	--	2.0	CLARC 2014
33213-65-9	Endosulfan II	2,040	CLARC 2014	2.0	--	--	2.0	CLARC 2014
1031-07-8	Endosulfan sulfate	9,850	ORNL 2014	9.9	--	--	9.9	ORNL 2014
72-20-8	Endrin	10,811	CLARC 2014	11	--	--	11	CLARC 2014
7421-93-4	Endrin aldehyde	3,270	ORNL 2014	3.3	--	--	3.3	ORNL 2014
53494-70-5	Endrin ketone	9,720	ORNL 2014	9.7	--	--	9.7	ORNL 2014
141-78-6	Ethyl acetate	5.6	EPA 2012	0.0056	--	--	0.0056	EPA 2012
100-41-4	Ethylbenzene	204	CLARC 2014	0.20	--	--	0.20	CLARC 2014
107-21-1	Ethylene glycol	1.0	EPA 2012	0.0010	--	--	0.0010	EPA 2012
206-44-0	Fluoranthene	49,096	CLARC 2014	49	--	--	49	CLARC 2014
86-73-7	Fluorene	7,707	CLARC 2014	7.7	--	--	7.7	CLARC 2014
16984-48-8	Fluoride	--	--	--	150	EPA 2012	150	EPA 2012
58-89-9	Gamma-BHC (Lindane)	1,352	CLARC 2014	1.4	--	--	1.4	CLARC 2014
76-44-8	Heptachlor	9,528	CLARC 2014	9.5	--	--	9.5	CLARC 2014
1024-57-3	Heptachlor epoxide	83,200	CLARC 2014	83	--	--	83	CLARC 2014
118-74-1	Hexachlorobenzene	80,000	CLARC 2014	80	--	--	80	CLARC 2014
87-68-3	Hexachlorobutadiene	53,700	CLARC 2014	54	--	--	54	CLARC 2014
77-47-4	Hexachlorocyclopentadiene	200,000	CLARC 2014	200	--	--	200	CLARC 2014
67-72-1	Hexachloroethane	1,780	CLARC 2014	1.8	--	--	1.8	CLARC 2014
18540-29-9	Hexavalent Chromium	--	--	--	0.80	ECF-HANFORD-11-0165	0.80	ECF-HANFORD-11-0165
193-39-5	Indeno(1,2,3-cd)pyrene	3.47E+06	CLARC 2014	3,470	--	--	3,470	CLARC 2014
7439-89-6	Iron	--	--	--	25	EPA 2012	25	EPA 2012
78-59-1	Isophorone	47	CLARC 2014	0.047	--	--	0.047	CLARC 2014
98-82-8	Isopropylbenzene	698	EPA 2012	0.70	--	--	0.70	EPA 2012
7439-92-1	Lead	--	--	--	10,000	CLARC 2014	10,000	CLARC 2014
7439-93-2	Lithium	--	--	--	300	EPA 2012	300	EPA 2012
7439-95-4	Magnesium	--	--	--	--	--	4.5	EPA 2012
7439-96-5	Manganese	--	--	--	65	EPA 2012	65	EPA 2012
7439-97-6	Mercury	--	--	--	52	CLARC 2014	52	CLARC 2014
67-56-1	Methanol	1.0	EPA 2012	0.0010	--	--	0.0010	EPA 2012
72-43-5	Methoxychlor	80,000	CLARC 2014	80	--	--	80	CLARC 2014
75-09-2	Methylene chloride	10	CLARC 2014	0.010	--	--	0.010	CLARC 2014
7439-98-7	Molybdenum	--	--	--	20	EPA 2012	20	EPA 2012
108-38-3	m-Xylene	196	CLARC 2014	0.20	--	--	0.20	CLARC 2014
91-20-3	Naphthalene	1,191	CLARC 2014	1.2	--	--	1.2	CLARC 2014
7440-02-0	Nickel	--	--	--	65	CLARC 2014	65	CLARC 2014
14797-55-8	Nitrate	--	--	--	--	--	0	EPA 2012
14797-65-0	Nitrite	--	--	--	--	--	0	EPA 2012
98-95-3	Nitrobenzene	119	CLARC 2014	0.12	--	--	0.12	CLARC 2014
NO3-N	Nitrogen in Nitrate	--	--	--	--	--	0	EPA 2012
NO2-N	Nitrogen in Nitrite	--	--	--	--	--	0	EPA 2012
NO2+NO3-N	Nitrogen in Nitrite and Nitrate	--	--	--	--	--	0	EPA 2012
621-64-7	n-Nitrosodi-n-dipropylamine	24	CLARC 2014	0.024	--	--	0.024	CLARC 2014
86-30-6	n-Nitrosodiphenylamine	1,290	CLARC 2014	1.3	--	--	1.3	CLARC 2014
95-47-6	o-Xylene	241	CLARC 2014	0.24	--	--	0.24	CLARC 2014
87-86-5	Pentachlorophenol	592	CLARC 2014	0.59	--	--	0.59	CLARC 2014
85-01-8	Phenanthrene	16,700	ORNL 2014	17	--	--	17	ORNL 2014
108-95-2	Phenol	29	CLARC 2014	0.029	--	--	0.029	CLARC 2014
14265-44-2	Phosphate	--	--	--	--	--	--	--
7723-14-0	Phosphorus	--	--	--	--	--	3.5	EPA 2012
PO4-P	Phosphorus in phosphate	--	--	--	--	--	3.5	EPA 2012
7440-09-7	Potassium	--	--	--	--	--	5.5	EPA 2012
129-00-0	Pyrene	67,992	CLARC 2014	68	--	--	68	CLARC 2014
7782-49-2	Selenium	--	--	--	5.0	CLARC 2014	5.0	CLARC 2014
7440-21-3	Silicon	--	--	--	--	--	--	--
7440-22-4	Silver	--	--	--	8.3	CLARC 2014	8.3	CLARC 2014
7440-23-5	Sodium	--	--	--	--	--	100	EPA 2012
7440-24-6	Strontium	--	--	--	35	EPA 2012	35	EPA 2012
100-42-5	Styrene	912	CLARC 2014	0.91	--	--	0.91	CLARC 2014
14808-79-8	Sulfate	--	--	--	--	--	0	EPA 2012
18496-25-8	Sulfide	--	--	--	--	--	0	EPA 2012
127-18-4	Tetrachloroethene	265	CLARC 2014	0.27	--	--	0.27	CLARC 2014
7440-28-0	Thallium	--	--	--	71	CLARC 2014	71	CLARC 2014
7440-31-5	Tin	--	--	--	250	EPA 2012	250	EPA 2012
108-88-3	Toluene	140	CLARC 2014	0.14	--	--	0.14	CLARC 2014
TPH	Total petroleum hydrocarbons	--	--	--	--	--	4.0	ECF-100NR2-12-0053
TPHDIESEL	Total petroleum hydrocarbons - diesel range	--	--	--	--	--	4.0	ECF-100NR2-12-0053
TPHGASOLINE	Total petroleum hydrocarbons - gasoline range	--	--	--	--	--	4.0	ECF-100NR2-12-0053
TPH/OILH	Total petroleum hydrocarbons - motor oil (high boiling)	--	--	--	--	--	4.0	ECF-100NR2-12-0053
8001-35-2	Toxaphene	95,816	CLARC 2014	96	--	--	96	CLARC 2014
156-60-5	trans-1,2-Dichloroethylene	38	CLARC 2014	0.038	--	--	0.038	CLARC 2014
10061-02-6	trans-1,3-Dichloropropene	27	CLARC 2014	0.027	--	--	0.027	CLARC 2014
126-73-8	Tributyl phosphate	2,350	EPA 2012	2.4	--	--	2.4	EPA 2012
79-01-6	Trichloroethene	94	CLARC 2014	0.094	--	--	0.094	CLARC 2014
75-69-4	Trichloromonofluoromethane	44	EPA 2012	0.044	--	--	0.044	EPA 2012
7440-61-1	Uranium[b]	--	--	--	450[b]	EPA 2012	450	EPA 2012
7440-62-2	Vanadium	--	--	--	1,000	CLARC 2014	1,000	CLARC 2014
75-01-4	Vinyl chloride	19	CLARC 2014	0.019	--	--	0.019	CLARC 2014
1330-20-7	Xylenes (total)	233	CLARC 2014	0.23	--	--	0.23	CLARC 2014
7440-66-6	Zinc	--	--	--	62	CLARC 2014	62	CLARC 2014

