

# Idaho Human Health Criteria

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Technical Support Document



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Technical Support Document

December 2015



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## Overview

This technical support document is intended to serve as a reference for those interested in understanding how Idaho's 2015 human health criteria were derived. It does not detail deliberations or rationale for how inputs were selected, but rather it describes the inputs used and how criteria were calculated based on the inputs presented.

## 1 Criteria Equations

Three equations are used to develop ambient water quality criteria (AWQC) for toxic substances: one for noncarcinogens and two for carcinogens.

For **noncarcinogenic** toxics, AWQC ( $\mu\text{g/L}$ ) are calculated as follows:

$$\text{AWQC} = \text{RfD} * \text{RSC} * \left( \frac{\text{BW}}{\text{DI} + (\text{FI} * \text{BAF})} \right) * 1000$$

Where:

- RfD = reference dose for noncancer effects (mg/kg-day)
- RSC = relative source contribution factor
- BW = human body weight (kg)
- DI = drinking water intake (L/day)
- FI = fish intake (kg/day)
- BAF = bioaccumulation factor (L/kg)

For **carcinogens**, AWQC are calculated following either the nonlinear or linear low-dose extrapolation equations. The nonlinear low-dose extrapolation equation is used for carcinogens where there is evidence of a threshold below which there is no risk for cancer. The **nonlinear** low-dose equation is as follows:

$$\text{AWQC} = \frac{\text{POD}}{\text{UF}} * \text{RSC} * \left( \frac{\text{BW}}{\text{DI} + (\text{FI} * \text{BAF})} \right) * 1000$$

Where:

- POD = point of departure for carcinogens based on a nonlinear low-dose extrapolation (mg/kg-day)
- UF = uncertainty factor for carcinogens based on a nonlinear low-dose extrapolation
- RSC = relative source contribution factor
- BW = human body weight (kg)
- DI = drinking water intake (L/day)
- FI = fish intake (kg/day)
- BAF = bioaccumulation factor (L/kg)

The **linear** low-dose extrapolation equation, which is used when there is no risk-free dose, is as follows:

$$\text{AWQC} = \text{RSD} * \left( \frac{\text{BW}}{\text{DI} + (\text{FI} * \text{BAF})} \right) * 1000$$

Where:

RSD = risk-specific dose for carcinogens (mg/kg-day)

BW = human body weight (kg)

DI = drinking water intake (L/day)

FI = fish intake (kg/day)

BAF = bioaccumulation factor (L/kg)

For more information on how these equations were derived and used to develop criteria, see the US Environmental Protection Agency's (EPA) *Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health* (EPA 2000).

## 2 Description of Input Variables

The following input variables were used in the above water quality criteria calculations.

**Reference dose (RfD)**—The RfD is an estimate of a daily exposure to the human population (including sensitive subgroups) that is not likely to cause an appreciable risk of deleterious effects over a lifetime. RfD is expressed as mg/kg-day and is chemical-specific.

**Relative source contribution factor (RSC)**—The RSC is a chemical-specific factor to account for non-water sources of exposure (such as air and other foods). RSC is expressed as a proportion.

**Risk-specific dose (RSD)**—The RSD is used for carcinogens where there is a linear dose-response relationship. The RSD is the dose that results in an incremental cancer risk at the target risk factor, which is  $1 \times 10^{-5}$ . RSD is expressed as mg/kg-day and is chemical-specific.

The remaining input variables are discussed in more detail in the following sections.

### 2.1 BAF/BCF

An important part of determining appropriate human health criteria is identifying potential for pollutants to increase in concentration in the fish and other aquatic organisms people may consume. This increased exposure, relative to the water, can be measured as a bioconcentration rate or bioaccumulation rate. The latter varies by trophic level among other factors. Both are a ratio of the concentration in tissue to the concentration in water. Chemicals can act very differently in the aquatic environment. For example, hydrophobic chemicals avoid partitioning into a water phase and rather partition into nonpolar phases of lipids or organic carbon (EPA 2003). Different behavior among chemicals affects how a chemical might bioconcentrate, bioaccumulate, or biomagnify in aquatic organisms, in their consumers, and in the greater food web.

**Bioconcentration** is “the net accumulation of a chemical by an aquatic organism as a result of uptake directly from the ambient water, through gill membranes or other external body surfaces” (EPA 2003).

**Bioaccumulation** “is a process in which a chemical substance is absorbed in an organism by all routes of exposure as occurs in the natural environment, i.e., dietary and ambient environmental sources” (Arnot and Gobas 2006).

Bioconcentration factors (BCFs) and bioaccumulation factors (BAFs) are “ratios (in liters per kilogram of tissue) of the concentration of a chemical in the tissue of an aquatic organism to its concentration in water” (EPA 2003).

**Biomagnification** is “the increase in concentration of a chemical in the tissue of organisms along a series of predator-prey associations, primarily through the mechanism of dietary accumulation” (EPA 2003). Chemicals which have a propensity for biomagnification will often have highest BAFs in the higher trophic level species. Chemicals that tend to biomagnify will usually have significantly greater field-measured BAF values compared to laboratory generated BCF values (Arnot and Gobas 2006).

Field-based BAF data for chemicals may be difficult to find but are generally preferred for calculating human health criteria. BAF is a preferred input in determining human health criteria at the national level for EPA and at the state level for the Idaho Department of Environmental Quality (DEQ) as the BAF values include both dietary and environmental contribution; BCF values only account for environmental contribution.

One way to reduce the variability associated with BAF values is to calculate the values by trophic level (TL). More specifically, calculation by TL helps to account for broad physiological differences, such as lipid content or life stage, among organisms that may influence bioaccumulation (EPA 2003).

DEQ used EPA’s TL-weighted BAFs for calculation of AWQC. EPA developed TL-specific BAF weighting factors based on the 90th percentile of the FI (approximately 22 g/day) determined in EPA (2014a) (EPA 2014b; EPA 2015a). FI was divided by each TL (2, 3 and 4) resulting in FIs for TL2 of 7.6, for TL3 of 8.6 and TL4 of 5.1. These ratios were simplified and used to create the following simplified equation which calculates a TL-weighted BAF (EPA 2014b; EPA 2015a):

$$EPA\ 2015\ National\ BAF = \frac{((TL2 \times 0.008) + (TL3 \times 0.009) + (TL4 \times 0.005))}{0.022}$$

See for example EPA’s 2015 chemical specific document for Aldrin:

<http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OW-2014-0135-0163>) in section 4.3. More information regarding development of this EPA TL weighting equation was not located in EPA’s methodology or technical support documents. However EPA does say: “EPA recommends using the TL-specific FCRs when deriving AWQC; however, the overall FCR rate (22.0 g/d) may be used if a simplified approach is preferred.”

We are using a local fish consumption rate for which a trophic level breakdown is currently not known. Therefore, we are using EPA’s national trophic level breakdown as a proxy to derive a single trophic level weighted BAF we are able to employ in our criteria calculations.

Of the 104 updated or newly added chemicals in Idaho’s water quality standards, criteria for 31 of the chemicals used an alternate BAF value or BCF value. EPA either did not update the BAF/BCF in 2015 or the 2015 update reported a single bioaccumulation value in the criteria calculation of these chemicals. For most of these chemicals, “EPA was not able to locate peer-reviewed, field measured BAFs, BSAFs [biota-sediment accumulation factor], or lab-measured BCFs for TLs (2, 3, and 4)” and therefore used other methods to derive a national BAF for the chemical (EPA 2015b). For these chemicals, DEQ used the alternate BAFs or BCFs currently used by EPA to calculate Idaho’s updated criteria.

## 2.2 Body Weight

The range of body weights reported from the Idaho Fish Consumption Survey (NWRG 2015) was 27–181 kg, with a mean of 80 kg (Table 1). Idaho survey data closely matched the national EPA data and thus the national mean of 80 kg, reported in EPA’s Exposure Factors Handbook (EPA 2011, Table 8-1) was used for development of the AWQC.

**Table 1. Selected statistics for body weight distribution.**

Source and Population	No. of Participants	Body Weight							
		Mean (kg)	Min (kg)	Max (kg)	Percentile				
					25th	50th	75th	90th	95th
General population in Idaho (from survey data)	4,168	80	27	181	66	77	91	107	115

## 2.3 Drinking Water Intake

DIs for the calculation of AWQC were based on the National Health and Nutrition Examination Survey (NHANES) 2003 to 2006 data, as presented in EPA’s Exposure Factors Handbook (EPA 2011). These data were normalized to body weight.

