Navigation note: Links to external websites are spelled out. Remaining links are bookmarks to sections in this document.

CLARC List of Chemicals with Chemical-Specific Considerations - February 2021

CAS #	Chemical Data Group	Chemical Name	Grouping
7440-43-9	Metals	CADMIUM	HARDNESS - DEPENDENT
16065-83-1	Metals	CHROMIUM (III)	HARDNESS - DEPENDENT
7440-50-8	Metals	COPPER	HARDNESS - DEPENDENT
7439-92-1	Metals	LEAD	HARDNESS - DEPENDENT
7440-02-0	Metals	NICKEL SOLUBLE SALTS	HARDNESS - DEPENDENT
7440-22-4	Metals	SILVER	HARDNESS - DEPENDENT
7440-66-6	Metals	ZINC	HARDNESS - DEPENDENT
7782-50-5	Nutrients	chlorine	MCL FOR DISINFECTANTS
10049-04-4	VOCs	chlorine dioxide	MCL FOR DISINFECTANTS
3400-09-7	Disinfectants	dichloramine	MCL FOR DISINFECTANTS
10599-90-3	Disinfectants	monochloramine	MCL FOR DISINFECTANTS
10025-85-1	Disinfectants	trichloramine	MCL FOR DISINFECTANTS
56-55-3	cPAHs	BENZO[a]ANTHRACENE	PAH NOTES
50-32-8	cPAHs	BENZO[a]PYRENE	PAH NOTES
205-99-2	cPAHs	BENZO[b]FLUORANTHENE	PAH NOTES
207-08-9	cPAHs	BENZO[k]FLUORANTHENE	PAH NOTES
218-01-9	cPAHs	CHRYSENE	PAH NOTES
53-70-3	cPAHs	DIBENZ[a,h]ANTHRACENE	PAH NOTES
193-39-5	cPAHs	INDENO[1,2,3-cd]PYRENE	PAH NOTES
65-85-0	SVOCs	BENZOIC ACID	pH-DEPENDENT
95-57-8	Phenols	CHLOROPHENOL;2-	pH-DEPENDENT
120-83-2	Phenols	DICHLOROPHENOL;2,4-	pH-DEPENDENT
51-28-5	Phenols	DINITROPHENOL;2,4-	pH-DEPENDENT
87-86-5	Herbicides	PENTACHLOROPHENOL	pH-DEPENDENT
58-90-2	Phenols	TETRACHLOROPHENOL;2,3,4,6-	pH-DEPENDENT
95-95-4	Phenols	TRICHLOROPHENOL;2,4,5-	pH-DEPENDENT
88-06-2	Phenols	TRICHLOROPHENOL;2,4,6-	pH-DEPENDENT
75-27-4	VOCs	bromodichloromethane	TTHM NOTES
75-25-2	VOCs	bromoform	TTHM NOTES
67-66-3	VOCs	chloroform	TTHM NOTES
124-48-1	VOCs	dibromochloromethane	TTHM NOTES
unavailable13	VOCs	trihalomethanes, (total) (TTHMs)	TTHM NOTES
7440-43-9	Metals	CADMIUM (POTABLE GROUNDWATER & SURFACE WATER)	
7440-43-9a	Metals	CADMIUM (SOIL & NONPOTABLE SURFACE WATER)	
16065-83-1	Metals	CHROMIUM (III)	
7440-47-3	Metals	CHROMIUM (TOTAL)	
18540-29-9	Metals	CHROMIUM (VI)	
7439-92-1	Metals	LEAD	
7439-96-5	Metals	MANGANESE (Diet)	
7439-96-5a	Metals	MANGANESE (Non-Diet)	
22967-92-6	Metals (organometallic)	METHYL MERCURY	
57-12-5	Cyanides	CYANIDE	
7664-41-7	Nutrients	AMMONIA	
16984-48-8	Nutrients	FLUORIDE	
1746-01-6	Dioxins	TCDD;2,3,7,8- (LOW ORGANIC) (DIOXIN) https://www.ezview.wa.gov/Portals/_1987/Documents/Documents/UsingToxicityEquivalencyFactors2007.pdf	
127-18-4	VOCs	TETRACHLOROETHYLENE (PCE) https://www.ezview.wa.gov/Portals/_1987/Documents/Documents/TetrachloroethyleneNotes_Sept2012.pdf	
79-01-6	VOCs	TRICHLOROETHYLENE (TCE) https://www.ezview.wa.gov/Portals/_1987/Documents/Documents/TrichloroethyleneGuidance.pdf	
7440-61-1	Radionuclides	URANIUM, SOLUBLE SALTS https://www.ezview.wa.gov/Portals/_1987/Documents/Documents/UraniumOralRfD.pdf	
75-01-4	VOCs	VINYL CHLORIDE https://www.ezview.wa.gov/Portals/_1987/Documents/Documents/VinylChloride_2005.pdf	
unavailable20	Radionuclides	gross alpha particle activity	
unavailable21	Radionuclides	gross beta particle activity	
13982-63-3	Radionuclides	radium 226	
unavailable23	Radionuclides	radium 226 and 228	
1332-21-4	Fibers	ASBESTOS	
E715557	Fibers	REFRACTORY CERAMIC FIBERS	
unavailable19	General Chemistry	pH	