Notes:

a. Analyte-specific K_{oc} and K_d values were obtained from the following sources, in order of preference:

1. CLARC 2014, "Cleanup Levels and Risk Calculation (CLARC)" data tables (Ecology 2014).
2. EPA 2012, "Regional Screening Levels for Chemical Contaminants at Superfund Sites."
3. ORNL 2014, "Risk Assessment Information System."

b. Uranium K_d value listed applies only to 100-F/IU and 300 Areas default one-dimensional soil screening level and preliminary remediation goal models. For the 300 Area, a variable K_d approach is applicable where merited to address complex uranium geochemistry in the 300 Area subsurface environment in a multidimensional site-specific model. In the 100-D/H and 100-N Operational Units, the uranium value is assigned "NRV" (no value required) because uranium is not modeled; it was not identified in the groundwater risk assessment as a COC. Uranium Kd values for 100-B/C and 100-K Operational Units will be addressed in a later revision to this document.

f_{oc} = soil fraction of organic carbon (0.001 g/g).

Table 4-2. Nonradiological Analyte Distribution Coefficient (K_d) Selection

CAS #	Analyte Name	K_{oc} (mL/g)	K_{oc} Source*	Calculated Organic K_d (mL/g) = K_{oc} x f_{oc}	Inorganic K_d (mL/g)	Inorganic K_d Source*	Selected K_d (mL/g)	Source of Selected K_d

K_d = distribution coefficient.

K_{oc} = soil organic carbon-water partitioning coefficient.

ECF-100NR2-12-0053, *Saturated Zone Flow and Transport Modeling in Support of 100-N RI/FS Document*

ECF-HANFORD-11-0165, *Evaluation of Hexavalent Chromium Leach Test Data Conducted on Vadose Zone Sediment from the 100 Area.*

The following summarizes differences between the table above and the cited references--FOR INETERNAL USE ONLY

Alpha-Chlordane (5103-71-9): Uses Koc and Hcc for chlordane (57-74-9) in CLARC 2014

Chromium (7440-47-3) : Uses Koc and Hcc for Chromium (III) (16065-83-1) in CLARC 2014

Hexvalent Chromium (18540-29-9) references Kd from ECF-Hanford-11-0165 instead of CLARC 2014

Endosulfan I (959-98-8): Uses Koc and Hcc for Endosulfan (115-29-7) in CLARC 2014

Endosulfan II (33213-65-9): Uses Koc and Hcc for Endosulfan (115-29-7) in CLARC 2014

Mercury (7439-97-6): Uses Kd and Hcc for Mercuric Chloride (and other Mercury Salts) (7487-94-7) in CLARC 2014

cis-1,3-Dichloropropene (10061-01-5): Uses Koc and Hcc for 1,3-dichloropropene (542-75-6) in CLARC 2014

trans-1,3-Dichloropropene (10061-02-6): Uses Koc and Hcc for 1,3-dichloropropene (542-75-6) in CLARC 2014

Uranium (7440-61-1): Uses parameters for Uranium (Soluble Salts) and/or Uranium, Insoluble Compounds as available

Table 4-3. Nonradiological Analyte Henry's Law Constants

CAS#	Analyte Name	Dimensionless Henry's Law Constant (unitless) (H_{cc})[a]	Source
71-55-6	1,1,1-Trichloroethane	0.71	CLARC 2014
79-34-5	1,1,2,2-Tetrachloroethane	0.014	CLARC 2014
79-00-5	1,1,2-Trichloroethane	0.037	CLARC 2014
75-34-3	1,1-Dichloroethane	0.23	CLARC 2014
75-35-4	1,1-Dichloroethene	1.1	CLARC 2014
120-82-1	1,2,4-Trichlorobenzene	0.058	CLARC 2014
95-50-1	1,2-Dichlorobenzene	0.078	CLARC 2014
107-06-2	1,2-Dichloroethane	0.040	CLARC 2014
540-59-0	1,2-Dichloroethene (Total)	0.17	EPA 2012
78-87-5	1,2-Dichloropropane	0.12	CLARC 2014
541-73-1	1,3-Dichlorobenzene	0.11	ORNL 2014
106-46-7	1,4-Dichlorobenzene	0.100	CLARC 2014
93-65-2	2-(2-methyl-4-chlorophenoxy) propionic acid	3.66E-08	EPA 2012
93-76-5	2,4,5-T(2,4,5-Trichlorophenoxyacetic acid)	1.91E-06	EPA 2012
93-72-1	2,4,5-TP(2-(2,4,5-Trichlorophenoxy)propionic acid)Silvex	3.70E-07	EPA 2012
95-95-4	2,4,5-Trichlorophenol	1.78E-04	CLARC 2014
88-06-2	2,4,6-Trichlorophenol	3.19E-04	CLARC 2014
94-82-6	2,4-DB(4-(2,4-Dichlorophenoxy)butanoic acid)	2.40E-07	EPA 2012
120-83-2	2,4-Dichlorophenol	1.30E-04	CLARC 2014
94-75-7	2,4-Dichlorophenoxyacetic acid	1.45E-06	EPA 2012
105-67-9	2,4-Dimethylphenol	8.20E-05	CLARC 2014
51-28-5	2,4-Dinitrophenol	1.82E-05	CLARC 2014
121-14-2	2,4-Dinitrotoluene	3.80E-06	CLARC 2014
606-20-2	2,6-Dinitrotoluene	3.06E-05	CLARC 2014
78-93-3	2-Butanone	0.0023	EPA 2012
111-76-2	2-Butoxyethanol	6.54E-05	EPA 2012
91-58-7	2-Chloronaphthalene	0.013	EPA 2012
95-57-8	2-Chlorophenol	0.016	CLARC 2014
591-78-6	2-Hexanone	0.0038	EPA 2012
91-57-6	2-methylnaphthalene	0.021	EPA 2012
95-48-7	2-Methylphenol (cresol, o-)	4.92E-05	CLARC 2014
88-74-4	2-Nitroaniline	2.41E-06	EPA 2012
88-75-5	2-Nitrophenol	5.23E-04	ORNL 2014
91-94-1	3,3'-Dichlorobenzidine	1.64E-07	CLARC 2014
65794-96-9	3+4 Methylphenol (cresol, m+p)	--	--
108-39-4	3-Methylphenol (cresol, m-)	3.50E-05	EPA 2012
99-09-2	3-Nitroaniline	3.23E-07	ORNL 2014
72-54-8	4,4'-DDD (Dichlorodiphenyldichloroethane)	1.64E-04	CLARC 2014
72-55-9	4,4'-DDE (Dichlorodiphenyldichloroethylene)	8.61E-04	CLARC 2014
50-29-3	4,4'-DDT (Dichlorodiphenyltrichloroethane)	3.32E-04	CLARC 2014
534-52-1	4,6-Dinitro-2-methylphenol	5.72E-05	EPA 2012
1918-02-1	4-Amino-3,5,6-trichloropicolinic acid	2.18E-12	EPA 2012
101-55-3	4-Bromophenylphenyl ether	0.0048	ORNL 2014
59-50-7	4-Chloro-3-methylphenol	1.00E-04	EPA 2012
106-47-8	4-Chloroaniline	1.36E-05	CLARC 2014
7005-72-3	4-Chlorophenylphenyl ether	0.0098	ORNL 2014
108-10-1	4-Methyl-2-pentanone	0.0056	EPA 2012
106-44-5	4-Methylphenol (cresol, p-)	4.09E-05	EPA 2012
100-01-6	4-Nitroaniline	5.15E-08	EPA 2012
100-02-7	4-Nitrophenol	1.70E-08	ORNL 2014