For AWQC development, a drinking water intake (DI) of 2.4 L was used. This corresponds to the 90th percentile of DI from the NHANES dataset per-capita estimates of direct and indirect ingestion of community water for individuals aged 21 and over, which includes consumers and nonconsumers of this water source (EPA 2011) (Table 2).

**Table 2. Drinking water intake, from NHANES dataset for individuals over 21 years of age.**

Type	Unit	Drinking Water Intake Rate							
		Mean	Percentile						
			10th	25th	50th	75th	90th	95th	99th
Total daily rate	mL/day	1,043	0	227	787	1,577	2,414	2,958	4,405
Body weight-normalized daily rate	mL/kg-day	13	0	3	10	20	32	40	59

## 2.4 Fish Intake

Fish intake (FI) is estimated based on a fish consumption survey. Distributions of usual intake of fish were generated based on the NCI analysis of short-term dietary recall. The NCI analysis is designed to estimate usual intake of foods using short-term dietary recall data

(<http://epi.grants.cancer.gov/diet/usualintakes/#overview>).

For calculating Idaho AWQC, DEQ used the mean consumption rate of Group 2 Fish from the Nez Perce Tribes fish consumption survey (Polissar et al. 2015)

**Table 3. Selected statistics for fish intake from the Nez Perce Tribe.**

Population	No. of Individuals	Fish Intake (g/day)							
		Mean	Percentile						
			10th	25th	50th	75th	90th	95th	99th
Nez Perce Tribe <sup>a</sup>									
Group 2 Fish	446	66.5	6.8	15.1	36.0	81.7	159	234	nr

<sup>a</sup> Percentiles were based on the Nez Perce Tribe in Idaho, as reported in Table E-2 of Polissar et al. (2015). nr=not reported

The Nez Perce Tribe reported their consumption based on seven groupings of fish species.

Table 4, adapted from the Tribal Fish Consumption Survey Data Dictionary (Polissar et al., 2015), provides a description of the seven tribal fish groups.

**Table 4. Definitions of main species groups in tribal survey.**

<b>Species Group</b>	<b>Description</b>	<b>Species and Groups Included</b>
Group 1	All finfish and shellfish	Combination of Groups 3, 4, 5, 6, and 7
Group 2	Near coastal, estuarine, freshwater, and anadromous	All species in Groups 3, 4, and 5 as well as lobster, crab, shrimp, marine clams or mussels, octopus,* and scallops*
Group 3	Salmon or steelhead	Chinook, coho, sockeye, kokanee, steelhead, other salmon, and any unspecified salmon species
Group 4	Resident trout	Rainbow, cutthroat, cutbow, bull, brook, lake, brown, other trout, and any unspecified trout species.
Group 5	Other freshwater finfish or shellfish	Lamprey, sturgeon, whitefish, sucker, bass, bluegill, carp, catfish, crappie, sunfish, tilapia, walleye, yellow perch, crayfish, freshwater clams or mussels, other freshwater finfish, and any unspecified freshwater species
Group 6	Marine finfish or shellfish	Cod, halibut, pollock, tuna, lobster, crab, marine clams or mussels, shrimp, other marine fish, or shellfish
Group 7	Unspecified finfish or shellfish	Any response where the species was not specified sufficiently to be placed into Groups 3, 4, 5, or 6

### 3 Chemical-Specific Inputs

The following pages detail the chemical-specific inputs for the 104 toxins presented in DEQ's draft rule. For each chemical, the Chemical Abstracts Service (CAS) number is presented, along with the toxin's Idaho water quality standards number. Each summary then presents the toxicity value (e.g., RfD), RSC, and BAF or BCF. A table presents any previous and updated criteria, and the write-up concludes with sources used for the inputs.

## Antimony

**CAS:** 7440-36-0

**Water Quality Standards Number:** 1

### Toxicity Value

EPA did not update the human health water quality criteria for antimony in 2015. DEQ used the current IRIS RfD of 0.0004 mg/kg-d to calculate the 2015 proposed human health criteria. Previously, DEQ used the same RfD to calculate the 2006 human health criteria (EPA 2002).

### RSC

An RSC of 0.4 was used to calculate the human health criteria.

### BAF/BCF

A BCF of 1 was used. Previously, the 2006 Idaho criteria for antimony were also derived using a BCF of 1 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for antimony.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	640	190
Water + Fish	5.6	5.2

### Sources

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015.

[http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqctable\\_hh\\_cal\\_c\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqctable_hh_cal_c_matrix.pdf)

## Nickel

**CAS:** 7440-02-0

**Water Quality Standards Number:** 9

### Toxicity Value

EPA did not update the human health water quality criteria for nickel in 2015. DEQ used the current IRIS RfD of 0.02 mg/kg-d to calculate the Idaho 2015 proposed human health criteria. Previously, DEQ used the same RfD to calculate the 2006 human health criteria (EPA 2002).

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

A BCF of 47 was used. Previously, the 2006 Idaho criteria for nickel were also derived using a BCF of 47 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for nickel.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	4,600	100
Water + Fish	610	58

### Sources

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015.

[http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqctable\\_hh\\_cal\\_c\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqctable_hh_cal_c_matrix.pdf)

## Selenium

**CAS:** 7782-49-2

**Water Quality Standards Number:** 10

### Toxicity Value

EPA did not update the human health water quality criteria for selenium in 2015. DEQ used the current IRIS RfD of 0.005 mg/kg-d to calculate the Idaho 2015 proposed human health criteria. Previously, DEQ used the same RfD to calculate the 2006 human health criteria (EPA 2002)

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

A BCF of 4.8 was used. Previously, the 2006 Idaho criteria for selenium were also derived using a BCF of 4.8 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for selenium.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	4,200	250
Water + Fish	170	29

### Sources

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015.

[http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqctable\\_hh\\_cal\\_c\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqctable_hh_cal_c_matrix.pdf)

## Thallium

**CAS:** 7440-28-0

**Water Quality Standards Number:** 12

### Toxicity Value

The IRIS RfD used by EPA in the 2002 NRWQC matrix, 6.8E-5 mg/kg-d, for thallium sulfate (EPA 2002), is no longer listed in IRIS. In the IRIS assessment for thallium soluble salts, an RfD has not been developed because the candidate principal study has critical limitations, and there are difficulties in the selection of appropriate endpoints.

The EPA final updated human health criteria (EPA 2015) retain the 2003 thallium criteria of 0.24 µg/L for water and organisms and 0.47 µg/L for organisms only.

There is an EPA Provisional Peer Reviewed Toxicity Value (PPRTV) RfD for soluble salts of thallium (EPA 2012); it is 1.0E-5 mg/kg-d. DEQ used this RfD to calculate the 2015 proposed human health criteria.

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

A BCF of 116 was used. Previously, the 2006 Idaho criteria for thallium were also derived using a BCF of 116.

### Summary of previous (2006) and updated human health (HH) criteria for thallium.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	0.47	0.023
Water + Fish	0.14	0.017

### Sources

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002. Human Health Criteria Calculation Matrix. Washington, DC: EPA. EPA-822-R-02-012.

[http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqctable\\_hh\\_cal\\_c\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqctable_hh_cal_c_matrix.pdf)

EPA (US Environmental Protection Agency). 2012. Provisional Peer-Reviewed Toxicity Values for Thallium and Compounds. Superfund Health Risk Technical Support Center, National Center for Environmental Assessment, Office of Research and Development. Cincinnati, OH: EPA. 10-25-2012. [http://hhpprtv.ornl.gov/issue\\_papers/ThalliumSolubleSalts.pdf](http://hhpprtv.ornl.gov/issue_papers/ThalliumSolubleSalts.pdf)

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA.

<http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>

## Zinc

**CAS:** 7440-66-6

**Water Quality Standards Number:** 13

### Toxicity Value

EPA did not update the human health water quality criteria for zinc in 2015. DEQ used the current IRIS RfD of 0.3 mg/kg-d to calculate the Idaho 2015 proposed human health criteria. Previously, DEQ used the same RfD to calculate the 2006 human health criteria (EPA 2002).

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

A BCF of 47 was used. Previously, the 2006 Idaho criteria for zinc were also derived using a BCF of 47 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for zinc.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	26,000	1,500
Water + Fish	7,400	870

### Sources

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015.