CLARC Chemical-Specific Considerations - February 2021

Ammonia

The calculation of Chapter 173-201A WAC fresh water ammonia criteria for protection of aquatic species depends on the water quality characteristics (temperature and pH), fish life-stage, and the chemical form/species of ammonia (e.g., ionized or non-ionized). For federal CWA 304(a) protection of aquatic species, the ammonia Freshwater criteria vary depending on pH, temperature, and life-stage. The CWA 304(a) ammonia Saltwater criteria vary depending on pH and temperature.

Asbestos

The unit of measurement for asbestos in water is fibers/liter (and not the usual milligrams/liter or micrograms/liter). CLARC lists the federal and Washington State Maximum Contaminant Levels for asbestos (7 million fibers per liter), but does not provide pre-calculated Method B or C formula values which would depend on fiber type and content.

For inhaled asbestos, the number listed for the inhalation unit risk is in fibers/milliliter. An inhalation cancer potency factor could not be calculated.

Benzo[a]pyrene and Carcinogenic PAHs

In January 2017, the U.S. Environmental Protection Agency (EPA) published several changes to the toxicity values for benzo[a]pyrene (BaP) in its Integrated Risk Information System (IRIS) database. EPA also determined that benzo[a]pyrene has a mutagenic mode of action and therefore recommended the use of ADAFs (age-dependent adjustment factors) to address increased childhood sensitivity (compared to adults) to its carcinogenic (cancer-causing) effects.

These changes affect some Model Toxics Control Act Method B and Method C cleanup levels for BaP and for carcinogenic polycyclic aromatic hydrocarbons (cPAHs). Updated toxicity values and the approach for calculating cleanup levels for BaP and cPAHs are presented in a January 2020 Ecology memorandum (***see* link below - PAH/BaP January 2020 Memo**). Application of Toxicity Equivalence Factors (TEFs) in calculating cleanup levels for cPAH mixtures is described in Implementation Memo #10 (***see* link below - cPAH TEF Implementation #10**).