CAS#	Analyte Name	Dimensionless Henry's Law Constant (unitless) (H_{cc})[a]	Source
83-32-9	Acenaphthene	0.0064	CLARC 2014
208-96-8	Acenaphthylene	0.0047	ORNL 2014
67-64-1	Acetone	0.0016	CLARC 2014
79-06-1	Acrylamide	6.95E-08	EPA 2012
107-13-1	Acrylonitrile	0.0056	EPA 2012
309-00-2	Aldrin	0.0070	CLARC 2014
319-84-6	Alpha-BHC	4.35E-04	CLARC 2014
5103-71-9	Alpha-Chlordane	0.0020	CLARC 2014
7429-90-5	Aluminum	0	CLARC 2014
120-12-7	Anthracene	0.0027	CLARC 2014
7440-36-0	Antimony	0	CLARC 2014
12674-11-2	Aroclor-1016	0.0082	EPA 2012
11104-28-2	Aroclor-1221	0.030	EPA 2012
11141-16-5	Aroclor-1232	0.030	EPA 2012
53469-21-9	Aroclor-1242	0.0078	EPA 2012
12672-29-6	Aroclor-1248	0.018	EPA 2012
11097-69-1	Aroclor-1254	0.012	EPA 2012
11096-82-5	Aroclor-1260	0.014	EPA 2012
7440-38-2	Arsenic	0	CLARC 2014
7440-39-3	Barium	0	CLARC 2014
71-43-2	Benzene	0.23	CLARC 2014
56-55-3	Benzo(a)anthracene	1.37E-04	CLARC 2014
50-32-8	Benzo(a)pyrene	4.63E-05	CLARC 2014
205-99-2	Benzo(b)fluoranthene	0.0046	CLARC 2014
191-24-2	Benzo(ghi)perylene	1.35E-05	ORNL 2014
207-08-9	Benzo(k)fluoranthene	3.40E-05	CLARC 2014
7440-41-7	Beryllium	0	CLARC 2014
319-85-7	beta-1,2,3,4,5,6-Hexachlorocyclohexane (beta-BHC)	3.05E-05	CLARC 2014
108-60-1	Bis(2-chloro-1-methylethyl)ether	0.0030	EPA 2012
111-91-1	Bis(2-Chloroethoxy)methane	1.57E-04	EPA 2012
111-44-4	Bis(2-chloroethyl) ether	7.38E-04	CLARC 2014
117-81-7	Bis(2-ethylhexyl) phthalate	4.18E-06	CLARC 2014
7440-69-9	Bismuth	--	--
7440-42-8	Boron	0	CLARC 2014
24959-67-9	Bromide	--	--
75-27-4	Bromodichloromethane	0.066	CLARC 2014
75-25-2	Bromoform	0.022	CLARC 2014
74-83-9	Bromomethane	0.26	CLARC 2014
85-68-7	Butylbenzylphthalate	5.17E-05	CLARC 2014
7440-43-9	Cadmium	0	CLARC 2014
7440-70-2	Calcium	--	--
86-74-8	Carbazole	6.26E-07	CLARC 2014
75-15-0	Carbon disulfide	1.2	CLARC 2014
56-23-5	Carbon tetrachloride	1.3	CLARC 2014
57-74-9	Chlordane	0.0020	CLARC 2014
16887-00-6	Chloride	0	--
108-90-7	Chlorobenzene	0.15	CLARC 2014
75-00-3	Chloroethane	0.45	EPA 2012
67-66-3	Chloroform	0.15	CLARC 2014
74-87-3	Chloromethane	0.36	EPA 2012
7440-47-3	Chromium	0	CLARC 2014

CAS#	Analyte Name	Dimensionless Henry's Law Constant (unitless) (H_{cc})[a]	Source
218-01-9	Chrysene	0.0039	CLARC 2014
156-59-2	cis-1,2-Dichloroethylene	0.17	CLARC 2014
10061-01-5	cis-1,3-Dichloropropene	0.73	CLARC 2014
7440-48-4	Cobalt	0	EPA 2012
PCB1242/1016	Co-elution of Aroclor 1242 and Aroclor 1016	--	--
7440-50-8	Copper	0	CLARC 2014
57-12-5	Cyanide	0.0054	EPA 2012
75-99-0	Dalapon	2.31E-06	EPA 2012
319-86-8	Delta-BHC	2.10E-04	ORNL 2014
53-70-3	Dibenz[a,h]anthracene	6.03E-07	CLARC 2014
132-64-9	Dibenzofuran	0.0087	EPA 2012
124-48-1	Dibromochloromethane	0.032	CLARC 2014
1918-00-9	Dicamba	8.91E-08	EPA 2012
120-36-5	Dichloroprop	4.99E-07	ORNL 2014
60-57-1	Dieldrin	6.19E-04	CLARC 2014
60-29-7	Diethyl ether	0.050	EPA 2012
84-66-2	Diethylphthalate	1.85E-05	CLARC 2014
131-11-3	Dimethyl phthalate	8.05E-06	ORNL 2014
84-74-2	Di-n-butylphthalate	3.85E-08	CLARC 2014
117-84-0	Di-n-octylphthalate	0.0027	CLARC 2014
88-85-7	Dinoseb(2-secButyl-4,6-dinitrophenol)	1.86E-05	EPA 2012
959-98-8	Endosulfan I	4.59E-04	CLARC 2014
33213-65-9	Endosulfan II	4.59E-04	CLARC 2014
1031-07-8	Endosulfan sulfate	1.33E-05	ORNL 2014
72-20-8	Endrin	3.08E-04	CLARC 2014
7421-93-4	Endrin Aldehyde	1.71E-04	ORNL 2014
53494-70-5	Endrin ketone	8.26E-07	ORNL 2014
141-78-6	Ethyl acetate	0.0055	EPA 2012
100-41-4	Ethylbenzene	0.32	CLARC 2014
107-21-1	Ethylene glycol	2.45E-06	EPA 2012
206-44-0	Fluoranthene	6.60E-04	CLARC 2014
86-73-7	Fluorene	0.0026	CLARC 2014
16984-48-8	Fluoride	0	EPA 2012
58-89-9	Gamma-BHC (Lindane)	5.74E-04	CLARC 2014
76-44-8	Heptachlor	0.045	CLARC 2014
1024-57-3	Heptachlor epoxide	3.90E-04	CLARC 2014
118-74-1	Hexachlorobenzene	0.054	CLARC 2014
87-68-3	Hexachlorobutadiene	0.33	CLARC 2014
77-47-4	Hexachlorocyclopentadiene	1.1	CLARC 2014
67-72-1	Hexachloroethane	0.16	CLARC 2014
18540-29-9	Hexavalent Chromium	0	CLARC 2014
193-39-5	Indeno(1,2,3-cd)pyrene	6.56E-05	CLARC 2014
7439-89-6	Iron	0	CLARC 2014
78-59-1	Isophorone	2.72E-04	CLARC 2014
98-82-8	Isopropylbenzene	0.47	EPA 2012
7439-92-1	Lead	0	CLARC 2014
7439-93-2	Lithium	0	EPA 2012
7439-95-4	Magnesium	--	--
7439-96-5	Manganese	0	CLARC 2014
7439-97-6	Mercury	0.47	CLARC 2014
67-56-1	Methanol	1.86E-04	EPA 2012