[http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqctable\\_hh\\_cal\\_c\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqctable_hh_cal_c_matrix.pdf)

## Cyanide

CAS: 57-12-5

Water Quality Standards Number: 14

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used an RfD of 0.0006 mg/kg-d for free cyanide based on a 2010 EPA IRIS assessment for hydrogen cyanide and cyanide salts (EPA 2010). EPA IRIS states that the “use of the RfD for free cyanide to calculate RfDs of other cyanide compounds may be merited, but the ability of the individual cyanogenic species to dissociate and release free cyanide in aqueous solution (and at physiological pHs) should be taken into consideration. If dissociation of the compound is expected, then liberated cations should be considered for potential toxicity independent of CN<sup>-</sup>. Also, some metalocyanides, such as copper cyanide, have chemical-specific data and are not included in this (IRIS) analysis” (EPA 2010).

EPA’s IRIS program identified a study by the National Toxicology Program (NTP 1993) as the critical study and decreased cauda epididymis weight as the critical effect in male rats exposed to cyanide in drinking water. The lower-bound confidence limit on the benchmark dose (BMDL<sub>1SD</sub>) is 1.9 mg/kg-d. In deriving the RfD, the IRIS program applied an uncertainty factor of 3,000 to account for interspecies extrapolation (10), intraspecies variation (10), subchronic-to-chronic exposure extrapolation (10), and database deficiencies (3).

DEQ used this RfD of 0.0006 mg/kg-d to calculate the 2015 proposed human health criteria. Previously, DEQ used an RfD of 0.02 mg/kg-d (EPA 2002).

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

A BCF of 1 was used. Previously, the 2006 Idaho criteria for cyanide were also derived using a BCF of 1 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for cyanide.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	140	140
Water + Fish	140	3.9

### Sources

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015.

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EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

NTP (National Toxicology Program). 1993. NTP Technical Report on Toxicity Studies of Sodium Cyanide (CAS No. 143-33-9) Administered in Drinking Water to F344/N Rats and B6C3F1 Mice. Research Triangle Park, NC: US Department of Health and Human Services, US Public Health Service, National Institutes of Health, NTP. NTP Toxicity Report Series no. 37. Accessed February 2015.

[http://ntp.niehs.nih.gov/ntp/htdocs/ST\\_rpts/tox037.pdf](http://ntp.niehs.nih.gov/ntp/htdocs/ST_rpts/tox037.pdf).

## 2,3,7,8-TCDD Dioxin (Carcinogen)

**CAS:** 174-60-16

**Water Quality Standards Number:** 16

### Toxicity Value

EPA did not update the human health water quality criteria for 2,3,7,8-TCDD in 2015. DEQ used a CSF of  $1.3E+05$  (mg/kg-d)<sup>-1</sup> to calculate the Idaho 2015 proposed human health criteria. This CSF is based on a California EPA assessment of 2,3,7,8-TCDD (CalEPA 1986, 2002) based on the occurrence of hepatocellular adenomas and carcinomas in male mice in a study by the National Toxicology Program (NTP 1982).

Previously, DEQ used a CSF of  $1.56E+05$  to calculate the 2006 human health criteria (EPA 2002).

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

A BCF of 5,000 was used. Previously, the 2006 Idaho criteria for 2,3,7,8-TCDD were also derived using a BCF of 5,000 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for 2,3,7,8-TCDD.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	0.000000005	1.9E-08
Water + Fish	0.000000005	1.8E-08

### Sources

CalEPA (California Environmental Protection Agency). 1986. Technical Support Document. Report on Chlorinated Dioxins and Dibenzofurans. Part B - Health Effects of Chlorinated Dioxins and Dibenzofurans. CalEPA, Department of Health Services. Available online at: <http://www.arb.ca.gov/toxics/id/summary/dioxptB.pdf>

CalEPA (California Environmental Protection Agency). 2002. Air Toxics Hot Spots Program, Risk Assessment Guidelines, Part II, Technical Support Document for Describing Available Cancer Potency Factors. Sacramento, CA: CalEPA, Office of Environmental Health Hazard Assessment (OEHHA). Available online at: [http://www.oehha.ca.gov/air/hot\\_spots/pdf/TSDNov2002.pdf](http://www.oehha.ca.gov/air/hot_spots/pdf/TSDNov2002.pdf)

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015. [http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqctable\\_hh\\_cal\\_c\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqctable_hh_cal_c_matrix.pdf)

NTP (National Toxicology Program). 1982. Carcinogenesis Bioassay of 2,3,7,8-tetrachlorodibenzo-p-dioxin (CAS No. 1746-01-6) in Osborne-Mendel Rats and B6C3F1 Mice (Gavage Study). NTP. Technical Report Series, Issue 209:195.

## Acrolein

**CAS:** 107-02-08

**Water Quality Standards Number:** 17

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used an RfD of 0.0005 mg/kg-d for acrolein based on a 2003 EPA IRIS assessment (EPA 2003). The IRIS program identified a study by Parent et al. (1992) as the critical study and decreased survival as a critical effect in rats orally exposed to acrolein. The chronic study had a NOAEL of 0.05 mg/kg-d. In deriving the RfD, the IRIS program applied an uncertainty factor of 100 to account for intraspecies differences (10) and interspecies extrapolation (10).

DEQ used the RfD of 0.0005 mg/kg-d to calculate the proposed 2015 human health criteria. Previously, DEQ had used an RfD of 0.0156 mg/kg-d (EPA 2002).

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA default trophic level-weighted BAF of 1.0 was used. Previously, the 2006 Idaho criteria for acrolein were derived using a BCF of 215.

### Summary of previous (2006) and updated human health (HH) criteria for acrolein.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	290	120
Water + Fish	190	3.2

### Sources

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015.

[http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqctable\\_hh\\_cal\\_c\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqctable_hh_cal_c_matrix.pdf).

EPA (US Environmental Protection Agency). 2003. Acrolein (CASRN 107-02-8). Integrated Risk Information System. Oral RfD Agency consensus date May 16, 2003. Washington, DC: EPA, Office of Research and Development. Accessed May 2015.

<http://www.epa.gov/iris/subst/0364.htm>.

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA.

<http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

Parent, R.A., H.E. Caravello, and J.E. Long. 1992. Two-Year Toxicity and Carcinogenicity Study of Acrolein in Rats. *Journal of Applied Toxicology* 12(2):131–139.

## Acrylonitrile (Carcinogen)

CAS: 107-13-1

Water Quality Standards Number: 18

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) were developed using a CSF of  $5.4E-1(\text{mg/kg-d})^{-1}$  for acrylonitrile based on a 1987 EPA IRIS assessment (EPA 1987). EPA's IRIS program identified Biodynamics Inc. (1980a; 1980b) and Quast et al. (1980) as the critical studies and development of brain and spinal cord astrocytomas, Zymbal gland carcinomas, and stomach papillomas and carcinomas as the critical effects in rats orally exposed to acrylonitrile (EPA 1987).

EPA's IRIS program has conducted a screening-level review of the more recent toxicology literature pertinent to the cancer assessment for acrylonitrile and identified one or more significant new studies, but the IRIS program has not reassessed this chemical. DEQ used the IRIS CSF of  $5.4E-1(\text{mg/kg-d})^{-1}$  to calculate the 2015 proposed human health criteria.

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA default trophic level-weighted BAF of 1.0 was used. Previously, the 2006 Idaho criteria for acrylonitrile were derived using a BCF of 30.

### Summary of previous (2006) and updated human health (HH) criteria for acrylonitrile.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	0.25	22
Water + Fish	0.051	0.60

### Sources

- Biodynamics Inc. 1980a. A Twenty-four Month Oral Toxicity/Carcinogenicity Study of Acrylonitrile Administered to Spartan Rats in the Drinking Water. East Millstone, NJ: Biodynamics, Inc., Division of Biology and Safety Evaluation. Project No. BDN-77-28.
- Biodynamics Inc. 1980b. A Twenty-Four Month Oral Toxicity/Carcinogenicity Study of Acrylonitrile Administered in the Drinking Water to Fischer 344 Rats. Vol. 1–4. East Millstone, NJ: Biodynamics Inc., Division of Biology and Safety Evaluation. Prepared for the Monsanto Company.
- EPA (US Environmental Protection Agency). 1987. Acrylonitrile (CASRN 107-13-1). Integrated Risk Information System. Carcinogenicity assessment verification date February 11, 1987. Washington, DC: EPA, Office of Research and Development. Accessed March 2015. <http://www.epa.gov/iris/subst/0206.htm>.
- EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.
- Quast, J.F., D.J. Schwetz, M.F. Balmer, T.S. Gushow, C.N. Park, and M.J. McKenna. 1980. A Two-Year Toxicity and Oncogenicity Study with Acrylonitrile following Inhalation Exposure of Rats. Midland, MI: Dow Chemical USA, Toxicology Research Laboratory. Prepared for the US Environmental Protection Agency.