Polycyclic Aromatic Hydrocarbons and Benzo[a]pyrene: Changes to MTCA Default Cleanup Levels for 2017 (January 2020), available at https://www.ezview.wa.gov/Portals/_1987/Documents/Documents/MTCA_PAHCleanupLevels.pdf

Ecology's Implementation Memo No. 10: *Evaluating the Human Health Toxicity of Carcinogenic PAHs (cPAHs) Using Toxicity Equivalency Factors (TEFs)* (April 2015), Publication No. 15-09-049, available at

https://apps.ecology.wa.gov/publications/SummaryPages/1509049.html

CLARC Chemical-Specific Considerations - February 2021

Cadmium - Soil and Water

EPA's IRIS database lists two oral noncancer reference doses for cadmium: one for cadmium in water (0.0005 mg/kg-day) and one for cadmium in food (0.001 mg/kg-day). As explained in EPA's User's Guide for the Regional Screening Levels Tables (***see* link below for EPA RSL Table**), the oral reference dose for cadmium in food should be used for the assessment of noncancer effects to soil and biota. When using the MTCA Equations to calculate soil, groundwater, and surface water cleanup levels, the more protective oral reference dose (0.0005 mg/kg-d for "water") is used for potable groundwater and surface water, while the less protective one (0.001 for "food") is used for soil and nonpotable surface water (where the calculated cleanup level is based on ingestion of fish and shellfish).

EPA RSL Table:
https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables

Cadmium - Applicable Federal and State Laws for Fresh Surface Water

For cadmium, federal and state fresh surface water criteria for the protection of aquatic life vary depending on hardness of the water at the site (***see* link below**)

Link to hardness note within this document

Chromium

CLARC does not provide pre-calculated standard Method B or C formula values for total chromium. CLARC does provide pre-calculated standard Method B and C formula values for chromium III and chromium VI.

Assessors should test for total chromium first and then test for chromium VI only if the concentration for total chromium exceeds the cleanup level for chromium VI.

If chromium VI is present at the site, then the concentration of chromium III is determined by subtracting the chromium VI concentration from the total chromium concentration. If chromium VI is NOT present at the site, then the site assessor may assume that the measured concentration of total chromium is the concentration of chromium III.

If there is documented evidence that chromium VI was never used at the site, then the site assessor does not need to test for chromium VI and may assume that the measured concentration of total chromium is the concentration of chromium III.

For groundwater, the total chromium federal and Washington State Maximum Contaminant Level is 100 µg/L, and CLARC contains the value from the Method A Groundwater Table (Table 720-1) of 50 µg/L. The Method A number assumes that a portion of the chromium is hexavalent; if all of the chromium is trivalent, then the Method A number is 100 µg/L.

Chromium - Applicable Federal and State Laws for Fresh Surface Water

For chromium, federal and state fresh surface water criteria for the protection of aquatic life vary depending on hardness of the water at the site (***see* link below**).

Link to hardness note

CLARC Chemical-Specific Considerations - February 2021

Cyanide

In broad terms, analytical techniques for cyanide can quantify either "total" cyanide or "free" cyanide. The oral reference dose for cyanide that is listed in CLARC, and the cleanup levels calculated with the MTCA Equations, are based on free cyanide, meaning that results from analyses for free cyanide are acceptable for samples. A total cyanide measurement is also acceptable, but the measured concentration of total cyanide in a sample may be higher than the concentration quantified with a free cyanide analysis, potentially leading to unnecessary cleanup.

CLARC also lists several individual cyanide compounds with reference doses from IRIS:

Compound	IRIS Reference Dose (mg/kg-d)
Calcium cyanide	0.001
Chlorine cyanide	0.05
Copper cyanide	0.005
Hydrogen cyanide	0.0006
Potassium cyanide	0.002
Potassium silver cyanide	0.005
Silver cyanide	0.1
Sodium cyanide	0.001
Zinc cyanide	0.05

Fluoride

Different agencies, including Ecology, have used several CAS numbers to identify fluoride. The CLARC Tables will now use a single name ("fluoride") and a single CAS number (16984-48-8) to evaluate fluoride contamination in water, soil, and air. ChemIDplus **(*see* link below)** lists this CAS number as
"Fluoride," "F-," or "inorganic salts of hydrofluoric acid, HF, in which the fluorine atom is in the -1 oxidation state."