CAS#	Analyte Name	Dimensionless Henry's Law Constant (unitless) (H_{cc})[a]	Source
72-43-5	Methoxychlor	6.48E-04	CLARC 2014
75-09-2	Methylene chloride	0.090	CLARC 2014
7439-98-7	Molybdenum	0	CLARC 2014
108-38-3	m-Xylene	0.30	CLARC 2014
91-20-3	Naphthalene	0.020	CLARC 2014
7440-02-0	Nickel	0	CLARC 2014
14797-55-8	Nitrate	0	EPA 2012
14797-65-0	Nitrite	0	EPA 2012
98-95-3	Nitrobenzene	9.84E-04	CLARC 2014
NO3-N	Nitrogen in Nitrate	0	EPA 2012
NO2-N	Nitrogen in Nitrite	0	EPA 2012
NO2+NO3-N	Nitrogen in Nitrite and Nitrate	0	EPA 2012
621-64-7	n-Nitrosodi-n-dipropylamine	9.23E-05	CLARC 2014
86-30-6	n-Nitrosodiphenylamine	2.05E-04	CLARC 2014
95-47-6	o-Xylene	0.21	CLARC 2014
87-86-5	Pentachlorophenol	1.00E-06	CLARC 2014
85-01-8	Phenanthrene	0.0017	ORNL 2014
108-95-2	Phenol	1.63E-05	CLARC 2014
14265-44-2	Phosphate	--	--
7723-14-0	Phosphorus	--	--
PO4-P	Phosphorus in phosphate	--	--
7440-09-7	Potassium	--	--
129-00-0	Pyrene	4.51E-04	CLARC 2014
7782-49-2	Selenium	0	CLARC 2014
7440-21-3	Silicon	--	--
7440-22-4	Silver	0	CLARC 2014
7440-23-5	Sodium	--	--
7440-24-6	Strontium	0	CLARC 2014
100-42-5	Styrene	0.11	CLARC 2014
14808-79-8	Sulfate	0	--
18496-25-8	Sulfide	--	--
127-18-4	Tetrachloroethene	0.75	CLARC 2014
7440-28-0	Thallium	0	CLARC 2014
7440-31-5	Tin	0	CLARC 2014
108-88-3	Toluene	0.27	CLARC 2014
TPH	Total petroleum hydrocarbons	--	--
TPHDIESEL	Total petroleum hydrocarbons - diesel range	--	--
TPHGASOLINE	Total petroleum hydrocarbons - gasoline range	--	--
TPH/OILH	Total petroleum hydrocarbons - motor oil (high boiling)	--	--
8001-35-2	Toxaphene	2.46E-04	CLARC 2014
156-60-5	trans-1,2-Dichloroethylene	0.39	CLARC 2014
10061-02-6	trans-1,3-Dichloropropene	0.73	CLARC 2014
126-73-8	Tributyl phosphate	5.76E-05	EPA 2012
79-01-6	Trichloroethene	0.42	CLARC 2014
75-69-4	Trichloromonofluoromethane	4.0	EPA 2012
7440-61-1	Uranium	0	CLARC 2014
7440-62-2	Vanadium	0	CLARC 2014
75-01-4	Vinyl chloride	1.1	CLARC 2014
1330-20-7	Xylenes (total)	0.28	CLARC 2014
7440-66-6	Zinc	0	CLARC 2014

Notes:

CAS#	Analyte Name	Dimensionless Henry's Law Constant (unitless) (H_{cc})[a]	Source

a. Analyte-specific H_{cc} values were obtained from the following sources, in order of preference:

1. CLARC 2014, "Cleanup Levels and Risk Calculation (CLARC)" data tables (Ecology 2014).
2. EPA 2012, "Regional Screening Levels for Chemical Contaminants at Superfund Sites."
3. ORNL 2014, "Risk Assessment Information System."

The following summarizes differences between the table above and the cited references--FOR INETERNAL USE ONLY

Alpha-Chlordane (5103-71-9): Uses Koc and Hcc for chlordane (57-74-9) in CLARC 2014

Chromium (7440-47-3) : Uses Koc and Hcc for Chromium (III) (16065-83-1) in CLARC 2014

Hexvalent Chromium (18540-29-9) references Kd from ECF-Hanford-11-0165 instead of CLARC 2014

Endosulfan I (959-98-8): Uses Koc and Hcc for Endosulfan (115-29-7) in CLARC 2014

Endosulfan II (33213-65-9): Uses Koc and Hcc for Endosulfan (115-29-7) in CLARC 2014

Mercury (7439-97-6): Uses Kd and Hcc for Mercuric Chloride (and other Mercury Salts) (7487-94-7) in CLARC 2014

cis-1,3-Dichloropropene (10061-01-5): Uses Koc and Hcc for 1,3-dichloropropene (542-75-6) in CLARC 2014

trans-1,3-Dichloropropene (10061-02-6): Uses Koc and Hcc for 1,3-dichloropropene (542-75-6) in CLARC 2014

Uranium (7440-61-1): Uses parameters for Uranium (Soluble Salts) and/or Uranium, Isoluble Compounds as available

Table 7-1. Soil Concentrations Protective of Groundwater Calculated Using the Fixed Parameter 3-Phase Partitioning Model

