ECF-HANFORD-10-0453
Revision 1

Calculation of Standard Method C Direct Contact Soil Cleanup Levels for Industrial Land Use for the 100 Areas and 300 Area Remedial Investigation/Feasibility Study Reports

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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Plateau Remediation Company
P.O. Box 1600
Richland, Washington 99352

Approved for Public Release;
Further Dissemination Unlimited

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Document Type: ENV Program/Project: EP & SP

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Date Published
April 2013

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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 Area RI/FS **Date: March 26, 2012**

Calculation Title & Description: Calculation of Standard Method C Direct Contact Soil Cleanup Levels for Industrial Land Use for the 100 Areas and 300 Area Remedial Investigation/Feasibility Study Reports

Determine nonradiological soil preliminary remediation goals that will be used to support the 100 Areas and 300 Area Remedial Investigation/ Feasibility Study Reports.

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Checker: Linda Carr	**Basis of Qualification: Education & experience**
Senior Reviewer: Donna Morgans	**Basis of Qualification: Education & experience**

Part 2: Completed by Preparer

Calculation No.: ECF-HANFORD-10-0453 **Revision No.:** 1

Revision History:

Revision No.	Description	Date	Affected Pages
0	Initial Issue	12/18/2012	
1	PRGs were revised as applicable to be consistent with updated IRIS toxicity values as documented in EPA Regional Screening Level Table issued November 2012	3/26/2013	ALL

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Calculation No.: ECF-HANFORD-10-0453 **Revision No.:** 1

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Terms

ATSDR	Agency for Toxic Substances and Disease Registry
CalEPA	California Environmental Protection Agency
CLARC	Cleanup Level and Risk Calculator
ECF	environmental calculation file
EPA	Environmental Protection Agency
HEAST	Health Effects Assessment Summary Tables
HQ	hazard quotient
IRIS	Integrated Risk Information System
NJDEP	New Jersey Department of Environmental Protection
NCEA	National Center for Environmental Assessment
OEHHA	Office of Environmental Health Hazard Assessment
OU	operable unit
PPRTVs	Provisional Peer Reviewed Toxicity Values
PRG	Preliminary Remediation Goal
RAIS	Risk Assessment Information System
RDR/RAWP	Remedial Design Report/Remedial Action Work Plan
RfD	reference dose
RI/RS	Remedial Investigation/Feasibility Study
WAC	Washington Administrative Code

1 Purpose

This Environmental Calculation documents the methods and assumptions for development of non-radiological soil Preliminary Remediation Goals (PRGs) that will be used to support the 100 Areas and 300 Area Remedial Investigation/Feasibility Study (RI/FS) Reports. PRGs are concentration goals for a specific medium that are intended to protect specified receptors from exposure to contaminants through identified exposure pathways.

The PRGs described in the Environmental Calculation represent concentration goals that are protective of an industrial worker and as defined in the Model Toxics Control Act Statute and Regulation (MTCA) Cleanup Regulation Chapter 173-340 Washington Administrative Code (WAC). The PRG values calculated in this Environmental Calculation are further described in WAC 173-340-745(5)(b), "Method C Industrial Soil Cleanup Levels," "Standard Method C Industrial Soil Cleanup Levels".

2 Background

As described in DOE/RL-2008-46, *Integrated 100 Area Remedial Investigation/Feasibility Study Work Plan* and DOE/RL-2009-30, 3*00 Area Decision Unit Remedial Investigation/Feasibility Study Work Plan*, the 100 Areas and 300 Area contain multiple source and groundwater operable units (OUs), that are part of the Hanford Site River Corridor, which encompasses approximately 570 km^2 (220 mi^2) adjacent to the Columbia River. To date, waste sites within the River Corridor have been remediated to both unrestricted and industrial land use levels. This calculation focuses on cleanup levels corresponding to industrial land use. Cleanup levels corresponding to industrial land use in the River Corridor have been calculated in DOE/RL-2001-47, *Remedial Design Report/Remedial Action Work Plan for the 300 Area*. For the purposes of developing non-radiological PRGs within this Environmental Calculation document, the following target objective is used:

- Prevent unacceptable risk to human health from exposure to soils and/or debris contaminated with nonradiological contaminants less than 4.6 m (15 ft) below ground surface (bgs). PRGs that achieve this objective are based on State of Washington Method C standards (WAC 173-340-745). Standard Method C cleanup levels for individual carcinogenic substances correspond to an upper bound of the estimated excess lifetime cancer risk of one in one hundred thousand (1×10^{-5}). Standard Method C cleanup levels for individual noncarcinogenic substances are set at concentrations that are anticipated to result in no acute or chronic toxic effects on human health; this level corresponds to a Hazard Quotient (HQ) of one.

This target objective has been developed only for the purpose of calculating PRGs that are presented in this Environmental Calculation. This target objective is not intended to supersede Remedial Action Objectives (RAOs) being developed as part of the 100 Areas RI/FS reports or the 300 Area RI/FS Report. This Environmental Calculation document will be revised as needed to incorporate updates to these PRGs that may result from changes in RAOs occurring during development of the 100 Areas and 300 Area RI/FS Reports.

3 Methodology

The methodology used to determine Standard Method C industrial soil direct contact cleanup levels is described in WAC 173-340-745(5)(b).

The Standard Method C soil cleanup levels are calculated for noncarcinogens and carcinogens using Equation 745-1 and Equation 745-2, respectively. Default input parameters for calculating the soil cleanup levels are defined within the equations. Standard Method C soil cleanup levels are based on a

HQ of 1 for noncarcinogens and an acceptable cancer risk level of 1×10^{-5} for carcinogens. Reference dose and carcinogenic potency factors are obtained from the U.S. Environmental Protection Agency (EPA) "Regional Screening Levels for Chemical Contaminants at Superfund Sites" web site (EPA, 2012) (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm/) or the Washington Department of Ecology (Ecology) "Cleanup Levels and Risk Calculations (CLARC)" web site (Ecology, 2013) (https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx) . Further details on the selection of toxicity values are presented in Section 4 of this Environmental Calculation.

The following steps were used to calculate Standard Method C industrial soil cleanup levels:

1. Identify Equation 745-1 and Equation 745-2 from WAC 173-340-745(5)(b) for noncarcinogenic and carcinogenic Standard Method C soil cleanup levels.
2. Identify the exposure assumptions within Equation 745-1 and Equation 745-2 from WAC 173-340-745(5)(b) for noncarcinogens and carcinogens.
3. Obtain toxicity values for each contaminant.
4. Calculate concentrations in soil that correspond to a HQ of 1 or a 1×10^{-5} risk level.
5. When the nonradiological analyte has a Standard Method C soil cleanup level calculated for both carcinogenic and noncarcinogenic effects, use the lower of the two soil cleanup levels; the lower value is protective of both effects.
6. Document exposure assumptions, chemical-specific parameters, and their primary sources in a summary table.

The WAC 173-340-745 Standard Method C soil cleanup levels consider exposure through the soil ingestion pathway. The following represents the Standard Method C soil cleanup level equations for non-carcinogens and carcinogens. The parameters used for calculating the soil cleanup levels are defined in Table 3-1.

3.1.1 Equation 745-1 – Soil Cleanup Levels for Noncarcinogens

For chemical noncarcinogens, the Standard Method C soil cleanup levels are calculated using Equation 745-1 which is obtained from WAC 173-340-745.

$$Soil\ Cleanup\ Level\ (mg/kg) = \frac{RfD \times ABW \times UCF \times HQ \times AT}{SIR \times AB1 \times EF \times ED}$$

3.1.2 Equation 745-2 – Soil Cleanup Levels for Carcinogens

For chemical carcinogens, the Standard Method C soil cleanup levels are calculated using Equation 745-2 which is obtained from WAC 173-340-745

$$Soil\ Cleanup\ Level\ (mg/kg) = \frac{RISK \times ABW \times AT \times UCF}{CPF \times SIR \times AB1 \times ED \times EF}$$

Table 3-1. Summary of Exposure Assumptions Used to Calculate Standard Method C Industrial Soil Direct Contact Cleanup Levels

Exposure Factor	Symbol	Value	Units	Source
Gastrointestinal absorption fraction	AB1	1	unitless	WAC 173-340-745(5)(b)(iii)(B)(I) Equation 745-1 and WAC 173-340-745(5)(b)(iii)(B)(II) Equation 745-2
		0.6	unitless	WAC 173-340-745(5)(b)(iii)(B)(II) Equation 745-2 (for mixtures of dioxins and furans)
Average body weight	ABW	70	kg	WAC 173-340-745(5)(b)(iii)(B)(I) Equation 745-1 and WAC 173-340-745(5)(b)(iii)(B)(II) Equation 745-2
Averaging time	AT	20	years	WAC 173-340-745(5)(b)(iii)(B)(II) Equation 745-1
		75	years	WAC 173-340-745(5)(b)(iii)(B)(I) Equation 745-2
Carcinogenic Potency Factor	CPF	Chemical-Specific	kg-day/mg	See Table 4-1
Exposure duration	ED	20	years	WAC 173-340-745(5)(b)(iii)(B)(I) Equation 745-1 and WAC 173-340-745(5)(b)(iii)(B)(II) Equation 745-2
Exposure frequency	EF	0.4	unitless	WAC 173-340-745(5)(b)(iii)(B)(I) Equation 745-1 and WAC 173-340-745(5)(b)(iii)(B)(II) Equation 745-2
Hazard quotient	HQ	1	unitless	WAC 173-340-745(5)(b)(iii)(B)(I) Equation 745-1
Reference Dose	RfD	Chemical-Specific	mg/kg-day	See Table 4-1
Acceptable cancer risk level	RISK	1 in 100,000	unitless	WAC 173-340-745(5)(b)(iii)(B)(II) Equation 745-2
Soil ingestion rate	SIR	50	mg/day	WAC 173-340-745(5)(b)(iii)(B)(I) Equation 745-1 and WAC 173-340-745(5)(b)(iii)(B)(II) Equation 745-2
Unit conversion factor	UCF	1,000,000	mg/kg	WAC 173-340-745(5)(b)(iii)(B)(I) Equation 745-1 and WAC 173-340-745(5)(b)(iii)(B)(II) Equation 745-2

4 Assumptions and Inputs

The key assumptions and inputs used to calculate the WAC 173-340-745 Standard Method C industrial soil direct contact cleanup levels are as follows:

4.1 Exposure Factors

- The exposure route included in the Standard Method C soil cleanup level is incidental soil ingestion.
- Exposure assumptions for both noncarcinogens and carcinogens are in Table 3-1, along with the sources for each assumption.
- A gastrointestinal absorption fraction of 1.0 is used for all analytes except dioxins and/or furans. In accordance with Equation 745-2 of WAC 173-340-745(5), a gastrointestinal absorption fraction of 0.6 is used for dioxins and/or furans.

4.2 Toxicity Values

The chemical-specific toxicity values (reference dose and carcinogenic potency factors) used for the Standard Method C soil cleanup level calculations are shown in Table 4-1, along with the sources for the values. The chemical-specific reference dose (RfD) used in equation 745-1 for noncarcinogens and the chemical-specific carcinogenic potency factor (CPF) used in equation 745-2 for carcinogens are determined using the EPA recommended reference hierarchy as described in Cook, 2003, Human Health Toxicity Values in Superfund Risk Assessments (OSWER Directive 9285.7-53). The hierarchy is summarized below.