The following CAS numbers are assumed to be equivalent for the purpose of screening water, soil, and air for fluoride (unless analyzing specifically for fluorine gas, CAS 7782-41-4):

• 7664-39-3, listed in ChemIDplus as hydrofluoric acid or hydrogen fluoride. This is the CAS number associated with the California EPA Reference Exposure Levels for hydrogen fluoride. Cal EPA also has a listing for "Fluorides (other than Hydrogen Fluoride)" without a CAS number. CLARC does not include the Cal EPA oral REL because the oral reference dose for soluble fluoride that is listed in IRIS is used instead. The Cal EPA inhalation REL for "Fluorides (other than Hydrogen Fluoride)" is listed in CLARC and has been associated with CAS 16984-48-8.

• 7681-49-4, listed in ChemIDplus as sodium fluoride. This is the CAS number associated with the U.S. EPA Maximum Contaminant Level for fluoride.

• 7782-41-4, listed in ChemIDplus as fluorine gas. This is the CAS number associated the listing in the U.S. EPA IRIS database (listed as Fluorine; soluble fluoride). Note that the IRIS reference dose is based on studies of fluoride in drinking water and not fluorine gas.

ChemIDplus Advanced search from the National Institutes of Health has chemical information with searchable synonyms, structures, and formulas: **ChemIDplus:** https://chem.nlm.nih.gov/chemidplus/

Gross alpha particle activity

The unit of measure for the Method A and Maximum Contaminant Level value of 15 is picocuries/liter (not micrograms/liter).

CLARC Chemical-Specific Considerations - February 2021

Gross beta particle activity

The unit of measure for the Method A and Maximum Contaminant Level value of 4 is millirem/year (not micrograms/liter).

Hardness-dependent Fresh Surface Water Criteria to Protect Aquatic Life

For the following metals, fresh surface water criteria for the protection of aquatic life are not a single number, but change based on hardness of the water at the site:

- Cadmium
- Chromium III
- Copper
- Lead
- Nickel
- Silver
- Zinc

To calculate the appropriate criteria for Washington's Chapter 173-201A WAC, apply site-specific hardness to the formulas provided in WAC 173-201A-240 (***see* link below**).

WAC 173-201A-240: https://apps.leg.wa.gov/wac/default.aspx?cite=173-201A-240

For EPA's Recommended Water Quality Criteria, apply site-specific hardness to the formulas provided in EPA's National Recommended Water Quality Criteria Table (CWA 304(a); ***see* link below**). Note that for its copper criteria, EPA recommends using the Biotic Ligand Model (***see* link below**).

CWA 304: https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table

Copper Biotic Ligand Model: https://www.epa.gov/wqc/aquatic-life-criteria-copper

Prior to 2018, fresh water criteria in Chapter 173-201A WAC listed in CLARC were based on a hardness of 25 mg/L and those for CWA 304(a) were based on a hardness of 100 mg/L. As of this update, both sets of criteria are based on a hardness of 100 mg/L.

Lead

CLARC does not provide pre-calculated standard Method B or C formula values for lead. Values for lead cannot be calculated using the equations provided in the regulation. Assessors should consult with the Department of Ecology regarding the use of EPA's Integrated Exposure Uptake Biokinetic (IEUBK) model to calculate soil cleanup levels (***see* link below**).

Link to EPA IEUBK Model

Lead - Applicable Federal and State Laws for Fresh Surface Water

For lead, federal and state fresh surface water criteria for the protection of aquatic life vary depending on hardness of the water at the site (***see* link below**).

Link to hardness note within this document

Manganese

The oral reference dose used in the soil and water Method B and C cleanup level calculations was obtained from the U.S. Environmental Protection Agency's Integrated Risk Information System (IRIS) and is based on manganese intake from food. EPA recommends modifying (dividing) the reference dose by a factor of 3 when assessing manganese exposure to water or soil. This generates a modified oral reference dose of 0.0467 mg/kg-day to be applied to non-food sources such as soil and water. The reasons for this adjustment are described in EPA's IRIS summary.