CAS #	Analyte Name	Groundwater Cleanup Level (µg/L)	Groundwater Cleanup Level Basis	Distribution Coefficient (K_d) (mL/g)	K_d Source	Henry's Law Constant (H_c) (Unitless)	H_c Source	Soil Concentration Protective of Groundwater (mg/kg)
71-55-6	1,1,1-Trichloroethane	200	Primary Federal MCL	0.14	CLARC 2014	0.71	CLARC 2014	1.6
79-34-5	1,1,2,2-Tetrachloroethane	0.22	Method B Groundwater Cleanup Level	0.079	CLARC 2014	0.014	CLARC 2014	0.0012
79-00-5	1,1,2-Trichloroethane	0.77	Method B Groundwater Cleanup Level	0.075	CLARC 2014	0.037	CLARC 2014	0.0043
75-34-3	1,1-Dichloroethane	7.7	Method B Groundwater Cleanup Level	0.053	CLARC 2014	0.23	CLARC 2014	0.042
75-35-4	1,1-Dichloroethene	7.0	Primary Federal MCL	0.065	CLARC 2014	1.1	CLARC 2014	0.050
120-82-1	1,2,4-Trichlorobenzene	1.5	Method B Groundwater Cleanup Level	1.7	CLARC 2014	0.058	CLARC 2014	0.056
95-50-1	1,2-Dichlorobenzene	600	Primary Federal MCL	0.38	CLARC 2014	0.078	CLARC 2014	7.0
107-06-2	1,2-Dichloroethane	0.46	Method B Groundwater Cleanup Level	0.038	CLARC 2014	0.040	CLARC 2014	0.0023
540-59-0	1,2-Dichloroethene (Total)	72	Method B Groundwater Cleanup Level	0.040	EPA 2012	0.17	EPA 2012	0.37
78-87-5	1,2-Dichloropropane	1.2	Method B Groundwater Cleanup Level	0.047	CLARC 2014	0.12	CLARC 2014	0.0062
541-73-1	1,3-Dichlorobenzene	--	--	0.38	ORNL 2014	0.11	ORNL 2014	--
106-46-7	1,4-Dichlorobenzene	8.1	Method B Groundwater Cleanup Level	0.62	CLARC 2014	0.100	CLARC 2014	0.13
93-65-2	2-(2-methyl-4-chlorophenoxy) propionic acid	16	Method B Groundwater Cleanup Level	0.049	EPA 2012	3.66E-08	EPA 2012	0.080
93-76-5	2,4,5-T(2,4,5-Trichlorophenoxyacetic acid)	160	Method B Groundwater Cleanup Level	0.11	EPA 2012	1.91E-06	EPA 2012	0.98
93-72-1	2,4,5-TP(2-(2,4,5-Trichlorophenoxy)propionic acid)Silvex	50	Primary Federal MCL	0.18	EPA 2012	3.70E-07	EPA 2012	0.38
95-95-4	2,4,5-Trichlorophenol	800	Method B Groundwater Cleanup Level	1.6	CLARC 2014	1.78E-04	CLARC 2014	29
88-06-2	2,4,6-Trichlorophenol	4.0	Method B Groundwater Cleanup Level	0.38	CLARC 2014	3.19E-04	CLARC 2014	0.046
94-82-6	2,4-DB(4-(2,4-Dichlorophenoxy)butanoic acid)	128	Method B Groundwater Cleanup Level	0.098	EPA 2012	2.40E-07	EPA 2012	0.76
120-83-2	2,4-Dichlorophenol	24	Method B Groundwater Cleanup Level	0.15	CLARC 2014	1.30E-04	CLARC 2014	0.17
94-75-7	2,4-Dichlorophenoxyacetic acid	70	Primary Federal MCL	0.030	EPA 2012	1.45E-06	EPA 2012	0.32
105-67-9	2,4-Dimethylphenol	160	Method B Groundwater Cleanup Level	0.21	CLARC 2014	8.20E-05	CLARC 2014	1.3
51-28-5	2,4-Dinitrophenol	32	Method B Groundwater Cleanup Level	1.00E-05	CLARC 2014	1.82E-05	CLARC 2014	0.13
121-14-2	2,4-Dinitrotoluene	0.28	Method B Groundwater Cleanup Level	0.096	CLARC 2014	3.80E-06	CLARC 2014	0.0017
606-20-2	2,6-Dinitrotoluene	16	Method B Groundwater Cleanup Level	0.069	CLARC 2014	3.06E-05	CLARC 2014	0.086
78-93-3	2-Butanone	4,800	Method B Groundwater Cleanup Level	0.0045	EPA 2012	0.0023	EPA 2012	20
111-76-2	2-Butoxyethanol	800	Method B Groundwater Cleanup Level	0.0028	EPA 2012	6.54E-05	EPA 2012	3.2
91-58-7	2-Chloronaphthalene	640	Method B Groundwater Cleanup Level	2.5	EPA 2012	0.013	EPA 2012	34
95-57-8	2-Chlorophenol	40	Method B Groundwater Cleanup Level	0.39	CLARC 2014	0.016	CLARC 2014	0.47
591-78-6	2-Hexanone	40	Method B Groundwater Cleanup Level	0.015	EPA 2012	0.0038	EPA 2012	0.17
91-57-6	2-Methylnaphthalene	32	Method B Groundwater Cleanup Level	2.5	EPA 2012	0.021	EPA 2012	1.7
95-48-7	2-Methylphenol (cresol, o-)	400	Method B Groundwater Cleanup Level	0.091	CLARC 2014	4.92E-05	CLARC 2014	2.3
88-74-4	2-Nitroaniline	160	Method B Groundwater Cleanup Level	0.11	EPA 2012	2.41E-06	EPA 2012	1.00
88-75-5	2-Nitrophenol	--	--	0.30	ORNL 2014	5.23E-04	ORNL 2014	--
91-94-1	3,3'-Dichlorobenzidine	0.19	Method B Groundwater Cleanup Level	0.72	CLARC 2014	1.64E-07	CLARC 2014	0.0036
65794-96-9	3+4 Methylphenol (cresol, m+p)	--	--	--	--	--	--	--
108-39-4	3-Methylphenol (cresol, m-)	400	Method B Groundwater Cleanup Level	0.30	EPA 2012	3.50E-05	EPA 2012	4.0
99-09-2	3-Nitroaniline	4.2	Method B Groundwater Cleanup Level	0.11	ORNL 2014	3.23E-07	ORNL 2014	0.026
72-54-8	4,4'-DDD (Dichlorodiphenyldichloroethane)	0.36	Method B Groundwater Cleanup Level	46	CLARC 2014	1.64E-04	CLARC 2014	0.34
72-55-9	4,4'-DDE (Dichlorodiphenyldichloroethylene)	0.26	Method B Groundwater Cleanup Level	86	CLARC 2014	8.61E-04	CLARC 2014	0.45
50-29-3	4,4'-DDT (Dichlorodiphenyltrichloroethane)	0.26	Method B Groundwater Cleanup Level	678	CLARC 2014	3.32E-04	CLARC 2014	3.5
534-52-1	4,6-Dinitro-2-methylphenol	1.3	Method B Groundwater Cleanup Level	0.75	EPA 2012	5.72E-05	EPA 2012	0.024
1918-02-1	4-Amino-3,5,6-trichloropicolinic acid	500	Primary Federal MCL	0.039	EPA 2012	2.18E-12	EPA 2012	2.4
101-55-3	4-Bromophenylphenyl ether	--	--	3.1	ORNL 2014	0.0048	ORNL 2014	--
59-50-7	4-Chloro-3-methylphenol	1,600	Method B Groundwater Cleanup Level	0.49	EPA 2012	1.00E-04	EPA 2012	22
106-47-8	4-Chloroaniline	0.22	Method B Groundwater Cleanup Level	0.066	CLARC 2014	1.36E-05	CLARC 2014	0.0012
7005-72-3	4-Chlorophenylphenyl ether	--	--	3.1	ORNL 2014	0.0088	ORNL 2014	--
108-10-1	4-Methyl-2-pentanone	640	Method B Groundwater Cleanup Level	0.013	EPA 2012	0.0056	EPA 2012	2.7
106-44-5	4-Methylphenol (cresol, p-)	800	Method B Groundwater Cleanup Level	0.30	EPA 2012	4.09E-05	EPA 2012	8.0
100-01-6	4-Nitroaniline	4.4	Method B Groundwater Cleanup Level	0.11	EPA 2012	5.15E-08	EPA 2012	0.027
100-02-7	4-Nitrophenol	--	--	0.29	ORNL 2014	1.70E-08	ORNL 2014	--
83-32-9	Acenaphthene	960	Method B Groundwater Cleanup Level	4.9	CLARC 2014	0.0064	CLARC 2014	96
208-96-8	Acenaphthylene	--	--	5.0	ORNL 2014	0.0047	ORNL 2014	--
67-64-1	Acetone	7,200	Method B Groundwater Cleanup Level	5.75E-04	CLARC 2014	0.0016	CLARC 2014	29
79-06-1	Acrylamide	0.088	Method B Groundwater Cleanup Level	0.0057	EPA 2012	6.95E-08	EPA 2012	3.60E-04
107-13-1	Acrylonitrile	0.061	Method B Groundwater Cleanup Level	0.0085	EPA 2012	0.0056	EPA 2012	3.39E-04
309-00-2	Aldrin	0.0026	Method B Groundwater Cleanup Level	49	CLARC 2014	0.0070	CLARC 2014	0.0025
319-84-6	Alpha-BHC	0.014	Method B Groundwater Cleanup Level	1.8	CLARC 2014	4.35E-04	CLARC 2014	5.44E-04
5103-71-9	Alpha-Chlordane	0.25	Method B Groundwater Cleanup Level	51	CLARC 2014	0.0020	CLARC 2014	0.26
7429-90-5	Aluminum	16,000	Method B Groundwater Cleanup Level	1,500	EPA 2012	0	CLARC 2014	480,064
120-12-7	Anthracene	4,800	Method B Groundwater Cleanup Level	23	CLARC 2014	0.0027	CLARC 2014	2,275