- Tier 1 – The EPA Integrated Risk Information System (IRIS)
- Tier 2 – The EPA Provisional Peer Reviewed Toxicity Values (PPRTVs)
- Tier 3 – Other Toxicity Values

Tier 1 – IRIS

The preferred source of toxicity data is EPA's IRIS database (http://www.epa.gov/iris/index.html). Expert toxicologists at EPA have derived the values in this database and most values have undergone a thorough review and validation both within and outside EPA. If a toxicity value is available in IRIS, that value is used in preference to any other value.

Tier 2 – PPRTVs

If a toxicity value is not available in IRIS, the next source is EPA's PPRTVs. This source includes toxicity values that have been developed by the Office of Research and Development/National Center for Environmental Assessment/Superfund Health Risk Technical Support Center. This database is not available to the general public, but is accessible to EPA risk assessors via EPA's intranet. These values are also published at the EPA's "Regional Screening Levels for Chemical Contaminants at Superfund Sites" website at http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm

Tier 3 – Other Toxicity Values

Tier 3 toxicity values includes additional EPA and non-EPA sources of toxicity information, including:

- The California EPA (CalEPA)'s Toxicity Criteria Database contains toxicity values that are peer reviewed and address both cancer and non-cancer effects.

- The Agency for Toxic Substances and Disease Registry (ATSDR)'s Minimal Risk Levels (MRLs) for Hazard Substances are peer-reviewed estimates of the daily human exposure to hazardous substances that is likely to be without appreciable risk of adverse non-cancer health effects over a specified duration of exposure.

- Toxicity values in EPA 540-R-97-036, *Health Effects Assessment summary Tables (HEAST)*. The HEAST values for chemical contaminants are not currently available on an EPA internet site.

When Tier 1, Tier 2, or Tier 3 toxicity values are not available for a chemical, the toxicity values from the National Center for Environmental Assessment (NCEA) are used. NCEA values can be found in the Oak Ridge National Laboratory Risk Assessment Information System (RAIS) available at http://rais.ornl.gov/.

- Toxicity equivalency factors (TEFs) from Table 708-2 of WAC 173-340-708(8), "Human Health Risk Assessment Procedures, Carcinogenic Potency Factors" are used to calculate toxicity values for carcinogenic polyaromatic hydrocarbons (PAHs), as described in WAC-173-340-708(8)(e), "Mixtures of Carcinogenic PAHs." TEFs from Table 708-4 of WAC 173-340-708(8) are used to calculate toxicity values for dioxin-like polychlorinated biphenyl (PCB) congeners, as described in WAC-173-340-708(8)(f), "PCB Mixtures." Tables 708-2 and 708-4 are presented in WAC 173-340-900, "Tables."

- A derived RfD for nitrate was calculated from the RfD reported in IRIS (1.6 mg/kg-day) for nitrate as nitrogen (NO_3^--N) using the mass fraction of nitrogen in nitrate. The mass fraction of nitrogen in nitrate = mol wt N/mol wt NO_3^- = (14 g/mol)/(62 g/mol) = 0.226. The derived RfD for nitrate = (1.6 mg NO_3^- -N/kg-day) x (1 mg NO_3^-/0.226 mg NO_3^--N) = 7.1 mg NO_3^-/kg-day.

- A derived RfD for nitrite was calculated from the RfD reported in IRIS (0.1 mg/kg-day) for nitrite as nitrogen (NO_2^--N) using the mass fraction of nitrogen in nitrite. The mass fraction of nitrogen in nitrite = mol wt N/mol wt NO_2^- = (14 g/mol)/(46 g/mol) = 0.304. The derived RfD for nitrite = (0.1 mg NO_2^--N/kg-day) x (1 mg NO_2^-/0.304 mg NO_2^--N) = 0.3 mg NO_2^-/kg-day.

- For hexavalent chromium, the oral reference dose of 0.003 mg/kg-day published by IRIS is used to develop the Standard Method C soil cleanup level. An oral cancer slope factor has been published by the New Jersey Department of Environmental Protection (NJDEP). The oral cancer slope factor derived by NJDEP is 0.5 $(mg/kg\text{-}day)^{-1}$, as presented in NJDEP, 2009, *Derivation of an Ingestion-Based Soil Remediation Criterion for Cr+6 Based on the NTP Chronic Bioassay Data for Sodium Dichromate Dihydrate*. Use of the IRIS value in this assessment has the potential to under-estimate cancer risk. If the NJDEP value were used to calculate the Standard Method C soil cleanup level, the soil concentration would decrease from 10,500 mg/kg to 263 mg/kg.

- An IRIS Toxicological Review of Thallium and Compounds was developed and posted by EPA (http://www.epa.gov/iris/toxreviews/1012tr.pdf). However due to study and data quality limitations as stated in the IRIS Toxicological Review, an RfD was not derived. There are no human studies suitable for derivation of a provisional RfD. One of four animal studies was identified for the purpose of deriving an RfD that could be used for screening purposes. A screening RfD of 0.00005 mg/kg-day was derived for soluble thallium; an uncertainty factor of 1,000 was applied to the no observed adverse effect level (NOAEL) to derive the RfD. Hair follicle atrophy in female rats was identified as the critical effect because atrophy of hair follicles is consistent with the atrophic changes observed in cases of human thallium poisoning. Thallium occurs naturally in the earth's crust. It is used in industry, but is also released due to combustion of fossil fuels, refinement of oil fractions, smelting of ores, and by some other industrial processes such as cement production and brickworks. Thallium is not known to have been released to the Hanford site from industrial use or other mechanisms listed

above. As a result of the uncertainty associated with the screening RfD and because thallium was not released to the Hanford site, the screening RfD derived for soluble thallium is not used for development of a PRG for use in the RI/FS.

An IRIS Toxicological Review of Soluble Zirconium Compounds was developed and posted by EPA (http://hhpprtv.ornl.gov/issue_papers/Zirconium.pdf). There are no adequate human sub-chronic or chronic duration studies regarding the toxicity of oral exposure to zirconium to derive an RfD. One animal study was identified for the purpose of deriving an RfD that could be used for screening purposes. A screening RfD of 0.00008 mg/kg-day was derived for soluble zirconium; an uncertainty factor of 10,000 was applied to the lowest observed adverse effect level (LOAEL) to derive the RfD. Glycosuria in urine and increased glucose and cholesterol levels were identified as the critical effect. Zirconium is a metallic element and exists as a soft, malleable ductile solid or gray to gold, amorphous powder. It is resistant to corrosion by water and steam, mineral acids, strong alkalis, organic acids, salt solutions, and molten salts. It was used at the Hanford site for cladding fuel elements. Although it was used as cladding for fuel elements, it is an inert material. As a result the high uncertainty associated with the screening RfD and because zirconium is inert and available information suggests that zirconium is not a toxic substance, the screening RfD derived for soluble zirconium is not used for development of a PRG.

5 Software Applications

The WAC 173-340-745 Standard Method C soil cleanup level calculations are performed on an electronic spreadsheet using Microsoft Excel®.

6 Calculation

The WAC 173-340-745 Standard Method C industrial soil cleanup levels 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 presented 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

The calculated Standard Method C industrial soil cleanup levels are presented in Table 7-1. The table provides calculated values for both noncarinogens and carcinogens as well as a final value, which is the lower of the two soil concentrations for analytes with both noncarcinogenic and carcinogenic effects.

8 References

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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.

173-340-708, "Human Health Risk Assessment Procedures"

173-340-745, "Soil Cleanup Standards for Industrial Properties"

173-340-900, "Tables"

Table 4-1. Summary of Reference Dose and Carcinogenic Potency Factors Used to Calculate WAC 173-340-745 Standard Method C Soil Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Non-Carcinogen[a]		Carcinogen[a]		GI Absorption Factor
			Oral Reference Dose (RfD) (mg/kg-day)	Reference[b]	Oral Cancer Potency Factor (CPF) $(mg/kg\text{-}day)^{-1}$	Reference[b]	
630-20-6	1,1,1,2-Tetrachloroethane	Tetrachloroethane;1,1,1,2-	0.03	I	0.026	I	1
71-55-6	1,1,1-Trichloroethane	Trichloroethane;1,1,1-	2	I	--	--	1
79-34-5	1,1,2,2-Tetrachloroethane	tetrachloroethane;1,1,2,2-	0.02	I	0.2	I	1
79-00-5	1,1,2-Trichloroethane	trichloroethane;1,1,2-	0.004	I	0.057	I	1
75-34-3	1,1-Dichloroethane	dichloroethane;1,1-	0.2	P	0.0057	C	1
75-35-4	1,1-Dichloroethene	Dichloroethene;1,1-	0.05	I	--	--	1
96-18-4	1,2,3-Trichloropropane	Trichloropropane;1,2,3-	0.004	I	30	I	1
95-94-3	1,2,4,5-Tetrachlorobenzene	Tetrachlorobenzene;1,2,4,5-	0.0003	I	--	--	1
120-82-1	1,2,4-Trichlorobenzene	trichlorobenzene;1,2,4-	0.01	I	0.029	P	1
96-12-8	1,2-Dibromo-3-chloropropane	Dibromo-3-chloropropane;1,2-	0.0002	P	0.8	P	1
106-93-4	1,2-Dibromoethane	Dibromoethane;1,2-	0.009	I	2.0	I	1
95-50-1	1,2-Dichlorobenzene	dichlorobenzene;1,2- (ortho-Dichlorobenzene)	0.09	I	--	--	1
107-06-2	1,2-Dichloroethane	dichloroethane;1,2-	0.006	X	0.091	I	1
540-59-0	1,2-Dichloroethene (Total)	dichloroethylene,1,2- (mixed	0.009	H	--	--	1

Table 4-1. Summary of Reference Dose and Carcinogenic Potency Factors Used to Calculate WAC 173-340-745 Standard Method C Soil Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Non-Carcinogen[a]		Carcinogen[a]		GI Absorption Factor
			Oral Reference Dose (RfD) (mg/kg-day)	Reference[b]	Oral Cancer Potency Factor (CPF) $(mg/kg\text{-}day)^{-1}$	Reference[b]	
		isomers)					
78-87-5	1,2-Dichloropropane	dichloropropane;1,2-	0.09	A	0.036	C	1
541-73-1	1,3-Dichlorobenzene	dichlorobenzene;1,3	--	--	--	--	--
106-46-7	1,4-Dichlorobenzene	dichlorobenzene;1,4- (para-Dichlorobenzene)	0.07	A	0.0054	C	1
123-91-1	1,4-Dioxane	Dioxane;1,4-	0.03	I	0.1	I	1
71-36-3	1-Butanol	Butanol,N-	0.1	I	--	--	1
71-23-8	1-Propanol	N-Propanol	--	--	--	--	--
93-65-2	2-(2-methyl-4-chlorophenoxy) propionic acid	MCPP	0.001	I	--	--	1
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl	PCB 189	0.000033	E	3.9	WAC	0.6
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl	PCB 157	0.000033	E	3.9	WAC	0.6
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl	PCB 156	0.000033	E	3.9	WAC	0.6
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl	PCB 105	0.000033	E	3.9	WAC	0.6
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl	PCB 167	0.000033	E	3.9	WAC	0.6