## Benzene (Carcinogen)

CAS: 71-43-2

Water Quality Standards Number: 19

### Toxicity Value

IRIS provides a range of CSF values, from 0.015 to 0.055 (mg/kg-d)<sup>-1</sup>, based on a 2000 IRIS assessment (EPA 2000). The CSF range was derived using principal studies by Rinsky et al. (1981, 1987), Paustenbach et al. (1993), Crump (1994), and EPA (1998, 1999) based on the development of leukemia in humans with occupational inhalation exposure to benzene.

EPA's 2015 draft human health criteria update (EPA 2015) utilizes this range to calculate a range of criteria.

DEQ calculated criteria using each of the two CSF values 0.015 (mg/kg-d)<sup>-1</sup> and 0.055 (mg/kg-d)<sup>-1</sup>. The criteria calculated with the high and low values were then averaged. DEQ also calculated criteria based on noncarcinogenic health effects, using a chronic oral MRL of 0.0005 mg/kg-day based on an ATSDR assessment (ATSDR 2007). ATSDR identified the inhalation occupational exposure study by Lan et al. (2004a; 2004b) as the critical study and decreased B cell counts in benzene-exposed workers served as the effect for the determination of the point of departure for the derivation for the chronic-duration oral MRL for benzene. ATSDR cited toxicokinetic data in humans and animals exposed to low levels of benzene that demonstrate absorption of approximately 50 percent of an inhaled dose and essentially 100 percent of an oral dose as rationale for the use of a route-to-route extrapolation. The lower-bound confidence limit on the benchmark dose (BMDL<sub>0.25sdADJ</sub>) was 0.014 mg/kg-d. In deriving the MRL, an uncertainty factor of 30 was applied to account for route-to-route extrapolation (3) and intraspecies variation (10).

In evaluating criteria based on carcinogenic and noncarcinogenic effects, DEQ followed the current EPA recommendation to use the lower criteria. Because of the decision to base carcinogenic criteria on a risk level of 1×10<sup>-5</sup>, the noncarcinogenic criteria were lower, and were selected.

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA default trophic level-weighted BAF of 4.3 was used. Previously, the 2006 Idaho criteria for benzene were derived using a BCF of 5.2.

### Summary of previous (2006) and updated human health (HH) criteria for benzene.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2006 HH Criteria (µg/L)
Fish Only	51	28
Water + Fish	2.2	3.0

### Sources

- ATSDR. 2007. Toxicological Profile for Benzene. U.S. Department of Health and Human Services, U.S. Public Health Service, Agency for Toxic Substances and Disease Registry, Atlanta, GA. Accessed December 2015. <http://www.atsdr.cdc.gov/toxprofiles/tp3.pdf>.
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- EPA (US Environmental Protection Agency). 2000. Benzene (CASRN 71-43-2). Integrated Risk Information System. Carcinogenicity assessment Agency consensus date January 3, 2000. Washington, DC: EPA, Office of Research and Development. Accessed March 2015.  
<http://www.epa.gov/iris/subst/0276.htm>.
- EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA.  
<http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>
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- Paustenbach, D.J., R.D. Bass, and P. Price. 1993. "Benzene Toxicity and Risk Assessment, 1972–1992: Implications for Future Regulation." *Environmental Health Perspectives Supplements* 101(6):177–200.
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- Rinsky, R.A., R.J. Young, and A.B. Smith. 1981. "Leukemia in Benzene Workers." *American Journal of Industrial Medicine* 2(3):217–245.

## Bromoform (Carcinogen)

CAS: 75-25-2

Water Quality Standards Number: 20

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) are based on a revised Cancer Slope Factor (CSF) of  $0.0045 \text{ (mg/kg-d)}^{-1}$  derived by the Office of Water (EPA 2005). The previous CSF was the value currently in IRIS as of September 2015:  $0.0079 \text{ (mg/kg-d)}^{-1}$ . The 2005 Office of Water assessment evaluated the same principal study considered in the IRIS assessment (NTP 1989) but applied more current guidance and modeling approaches. DEQ used the revised CSF of  $0.0045 \text{ (mg/kg-d)}^{-1}$  to calculate the 2015 proposed Idaho human health criteria.

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA default trophic level-weighted BAF of 7.1 was used. Previously, the 2006 Idaho criteria for bromoform were derived using a BCF of 3.75.

### Summary of previous (2006) and updated human health (HH) criteria for bromoform.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	140	380
Water + Fish	4.3	62

### Sources

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA.

<http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

EPA (US Environmental Protection Agency). 2005. Drinking Water Criteria Document for Brominated Trihalomethanes. Washington, DC: EPA, Office of Water, Office of Science and Technology. EPA-822-R-05-011. Accessed February 2015.

[http://water.epa.gov/action/advisories/drinking/upload/2006\\_05\\_04\\_criteria\\_drinking\\_brthm-200605-508.pdf](http://water.epa.gov/action/advisories/drinking/upload/2006_05_04_criteria_drinking_brthm-200605-508.pdf).

NTP (National Toxicology Program). 1989. Toxicology and Carcinogenesis Studies of Tribromomethane (Bromoform) (CAS No. 75-25-2) in F344/N Rats and B6C3F1 Mice (Gavage Studies). Research Triangle Park, NC: U.S. Department of Health and Human Services, U.S. Public Health Service, National Institutes of Health, National Toxicology Program. NTP Technical Report Series no. 350. Accessed March 2015. [https://ntp.niehs.nih.gov/ntp/htdocs/lt\\_rpts/tr350.pdf](https://ntp.niehs.nih.gov/ntp/htdocs/lt_rpts/tr350.pdf).

## Carbon Tetrachloride (Carcinogen)

**CAS:** 56-23-5

**Water Quality Standards Number:** 21

### Toxicity Value

A CSF of 0.07 (mg/kg-d)<sup>-1</sup> for carbon tetrachloride was selected for the EPA updated human health water quality criteria (EPA 2015), based on a 2010 EPA IRIS assessment (EPA 2010). EPA's IRIS program calculated the CSF using principle studies by Nagano et al. (2007) and the JBRC (1998), based on development of hepatocellular adenomas or carcinomas in female mice with inhalation exposure to carbon tetrachloride (EPA 2010). Route-to-route extrapolation was performed and the mode of action could not be determined.

The 2010 IRIS assessment is the most current CSF source; DEQ used this value to calculate the 2015 proposed human health criteria.

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA default trophic level-weighted BAF of 12 was used. Previously, the 2006 Idaho criteria for carbon tetrachloride were derived using a BCF of 18.75.

### Summary of previous (2006) and updated human health (HH) criteria for carbon tetrachloride.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	1.6	15
Water + Fish	0.23	3.6

### Sources

- EPA (US Environmental Protection Agency). 2010. Carbon Tetrachloride (CASRN 56-23-5). Integrated Risk Information System. Carcinogenicity assessment Agency completion date March 31, 2010. Washington, DC: EPA, Office of Research and Development. Accessed April 2015. <http://www.epa.gov/iris/subst/0020.htm>.
- EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.
- JBRC (Japan Bioassay Research Center). 1998. Subchronic Inhalation Toxicity and Carcinogenicity Studies of Carbon Tetrachloride in F344 Rats and BDF1 Mice. Study nos. 0020, 0021, 0043, and 0044. Unpublished report. Prepared for the Ministry of Labor by the Japan Industrial Safety and Health Association, JBRC, Kanagawa, Japan.
- Nagano, K., T. Sasaki, Y. Umeda, T. Nishizawa, N. Ikawa, H. Ohbayashi, H. Arito, S. Yamamoto, and S. Fukushima. 2007. "Inhalation Carcinogenicity and Chronic Toxicity of Carbon Tetrachloride in Rats and Mice." *Inhalation Toxicology* 19(13):1089–1103.