Table 7-1. Soil Concentrations Protective of Groundwater Calculated Using the Fixed Parameter 3-Phase Partitioning Model

CAS #	Analyte Name	Groundwater Cleanup Level (µg/L)	Groundwater Cleanup Level Basis	Distribution Coefficient (K_d) (mL/g)	K_d Source	Henry's Law Constant (H_c) (Unitless)	H_c Source	Soil Concentration Protective of Groundwater (mg/kg)
7440-36-0	Antimony	6.0	Primary Federal MCL	45	CLARC 2014	0	CLARC 2014	5.4
12674-11-2	Aroclor-1016	0.50	Primary Federal MCL	107	CLARC 2014	0.0082	EPA 2012	1.1
11104-28-2	Aroclor-1221	0.022	Method B Groundwater Cleanup Level	8.4	EPA 2012	0.030	EPA 2012	0.0038
11141-16-5	Aroclor-1232	0.022	Method B Groundwater Cleanup Level	8.4	EPA 2012	0.030	EPA 2012	0.0038
53469-21-9	Aroclor-1242	0.044	Method B Groundwater Cleanup Level	78	EPA 2012	0.0078	EPA 2012	0.069
12672-29-6	Aroclor-1248	0.044	Method B Groundwater Cleanup Level	77	EPA 2012	0.018	EPA 2012	0.067
11097-69-1	Aroclor-1254	0.044	Method B Groundwater Cleanup Level	131	EPA 2012	0.012	EPA 2012	0.11
11096-82-5	Aroclor-1260	0.044	Method B Groundwater Cleanup Level	822	CLARC 2014	0.014	EPA 2012	0.72
7440-38-2	Arsenic	0.058	Method B Groundwater Cleanup Level	29	CLARC 2014	0	CLARC 2014	0.034
7440-39-3	Barium	2,000	Primary Federal MCL	41	CLARC 2014	0	CLARC 2014	1,648
71-43-2	Benzene	0.80	Method B Groundwater Cleanup Level	0.062	CLARC 2014	0.23	CLARC 2014	0.0045
56-55-3	Benzo(a)anthracene	0.12	Method B Groundwater Cleanup Level	358	CLARC 2014	1.37E-04	CLARC 2014	0.86
50-32-8	Benzo(a)pyrene	0.012	Method B Groundwater Cleanup Level	969	CLARC 2014	4.63E-05	CLARC 2014	0.23
205-99-2	Benzo(b)fluoranthene	0.12	Method B Groundwater Cleanup Level	1,230	CLARC 2014	0.0046	CLARC 2014	2.9
191-24-2	Benzo(ghi)perylene	--	--	1,950	ORNL 2014	1.35E-05	ORNL 2014	--
207-08-9	Benzo(k)fluoranthene	0.12	Method B Groundwater Cleanup Level	1,230	CLARC 2014	3.40E-05	CLARC 2014	2.9
7440-41-7	Beryllium	4.0	Primary Federal MCL	790	CLARC 2014	0	CLARC 2014	63
319-85-7	beta-1,2,3,4,5,6-Hexachlorocyclohexane (beta-BHC)	0.049	Method B Groundwater Cleanup Level	2.1	CLARC 2014	3.05E-05	CLARC 2014	0.0023
108-60-1	Bis(2-chloro-1-methylethyl)ether	0.63	Method B Groundwater Cleanup Level	0.083	EPA 2012	0.0030	EPA 2012	0.0035
111-91-1	Bis(2-Chloroethoxy)methane	48	Method B Groundwater Cleanup Level	0.014	EPA 2012	1.57E-04	EPA 2012	0.21
111-44-4	Bis(2-chloroethyl) ether	0.040	Method B Groundwater Cleanup Level	0.076	CLARC 2014	7.38E-04	CLARC 2014	2.20E-04
117-81-7	Bis(2-ethylhexyl) phthalate	6.0	Primary Federal MCL	111	CLARC 2014	4.18E-06	CLARC 2014	13
7440-69-9	Bismuth	--	--	--	--	--	--	--
7440-42-8	Boron	3,200	Method B Groundwater Cleanup Level	3.0	EPA 2012	0	CLARC 2014	205
24959-67-9	Bromide	--	--	--	--	--	--	--
75-27-4	Bromodichloromethane	0.71	Method B Groundwater Cleanup Level	0.055	CLARC 2014	0.066	CLARC 2014	0.0037
75-25-2	Bromoform	5.5	Method B Groundwater Cleanup Level	0.13	CLARC 2014	0.022	CLARC 2014	0.036
74-83-9	Bromomethane	11	Method B Groundwater Cleanup Level	0.0090	CLARC 2014	0.26	CLARC 2014	0.052
85-68-7	Butylbenzylphthalate	46	Method B Groundwater Cleanup Level	14	CLARC 2014	5.17E-05	CLARC 2014	13
7440-43-9	Cadmium	5.0	Primary Federal MCL	6.7	CLARC 2014	0	CLARC 2014	0.69
7440-70-2	Calcium	--	--	--	--	--	--	--
86-74-8	Carbazole	4.4	Method B Groundwater Cleanup Level	3.4	CLARC 2014	6.26E-07	CLARC 2014	0.31
75-15-0	Carbon disulfide	800	Method B Groundwater Cleanup Level	0.046	CLARC 2014	1.2	CLARC 2014	5.7
56-23-5	Carbon tetrachloride	0.63	Method B Groundwater Cleanup Level	0.15	CLARC 2014	1.3	CLARC 2014	0.0058
57-74-9	Chlordane	0.25	Method B Groundwater Cleanup Level	51	CLARC 2014	0.0020	CLARC 2014	0.26
16887-00-6	Chloride	250,000	Secondary Federal MCL	0	EPA 2012	0	--	1,000
108-90-7	Chlorobenzene	100	Primary Federal MCL	0.22	CLARC 2014	0.15	CLARC 2014	0.87
75-00-3	Chloroethane	--	--	0.022	EPA 2012	0.45	EPA 2012	--
67-66-3	Chloroform	1.4	Method B Groundwater Cleanup Level	0.053	CLARC 2014	0.15	CLARC 2014	0.0075
74-87-3	Chloromethane	--	--	0.0060	CLARC 2014	0.36	EPA 2012	--
7440-47-3	Chromium	100	Primary Federal MCL	1,000	CLARC 2014	0	CLARC 2014	2,000
218-01-9	chrysene	1.2	Method B Groundwater Cleanup Level	398	CLARC 2014	0.0039	CLARC 2014	9.5
156-59-2	cis-1,2-Dichloroethylene	16	Method B Groundwater Cleanup Level	0.036	CLARC 2014	0.17	CLARC 2014	0.080
10061-01-5	cis-1,3-Dichloropropene	0.44	Method B Groundwater Cleanup Level	0.027	CLARC 2014	0.73	CLARC 2014	0.0025
7440-48-4	cobalt	4.8	Method B Groundwater Cleanup Level	45	EPA 2012	0	EPA 2012	4.3
PCB1242/1016	Co-elution of Aroclor 1242 and Aroclor 1016	--	--	--	--	--	--	--
7440-50-8	Copper	640	Method B Groundwater Cleanup Level	22	CLARC 2014	0	CLARC 2014	284
57-12-5	Cyanide	4.8	Method B Groundwater Cleanup Level	9.9	EPA 2012	0.0054	EPA 2012	0.97
75-99-0	Dalapon	200	Primary Federal MCL	0.0032	EPA 2012	2.31E-06	EPA 2012	0.81
319-86-8	Delta-BHC	--	--	2.8	ORNL 2014	2.10E-04	ORNL 2014	--
53-70-3	Dibenz[a,h]anthracene	0.12	Method B Groundwater Cleanup Level	1,789	CLARC 2014	6.03E-07	CLARC 2014	4.3
132-64-9	Dibenzofuran	16	Method B Groundwater Cleanup Level	9.2	EPA 2012	0.0087	EPA 2012	3.0
124-48-1	Dibromochloromethane	0.52	Method B Groundwater Cleanup Level	0.063	CLARC 2014	0.032	CLARC 2014	0.0028
1918-00-9	Dicamba	480	Method B Groundwater Cleanup Level	0.029	EPA 2012	8.91E-08	EPA 2012	2.2
120-36-5	Dichloroprop	--	--	0.049	ORNL 2014	4.98E-07	ORNL 2014	--
60-57-1	Dieldrin	0.0055	Method B Groundwater Cleanup Level	26	CLARC 2014	6.19E-04	CLARC 2014	0.0028
60-29-7	Diethyl ether	1,600	Method B Groundwater Cleanup Level	0.0097	EPA 2012	0.050	EPA 2012	6.8
84-66-2	Diethylphthalate	12,800	Method B Groundwater Cleanup Level	0.082	CLARC 2014	1.85E-05	CLARC 2014	72
131-11-3	Dimethyl phthalate	--	--	0.032	ORNL 2014	8.05E-06	ORNL 2014	--
84-74-2	Di-n-butylphthalate	1,600	Method B Groundwater Cleanup Level	1.6	CLARC 2014	3.85E-08	CLARC 2014	57