Table 4-1. Summary of Reference Dose and Carcinogenic Potency Factors Used to Calculate WAC 173-340-745 Standard Method C Soil Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Non-Carcinogen[a]		Carcinogen[a]		GI Absorption Factor
			Oral Reference Dose (RfD) (mg/kg-day)	Reference[b]	Oral Cancer Potency Factor (CPF) $(mg/kg\text{-}day)^{-1}$	Reference[b]	
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl	PCB 114	0.000033	E	3.9	WAC	0.6
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl	PCB 123	0.000033	E	3.9	WAC	0.6
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl	PCB 118	0.000033	E	3.9	WAC	0.6
58-90-2	2,3,4,6-Tetrachlorophenol	Tetrachlorophenol;2,3,4,6-	0.03	I	--	--	1
93-76-5	2,4,5-T(2,4,5-Trichlorophenoxyacetic acid)	Trichlorophenoxyacetic Acid, 2,4,5-	1.0E-02	I	--	--	1
93-72-1	2,4,5-TP(2-(2,4,5-Trichlorophenoxy)propionic acid)Silvex	Trichlorophenoxypropionic acid, -2,4,5	8.0E-03	I	--	--	1
95-95-4	2,4,5-Trichlorophenol	Trichlorophenol;2,4,5-	0.1	I	--	--	1
88-06-2	2,4,6-Trichlorophenol	Trichlorophenol2,4,6-	0.001	P	0.011	I	1
94-75-7	2,4-D(2,4-Dichlorophenoxyacetic acid)	Dichlorophenoxy Acetic Acid, 2,4-	1.0E-02	I	--	--	1
94-82-6	2,4-DB(4-(2,4-Dichlorophenoxy)butanoic acid)	Dichlorophenoxy)butyric Acid, 4-(2,4-	8.0E-03	I	--	--	1
120-83-2	2,4-Dichlorophenol	dichlorophenol;2,4-	0.003	I	--	--	1
105-67-9	2,4-Dimethylphenol	dimethylphenol;2,4-	0.02	I	--	--	1
51-28-5	2,4-Dinitrophenol	dinitrophenol;2,4-	0.002	I	--	--	1

Table 4-1. Summary of Reference Dose and Carcinogenic Potency Factors Used to Calculate WAC 173-340-745 Standard Method C Soil Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Non-Carcinogen[a]		Carcinogen[a]		GI Absorption Factor
			Oral Reference Dose (RfD) (mg/kg-day)	Reference[b]	Oral Cancer Potency Factor (CPF) $(mg/kg\text{-}day)^{-1}$	Reference[b]	
121-14-2	2,4-Dinitrotoluene	dinitrotoluene;2,4-	0.002	I	0.31	C	1
606-20-2	2,6-Dinitrotoluene	dinitrotoluene;2,6-	0.001	P	--	--	1
53-96-3	2-Acetylaminofluorene	Acetylaminofluorene,2-	--	--	3.8	C	1
78-93-3	2-Butanone	methyl ethyl ketone (MEK; 2-butanone)	0.6	I	--	--	1
111-76-2	2-butoxyethanol	ethylen glycol monobutyl ether (EGBE)	0.1	I	--	--	1
91-58-7	2-Chloronaphthalene	beta-chloronaphthalene	0.08	I	--	--	1
95-57-8	2-Chlorophenol	Chlorophenol;2-	0.005	I	--	--	1
591-78-6	2-Hexanone	HEXANONE;2- [MBK, methyl butyl ketone]	0.005	I	--	--	1
94-74-6	2-Methyl-4 chlorophenoxyacetic acid	MCPA	0.0005	I	--	--	1
91-57-6	2-Methylnaphthalene	methylnapthalene;2-	0.004	I	--	--	1
95-48-7	2-Methylphenol (cresol, o-)	cresol;o-	0.05	I	--	--	1
91-59-8	2-Naphthylamine	Naphthylamine,2-	--	--	1.8	C	1
88-74-4	2-Nitroaniline	nitroaniline, 2-	0.01	X	--	--	1

Table 4-1. Summary of Reference Dose and Carcinogenic Potency Factors Used to Calculate WAC 173-340-745 Standard Method C Soil Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Non-Carcinogen[a]		Carcinogen[a]		GI Absorption Factor
			Oral Reference Dose (RfD) (mg/kg-day)	Reference[b]	Oral Cancer Potency Factor (CPF) $(mg/kg\text{-}day)^{-1}$	Reference[b]	
88-75-5	2-Nitrophenol	nitrophenol;2-	--	--	--	--	--
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl	PCB 169	3.3E-08	E	3900	WAC	1
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl	PCB 126	1.0E-08	E	13000	WAC	0.6
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl	PCB 77	0.00001	E	13	WAC	0.6
91-94-1	3,3'-Dichlorobenzidine	dichlorobenzidine;3,3'-	--	--	0.45	I	0.6
119-93-7	3,3'-Dimethylbenzidine	Dimethylbenzidine;3,3'-	--	--	11	P	1
70362-50-4	3,4,4',5- Tetrachlorobiphenyl	PCB 81	0.0000033	E	39	WAC	1
65794-96-9	3+4 Methylphenol (cresol, m+p)	methylphenol,3+4 (cresol, m+p)	--	--	--	--	0.6
56-49-5	3-Methylcholanthrene	Methylcholanthrene,3-	--	--	22	C	--
99-09-2	3-Nitroaniline	nitroaniline, 3-	0.0003	NCEA	0.021	NCEA	1
72-54-8	4,4'-DDD (Dichlorodiphenyldichloroethane)	ddd	--	--	0.24	I	1
72-55-9	4,4'-DDE (Dichlorodiphenyldichloroethylene)	dde	--	--	0.34	I	1
50-29-3	4,4'-DDT (Dichlorodiphenyltrichloroethane)	ddt	0.0005	I	0.34	I	1

Table 4-1. Summary of Reference Dose and Carcinogenic Potency Factors Used to Calculate WAC 173-340-745 Standard Method C Soil Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Non-Carcinogen[a]		Carcinogen[a]		GI Absorption Factor
			Oral Reference Dose (RfD) (mg/kg-day)	Reference[b]	Oral Cancer Potency Factor (CPF) $(mg/kg\text{-}day)^{-1}$	Reference[b]	
534-52-1	4,6-Dinitro-2-methylphenol	dinitro-o-cresol;4,6-	0.00008	X	--	--	1
1918-02-1	4-Amino-3,5,6-trichloropicolinic acid	picloram	0.07	I	--	--	1
92-67-1	4-Aminobiphenyl	Aminobiphenyl,4-	--	--	21	C	1
101-55-3	4-Bromophenylphenyl ether	bromodiphenyl ether;4-	--	--	--	--	1
59-50-7	4-Chloro-3-methylphenol	chloro-3-methylphenol;4-	0.1	A	--	--	--
106-47-8	4-Chloroaniline	chloroaniline;p-	0.004	I	0.2	P	1
7005-72-3	4-Chlorophenylphenyl ether	chlorodiphenyl ether;4-	--	--	--	--	1
108-10-1	4-Methyl-2-pentanone	methyl isobutyl ketone	0.08	H	--	--	--
106-44-5	4-Methylphenol (cresol, p-)	cresol;p-	0.10	A	--	--	1
100-01-6	4-Nitroaniline	nitroaniline, 4-	0.004	P	0.02	P	1
100-02-7	4-Nitrophenol	nitrophenol;4-	--	--	--	--	--
99-55-8	5-Nitro-o-toluidine	Methyl-5-nitroaniline,2-	0.02	X	0.009	P	1
83-32-9	Acenaphthene	acenaphthene	0.06	I	--	--	1

Table 4-1. Summary of Reference Dose and Carcinogenic Potency Factors Used to Calculate WAC 173-340-745 Standard Method C Soil Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Non-Carcinogen[a]		Carcinogen[a]		GI Absorption Factor
			Oral Reference Dose (RfD) (mg/kg-day)	Reference[b]	Oral Cancer Potency Factor (CPF) $(mg/kg\text{-}day)^{-1}$	Reference[b]	
208-96-8	Acenaphthylene	acenaphthylene (Not in CLARC database tables; use acenaphthene as surrogate)	--	--	--	--	--
67-64-1	Acetone	Acetone	0.9	I	--	--	1
75-05-8	Acetonitrile	Acetonitrile	--	--	--	--	1
98-86-2	Acetophenone	Acetophenone	0.1	I	--	--	1
107-02-8	Acrolein	Acrolein	0.0005	I	--	--	1
79-06-1	Acrylamide	acrylamide	0.002	I	0.5	I	1
107-13-1	Acrylonitrile	Acrylonitrile	0.04	A	0.54	I	1
309-00-2	Aldrin	aldrin	0.00003	I	17	I	1
107-05-1	Allyl chloride	Allyl chloride	--	--	0.021	C	1
319-84-6	Alpha-BHC	hexachlorocyclohexane;alpha (alpha-BHC, HCH)	0.008	A	6.3	I	1
5103-71-9	Alpha-Chlordane	Alpha-Chlordane	0.0005	I	0.35	I	1
7429-90-5	Aluminum	Aluminum (soluble)	1	P	--	--	1
62-53-3	Aniline	Aniline	0.007	P	0.0057	I	1

Table 4-1. Summary of Reference Dose and Carcinogenic Potency Factors Used to Calculate WAC 173-340-745 Standard Method C Soil Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Non-Carcinogen[a]		Carcinogen[a]		GI Absorption Factor
			Oral Reference Dose (RfD) (mg/kg-day)	Reference[b]	Oral Cancer Potency Factor (CPF) $(mg/kg\text{-}day)^{-1}$	Reference[b]	
120-12-7	Anthracene	anthracene	0.3	I	--	--	1
7440-36-0	Antimony	antimony	0.0004	I	--	--	1
140-57-8	Aramite	aramite	0.05	H	0.025	I	1
12674-11-2	Aroclor-1016	aroclor 1016 (PCB)	0.00007	I	0.07	S	1
11104-28-2	Aroclor-1221	aroclor 1221 [PCB]	--	--	2	S	1
11141-16-5	Aroclor-1232	aroclor 1232 [PCB]	--	--	2	S	1
53469-21-9	Aroclor-1242	aroclor 1242 [PCB]	--	--	2	S	1
12672-29-6	Aroclor-1248	aroclor 1248 [PCB]	--	--	2	S	1
11097-69-1	Aroclor-1254	aroclor 1254 (PCB)	0.00002	I	2	S	1
11096-82-5	Aroclor-1260	aroclor 1260 (PCB)	--	--	2	S	1
37324-23-5	Aroclor-1262	aroclor 1262 (PCB)	--	--	--	--	--
11100-14-4	Aroclor-1268	aroclor 1268 (PCB)	--	--	--	--	--
7440-38-2	Arsenic	arsenic, inorganic	0.0003	I	1.5	I	1
103-33-3	Azobenzene	Azobenzene	--	--	0.11	I	1

Table 4-1. Summary of Reference Dose and Carcinogenic Potency Factors Used to Calculate WAC 173-340-745 Standard Method C Soil Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Non-Carcinogen[a]		Carcinogen[a]		GI Absorption Factor
			Oral Reference Dose (RfD) (mg/kg-day)	Reference[b]	Oral Cancer Potency Factor (CPF) $(mg/kg\text{-}day)^{-1}$	Reference[b]	
7440-39-3	Barium, compounds	Barium	0.2	I	--	--	1
71-43-2	Benzene	Benzene	0.004	I	0.055	I	1
56-55-3	Benzo(a)anthracene	Benzo(a)anthracene	--	--	0.73	WAC	1
50-32-8	Benzo(a)pyrene	Benzo(a)pyrene	--	--	7.3	I	1
205-99-2	Benzo(b)fluoranthene	Benzo(b)fluoranthene	--	--	0.73	WAC	1
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	--	--	0.73	WAC	1
65-85-0	Benzoic acid	Benzoic acid	4.0	I	--	--	1
100-51-6	Benzyl alcohol	Benzyl alcohol	0.1	P	--	--	1
7440-41-7	Beryllium	beryllium	0.002	I	--	--	1
319-85-7	beta-1,2,3,4,5,6-Hexachlorocyclohexane (beta-BHC)	hexachlorocyclohexane;beta-	--	--	1.8	I	1
108-60-1	Bis(2-chloro-1-methylethyl)ether	bis(2-chloro-1-methyl-ethyl)ether	0.04	I	0.07	H	1
111-91-1	Bis(2-Chloroethoxy)methane	bis(2-chloroethoxyl)methane	0.003	P	--	--	1