## Chlorobenzene

CAS: 108-90-7

Water Quality Standards Number: 22

### Toxicity Value

For the EPA updated human health water quality criteria (EPA 2015), EPA selected an RfD of 0.02 mg/kg-d for chlorobenzene based on a 1989 EPA IRIS assessment (EPA 1989). EPA's IRIS program identified studies by Monsanto Company (1967) and Knapp et al. (1971) as the critical studies and histopathologic changes in the liver as the critical effects in beagles orally exposed to chlorobenzene. The subchronic (13-week) study had a NOAEL of 27.25 mg/kg-d (adjusted dose 19 mg/kg-d). In deriving the RfD, EPA's IRIS program applied a composite uncertainty factor of 1,000 to account for interspecies extrapolation (10), intraspecies variation (10), and subchronic-to-chronic study extrapolation (10) (EPA 1989).

The most current RfD source is a CalEPA assessment (CalEPA 2014). The CalEPA RfD is based on a study that IRIS considered during its assessment but did not use quantitatively (Nair et al. 1987). EPA (2015) decided to stay with the IRIS RfD of 0.02 mg/kg-day. DEQ used this RfD to calculate the 2015 proposed human health criteria.

### RSC

The default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA default trophic level-weighted BAF of 18 was used. Previously, the 2006 Idaho criteria for chlorobenzene were derived using a BCF of 10.3.

### Summary of previous (2006) and updated human health (HH) criteria for chlorobenzene.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	1,600	270
Water + Fish	130	89

### Sources

CalEPA (California Environmental Protection Agency). 2014. Updated Public Health Goals for Chemicals in California Drinking Water: Chlorobenzene, Endothall, Hexachlorocyclopentadiene, Silvex, Trichlorofluoromethane. California Environmental Protection Agency, Office of Environmental Health Hazard Assessment. Accessed April 2015.

<http://www.oehha.ca.gov/water/phg/pdf/042414PHGTechFinal.pdf>.

EPA (US Environmental Protection Agency). 1989. Chlorobenzene (CASRN 108-90-7). Integrated Risk Information System. Oral RfD assessment verification date January 19, 1989. Washington, DC: EPA, Office of Research and Development. Accessed March 2015.

<http://www.epa.gov/iris/subst/0399.htm>.

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA.

<http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

Knapp, W.K., W.M. Busey, and W. Kundzins. 1971. "Subacute Oral Toxicity of Monochlorobenzene in Dogs and Rats." *Toxicology and Applied Pharmacology* 19:393.

Monsanto Company. 1967. 13-Week Oral Administration - Dogs. Monochlorobenzene. Final Report. Falls Church, VA: Hazelton Laboratories. Prepared for Monsanto Company. Project no. 241-105. Nair, R.S., J.A. Barter, R.E. Schroeder, A. Knezevich, and C.R. Stack. 1987. "A Two-Generation Reproduction Study with Monochlorobenzene Vapor in Rats." *Toxicological Sciences* 9(4):678-686.

## Chlorodibromomethane (Carcinogen)

**CAS:** 124-48-1

**Water Quality Standards Number:** 23

### Toxicity Value

For the EPA updated human health water quality criteria (EPA 2015), EPA selected a CSF of  $0.04 \text{ (mg/kg-d)}^{-1}$  for chlorodibromomethane based on a 2005 EPA Office of Water assessment (EPA 2005). The EPA Office of Water derived the CSF using a principal study by EPA (EPA 1998) based on development of liver tumors in female mice orally exposed to chlorodibromomethane.

DEQ used the CSF of  $0.04 \text{ (mg/kg-d)}^{-1}$  to calculate the Idaho proposed 2015 human health criteria.

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA default trophic level-weighted BAF of 4.5 was used. Previously, the 2006 Idaho criteria for chlorodibromomethane were derived using a BCF of 10.3.

### Summary of previous (2006) and updated human health (HH) criteria for chlorodibromomethane.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	13	67
Water + Fish	0.4	7.4

### Sources

EPA (US Environmental Protection Agency). 1998. Quantification of Toxicological Effects for Brominated Trihalomethanes. Prepared for EPA by ICF Inc., under contract to The Cadmus Group, Inc. Contract No. 68-C7-0002, Subcontract No. 0002-ICF-1.

EPA (US Environmental Protection Agency). 2005. Drinking Water Criteria Document for Brominated Trihalomethanes. Washington, DC: EPA, Office of Water, Office of Science and Technology. EPA-822-R-05-011. Accessed February 2015.  
[http://water.epa.gov/action/advisories/drinking/upload/2006\\_05\\_04\\_criteria\\_drinking\\_brthm-200605-508.pdf](http://water.epa.gov/action/advisories/drinking/upload/2006_05_04_criteria_drinking_brthm-200605-508.pdf).

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA.  
<http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

## Chloroform (Carcinogen)

**CAS:** 67-66-3

**Water Quality Standards Number:** 26

### Toxicity Value

The 2002 EPA human health criteria (EPA 2002a) treated chloroform as a linear carcinogen and used a CSF of  $6.1E-03$  (mg/kg-d)<sup>-1</sup>, citing IRIS 3/1/91 (EPA 2002b). The 2006 Idaho human health criteria are based on the same CSF. The current EPA assessment of chloroform uses a threshold, nonlinear carcinogen approach in which the carcinogenicity is likely a secondary effect of toxicity that is itself a threshold phenomenon.

For chloroform, available evidence indicates that chloroform-induced carcinogenicity is secondary to cytotoxicity and regenerative hyperplasia in the liver. These toxic responses occur at exposure only above some critical dose level, so a nonlinear approach is considered the most appropriate method for characterizing cancer risk.

According to EPA's carcinogen risk assessment guidelines (EPA 2005) for the situation in which a carcinogenic response is secondary to another toxicity with a threshold, the margin-of-exposure analysis performed for toxicity is the same as is done for a noncancer endpoint, and an RfD for that toxicity may be considered in the cancer assessment. Therefore, EPA used the chloroform RfD of 0.01 mg/kg-d to derive the 2015 human health criteria; this RfD should be protective for both cancer and noncancer health effects.

The RfD selected by EPA is based on a 2001 EPA IRIS assessment (EPA 2001). The IRIS program calculated the RfD using a principal study by Heywood et al. (1979) based on moderate to marked fatty cyst formation in the liver and elevated serum glutamate-pyruvate transaminase as the critical effects in dogs orally exposed to chloroform. The study has a lower-bound confidence limit on the benchmark dose of 1 mg/kg-d as the point of departure. In deriving the RfD, an uncertainty factor of 100 was applied to account for interspecies extrapolation (10) and intraspecies variation (10).

DEQ used this RfD of 0.01 mg/kg-d to calculate the 2015 proposed human health criteria for chloroform.

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA default trophic level-weighted BAF of 3.3 was used. Previously, the 2006 Idaho criteria for chloroform were derived using a BCF of 3.75.

### Summary of previous (2006) and updated human health (HH) criteria for chloroform.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	470	730
Water + Fish	5.7	61

### Sources

EPA (US Environmental Protection Agency). 2001. Chloroform (CASRN 67-66-3). Integrated Risk Information System. Oral RfD assessment Agency consensus date July 27, 2001. Washington, DC: EPA, Office of Research and Development. Accessed April 2015.  
<http://www.epa.gov/iris/substi/0025.htm>.

EPA (US Environmental Protection Agency). 2002a. National Recommended Water Quality Criteria: 2002. Washington, DC: EPA, Office of Water. EPA-822-R-02-047.  
[http://water.epa.gov/scitech/swguidance/standards/upload/2008\\_04\\_29\\_criteria\\_wqctable\\_nrwqc-2002.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2008_04_29_criteria_wqctable_nrwqc-2002.pdf).

EPA (US Environmental Protection Agency). 2002b. National Recommended Water Quality Criteria: 2002

Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012.

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EPA (US Environmental Protection Agency). 2005. Guidelines for Carcinogen Risk Assessment. Risk Assessment Forum. EPA/630/P-03/001F. <http://www2.epa.gov/osa/guidelines-carcinogen-risk-assessment>

EPA (US Environmental Protection Agency). 2014. Draft: Updated National Recommended Water Quality Criteria - Human Health. Washington, DC: EPA. Available from: <http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhdraft.cfm>.

Heywood, R., R.J. Sortwell, P.R.B. Noel, A.E. Street, D.E. Prentice, F.J. Roe, P.F. Wadsworth, A.N. Worden, and N.J. Van Abbé. 1979. "Safety Evaluation of Toothpaste Containing Chloroform: III. Long-Term Study in Beagle Dogs." *Journal of Environmental Pathology Toxicology* 2(3):835–851.