CLARC Chemical-Specific Considerations - February 2021

Methyl mercury

The unit of measure for the methyl mercury surface water cleanup levels for human health protection is milligrams per kilogram of fish tissue, not micrograms per liter of water.

WAC 173-201A Table 240 does not specifically list a protective concentration for methylmercury. However, the notes for mercury aquatic life chronic criteria (fresh and marine water) indicate that if the four-day average chronic surface water concentration is exceeded more than once in a three-year period, the edible portion of the consumed species should be analyzed and shall not be allowed to exceed 1.0 mg/kg of methylmercury (***see* link below**)

WAC 173-201A-240: https://apps.leg.wa.gov/wac/default.aspx?cite=173-201A-240

pH-dependent calculations

For the following chemicals, the cleanup levels for soil to protect groundwater vary depending on the pH of the soil. Soil Organic Carbon-Water Partitioning Coefficient (Koc) values based on a pH of 6.8 were used to calculate cleanup levels for soil to protect groundwater for the chemicals below.

Benzoic acid
Chlorophenol;2-
Dichlorophenol;2,4-
Dinitrophenol;2,4-
Pentachlorophenol
Tetrachlorophenol;2,3,4,6-
Trichlorophenol;2,4,5-
Trichlorophenol;2,4,6-

***Use the link* below** for information on determining the appropriate soil cleanup level to protect groundwater for these chemicals.

Link to Soil Protection of Groundwater Guidance:
https://www.ezview.wa.gov/Portals/_1987/Documents/Documents/SoilCleanupLevelsToProtectGroundwater.pdf

Washington State (WAC 201A) freshwater aquatic life criteria for pentachlorophenol are pH dependent. The values presented in CLARC correspond to a pH of 7.8 which is the same default pH used by EPA in their Ambient Water Quality Criteria. The formulas provided in WAC 173-201A-240 should be used to derive freshwater acute and chronic criteria for pentachlorophenol based on site-specific pH (***see link* below**).

Link to WAC 173-201A-240: https://apps.leg.wa.gov/wac/default.aspx?cite=173-201A-240

Radium 226

The unit of measure for the Method A number is picocuries/liter (not micrograms/liter).

Radium 226 and 228

The unit of measure for the Method A and Maximum Contaminant Level is picocuries/liter (not micrograms/liter).

CLARC Chemical-Specific Considerations - February 2021

Refractory ceramic fibers

The unit of measure for the inhalation reference concentration is fibers/m^3 (not mg/m^3). An inhalation reference dose could not be calculuated.

Total Trihalomethanes (TTHM) - Maximum Contaminant Levels

The individual trihalomethanes (bromodichloromethane, bromoform, chloroform, dibromochloromethane, chloroform) all have the state and federal MCL of 80 micrograms/liter listed in the table. However, 80 micrograms/liter is the MCL for Total Trihalomethanes (mixtures containing more than one of these chemicals). If the mixture contains only one of these chemicals, then the MCL of 80 micrograms/liter would apply to that chemical.

Listed Maximum Contaminant Level for Disinfectants

The chemical is a water additive used to control microbes. The listed MCL is a Maximum Residual Disinfectant Level (MRDL). The MRDL is the highest level of a disinfectant allowed in drinking water (***see*** **link below**).

EPA's National Primary Drinking Water Regulations:
https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations

pH Units

pH criteria are expressed in terms of pH units, not micrograms per liter. EPA's freshwater human health pH criteria range (pH of 5 to 9) is based on protection of domestic water supplies (***see*** **link below to EPA's 1986 Gold Book**). A range of pH from 5 to 9 provides a water treatable by typical (coagulation, sedimentation, filtration, and chlorination) treatment plant processes.

Quality Criteria for Water (1986 Gold Book):
https://www.epa.gov/wqc/quality-criteria-water-gold-book

EPA's aquatic life and human health surface water quality criteria for pH can be accessed using ***the link*** **below**.

CWA 304: https://www.epa.gov/wqc