Table 4-1. Summary of Reference Dose and Carcinogenic Potency Factors Used to Calculate WAC 173-340-745 Standard Method C Soil Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Non-Carcinogen[a]		Carcinogen[a]		GI Absorption Factor
			Oral Reference Dose (RfD) (mg/kg-day)	Reference[b]	Oral Cancer Potency Factor (CPF) $(mg/kg\text{-}day)^{-1}$	Reference[b]	
111-44-4	Bis(2-chloroethyl) ether	bis(2-chloroethyl)ether	--	--	1.1	I	1
117-81-7	Bis(2-ethylhexyl) phthalate	bis(2-ethylhexyl) phthalate	0.02	I	0.014	I	1
7440-69-9	Bismuth	Bismuth	--	--	--	--	--
7440-42-8	Boron	Boron	0.2	I	--	--	1
24959-67-9	Bromide	Bromide	--	--	--	--	--
75-27-4	Bromodichloromethane	bromodichloromethane	0.02	I	0.062	I	1
75-25-2	Bromoform	bromoform	0.02	I	0.0079	I	1
74-83-9	Bromomethane	bromomethane	0.0014	I	--	--	1
85-68-7	Butylbenzylphthalate	butyl benzyl phthalate	0.2	I	0.0019	P	1
7440-43-9	Cadmium	cadmium	0.001	I	--	--	1
7440-70-2	Calcium	Calcium	--	--	--	--	--
86-74-8	Carbazole	carbazole	--	--	0.02	H	1
75-15-0	Carbon disulfide	carbon disulfide	0.1	I	--	--	1
56-23-5	Carbon tetrachloride	carbon tetrachloride	0.004	I	0.07	I	1

Table 4-1. Summary of Reference Dose and Carcinogenic Potency Factors Used to Calculate WAC 173-340-745 Standard Method C Soil Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Non-Carcinogen[a]		Carcinogen[a]		GI Absorption Factor
			Oral Reference Dose (RfD) (mg/kg-day)	Reference[b]	Oral Cancer Potency Factor (CPF) $(mg/kg\text{-}day)^{-1}$	Reference[b]	
57-74-9	Chlordane	chlordane	0.0005	I	0.35	I	1
16887-00-6	Chloride	chloride	--	--	--	--	--
108-90-7	Chlorobenzene	chlorobenzene	0.02	I	--	--	1
510-15-6	Chlorobenzilate	Chlorobenzilate	0.02	I	0.11	C	1
75-00-3	Chloroethane	ethyl chloride	--	--	--	--	1
67-66-3	Chloroform	chloroform	0.01	I	0.031	C	1
74-87-3	Chloromethane	chloromethane	--	--	--	--	1
126-99-8	Chloroprene	Chloro-1,3-butadiene,2-	0.02	H	--	--	1
7440-47-3	Chromium	chromium (total)	1.5	I	--	--	1
218-01-9	chrysene	Chrysene	--	--	0.073	WAC	1
156-59-2	cis-1,2-Dichloroethylene	dichloroethylene;1,2-,cis	0.002	I	--	--	1
10061-01-5	cis-1,3-Dichloropropene	dichloropropene;1,2-,cis	0.03	I	0.1	I	1
7440-48-4	cobalt	Cobalt	0.0003	P	--	--	1
PCB1242/1016	Co-elution of Aroclor 1242 and Aroclor 1016	Co-elution of Aroclor 1242 and Aroclor 1017	--	--	--	--	--

Table 4-1. Summary of Reference Dose and Carcinogenic Potency Factors Used to Calculate WAC 173-340-745 Standard Method C Soil Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Non-Carcinogen[a]		Carcinogen[a]		GI Absorption Factor
			Oral Reference Dose (RfD) (mg/kg-day)	Reference[b]	Oral Cancer Potency Factor (CPF) $(mg/kg\text{-}day)^{-1}$	Reference[b]	
7440-50-8	Copper	copper	0.04	H	--	--	1
57-12-5	Cyanide	cyanide	0.0006	I	--	--	1
110-82-7	Cyclohexane	Cyclohexane	--	--	--	--	1
108-94-1	Cyclohexanone	Cyclohexanone	5.0	I	--	--	1
75-99-0	Dalapon	Dalapon	0.03	I	--	--	1
124-18-5	Decane	Decane	--	--	--	--	--
319-86-8	Delta-BHC	hexachlorocyclohexane;delta -	--	--	--	--	--
2303-16-4	Diallate	Diallate	--	--	0.061	H	1
53-70-3	Dibenz[a,h]anthracene	Dibenz[a,h]anthracene	--	--	0.73	WAC	1
132-64-9	Dibenzofuran	dibenzofuran	0.001	X	--	--	0.6
124-48-1	Dibromochloromethane	chlorodibromomethane [dibromochloromethane]	0.02	I	0.084	I	1
74-95-3	Dibromomethane	Methylene bromide	0.01	H	--	--	1
1918-00-9	Dicamba	Dicamba	0.03	I	--	--	1
75-71-8	Dichlorodifluoromethane	Dichlorodifluoromethane	0.2	I	--	--	1

Table 4-1. Summary of Reference Dose and Carcinogenic Potency Factors Used to Calculate WAC 173-340-745 Standard Method C Soil Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Non-Carcinogen[a]		Carcinogen[a]		GI Absorption Factor
			Oral Reference Dose (RfD) (mg/kg-day)	Reference[b]	Oral Cancer Potency Factor (CPF) $(mg/kg\text{-}day)^{-1}$	Reference[b]	
120-36-5	Dichloroprop	Dichloroprop	--	--	--	--	--
60-57-1	Dieldrin	dieldrin	0.00005	I	16	I	1
60-29-7	Diethyl ether	ethyl ether	0.2	I	--	--	1
84-66-2	Diethylphthalate	diethyl phthalate	0.8	I	--	--	1
60-51-5	Dimethoate	Dimethoate	0.0002	I	--	--	1
131-11-3	Dimethyl phthalate	dimethyl phthalate	--	--	--	--	--
84-74-2	Di-n-butylphthalate	di-butyl phthalate	0.1	I	--	--	1
117-84-0	Di-n-octylphthalate	di-n-octyl phthalate	0.012	P	--	--	1
88-85-7	Dinoseb(2-secButyl-4,6-dinitrophenol)	Dinoseb	1.0E-03	I	--	--	1
298-04-4	Disulfoton	Disulfoton	0.00004	I	--	--	1
959-98-8	Endosulfan I	Endosulfan I	0.006	--	--	--	1
33213-65-9	Endosulfan II	Endosulfan II	0.006	--	--	--	1
1031-07-8	Endosulfan sulfate	Endosulfan sulfate	--	--	--	--	--
72-20-8	Endrin	endrin	0.0003	I	--	--	1

Table 4-1. Summary of Reference Dose and Carcinogenic Potency Factors Used to Calculate WAC 173-340-745 Standard Method C Soil Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Non-Carcinogen[a]		Carcinogen[a]		GI Absorption Factor
			Oral Reference Dose (RfD) (mg/kg-day)	Reference[b]	Oral Cancer Potency Factor (CPF) $(mg/kg\text{-}day)^{-1}$	Reference[b]	
7421-93-4	Endrin aldehyde	Endrin aldehyde	--	--	--	--	--
53494-70-5	Endrin ketone	Endrin ketone	--	--	--	--	--
64-17-5	Ethanol	Ethanol	--	--	--	--	--
107-21-1	Ethylene glycol	Ethylene glycol	2	I	--	--	1
141-78-6	Ethyl acetate	Ethyl acetate	0.9	I	--	--	1
97-63-2	Ethyl methacrylate	Ethyl methacrylate	0.09	H	--	--	1
100-41-4	Ethylbenzene	ethylbenzene	0.1	I	0.011	C	1
206-44-0	Fluoranthene	fluoranthene	0.04	I	--	--	1
86-73-7	Fluorene	fluorene	0.04	I	--	--	1
16984-48-8	Fluoride	fluoride (using fluorine)	0.06	I	--	--	1
58-89-9	Gamma-BHC (Lindane)	lindane [gamma-BHC] (see hexachlorocyclohexane)	0.0003	I	1.1	C	1
5566-34-7	gamma-Chlordane	Chlordane (gamma)	0.0005	I	0.35	I	1
76-44-8	Heptachlor	heptachlor	0.0005	I	4.5	I	1
1024-57-3	Heptachlor epoxide	Heptachlor epoxide	0.000013	I	9.1	I	1

Table 4-1. Summary of Reference Dose and Carcinogenic Potency Factors Used to Calculate WAC 173-340-745 Standard Method C Soil Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Non-Carcinogen[a]		Carcinogen[a]		GI Absorption Factor
			Oral Reference Dose (RfD) (mg/kg-day)	Reference[b]	Oral Cancer Potency Factor (CPF) $(mg/kg\text{-}day)^{-1}$	Reference[b]	
118-74-1	Hexachlorobenzene	hexachlorobenzene	0.0008	I	1.6	I	1
87-68-3	Hexachlorobutadiene	hexachlorobutadiene	0.001	P	0.078	I	1
77-47-4	Hexachlorocyclopentadiene	hexachlorocyclopentadiene	0.006	I	--	--	1
67-72-1	Hexachloroethane	hexachloroethane	0.0007	I	0.04	I	1
70-30-4	Hexachlorophene	Hexachlorophene	0.0003	I	--	--	1
110-54-3	Hexane	Hexane,n-	0.06	H	--	--	1
18540-29-9	Hexavalent Chromium	chromium(VI)	0.003	I	--	--	1
302-01-2	Hydrazine	Hydrazine	--	--	3.0	I	1
193-39-5	Indeno(1,2,3-cd)pyrene	Indeno(1,2,3-cd)pyrene	--	--	0.73	WAC	1
7439-89-6	Iron	Iron	0.7	P	--	--	1
78-83-1	Isobutyl alcohol	Isobutyl alcohol	0.3	I	--	--	1
78-59-1	Isophorone	isophorone	0.2	I	0.00095	I	1
98-82-8	Isopropylbenzene	Cumene	0.1	I	--	--	1
143-50-0	Kepone	chlordecone	0.0003	I	10	I	1

Table 4-1. Summary of Reference Dose and Carcinogenic Potency Factors Used to Calculate WAC 173-340-745 Standard Method C Soil Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Non-Carcinogen[a]		Carcinogen[a]		GI Absorption Factor
			Oral Reference Dose (RfD) (mg/kg-day)	Reference[b]	Oral Cancer Potency Factor (CPF) $(mg/kg\text{-}day)^{-1}$	Reference[b]	
7439-92-1	Lead	lead	--	--	--	--	1
7439-93-2	Lithium	Lithium	0.002	P	--	--	1
7439-95-4	Magnesium	Magnesium (Not in CLARC database Tables)	--	--	--	--	--
7439-96-5	Manganese	manganese	0.14	I	--	--	1
99-65-0	m-Dinitrobenzene	Dinitrobenzene;1,3-	0.0001	I	--	--	1
7439-97-6	Mercury	Mercury (using mercuric chloride)	0.0003	I	--	--	1
126-98-7	Methacrylonitrile	Methacrylonitrile	0.0001	I	--	--	1
67-56-1	Methanol	methanol	0.5	I	--	--	1
72-43-5	Methoxychlor	methoxychlor	0.005	I	--	--	1
80-62-6	Methyl methacrylate	Methyl methacrylate	1.4	I	--	--	1
66-27-3	Methyl methanesulfonate	Methyl methanesulfonate	--	--	0.099	C	1
298-00-0	Methyl parathion	Methyl parathion	0.00025	I	--	--	1
75-09-2	Methylene chloride	methylene chloride	0.006	I	0.002	I	1
7439-98-7	Molybdenum	molybdenum	0.005	I	--	--	1