## Dichlorobromomethane (Carcinogen)

CAS: 75-27-4

Water Quality Standards Number: 27

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) were calculated using a CSF of  $0.034 \text{ (mg/kg-d)}^{-1}$  based on a 2005 EPA Office of Water assessment (EPA 2005a). The EPA Office of Water program derived the CSF using a principal study by the National Toxicology Program (NTP 1987) based on development of renal tumors in male mice orally exposed to dichlorobromomethane (EPA 2005a).

EPA identified one other CSF source: a 1992 IRIS assessment (EPA 1992). The 2005 assessment evaluated the same principal study considered in the IRIS assessment (NTP 1987) but applied more current guidance and modeling approaches. Specifically, the  $LED_{10}$  (the lower 95% confidence limit on the estimated dose associated with 10% extra risk) was selected as the point of departure for derivation of the slope factor in place of a linear multistage (LMS) slope factor. Additionally, the Office of Water CSF uses a cross-species scaling approach based on  $BW^{3/4}$ , which is consistent with current EPA guidelines (EPA 2005b).

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA default trophic level-weighted BAF of 4.1 was used. Previously, the 2006 Idaho criteria for dichlorobromomethane were derived using a BCF of 3.75.

### Summary of previous (2006) and updated human health (HH) criteria for dichlorobromomethane.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	17	86
Water + Fish	0.55	8.8

### Sources

EPA (US Environmental Protection Agency). 1992. Bromodichloromethane (CASRN 75-27-4). Integrated Risk Information System. Carcinogenicity assessment verification date April 2, 1992. Washington, DC: EPA, Office of Research and Development. Accessed March 2015.  
<http://www.epa.gov/iris/subst/0213.htm>.

EPA (US Environmental Protection Agency). 2005a. Drinking Water Criteria Document for Brominated Trihalomethanes. Washington, DC: EPA, Office of Water, Office of Science and Technology. EPA-822-R-05-011. Accessed February 2015.  
[http://water.epa.gov/action/advisories/drinking/upload/2006\\_05\\_04\\_criteria\\_drinking\\_brthm-200605-508.pdf](http://water.epa.gov/action/advisories/drinking/upload/2006_05_04_criteria_drinking_brthm-200605-508.pdf).

EPA (US Environmental Protection Agency). 2005b. Guidelines for Carcinogen Risk Assessment. Washington, DC: EPA. EPA-630-P-03-001F. Accessed February 2015.  
[http://www2.epa.gov/sites/production/files/2013-09/documents/cancer\\_guidelines\\_final\\_3-25-05.pdf](http://www2.epa.gov/sites/production/files/2013-09/documents/cancer_guidelines_final_3-25-05.pdf).

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA.  
<http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>. NTP (National Toxicology Program). 1987. Toxicity and Carcinogenesis Studies of Bromodichloromethane (CAS No. 75-27-4) in F344/N Rats and B6C3F1 Mice (Gavage Studies). Research Triangle Park, NC: US Department of Health and Human Services, US Public Health Service, National Institutes of Health, NTP. NTP Technical Report Series no. 321. Accessed February 2015.

[http://ntp.niehs.nih.gov/ntp/htdocs/lt\\_rpts/tr321.pdf](http://ntp.niehs.nih.gov/ntp/htdocs/lt_rpts/tr321.pdf).

## 1,2-Dichloroethane (Carcinogen)

CAS: 107-06-2

Water Quality Standards Number: 29

### Toxicity Value

The EPA updated human health water quality criteria for 1,2-dichloroethane (EPA 2015) were developed using a CSF of  $0.0033 \text{ (mg/kg-d)}^{-1}$  based on a 2015 Health Canada assessment (Health Canada 2015). Health Canada derived the CSF using a principal study by Nagano et al. (2006) based on development of mammary tumors in female rats orally exposed to 1,2-dichloroethane. The Health Canada assessment was preferred to the current IRIS assessment (EPA 1986).

Compared to the current IRIS assessment, the Health Canada assessment is based on a more recent critical study (Nagano et al. 2006) and applied more current guidance and modeling approaches. Specifically, the LED10 (the lower 95% confidence limit on the estimated dose associated with 10% extra risk) was selected by Health Canada as the point of departure for derivation of the slope factor in place of a linear multistage (LMS) slope factor. Additionally, the Health Canada CSF uses a cross-species scaling approach based on  $BW^{3/4}$ , which is consistent with current EPA practice (Health Canada 2015; EPA 2005).

DEQ used the same CSF,  $0.0033 \text{ (mg/kg-d)}^{-1}$ , to calculate the 2015 proposed human health criteria.

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA default trophic level-weighted BAF of 1.8 was used. Previously, the 2006 Idaho criteria for 1,2-dichloroethane were derived using a BCF of 1.2.

### Summary of previous (2006) and updated human health (HH) criteria for 1,2-dichloroethane.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	37	2,000
Water + Fish	0.38	96

### Sources

EPA (US Environmental Protection Agency). 1986. 1,2-Dichloroethane (CASRN 107-06-2). Integrated Risk Information System. Carcinogenicity assessment verification date December 4, 1986. Washington, DC: EPA, Office of Research and Development. Accessed March 2015. <http://www.epa.gov/iris/subst/0149.htm>.

EPA (US Environmental Protection Agency). 2005. Guidelines for Carcinogen Risk Assessment. Washington, DC: EPA. EPA-630-P-03-001F. Accessed February 2015. [http://www2.epa.gov/sites/production/files/2013-09/documents/cancer\\_guidelines\\_final\\_3-25-05.pdf](http://www2.epa.gov/sites/production/files/2013-09/documents/cancer_guidelines_final_3-25-05.pdf).

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

Health Canada. 2015. Guidelines for Canadian Drinking Water Quality. Guideline Technical Document: 1,2-Dichloroethane. Ottawa, Ontario: Health Canada. Last updated March 10, 2015. <http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/dichloroethane/index-eng.php>.

Nagano, K., Y. Umeda, H. Senoh, K. Gotoh, H. Arito, S. Yamamoto, and T. Matsushima. 2006. "Carcinogenicity and Chronic Toxicity in Rats and Mice Exposed by Inhalation to 1,2-Dichloroethane for Two Years." *Journal of Occupational Health* 48(6):424–436.

## 1,1-Dichloroethylene

**CAS:** 75-35-4

**Water Quality Standards Number:** 30

### Toxicity Value

For the EPA updated human health water quality criteria (EPA 2015), EPA selected an RfD of 0.05 mg/kg-d based on a 2002 EPA IRIS assessment (EPA 2002). The critical study was by Quast et al. (1983), and the critical effect was the development of liver toxicity and fatty changes in rats orally exposed to 1,1-dichloroethylene. The chronic study had a lower-bound confidence limit on the benchmark dose (BMDL<sub>10</sub>) of 4.6 mg/kg-d. In deriving the RfD, an uncertainty factor of 100 was applied to account for intraspecies variation and interspecies extrapolation.

DEQ used this IRIS RfD of 0.05 mg/kg-d to calculate the 2015 proposed human health criteria.

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA default trophic level-weighted BAF of 2.3 was used. Previously, the 2006 Idaho criteria for 1,1-dichloroethylene were derived using a BCF of 5.6.

### Summary of previous (2006) and updated human health (HH) criteria for 1,1-dichloroethylene.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	7,100	5,200
Water + Fish	330	310

### Sources

EPA (US Environmental Protection Agency). 2002. 1,1-Dichloroethylene (CASRN 75-35-4). Integrated Risk Information System. Oral RfD assessment Agency consensus date June 7, 2002. Washington, DC: EPA, Office of Research and Development. Accessed March 2015. <http://www.epa.gov/iris/subst/0039.htm>.

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

Quast, J.F., C.G. Humiston, C.E. Wade, J. Ballard, J.E. Beyer, R.W. Schwetz, and J.M. Norris. 1983. "A Chronic Toxicity and Oncogenicity Study in Rats and Subchronic Toxicity Study in Dogs on Ingested Vinylidene Chloride." *Fundamental and Applied Toxicology* 3:55–62.