Table 7-1. Soil Concentrations Protective of Groundwater Calculated Using the Fixed Parameter 3-Phase Partitioning Model

CAS #	Analyte Name	Groundwater Cleanup Level (µg/L)	Groundwater Cleanup Level Basis	Distribution Coefficient (K_d) (mL/g)	K_d Source	Henry's Law Constant (H_{cc}) (Unitless)	H_{cc} Source	Soil Concentration Protective of Groundwater (mg/kg)
117-84-0	Di-n-octylphthalate	192	Method B Groundwater Cleanup Level	83,200	CLARC 2014	0.0027	CLARC 2014	319,489
88-85-7	Dinoseb(2-secButyl-4,6-dinitrophenol)	7.0	Primary Federal MCL	4.3	EPA 2012	1.86E-05	EPA 2012	0.63
959-98-8	Endosulfan I	96	Method B Groundwater Cleanup Level	2.0	CLARC 2014	4.59E-04	CLARC 2014	4.3
33213-65-9	Endosulfan II	96	Method B Groundwater Cleanup Level	2.0	CLARC 2014	4.59E-04	CLARC 2014	4.3
1031-07-8	Endosulfan sulfate	--	--	9.9	ORNL 2014	1.33E-05	ORNL 2014	--
72-20-8	Endrin	2.0	Primary Federal MCL	11	CLARC 2014	3.08E-04	CLARC 2014	0.44
7421-93-4	Endrin aldehyde	--	--	3.3	ORNL 2014	1.71E-04	ORNL 2014	--
53494-70-5	Endrin ketone	--	--	9.7	ORNL 2014	8.28E-07	ORNL 2014	--
141-78-6	Ethyl acetate	7,200	Method B Groundwater Cleanup Level	0.0056	EPA 2012	0.0055	EPA 2012	30
100-41-4	Ethylbenzene	4.0	Method B Groundwater Cleanup Level	0.20	CLARC 2014	0.32	CLARC 2014	0.034
107-21-1	Ethylene glycol	16,000	Method B Groundwater Cleanup Level	0.0010	EPA 2012	2.45E-06	EPA 2012	64
206-44-0	Fluoranthene	640	Method B Groundwater Cleanup Level	49	CLARC 2014	6.60E-04	CLARC 2014	631
86-73-7	Fluorene	320	Method B Groundwater Cleanup Level	7.7	CLARC 2014	0.0026	CLARC 2014	51
16984-48-8	Fluoride	960	Method B Groundwater Cleanup Level	150	EPA 2012	0	EPA 2012	2,884
58-89-9	Gamma-BHC (Lindane)	0.080	Method B Groundwater Cleanup Level	1.4	CLARC 2014	5.74E-04	CLARC 2014	0.0025
76-44-8	Heptachlor	0.019	Method B Groundwater Cleanup Level	9.5	CLARC 2014	0.045	CLARC 2014	0.0038
1024-57-3	Heptachlor epoxide	0.0048	Method B Groundwater Cleanup Level	83	CLARC 2014	3.90E-04	CLARC 2014	0.0080
118-74-1	Hexachlorobenzene	0.055	Method B Groundwater Cleanup Level	80	CLARC 2014	0.054	CLARC 2014	0.088
87-68-3	Hexachlorobutadiene	0.56	Method B Groundwater Cleanup Level	54	CLARC 2014	0.33	CLARC 2014	0.60
77-47-4	Hexachlorocyclopentadiene	48	Method B Groundwater Cleanup Level	200	CLARC 2014	1.1	CLARC 2014	192
67-72-1	Hexachloroethane	1.1	Method B Groundwater Cleanup Level	1.8	CLARC 2014	0.16	CLARC 2014	0.044
18540-29-9	Hexavalent Chromium	48	Method B Groundwater Cleanup Level	0.80	ECF-HANFORD-11-0165	0	CLARC 2014	0.96
193-39-5	Indeno(1,2,3-cd)pyrene	0.12	Method B Groundwater Cleanup Level	3,470	CLARC 2014	6.56E-05	CLARC 2014	8.3
7439-89-6	Iron	11,200	Method B Groundwater Cleanup Level	25	EPA 2012	0	CLARC 2014	5,645
78-59-1	Isophorone	46	Method B Groundwater Cleanup Level	0.047	CLARC 2014	2.72E-04	CLARC 2014	0.23
98-82-8	Isopropylbenzene	800	Method B Groundwater Cleanup Level	0.70	EPA 2012	0.47	EPA 2012	15
7439-92-1	Lead	15	Primary Federal MCL	10,000	CLARC 2014	0	CLARC 2014	3,000
7439-93-2	Lithium	32	Method B Groundwater Cleanup Level	300	EPA 2012	0	EPA 2012	192
7439-95-4	Magnesium	--	--	4.5	EPA 2012	--	--	--
7439-96-5	Manganese	384	Method B Groundwater Cleanup Level	65	EPA 2012	0	CLARC 2014	501
7439-97-6	Mercury	2.0	Primary Federal MCL	52	CLARC 2014	0.47	CLARC 2014	2.1
67-56-1	Methanol	4,000	Method B Groundwater Cleanup Level	0.0010	EPA 2012	1.86E-04	EPA 2012	16
72-43-5	Methoxychlor	40	Primary Federal MCL	80	CLARC 2014	6.48E-04	CLARC 2014	64
75-09-2	Methylene chloride	5.0	Primary Federal MCL	0.010	CLARC 2014	0.090	CLARC 2014	0.022
7439-98-7	Molybdenum	80	Method B Groundwater Cleanup Level	20	EPA 2012	0	CLARC 2014	32
108-38-3	m-Xylene	1,600	Method B Groundwater Cleanup Level	0.20	CLARC 2014	0.30	CLARC 2014	14
91-20-3	Naphthalene	160	Method B Groundwater Cleanup Level	1.2	CLARC 2014	0.020	CLARC 2014	4.5
7440-02-0	Nickel	100	State MCL	65	CLARC 2014	0	CLARC 2014	130
14797-55-8	Nitrate	45,000	Primary Federal MCL	0	EPA 2012	0	EPA 2012	180
14797-65-0	Nitrite	3,300	Primary Federal MCL	0	EPA 2012	0	EPA 2012	13
98-95-3	Nitrobenzene	16	Method B Groundwater Cleanup Level	0.12	CLARC 2014	9.84E-04	CLARC 2014	0.10
NO3-N	Nitrogen in Nitrate	10,000	Primary Federal MCL	0	EPA 2012	0	EPA 2012	40
NO2-N	Nitrogen in Nitrite	1,000	Primary Federal MCL	0	EPA 2012	0	EPA 2012	4.0
NO2+NO3-N	Nitrogen in Nitrite and Nitrate	10,000	Primary Federal MCL	0	EPA 2012	0	EPA 2012	40
621-64-7	n-Nitrosodi-n-dipropylamine	0.013	Method B Groundwater Cleanup Level	0.024	CLARC 2014	9.23E-05	CLARC 2014	5.60E-05
86-30-6	n-Nitrosodiphenylamine	18	Method B Groundwater Cleanup Level	1.3	CLARC 2014	2.05E-04	CLARC 2014	0.53
95-47-6	o-Xylene	1,600	Method B Groundwater Cleanup Level	0.24	CLARC 2014	0.21	CLARC 2014	15
87-86-5	Pentachlorophenol	0.22	Method B Groundwater Cleanup Level	0.59	CLARC 2014	1.00E-06	CLARC 2014	0.0035
85-01-8	Phenanthrene	--	--	17	ORNL 2014	0.0017	ORNL 2014	--
108-95-2	Phenol	2,400	Method B Groundwater Cleanup Level	0.029	CLARC 2014	1.63E-05	CLARC 2014	11
14265-44-2	Phosphate	--	--	--	--	--	--	--
7723-14-0	Phosphorus	--	--	3.5	EPA 2012	--	--	--
PO4-P	Phosphorus in phosphate	--	--	3.5	EPA 2012	--	--	--
7440-09-7	Potassium	--	--	5.5	EPA 2012	--	--	--
129-00-0	Pyrene	480	Method B Groundwater Cleanup Level	68	CLARC 2014	4.51E-04	CLARC 2014	655
7782-49-2	Selenium	50	Primary Federal MCL	5.0	CLARC 2014	0	CLARC 2014	5.2
7440-21-3	Silicon	--	--	--	--	--	--	--
7440-22-4	Silver	80	Method B Groundwater Cleanup Level	8.3	CLARC 2014	0	CLARC 2014	14
7440-23-5	Sodium	--	--	100	EPA 2012	--	--	--
7440-24-6	Strontium	9,600	Method B Groundwater Cleanup Level	35	EPA 2012	0	CLARC 2014	6,758