Table 4-1. Summary of Reference Dose and Carcinogenic Potency Factors Used to Calculate WAC 173-340-745 Standard Method C Soil Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Non-Carcinogen[a]		Carcinogen[a]		GI Absorption Factor
			Oral Reference Dose (RfD) (mg/kg-day)	Reference[b]	Oral Cancer Potency Factor (CPF) $(mg/kg\text{-}day)^{-1}$	Reference[b]	
108-38-3	m-Xylene	Xylene, m-	0.2	S	--	--	1
91-20-3	Naphthalene	naphthalene	0.02	I	--	--	1
104-51-8	n-Butylbenzene	n-Butylbenzene	0.05	P	--	--	1
7440-02-0	Nickel	nickel soluble salts	0.02	I	--	--	1
14797-55-8	Nitrate	Nitrate	7.1	I	--	--	1
14797-65-0	Nitrite	Nitrite	0.3	I	--	--	1
98-95-3	Nitrobenzene	Nitrobenzene	0.002	I	--	--	1
NO3-N	Nitrogen in Nitrate	Nitrogen as Nitrate	1.6	I	--	--	1
NO2-N	Nitrogen in Nitrite	Nitrogen as Nitrite	0.1	I	--	--	1
NO2+NO3-N	Nitrogen in Nitrite and Nitrate	Nitrogen in Nitrite and Nitrate	1.6	I	--	--	1
930-55-2	Nitrosopyrrolidine	Nitrosopyrrolidine,n-	--	--	2.1	I	1
55-18-5	n-Nitrosodiethylamine	Nitrosodiethylamine,n-	--	--	150	I	1
62-75-9	n-Nitrosodimethylamine	Nitrosodimethylamine,n-	8.0E-06	P	51	I	1
924-16-3	n-Nitrosodi-n-butylamine	Nitroso-di-n-butylamine,n-	--	--	5.4	I	1

Table 4-1. Summary of Reference Dose and Carcinogenic Potency Factors Used to Calculate WAC 173-340-745 Standard Method C Soil Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Non-Carcinogen[a]		Carcinogen[a]		GI Absorption Factor
			Oral Reference Dose (RfD) (mg/kg-day)	Reference[b]	Oral Cancer Potency Factor (CPF) $(mg/kg\text{-}day)^{-1}$	Reference[b]	
621-64-7	n-Nitrosodi-n-dipropylamine	nitroso-di-n-propylamine;N-	--	--	7	I	1
86-30-6	n-Nitrosodiphenylamine	nitrosodiphenylamine;N-	--	--	0.0049	I	1
10595-95-6	n-Nitrosomethylethylamine	Nitrosomethylethylamine,n-	--	--	22	I	1
59-89-2	n-Nitrosomorpholine	Nitrosomorpholine [N-]	--	--	6.7	C	1
100-75-4	n-Nitrosopiperidine	Nitrosopiperidine [N-]	--	--	9.4	C	1
95-47-6	o-Xylene	xylene,o-	0.2	S	--	--	1
56-38-2	Parathion	Parathion	0.006	H	--	--	1
60-11-7	p-Dimethylaminoazobenzene	Dimethylaminoazobenzene [p-]	--	--	4.6	C	1
608-93-5	Pentachlorobenzene	Pentachlorobenzene	0.0008	I	--	--	1
76-01-7	Pentachloroethane	Pentachloroethane	--	--	0.09	P	1
82-68-8	Pentachloronitrobenzene (PCNB)	Pentachloronitrobenzene	0.003	I	0.26	H	1
87-86-5	Pentachlorophenol	pentachlorophenol	0.005	I	0.4	I	1
62-44-2	Phenacetin	Phenacetin	--	--	0.0022	C	1
85-01-8	Phenanthrene	Phenanthrene	--	--	--	--	--

Table 4-1. Summary of Reference Dose and Carcinogenic Potency Factors Used to Calculate WAC 173-340-745 Standard Method C Soil Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Non-Carcinogen[a]		Carcinogen[a]		GI Absorption Factor
			Oral Reference Dose (RfD) (mg/kg-day)	Reference[b]	Oral Cancer Potency Factor (CPF) $(mg/kg\text{-}day)^{-1}$	Reference[b]	
108-95-2	Phenol	Phenol	0.3	I	--	--	1
298-02-2	Phorate	Phorate	0.0002	H	--	--	1
14265-44-2	Phosphate	Phosphate	--	--	--	--	--
7723-14-0	Phosphorus	phosphorus	--	--	--	--	1
PO4-P	Phosphorus in phosphate	Phosphorus in phosphate	--	--	--	--	--
1336-36-3	Polychlorinated Biphenyls	Polychlorinated Biphenyls (high risk)	--	--	2.0	I	--
7440-09-7	Potassium	Potassium	--	--	--	--	1
106-50-3	p-Phenylenediamine	Phenylenediamine,p-	0.19	H	--	--	1
23950-58-5	Pronamide	Pronamide	--	--	--	--	1
129-00-0	Pyrene	pyrene	0.03	I	--	--	1
110-86-1	Pyridine	Pyridine	0.001	I	--	--	1
94-59-7	Safrole	Safrole	--	--	0.22	C	1
7782-49-2	Selenium	selenium and compounds	0.005	I	--	--	--
7440-21-3	Silicon	Silicon	--	--	--	--	1

Table 4-1. Summary of Reference Dose and Carcinogenic Potency Factors Used to Calculate WAC 173-340-745 Standard Method C Soil Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Non-Carcinogen[a]		Carcinogen[a]		GI Absorption Factor
			Oral Reference Dose (RfD) (mg/kg-day)	Reference[b]	Oral Cancer Potency Factor (CPF) $(mg/kg\text{-}day)^{-1}$	Reference[b]	
7440-22-4	Silver	silver	0.005	I	--	--	--
7440-23-5	Sodium	Sodium	--	--	--	--	1
7440-24-6	Strontium	strontium	0.6	I	--	--	1
100-42-5	Styrene	styrene	0.2	I	--	--	--
14808-79-8	Sulfate	sulfate	--	--	--	--	--
18496-25-8	Sulfide	Sulfide	--	--	--	--	1
99-35-4	sym-Trinitrobenzene	Trinitrobenzene,1,3,5-	0.03	I	--	--	1
127-18-4	Tetrachloroethene	tetrachloroethylene	0.006	I	0.0021	I	1
3689-24-5	Tetraethyl dithiopyrophosphate (Sulfotepp)	Tetraethyl dithiopyrophosphate	0.005	I	--	--	1
7440-28-0	Thallium	Thallium, soluble salts	--	--	--	--	--
7440-31-5	Tin	tin	0.6	H	--	--	--
7440-32-6	Titanium	Titanium	--	--	--	--	1
108-88-3	Toluene	Toluene	0.08	I	--	--	1
TPH	Total petroleum hydrocarbons	Total petroleum hydrocarbons	--	--	--	--	--

Table 4-1. Summary of Reference Dose and Carcinogenic Potency Factors Used to Calculate WAC 173-340-745 Standard Method C Soil Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Non-Carcinogen[a]		Carcinogen[a]		GI Absorption Factor
			Oral Reference Dose (RfD) (mg/kg-day)	Reference[b]	Oral Cancer Potency Factor (CPF) $(mg/kg\text{-}day)^{-1}$	Reference[b]	
TPHDIESEL	Total petroleum hydrocarbons - diesel range	Total petroleum hydrocarbons - diesel range	--	--	--	--	--
TPHGASOLINE	Total petroleum hydrocarbons - gasoline range	Total petroleum hydrocarbons - gasoline range	--	--	--	--	--
TPHKEROSENE	Total petroleum hydrocarbons - kerosene range	Total petroleum hydrocarbons - kerosene range	--	--	--	--	--
TPH/OILH	Total petroleum hydrocarbons - motor oil (high boiling)	Total petroleum hydrocarbons - motor oil (high boiling)	--	--	--	--	--
TOTALPCB	Total Polychlorinated Biphenyls	Polychlorinated Biphenyls, high risk	--	--	2.0	I	1
8001-35-2	Toxaphene	toxaphene	--	--	1.1	I	1
156-60-5	trans-1,2-Dichloroethylene	dichloroethylene;1,2-,trans	0.02	I	--	--	1
10061-02-6	trans-1,3-Dichloropropene	dichloropropene;1,3-,trans	0.03	I	0.1	I	1
5103-74-2	trans-Chlordane	gamma chlordane	0.0005	I	0.35	I	1
126-73-8	Tributyl phosphate	Tributyl phosphate	0.01	I	0.009	I	1
79-01-6	Trichloroethene	trichloroethylene (TCE)	0.0005	I	0.046	I	1

Table 4-1. Summary of Reference Dose and Carcinogenic Potency Factors Used to Calculate WAC 173-340-745 Standard Method C Soil Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Non-Carcinogen[a]		Carcinogen[a]		GI Absorption Factor
			Oral Reference Dose (RfD) (mg/kg-day)	Reference[b]	Oral Cancer Potency Factor (CPF) $(mg/kg\text{-}day)^{-1}$	Reference[b]	
75-69-4	Trichloromonofluoro-methane	Trichlorofluoromethane	0.3	I	--	I	1
7440-61-1	Uranium	Uranium	0.003	I	--	--	1
7440-62-2	Vanadium	Vanadium,metallic	0.005	S	--	--	1
108-05-4	Vinyl acetate	Vinyl acetate	1.0	H	--	--	1
75-01-4	Vinyl chloride	vinyl chloride [chloroethene; 1-]	0.003	I	0.72	I	1
1330-20-7	Xylenes (total)	Xylenes (total)	0.2	I	--	--	1
7440-66-6	Zinc	zinc	0.3	I	--	--	1
7440-67-7	Zirconium	Zirconium	--	--	--	--	--

Notes:

a. Source = EPA Regional Screening Levels web site (EPA, 2012).

b. Reference key:

A = The Agency for Toxic Substances and Disease Registry (ATSDR)

C = The California Environmental Protection Agency (CalEPA)

H = Health Effects Assessment Summary Tables (HEAST)

I = EPA's Integrated Risk Information System (IRIS)

NCEA = National Center for Environmental Assessment (NCEA)

P = Provisional Peer Reviewed Toxicity Values (PPRTV)

Table 4-1. Summary of Reference Dose and Carcinogenic Potency Factors Used to Calculate WAC 173-340-745 Standard Method C Soil Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Non-Carcinogen[a]		Carcinogen[a]		GI Absorption Factor
			Oral Reference Dose (RfD) (mg/kg-day)	Reference[b]	Oral Cancer Potency Factor (CPF) $(mg/kg\text{-}day)^{-1}$	Reference[b]	

S = Special case chemical; basis for value discussed on EPA Regional Screening Levels web site (EPA, 2012)

WAC = Value calculated using a toxicity equivalency factor (TEF) as provided by WAC 173-340-708(8), "Human Health Risk Assessment Procedures, Carcinogenic Potency Factor," and WAC 173-340-900, "Tables"