## 1,2-Dichloropropane (Carcinogen)

CAS: 78-87-5

Water Quality Standards Number: 31

### Toxicity Value

The EPA updated human health water quality criteria for 1,2-dichloropropane (EPA 2015) used a CSF of  $0.036 \text{ (mg/kg-d)}^{-1}$  based on a 1999 California EPA assessment (CalEPA 1999). CalEPA derived the CSF for 1,2-dichloropropane based on a principal study from the National Toxicology Program (NTP 1986), which was based on hepatocellular adenomas and carcinomas observed in male mice. Two potency estimates were calculated using the Linearized Multistage Model (LMS) and the LED<sub>10</sub> methodology (the lower 95% confidence limit on the estimated dose associated with 10% extra risk). CalEPA selected the LED<sub>10</sub> estimated CSF.

An earlier EPA assessment provided another potential CSF source (EPA 1987). The CalEPA (1999) assessment evaluated the same principal study but used a more current modeling approach, specifically the LED<sub>10</sub> methodology. In addition, CalEPA (1999) used the more current cross-species scaling approach of  $BW^{3/4}$  rather than  $BW^{2/3}$  (EPA 2005).

DEQ used this CSF of  $0.036 \text{ (mg/kg-d)}^{-1}$  to calculate the 2015 proposed human health criteria.

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA default trophic level-weighted BAF of 3.4 was used. Previously, the 2006 Idaho criteria for 1,2-dichloropropane were derived using a BCF of 4.1.

### Summary of previous (2006) and updated human health (HH) criteria for 1,2-dichloropropane.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	15	98
Water + Fish	0.50	8.5

### Sources

CalEPA (California Environmental Protection Agency). 1999. Public Health Goal for 1,2-Dichloropropane in Drinking Water. CalEPA, Office of Environmental Health Hazard Assessment. Accessed February 2015. [http://www.oehha.ca.gov/water/phg/pdf/12dcp\\_f.pdf](http://www.oehha.ca.gov/water/phg/pdf/12dcp_f.pdf).

NTP (National Toxicology Program). 1986. Toxicology and Carcinogenesis Studies of 1,2-Dichloropropane (Propylene Dichloride) (CAS No. 78-87-5) in F344/N Rats and B6C3F1 Mice (Gavage Studies). NTP Technical Report Series no. 263. U.S. Department of Health and Human Services, U.S. Public Health Service, National Institutes of Health, National Toxicology Program, Research Triangle Park, NC. Accessed February 2015. [http://ntp.niehs.nih.gov/ntp/htdocs/lt\\_rpts/tr263.pdf](http://ntp.niehs.nih.gov/ntp/htdocs/lt_rpts/tr263.pdf).

EPA. (US Environmental Protection Agency). 1987. Health Effects Assessment for 1,2-Dichloropropane. ECAO-CIN-H077. EPA-600-8-88-029. U.S. Environmental Protection Agency, Office of Health and Environmental Assessment, Office of Research and Development, Cincinnati, OH. Accessed February 2015. <http://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=2000T865.txt>.

EPA (US Environmental Protection Agency). 2005. Guidelines for Carcinogen Risk Assessment. Washington, DC: EPA. EPA-630-P-03-001F. Accessed February 2015. [http://www2.epa.gov/sites/production/files/2013-09/documents/cancer\\_guidelines\\_final\\_3-25-05.pdf](http://www2.epa.gov/sites/production/files/2013-09/documents/cancer_guidelines_final_3-25-05.pdf).

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA.

<http://water.epa.gov/scitech/swguidance/standards/criteria/current/hfinal.cfm>

## 1,3-Dichloropropene (Carcinogen)

CAS: 542-75-6

Water Quality Standards Number: 32

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) utilized a CSF of  $0.122 \text{ (mg/kg-d)}^{-1}$  for 1,3-dichloropropene based on a 1998 EPA OPP RED (EPA 1998). EPA OPP derived the CSF using a principal study by the National Toxicology Program (NTP 1985) based on development of urinary bladder tumors in mice orally exposed to 1,3-dichloropropene.

DEQ used this CSF to calculate the 2015 proposed human health criteria.

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA default trophic level-weighted BAF of 2.6 was used. Previously, the 2006 Idaho criteria for 1,3-dichloropropene were derived using a BCF of 1.9.

### Summary of previous (2006) and updated human health

#### (HH) criteria for 1,3-dichloropropene.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	11	38
Water + Fish	0.34	2.5

### Sources

EPA (US Environmental Protection Agency). 1998. Reregistration Eligibility Decision (RED). 1,3-Dichloropropene. Washington, DC: EPA, Office of Prevention, Pesticides and Toxic Substances. EPA 738-R-98-016. Accessed May 2015.

<http://www.epa.gov/oppsrrd1/reregistration/REDs/0328red.pdf>.

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA.

<http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

NTP (National Toxicology Program). 1985. Toxicology and Carcinogenesis Studies of Telone II (Technical-grade 1,3-Dichloropropene Containing 1.0% Epichlorohydrin as a Stabilizer) in F344/N Rats and B6C3F1 Mice (Gavage Studies). Research Triangle Park, NC: US Department of Health and Human Services, US Public Health Service, National Institutes of Health, NTP. NTP Technical Report Series no. 269. Accessed February 2015.

[http://ntp.niehs.nih.gov/ntp/htdocs/lt\\_rpts/tr269.pdf](http://ntp.niehs.nih.gov/ntp/htdocs/lt_rpts/tr269.pdf).

## Ethylbenzene

**CAS:** 100-41-4

**Water Quality Standards Number:** 33

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) utilized an RfD of 0.022 mg/kg-d for ethylbenzene based on a 2015 Health Canada assessment (Health Canada 2015) that identified this dose as a tolerable daily intake (TDI). Health Canada utilized a study by the National Toxicology Program (NTP 1996) as the critical study and the development of hyperplasia of the pituitary gland and liver cellular alterations as the critical effects in mice exposed to ethylbenzene in an inhalation study. The chronic study had a NOAEL of 75 ppm (326 mg/m<sup>3</sup>). Health Canada used a physiologically based pharmacokinetic (PBPK) model to derive a human dose of 0.54 mg/kg-d. In deriving the TDI, Health Canada applied a composite uncertainty factor of 25 to account for interspecies extrapolation (2.5) and intraspecies variation (10) (Health Canada 2015).

DEQ used this RfD of 0.022 mg/kg-d to calculate the 2015 proposed human health criteria.

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA default trophic level-weighted BAF of 130 was used. Previously, the 2006 Idaho criteria for ethylbenzene were derived using a BCF of 37.5.

### Summary of previous (2006) and updated human health (HH) criteria for ethylbenzene.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	2,100	41
Water + Fish	530	32

### Sources

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA.

<http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

Health Canada. 2015. Guidelines for Canadian Drinking Water Quality. Guideline Technical Document: Toluene, Ethylbenzene and Xylenes. Ottawa, Ontario: Health Canada. Last updated April 15, 2015. <http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/toluene/index-eng.php>.

NTP (National Toxicology Program). 1996. Toxicology and Carcinogenesis Studies of Ethylbenzene (CAS No. 100-41-4) in F344/N Rats and B6C3F1 Mice (Inhalation Studies). TR-466. Draft Report. US Department of Health and Human Services, US Public Health Service, National Institutes of Health, NTP.

## Methyl Bromide

**CAS:** 74-83-9

**Water Quality Standards Number:** 34

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) utilized an RfD of 0.02 mg/kg-d for methyl bromide, based on a 2006 EPA Office of Pesticide Programs (OPP) human health risk assessment (EPA 2006). EPA OPP identified a study by Danse et al. (1984) in which the authors found decreased body weight, rate of body weight gain, and food consumption as the critical effects in rats orally exposed to methyl bromide. The study had a NOAEL of 2.2 mg/kg-d. In deriving the RfD, EPA OPP applied a composite uncertainty factor of 100 to account for interspecies extrapolation (10) and intraspecies variation (10).

Previously, the RfD of 0.0014 mg/kg-d from an EPA IRIS assessment (EPA 1988) was used to calculate the Idaho 2006 human health criteria. In 2015, EPA selected the OPP RfD to derive the updated ambient water quality criteria because methyl bromide is a current-use pesticide. DEQ followed EPA's lead and used the RfD of 0.02 mg/kg-d to calculate the 2015 proposed human health criteria.

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA default trophic level-weighted BAF of 1.3 was used. Previously, the 2006 Idaho criteria for methyl bromide were derived using a BCF of 3.75.

### Summary of previous (2006) and updated human health (HH) criteria for methyl bromide.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	1,500	3,700
Water + Fish	47	130

### Sources

Danse, L.H., F.L. van Velsen, and C.A. van der Heijden. 1984. "Methylbromide: Carcinogenic Effects in the Rat Forestomach." *Toxicology and Applied Pharmacology* 72(2):262–271.