Table 7-1. Soil Concentrations Protective of Groundwater Calculated Using the Fixed Parameter 3-Phase Partitioning Model

CAS #	Analyte Name	Groundwater Cleanup Level (µg/L)	Groundwater Cleanup Level Basis	Distribution Coefficient (K_d) (mL/g)	K_d Source	Henry's Law Constant (H_{cc}) (Unitless)	H_{cc} Source	Soil Concentration Protective of Groundwater (mg/kg)
100-42-5	Styrene	100	Primary Federal MCL	0.91	CLARC 2014	0.11	CLARC 2014	2.2
14808-79-8	Sulfate	250,000	Secondary Federal MCL	0	EPA 2012	0	--	1,000
18496-25-8	Sulfide	--	--	0	EPA 2012	--	--	--
127-18-4	Tetrachloroethene	5.0	Primary Federal MCL	0.27	CLARC 2014	0.75	CLARC 2014	0.053
7440-28-0	Thallium	0.50	Federal MCLG	71	CLARC 2014	0	CLARC 2014	0.71
7440-31-5	Tin	9,600	Method B Groundwater Cleanup Level	250	EPA 2012	0	CLARC 2014	48,038
108-88-3	Toluene	640	Method B Groundwater Cleanup Level	0.14	CLARC 2014	0.27	CLARC 2014	4.7
TPH	Total petroleum hydrocarbons	500	Method A Groundwater Cleanup Level	4.0	ECF-100NR2-12-0053	--	--	1,000
TPHDIESEL	Total petroleum hydrocarbons - diesel range	500	Method A Groundwater Cleanup Level	4.0	ECF-100NR2-12-0053	--	--	2,000
TPHGASOLINE	Total petroleum hydrocarbons - gasoline range	800	Method A Groundwater Cleanup Level	4.0	ECF-100NR2-12-0053	--	--	1,000
TPHOILH	Total petroleum hydrocarbons - motor oil (high boiling)	500	Method A Groundwater Cleanup Level	4.0	ECF-100NR2-12-0053	--	--	2,000
8001-35-2	Toxaphene	0.080	Method B Groundwater Cleanup Level	96	CLARC 2014	2.46E-04	CLARC 2014	0.15
156-60-5	trans-1,2-Dichloroethylene	100	Primary Federal MCL	0.038	CLARC 2014	0.39	CLARC 2014	0.54
10061-02-6	trans-1,3-Dichloropropene	0.44	Method B Groundwater Cleanup Level	0.027	CLARC 2014	0.73	CLARC 2014	0.0025
126-73-8	Tributyl phosphate	9.7	Method B Groundwater Cleanup Level	2.4	EPA 2012	5.76E-05	EPA 2012	0.50
79-01-6	Trichloroethene	0.54	Method B Groundwater Cleanup Level	0.094	CLARC 2014	0.42	CLARC 2014	0.0036
75-69-4	Trichloromonofluoromethane	2,400	Method B Groundwater Cleanup Level	0.044	EPA 2012	4.0	EPA 2012	28
7440-61-1	Uranium	30	Primary Federal MCL	450	EPA 2012	0	CLARC 2014	270
7440-62-2	Vanadium	80	Method B Groundwater Cleanup Level	1,000	CLARC 2014	0	CLARC 2014	1,600
75-01-4	Vinyl chloride	0.061	Method B Groundwater Cleanup Level	0.019	CLARC 2014	1.1	CLARC 2014	3.83E-04
1330-20-7	Xylenes (total)	1,600	Method B Groundwater Cleanup Level	0.23	CLARC 2014	0.28	CLARC 2014	15
7440-66-6	Zinc	4,800	Method B Groundwater Cleanup Level	62	CLARC 2014	0	CLARC 2014	5,971

Notes:

MCL = maximum contaminant level.

MCLG = maximum contaminant level goal.

CLARC 2014, "Cleanup Levels and Risk Calculation (CLARC)" data tables (Ecology 2014).

EPA 2012, "Regional Screening Levels for Chemical Contaminants at Superfund Sites."

ORNL 2014, "Risk Assessment Information System."

The following summarizes differences between the table above and the cited references--FOR INETERNAL USE ONLY

Alpha-Chlordane (5103-71-9): Uses Koc and Hcc for chlordane (57-74-9) in CLARC 2014

Chromium (7440-47-3) : Uses Koc and Hcc for Chromium (III) (16065-83-1) in CLARC 2014

Hexavalent Chromium (18540-29-9) references Kd from ECF-Hanford-11-0165 instead of CLARC 2014

Endosulfan I (959-98-8): Uses Koc and Hcc for Endosulfan (115-29-7) in CLARC 2014

Endosulfan II (33213-65-9): Uses Koc and Hcc for Endosulfan (115-29-7) in CLARC 2014

Mercury (7439-97-6): Uses Kd and Hcc for Mercuric Chloride (and other Mercury Salts) (7487-94-7) in CLARC 2014

cis-1,3-Dichloropropene (10061-01-5): Uses Koc and Hcc for 1,3-dichloropropene (542-75-6) in CLARC 2014

trans-1,3-Dichloropropene (10061-02-6): Uses Koc and Hcc for 1,3-dichloropropene (542-75-6) in CLARC 2014

Uranium (7440-61-1): Uses parameters for Uranium (Soluble Salts) and/or Uranium, Insoluble Compounds as available