X = PPRTV Appendix

Table 7-1. Summary of WAC 173-340-745 Standard Method C Industrial Soil Direct Contact Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Soil Method C Industrial Land Use[c]		
			10^{-6} Carcinogen (mg/kg)	Non-Carcinogen (mg/kg)	Final (mg/kg)
630-20-6	1,1,1,2-Tetrachloroethane	Tetrachloroethane;1,1,1,2-	5,048	105,000	5,048
71-55-6	1,1,1-Trichloroethane	Trichloroethane;1,1,1-	--	7.00E+06	7.00E+06
79-34-5	1,1,2,2-Tetrachloroethane	tetrachloroethane;1,1,2,2-	656	70,000	656
79-00-5	1,1,2-Trichloroethane	trichloroethane;1,1,2-	2,303	14,000	2,303
75-34-3	1,1-Dichloroethane	dichloroethane;1,1-	23,026	700,000	23,026
75-35-4	1,1-Dichloroethene	Dichloroethene;1,1-	--	175,000	175,000
96-18-4	1,2,3-Trichloropropane	Trichloropropane;1,2,3-	4.4	14,000	4.4
95-94-3	1,2,4,5-Tetrachlorobenzene	Tetrachlorobenzene;1,2,4,5-	--	1,050	1,050
120-82-1	1,2,4-Trichlorobenzene	trichlorobenzene;1,2,4-	4,526	35,000	4,526
96-12-8	1,2-Dibromo-3-chloropropane	Dibromo-3-chloropropane;1,2-	164	700	164
106-93-4	1,2-Dibromoethane	Dibromoethane;1,2-	66	31,500	66
95-50-1	1,2-Dichlorobenzene	dichlorobenzene;1,2- (ortho-Dichlorobenzene)	--	315,000	315,000
107-06-2	1,2-Dichloroethane	dichloroethane;1,2-	1,442	21,000	1,442
540-59-0	1,2-Dichloroethene (Total)	dichloroethylene,1,2- (mixed isomers)	--	31,500	31,500
78-87-5	1,2-Dichloropropane	dichloropropane;1,2-	3,646	315,000	3,646
541-73-1	1,3-Dichlorobenzene	dichlorobenzene;1,3	--	--	--

Table 7-1. Summary of WAC 173-340-745 Standard Method C Industrial Soil Direct Contact Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Soil Method C Industrial Land Use[c]		
			10^{-6} Carcinogen (mg/kg)	Non-Carcinogen (mg/kg)	Final (mg/kg)
106-46-7	1,4-Dichlorobenzene	dichlorobenzene;1,4- (para-Dichlorobenzene)	24,306	245,000	24,306
123-91-1	1,4-Dioxane	Dioxane;1,4-	1,313	105,000	1,313
71-36-3	1-Butanol	Butanol,N-	--	350,000	350,000
71-23-8	1-Propanol	N-Propanol	--	--	--
93-65-2	2-(2-methyl-4-chlorophenoxy) propionic acid	MCPP	--	3,500	3,500
39635-31-9	2,3,3',4,4',5,5'-Heptachlorobiphenyl	PCB 189	56	116	56
69782-90-7	2,3,3',4,4',5'-Hexachlorobiphenyl	PCB 157	56	116	56
38380-08-4	2,3,3',4,4',5-Hexachlorobiphenyl	PCB 156	56	116	56
32598-14-4	2,3,3',4,4'-Pentachlorobiphenyl	PCB 105	56	116	56
52663-72-6	2,3',4,4',5,5'-Hexachlorobiphenyl	PCB 167	56	116	56
74472-37-0	2,3,4,4',5-Pentachlorobiphenyl	PCB 114	56	116	56
31508-00-6	2,3',4,4',5-Pentachlorobiphenyl	PCB 118	56	116	56
65510-44-3	2',3,4,4',5-Pentachlorobiphenyl	PCB 123	56	116	56
58-90-2	2,3,4,6-Tetrachlorophenol	Tetrachlorophenol;2,3,4,6-	--	105,000	105,000
93-76-5	2,4,5-T(2,4,5-Trichlorophenoxyacetic acid)	Trichlorophenoxyacetic Acid, 2,4,5-	--	35,000	35,000

Table 7-1. Summary of WAC 173-340-745 Standard Method C Industrial Soil Direct Contact Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Soil Method C Industrial Land Use[c]		
			10^{-6} Carcinogen (mg/kg)	Non-Carcinogen (mg/kg)	Final (mg/kg)
93-72-1	2,4,5-TP(2-(2,4,5-Trichlorophenoxy)propionic acid)Silvex	Trichlorophenoxypropionic acid, -2,4,5	--	28,000	28,000
95-95-4	2,4,5-Trichlorophenol	Trichlorophenol;2,4,5-	--	350,000	350,000
88-06-2	2,4,6-Trichlorophenol	Trichlorophenol2,4,6-	11,932	3,500	3,500
94-75-7	2,4-D(2,4-Dichlorophenoxyacetic acid)	Dichlorophenoxy Acetic Acid, 2,4-	--	35,000	35,000
94-82-6	2,4-DB(4-(2,4-Dichlorophenoxy)butanoic acid)	Dichlorophenoxy)butyric Acid, 4-(2,4-	--	28,000	28,000
120-83-2	2,4-Dichlorophenol	dichlorophenol;2,4-	--	10,500	10,500
105-67-9	2,4-Dimethylphenol	dimethylphenol;2,4-	--	70,000	70,000
51-28-5	2,4-Dinitrophenol	dinitrophenol;2,4-	--	7,000	7,000
121-14-2	2,4-Dinitrotoluene	dinitrotoluene;2,4-	423	7,000	423
606-20-2	2,6-Dinitrotoluene	dinitrotoluene;2,6-	--	3,500	3,500
53-96-3	2-Acetylaminofluorene	Acetylaminofluorene,2-	35	--	35
78-93-3	2-Butanone	methyl ethyl ketone (MEK; 2-butanone)	--	2.10E+06	2.10E+06
111-76-2	2-butoxyethanol	ethylen glycol monobutyl ether (EGBE)	--	350,000	350,000
91-58-7	2-Chloronaphthalene	beta-chloronaphthalene	--	280,000	280,000

Table 7-1. Summary of WAC 173-340-745 Standard Method C Industrial Soil Direct Contact Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Soil Method C Industrial Land Use[c]		
			10^{-6} Carcinogen (mg/kg)	Non-Carcinogen (mg/kg)	Final (mg/kg)
95-57-8	2-Chlorophenol	Chlorophenol;2-	--	17,500	17,500
591-78-6	2-Hexanone	HEXANONE;2- [MBK, methyl butyl ketone]	--	17,500	17,500
94-74-6	2-Methyl-4 chlorophenoxyacetic acid	MCPA	--	1,750	1,750
91-57-6	2-Methylnaphthalene	methylnapthalene;2-	--	14,000	14,000
95-48-7	2-Methylphenol (cresol, o-)	cresol;o-	--	175,000	175,000
91-59-8	2-Naphthylamine	Naphthylamine,2-	73	--	73
88-74-4	2-Nitroaniline	nitroaniline, 2-	--	35,000	35,000
88-75-5	2-Nitrophenol	nitrophenol;2-	--	--	--
108-10-1	4-Methyl-2-pentanone	methyl isobutyl ketone	--	280,000	280,000
32774-16-6	3,3',4,4',5,5'-Hexachlorobiphenyl	PCB 169	0.056	0.12	0.056
57465-28-8	3,3',4,4',5-Pentachlorobiphenyl	PCB 126	0.017	0.035	0.017
32598-13-3	3,3',4,4'-Tetrachlorobiphenyl	PCB 77	17	35	17
91-94-1	3,3'-Dichlorobenzidine	dichlorobenzidine;3,3'-	292	--	292
119-93-7	3,3'-Dimethylbenzidine	Dimethylbenzidine;3,3'-	12	--	12
70362-50-4	3,4,4',5- Tetrachlorobiphenyl	PCB 81	5.6	12	5.6
65794-96-9	3+4 Methylphenol (cresol, m+p)	methylphenol,3+4 (cresol, m+p)	--	--	--

Table 7-1. Summary of WAC 173-340-745 Standard Method C Industrial Soil Direct Contact Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Soil Method C Industrial Land Use[c]		
			10^{-6} Carcinogen (mg/kg)	Non-Carcinogen (mg/kg)	Final (mg/kg)
56-49-5	3-Methylcholanthrene	Methylcholanthrene,3-	6.0	--	6.0
99-09-2	3-Nitroaniline	nitroaniline, 3-	6,250	1,050	1,050
72-54-8	4,4'-DDD (Dichlorodiphenyldichloroethane)	ddd	547	--	547
72-55-9	4,4'-DDE (Dichlorodiphenyldichloroethylene)	dde	386	--	386
50-29-3	4,4'-DDT (Dichlorodiphenyltrichloroethane)	ddt	386	1,750	386
534-52-1	4,6-Dinitro-2-methylphenol	dinitro-o-cresol;4,6-	--	280	280
1918-02-1	4-Amino-3,5,6-trichloropicolinic acid	picloram	--	245,000	245,000
92-67-1	4-Aminobiphenyl	Aminobiphenyl,4-	6.3	--	6.3
101-55-3	4-Bromophenylphenyl ether	bromodiphenyl ether;4-	--	--	--
59-50-7	4-Chloro-3-methylphenol	chloro-3-methylphenol;4-	--	350,000	350,000
106-47-8	4-Chloroaniline	chloroaniline;p-	656	14,000	656
7005-72-3	4-Chlorophenylphenyl ether	chlorodiphenyl ether;4-	--	--	--
106-44-5	4-Methylphenol (cresol, p-)	cresol;p-	--	350,000	350,000
100-01-6	4-Nitroaniline	nitroaniline, 4-	6,563	14,000	6,563

Table 7-1. Summary of WAC 173-340-745 Standard Method C Industrial Soil Direct Contact Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Soil Method C Industrial Land Use[c]		
			10^{-6} Carcinogen (mg/kg)	Non-Carcinogen (mg/kg)	Final (mg/kg)
100-02-7	4-Nitrophenol	nitrophenol;4-	--	--	--
99-55-8	5-Nitro-o-toluidine	Methyl-5-nitroaniline,2-	14,583	70,000	14,583
83-32-9	Acenaphthene	acenaphthene	--	210,000	210,000
208-96-8	Acenaphthylene	acenaphthylene (Not in CLARC database tables; use acenaphthene as surrogate)	--	--	--
67-64-1	Acetone	Acetone	--	3.15E+06	3.15E+06
75-05-8	Acetonitrile	Acetonitrile	--	--	--
98-86-2	Acetophenone	Acetophenone	--	350,000	350,000
107-02-8	Acrolein	Acrolein	--	1,750	1,750
79-06-1	Acrylamide	acrylamide	263	7,000	263
107-13-1	Acrylonitrile	Acrylonitrile	243	140,000	243
309-00-2	Aldrin	aldrin	7.7	105	7.7
107-05-1	Allyl chloride	Allyl chloride	6,250	--	6,250
319-84-6	Alpha-BHC	hexachlorocyclohexane;alpha (alpha-BHC, HCH)	21	28,000	21
5103-71-9	Alpha-Chlordane	Alpha-Chlordane	375	1,750	375
7429-90-5	Aluminum	Aluminum (soluble)	--	3.50E+06	3.50E+06

Table 7-1. Summary of WAC 173-340-745 Standard Method C Industrial Soil Direct Contact Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Soil Method C Industrial Land Use[c]		
			10^{-6} Carcinogen (mg/kg)	Non-Carcinogen (mg/kg)	Final (mg/kg)
62-53-3	Aniline	Aniline	23,026	24,500	23,026
120-12-7	Anthracene	anthracene	--	1.05E+06	1.05E+06
7440-36-0	Antimony	antimony	--	1,400	1,400
140-57-8	Aramite	aramite	5,250	175,000	5,250
12674-11-2	Aroclor-1016	aroclor 1016 (PCB)	1,875	245	245
11104-28-2	Aroclor-1221	aroclor 1221 [PCB]	66	--	66
11141-16-5	Aroclor-1232	aroclor 1232 [PCB]	66	--	66
53469-21-9	Aroclor-1242	aroclor 1242 [PCB]	66	--	66
12672-29-6	Aroclor-1248	aroclor 1248 [PCB]	66	--	66
11097-69-1	Aroclor-1254	aroclor 1254 (PCB)	66	70	66
11096-82-5	Aroclor-1260	aroclor 1260 (PCB)	66	--	66
37324-23-5	Aroclor-1262	aroclor 1262 (PCB)	--	--	--
11100-14-4	Aroclor-1268	aroclor 1268 (PCB)	--	--	--
7440-38-2	Arsenic	arsenic, inorganic	88	1,050	88
103-33-3	Azobenzene	Azobenzene	1,193	--	1,193
7440-39-3	Barium, compounds	Barium	--	700,000	700,000

Table 7-1. Summary of WAC 173-340-745 Standard Method C Industrial Soil Direct Contact Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Soil Method C Industrial Land Use[c]		
			10^{-6} Carcinogen (mg/kg)	Non-Carcinogen (mg/kg)	Final (mg/kg)
71-43-2	Benzene	Benzene	2,386	14,000	2,386
56-55-3	Benzo(a)anthracene	Benzo(a)anthracene	180	--	180
50-32-8	Benzo(a)pyrene	Benzo(a)pyrene	18	--	18
205-99-2	Benzo(b)fluoranthene	Benzo(b)fluoranthene	180	--	180
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	180	--	180
65-85-0	Benzoic acid	Benzoic acid	--	1.40E+07	1.40E+07
100-51-6	Benzyl alcohol	Benzyl alcohol	--	350,000	350,000
7440-41-7	Beryllium	beryllium	--	7,000	7,000
319-85-7	beta-1,2,3,4,5,6-Hexachlorocyclohexane (beta-BHC)	hexachlorocyclohexane;beta-	73	--	73
108-60-1	Bis(2-chloro-1-methylethyl)ether	bis(2-chloro-1-methyl-ethyl)ether	1,875	140,000	1,875
111-91-1	Bis(2-Chloroethoxy)methane	bis(2-chloroethoxyl)methane	--	10,500	10,500
111-44-4	Bis(2-chloroethyl) ether	bis(2-chloroethyl)ether	119	--	119
117-81-7	Bis(2-ethylhexyl) phthalate	bis(2-ethylhexyl) phthalate	9,375	70,000	9,375
7440-69-9	Bismuth	Bismuth	--	--	--

Table 7-1. Summary of WAC 173-340-745 Standard Method C Industrial Soil Direct Contact Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Soil Method C Industrial Land Use[c]		
			10^{-6} Carcinogen (mg/kg)	Non-Carcinogen (mg/kg)	Final (mg/kg)
7440-42-8	Boron	Boron	--	700,000	700,000
24959-67-9	Bromide	Bromide	--	--	--
75-27-4	Bromodichloromethane	bromodichloromethane	2,117	70,000	2,117
75-25-2	Bromoform	bromoform	16,614	70,000	16,614
74-83-9	Bromomethane	bromomethane	--	4,900	4,900
85-68-7	Butylbenzylphthalate	butyl benzyl phthalate	69,079	700,000	69,079
7440-43-9	Cadmium	cadmium	--	3,500	3,500
7440-70-2	Calcium	Calcium	--	--	--
86-74-8	Carbazole	carbazole	6,563	--	6,563
75-15-0	Carbon disulfide	carbon disulfide	--	350,000	350,000
56-23-5	Carbon tetrachloride	carbon tetrachloride	1,875	14,000	1,875
57-74-9	Chlordane	chlordane	375	1,750	375
16887-00-6	Chloride	chloride	--	--	--
108-90-7	Chlorobenzene	chlorobenzene	--	70,000	70,000
510-15-6	Chlorobenzilate	Chlorobenzilate	1,193	70,000	1,193
75-00-3	Chloroethane	ethyl chloride	--	--	--

Table 7-1. Summary of WAC 173-340-745 Standard Method C Industrial Soil Direct Contact Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Soil Method C Industrial Land Use[c]		
			10^{-6} Carcinogen (mg/kg)	Non-Carcinogen (mg/kg)	Final (mg/kg)
67-66-3	Chloroform	chloroform	4,234	35,000	4,234
74-87-3	Chloromethane	chloromethane	--	--	--
126-99-8	Chloroprene	Chloro-1,3-butadiene,2-	--	70,000	70,000
7440-47-3	Chromium	chromium (total)	--	5.25E+06	5.25E+06
218-01-9	chrysene	Chrysene	1,798	--	1,798
156-59-2	cis-1,2-Dichloroethylene	dichloroethylene;1,2-,cis	--	7,000	7,000
10061-01-5	cis-1,3-Dichloropropene	dichloropropene;1,2-,cis	1,313	105,000	1,313
7440-48-4	cobalt	Cobalt	--	1,050	1,050
PCB1242/1016	Co-elution of Aroclor 1242 and Aroclor 1016	Co-elution of Aroclor 1242 and Aroclor 1017	--	--	--
7440-50-8	Copper	copper	--	140,000	140,000
57-12-5	Cyanide	cyanide	--	2,100	2,100
110-82-7	Cyclohexane	Cyclohexane	--	--	--
108-94-1	Cyclohexanone	Cyclohexanone	--	1.75E+07	1.75E+07
75-99-0	Dalapon	Dalapon	--	105,000	105,000
124-18-5	Decane	Decane	--	--	--
319-86-8	Delta-BHC	hexachlorocyclohexane;delta-	--	--	--

Table 7-1. Summary of WAC 173-340-745 Standard Method C Industrial Soil Direct Contact Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Soil Method C Industrial Land Use[c]		
			10^{-6} Carcinogen (mg/kg)	Non-Carcinogen (mg/kg)	Final (mg/kg)
2303-16-4	Diallate	Diallate	2,152	--	2,152
53-70-3	Dibenz[a,h]anthracene	Dibenz[a,h]anthracene	180	--	180
132-64-9	Dibenzofuran	dibenzofuran	--	3,500	3,500
124-48-1	Dibromochloromethane	chlorodibromomethane [dibromochloromethane]	1,563	70,000	1,563
74-95-3	Dibromomethane	Methylene bromide	--	35,000	35,000
1918-00-9	Dicamba	Dicamba	--	105,000	105,000
75-71-8	Dichlorodifluoromethane	Dichlorodifluoromethane	--	700,000	700,000
120-36-5	Dichloroprop	Dichloroprop	--	--	--
60-57-1	Dieldrin	dieldrin	8.2	175	8.2
60-29-7	Diethyl ether	ethyl ether	--	700,000	700,000
84-66-2	Diethylphthalate	diethyl phthalate	--	2.80E+06	2.80E+06
60-51-5	Dimethoate	Dimethoate	--	700	700
131-11-3	Dimethyl phthalate	dimethyl phthalate	--	--	--
84-74-2	Di-n-butylphthalate	di-butyl phthalate	--	350,000	350,000
117-84-0	Di-n-octylphthalate	di-n-octyl phthalate	--	42,000	42,000
88-85-7	Dinoseb(2-secButyl-4,6-dinitrophenol)	Dinoseb	--	3,500	3,500

Table 7-1. Summary of WAC 173-340-745 Standard Method C Industrial Soil Direct Contact Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Soil Method C Industrial Land Use[c]		
			10^{-6} Carcinogen (mg/kg)	Non-Carcinogen (mg/kg)	Final (mg/kg)
298-04-4	Disulfoton	Disulfoton	--	140	140
959-98-8	Endosulfan I	Endosulfan I	--	21,000	21,000
33213-65-9	Endosulfan II	Endosulfan II	--	21,000	21,000
1031-07-8	Endosulfan sulfate	Endosulfan sulfate	--	--	--
72-20-8	Endrin	endrin	--	1,050	1,050
7421-93-4	Endrin aldehyde	Endrin aldehyde	--	--	--
53494-70-5	Endrin ketone	Endrin ketone	--	--	--
64-17-5	Ethanol	Ethanol	--	--	--
141-78-6	Ethyl acetate	Ethyl acetate	--	3.15E+06	3.15E+06
97-63-2	Ethyl methacrylate	Ethyl methacrylate	--	315,000	315,000
100-41-4	Ethylbenzene	ethylbenzene	11,932	350,000	11,932
107-21-1	Ethylene glycol	Ethylene glycol	--	7.00E+06	7.00E+06
206-44-0	Fluoranthene	fluoranthene	--	140,000	140,000
86-73-7	Fluorene	fluorene	--	140,000	140,000
16984-48-8	Fluoride	fluoride (using fluorine)	--	210,000	210,000
58-89-9	Gamma-BHC (Lindane)	lindane [gamma-BHC] (see hexachlorocyclohexane)	119	1,050	119

Table 7-1. Summary of WAC 173-340-745 Standard Method C Industrial Soil Direct Contact Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Soil Method C Industrial Land Use[c]		
			10^{-6} Carcinogen (mg/kg)	Non-Carcinogen (mg/kg)	Final (mg/kg)
5566-34-7	gamma-Chlordane	Chlordane (gamma)	375	1,750	375
76-44-8	Heptachlor	heptachlor	29	1,750	29
1024-57-3	Heptachlor epoxide	Heptachlor epoxide	14	46	14
118-74-1	Hexachlorobenzene	hexachlorobenzene	82	2,800	82
87-68-3	Hexachlorobutadiene	hexachlorobutadiene	1,683	3,500	1,683
77-47-4	Hexachlorocyclopentadiene	hexachlorocyclopentadiene	--	21,000	21,000
67-72-1	Hexachloroethane	hexachloroethane	3,281	2,450	2,450
70-30-4	Hexachlorophene	Hexachlorophene	--	1,050	1,050
110-54-3	Hexane	Hexane,n-	--	210,000	210,000
18540-29-9	Hexavalent Chromium	chromium(VI)	--	10,500	10,500
302-01-2	Hydrazine	Hydrazine	44	--	44
193-39-5	Indeno(1,2,3-cd)pyrene	Indeno(1,2,3-cd)pyrene	180	--	180
7439-89-6	Iron	Iron	--	2.45E+06	2.45E+06
78-83-1	Isobutyl alcohol	Isobutyl alcohol	--	1.05E+06	1.05E+06
78-59-1	Isophorone	isophorone	138,158	700,000	138,158
98-82-8	Isopropylbenzene	Cumene	--	350,000	350,000

Table 7-1. Summary of WAC 173-340-745 Standard Method C Industrial Soil Direct Contact Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Soil Method C Industrial Land Use[c]		
			10^{-6} Carcinogen (mg/kg)	Non-Carcinogen (mg/kg)	Final (mg/kg)
143-50-0	Kepone	chlordecone	13	1,050	13
7439-92-1	Lead[a]	lead	--	--	1,000
7439-93-2	Lithium	Lithium	--	7,000	7,000
7439-95-4	Magnesium	Magnesium (Not in CLARC database Tables)	--	--	--
7439-96-5	Manganese	manganese	--	490,000	490,000
99-65-0	m-Dinitrobenzene	Dinitrobenzene;1,3-	--	350	350
7439-97-6	Mercury	Mercury (using mercuric chloride)	--	1,050	1,050
126-98-7	Methacrylonitrile	Methacrylonitrile	--	350	350
67-56-1	Methanol	methanol	--	1.75E+06	1.75E+06
72-43-5	Methoxychlor	methoxychlor	--	17,500	17,500
80-62-6	Methyl methacrylate	Methyl methacrylate	--	4.90E+06	4.90E+06
66-27-3	Methyl methanesulfonate	Methyl methanesulfonate	1,326	--	1,326
298-00-0	Methyl parathion	Methyl parathion	--	875	875
75-09-2	Methylene chloride	methylene chloride	65,625	21,000	21,000
7439-98-7	Molybdenum	molybdenum	--	17,500	17,500
108-38-3	m-Xylene	Xylene, m-	--	700,000	700,000

Table 7-1. Summary of WAC 173-340-745 Standard Method C Industrial Soil Direct Contact Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Soil Method C Industrial Land Use[c]		
			10^{-6} Carcinogen (mg/kg)	Non-Carcinogen (mg/kg)	Final (mg/kg)
91-20-3	Naphthalene	naphthalene	--	70,000	70,000
104-51-8	n-Butylbenzene	n-Butylbenzene	--	175,000	175,000
7440-02-0	Nickel	nickel soluble salts	--	70,000	70,000
14797-55-8	Nitrate	Nitrate	--	2.49E+07	2.49E+07
14797-65-0	Nitrite	Nitrite	--	1.05E+06	1.05E+06
98-95-3	Nitrobenzene	Nitrobenzene	--	7,000	7,000
NO3-N	Nitrogen in Nitrate	Nitrogen as Nitrate	--	5.60E+06	5.60E+06
NO2-N	Nitrogen in Nitrite	Nitrogen as Nitrite	--	350,000	350,000
NO2+NO3-N	Nitrogen in Nitrite and Nitrate	Nitrogen in Nitrite and Nitrate	--	5.60E+06	5.60E+06
930-55-2	Nitrosopyrrolidine	Nitrosopyrrolidine,n-	63	--	63
55-18-5	n-Nitrosodiethylamine	Nitrosodiethylamine,n-	0.88	--	0.88
62-75-9	n-Nitrosodimethylamine	Nitrosodimethylamine,n-	2.6	28	2.6
924-16-3	n-Nitrosodi-n-butylamine	Nitroso-di-n-butylamine,n-	24	--	24
621-64-7	n-Nitrosodi-n-dipropylamine	nitroso-di-n-propylamine;N-	19	--	19
86-30-6	n-Nitrosodiphenylamine	nitrosodiphenylamine;N-	26,786	--	26,786
10595-95-6	n-Nitrosomethylethylamine	Nitrosomethylethylamine,n-	6.0	--	6.0

Table 7-1. Summary of WAC 173-340-745 Standard Method C Industrial Soil Direct Contact Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Soil Method C Industrial Land Use[c]		
			10^{-6} Carcinogen (mg/kg)	Non-Carcinogen (mg/kg)	Final (mg/kg)
59-89-2	n-Nitrosomorpholine	Nitrosomorpholine [N-]	20	--	20
100-75-4	n-Nitrosopiperidine	Nitrosopiperidine [N-]	14	--	14
95-47-6	o-Xylene	xylene,o-	--	700,000	700,000
56-38-2	Parathion	Parathion	--	21,000	21,000
60-11-7	p-Dimethylaminoazobenzene	Dimethylaminoazobenzene [p-]	29	--	29
608-93-5	Pentachlorobenzene	Pentachlorobenzene	--	2,800	2,800
76-01-7	Pentachloroethane	Pentachloroethane	1,458	--	1,458
82-68-8	Pentachloronitrobenzene (PCNB)	Pentachloronitrobenzene	505	10,500	505
87-86-5	Pentachlorophenol	pentachlorophenol	328	17,500	328
62-44-2	Phenacetin	Phenacetin	59,659	--	59,659
85-01-8	Phenanthrene	Phenanthrene	--	--	--
108-95-2	Phenol	Phenol	--	1.05E+06	1.05E+06
298-02-2	Phorate	Phorate	--	700	700
14265-44-2	Phosphate	Phosphate	--	--	--
7723-14-0	Phosphorus	phosphorus	--	--	--
PO4-P	Phosphorus in phosphate	Phosphorus in phosphate	--	--	--

Table 7-1. Summary of WAC 173-340-745 Standard Method C Industrial Soil Direct Contact Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Soil Method C Industrial Land Use[c]		
			10^{-6} Carcinogen (mg/kg)	Non-Carcinogen (mg/kg)	Final (mg/kg)
7440-09-7	Potassium	Potassium	--	--	--
106-50-3	p-Phenylenediamine	Phenylenediamine,p-	--	665,000	665,000
23950-58-5	Pronamide	Pronamide	--	262,500	262,500
129-00-0	Pyrene	pyrene	--	105,000	105,000
110-86-1	Pyridine	Pyridine	--	3,500	3,500
94-59-7	Safrole	Safrole	597	--	597
7782-49-2	Selenium	selenium and compounds	--	17,500	17,500
7440-21-3	Silicon	Silicon	--	--	--
7440-22-4	Silver	silver	--	17,500	17,500
7440-23-5	Sodium	Sodium	--	--	--
7440-24-6	Strontium	strontium	--	2.10E+06	2.10E+06
100-42-5	Styrene	styrene	--	700,000	700,000
14808-79-8	Sulfate	sulfate	--	--	--
18496-25-8	Sulfide	Sulfide	--	--	--
99-35-4	sym-Trinitrobenzene	Trinitrobenzene,1,3,5-	--	105,000	105,000
127-18-4	Tetrachloroethene	tetrachloroethylene	62,500	21,000	21,000

Table 7-1. Summary of WAC 173-340-745 Standard Method C Industrial Soil Direct Contact Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Soil Method C Industrial Land Use[c]		
			10^{-6} Carcinogen (mg/kg)	Non-Carcinogen (mg/kg)	Final (mg/kg)
3689-24-5	Tetraethyl dithiopyrophosphate (Sulfotepp)	Tetraethyl dithiopyrophosphate	--	1,750	1,750
7440-28-0	Thallium	Thallium, soluble salts	--	--	--
7440-31-5	Tin	tin	--	2.10E+06	2.10E+06
7440-32-6	Titanium	Titanium	--	--	--
108-88-3	Toluene	Toluene	--	280,000	280,000
1336-36-3	Polychlorinated Biphenyls	Polychlorinated Biphenyls (high risk)	66	--	66
TPHDIESEL	Total petroleum hydrocarbons - diesel range[b]	Total petroleum hydrocarbons - diesel range	--	--	30
TPHGASOLINE	Total petroleum hydrocarbons - gasoline range	Total petroleum hydrocarbons - gasoline range	--	--	--
TPHKEROSENE	Total petroleum hydrocarbons - kerosene range	Total petroleum hydrocarbons - kerosene range	--	--	--
TPH/OILH	Total petroleum hydrocarbons - motor oil (high boiling)[b]	Total petroleum hydrocarbons - motor oil (high boiling)	--	--	30
TPH	Total petroleum hydrocarbons	Total petroleum hydrocarbons	--	--	30
TOTALPCB	Total Polychlorinated Biphenyls	Polychlorinated Biphenyls, high risk	66	--	66
8001-35-2	Toxaphene	toxaphene	119	--	119
156-60-5	trans-1,2-Dichloroethylene	dichloroethylene;1,2-,trans	--	70,000	70,000

Table 7-1. Summary of WAC 173-340-745 Standard Method C Industrial Soil Direct Contact Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Soil Method C Industrial Land Use[c]		
			10^{-6} Carcinogen (mg/kg)	Non-Carcinogen (mg/kg)	Final (mg/kg)
10061-02-6	trans-1,3-Dichloropropene	dichloropropene;1,3-,trans	1,313	105,000	1,313
5103-74-2	trans-Chlordane	gamma chlordane	375	1,750	375
126-73-8	Tributyl phosphate	Tributyl phosphate	14,583	35,000	14,583
79-01-6	Trichloroethene	trichloroethylene (TCE)	2,853	1,750	1,750
75-69-4	Trichloromonofluoro-methane	Trichlorofluoromethane	--	1.05E+06	1.05E+06
7440-61-1	Uranium	Uranium	--	10,500	10,500
7440-62-2	Vanadium	Vanadium,metallic	--	17,500	17,500
108-05-4	Vinyl acetate	Vinyl acetate	--	3.50E+06	3.50E+06
75-01-4	Vinyl chloride	vinyl chloride [chloroethene; 1-]	182	10,500	182
1330-20-7	Xylenes (total)	Xylenes (total)	--	700,000	700,000
7440-66-6	Zinc	zinc	--	1.05E+06	1.05E+06
7440-67-7	Zirconium	Zirconium	--	--	--

Notes:

a. The lead cleanup value is the Method A industrial soil cleanup level from Table 745-1 of WAC 173-340-745(3).

b. The TPH cleanup value is the Method A industrial soil cleanup level from Table 745-1 of WAC 173-340-745(3).

c. The California Environmental Protection Agency Office of Environmental Health Hazard Assessment's (CalEPA)

CAS = Chemical Abstracts Service

TPH = total petroleum hydrocarbons

Table 7-1. Summary of WAC 173-340-745 Standard Method C Industrial Soil Direct Contact Cleanup Levels

Chemical Abstracts Service Registry Number	Contaminant Name	Alternate Contaminant Name	Soil Method C Industrial Land Use[c]		
			10^{-6} Carcinogen (mg/kg)	Non-Carcinogen (mg/kg)	Final (mg/kg)

WAC 173-340-745(3), "Method A Industrial Soil Cleanup Levels."

Figure 6-1
HAND CALCULATIONS
(2 Sheets)

3/18/2013 Method C WAC 173-340-745 Equation 745-1 Linda Carr

Noncarcinogen Industrial Land Use

$$\text{Soil Cleanup Level}\left(\frac{mg}{kg}\right) = \frac{RFD * ABW * UCF * HQ * AT}{SIR * AB1 * EF * ED}$$

→ Trichloroethene (TCE)

$$\text{Soil cleanup Level}\left(\frac{mg}{kg}\right) = \frac{0.0005\ \frac{mg}{kg \cdot d} * 70\ kg * 1E{+}06\ \frac{mg}{kg} * 1 * 20\ yr}{50\ \frac{mg}{d} * 1 * 0.4 * 20\ yr}$$

$$= 1750\ \frac{mg}{kg}$$ ✓

→ Dimethoate

$$\text{Soil cleanup level}\left(\frac{mg}{kg}\right) = \frac{0.0002\ \frac{mg}{kg \cdot d} * 70\ kg * 1E{+}06\ \frac{mg}{kg} * 1 * 20\ yr}{50\ \frac{mg}{d} * 1 * 0.4 * 20\ yr}$$

$$= 700\ \frac{mg}{kg}$$ ✓

1/18/2013 Method C WAC 173-340-745 Linda Carr
Equation 745-2

Carcinogen

$$\text{Soil Cleanup Level}\left(\frac{mg}{kg}\right) = \frac{RISK * ABW * AT * UCF}{CPF * SIR * ABI * ED * EF}$$

→ Carbon tetrachloride

$$\text{Soil cleanup level}\left(\frac{mg}{kg}\right) = \frac{1E\text{-}05 * 70\,kg * 75\,yr * 1E{+}06\,\frac{mg}{kg}}{0.07\,\frac{kg \cdot d}{mg} * 50\,\frac{mg}{d} * 1 * 20\,yrs * 0.4}$$

$$= 1875\,\frac{mg}{kg}$$

→ Hexachloroethane

$$\text{Soil cleanup level}\left(\frac{mg}{kg}\right) = \frac{1E\text{-}05 * 70\,kg * 75\,yr * 1E{+}06\,\frac{mg}{kg}}{0.04\,\frac{kg \cdot d}{mg} * 50\,\frac{mg}{d} * 1 * 20\,yrs * 0.4}$$

$$= 3281.25\,\frac{mg}{kg}$$