EPA (US Environmental Protection Agency). 1988. Bromomethane (CASRN 74-83-9). Integrated Risk Information System. Oral RfD assessment verification date May 26, 1988. Washington, DC: EPA, Office of Research and Development. Accessed March 2015. <http://www.epa.gov/iris/subst/0015.htm>.

EPA (US Environmental Protection Agency). 2006. Methyl Bromide: Phase 5 Health Effects Division (HED) Human Health Risk Assessment for Commodity Uses. PC Code 053201, DP Barcode D304623. Washington, DC: EPA, Office of Prevention, Pesticides and Toxic Substances. Accessed February 2015. [http://www.epa.gov/pesticides/chem\\_search/hhbp/D304623.pdf](http://www.epa.gov/pesticides/chem_search/hhbp/D304623.pdf).

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

## Methylene Chloride (Carcinogen)

CAS: 74-83-9

Water Quality Standards Number: 36

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) utilized a CSF of  $0.002 \text{ (mg/kg-d)}^{-1}$  for methylene chloride based on a 2011 EPA IRIS assessment (EPA 2011a). EPA's IRIS program identified a study by Serota et al. (1986) as the critical study and the development of hepatocellular carcinomas or adenomas as the critical effect in male mice orally exposed to methylene chloride. The oral slope factor of  $0.002 \text{ (mg/kg-d)}^{-1}$ , calculated from data from adult exposure, does not reflect presumed early-life susceptibility for this chemical (EPA 2011, 2005a, 2005b).

DEQ used the CSF of  $0.002 \text{ (mg/kg-d)}^{-1}$  to calculate criteria based on carcinogenic effects. DEQ also calculated criteria based on noncarcinogenic health effects, using an RfD of 0.006 mg/kg-day, based on a 2011 IRIS assessment (EPA 2011b). The IRIS program identified a study by Serota et al. (1986) as the critical study and hepatic effects (hepatic vacuolation, liver foci) as the critical effects in both sexes of rats orally exposed to methylene chloride. A lower-bound confidence limit on the benchmark dose ( $\text{BMDL}_1$ ) (1st percentile human equivalent dose) of 0.19 mg/kg-d was used as the point of departure for the RfD. An uncertainty factor of 30 was applied to account for toxicodynamic uncertainty, intraspecies variation, and database deficiencies.

In evaluating criteria based on carcinogenic and noncarcinogenic effects, DEQ followed the current EPA recommendation to use the lower criteria. Because of the decision to base carcinogenic criteria on a risk level of  $1 \times 10^{-5}$ , the noncarcinogenic criteria were lower, and were selected.

### RSC

The EPA default value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA default trophic level-weighted BAF of 1.5 was used. Previously, the 2006 Idaho criteria for methylene chloride were derived using a BCF of 0.9.

### Summary of previous (2006) and updated human health (HH) criteria for methylene chloride.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	590	960
Water + Fish	4.6	38

### Sources

EPA (US Environmental Protection Agency). 2005a. Guidelines for Carcinogen Risk Assessment. Washington, DC: EPA. EPA-630-P-03-001F. Accessed February 2015.  
[http://www2.epa.gov/sites/production/files/2013-09/documents/cancer\\_guidelines\\_final\\_3-25-05.pdf](http://www2.epa.gov/sites/production/files/2013-09/documents/cancer_guidelines_final_3-25-05.pdf).

EPA (US Environmental Protection Agency). 2005b. Supplemental Guidance for Assessing Susceptibility from Early-life Exposure to Carcinogens. Washington, DC: EPA, Office of the Science Advisor. EPA-630-R-03-003F. Accessed February 2015.  
[http://www.epa.gov/ttnatw01/childrens\\_supplement\\_final.pdf](http://www.epa.gov/ttnatw01/childrens_supplement_final.pdf).

EPA (US Environmental Protection Agency). 2011a. Dichloromethane (CASRN 75-09-2). Integrated Risk Information System. Carcinogenicity assessment Agency completion date November 18, 2011. Washington, DC: EPA, Office of Research and Development. Accessed May 2015.  
<http://www.epa.gov/iris/subst/0070.htm>.

EPA (US Environmental Protection Agency). 2011b. Dichloromethane (CASRN 75-09-2). Integrated Risk Information System. Oral RfD assessment Agency completion date November 18, 2011. U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC.

Accessed March 2015. <http://www.epa.gov/iris/subst/0070.htm>.

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA.

<http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

Serota, D.G., A.K. Thakur, B.M. Ulland, J.C. Kirschman, N.M. Brown, R.H. Coots, and K. Morgareidge. 1986. "A Two-Year Drinking-Water Study of Dichloromethane in Rodents: II. Mice." *Food and Chemical Toxicology* 24:959–963. Accessed March 2015. [http://dx.doi.org/10.1016/0278-6915\(86\)90324-8](http://dx.doi.org/10.1016/0278-6915(86)90324-8).

## 1,1,2,2-Tetrachloroethane (Carcinogen)

CAS: 79-34-5

Water Quality Standards Number: 37

### Toxicity Value

For the EPA updated human health water quality criteria (EPA 2015), EPA selected a CSF of 0.2 (mg/kg-d)<sup>-1</sup> for 1,1,2,2-tetrachloroethane based on a 2010 IRIS assessment (EPA 2010). The IRIS program calculated the CSF using a principal study by the National Cancer Institute (NCI 1978) based on development of hepatocellular carcinomas in female mice orally exposed to 1,1,2,2-tetrachloroethane. EPA considers the 2010 IRIS assessment to be the most current CSF source.

DEQ used this CSF to calculate the 2015 proposed human health criteria. Previously, the same CSF was used to calculate the Idaho 2006 human health criteria.

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

A trophic level-weighted BAF of 7 used. Previously, the 2006 Idaho criteria for 1,1,2,2-tetrachloroethane were derived using a BCF of 5.

### Summary of previous (2006) and updated human health (HH) criteria for 1,1,2,2-tetrachloroethane.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	4.0	8.6
Water + Fish	0.17	1.4

### Sources

EPA (US Environmental Protection Agency). 2010. 1,1,2,2-Tetrachloroethane (CASRN 79-34-5). Integrated Risk Information System. Carcinogenicity assessment Agency completion date September 30, 2010. Washington, DC: EPA, Office of Research and Development. Accessed March 2015. <http://www.epa.gov/iris/subst/0193.htm>.

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

NCI (National Cancer Institute). 1978. Bioassay of 1,1,2,2-Tetrachloroethane for Possible Carcinogenicity (CAS No. 79-34-5). Bethesda, MD: US Department of Health, Education and Welfare, US Public Health Service, National Institutes of Health, NCI. DHEW publication no. (NIH) 78-827. Accessed February 2015. [http://ntp.niehs.nih.gov/ntp/htdocs/lt\\_rpts/tr027.pdf](http://ntp.niehs.nih.gov/ntp/htdocs/lt_rpts/tr027.pdf).

## Tetrachloroethylene (Carcinogen)

**CAS:** 127-18-4

**Water Quality Standards Number:** 38

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used a CSF of  $0.0021$  (per mg/kg-d)<sup>-1</sup> for tetrachloroethylene based on a 2012 EPA IRIS assessment (EPA 2012a). EPA's IRIS program calculated the CSF using a principal study by the Japan Industrial Safety Association (JISA 1993) based on development of hepatocellular adenomas or carcinomas in male mice through inhalation exposure to tetrachloroethylene. The oral CSF is developed from inhalation data because the only available oral bioassay had several limitations for extrapolating to lifetime risk in humans. Route-to-route extrapolation from the inhalation PODs developed from the JISA study was carried out using a harmonized PBPK model.

EPA considers the 2012 IRIS assessment to be the most current CSF source. DEQ used this CSF of  $0.0021$  (per mg/kg-d)<sup>-1</sup> to calculate human health criteria based on carcinogenic effects. The 2006 Idaho human health criteria used a CSF of  $0.0398$  (per mg/kg-d)<sup>-1</sup> (EPA 2002) based on a 1980 ambient water quality criteria document (EPA 1980). DEQ also calculated criteria based on noncarcinogenic health effects, using the RfD of  $0.006$  mg/kg-day, based on a 2012 IRIS assessment (EPA 2012b). The IRIS program identified studies by Cavalleri et al. (1994) and Echeverria et al. (1995) as the critical studies and the development of neurological effects (i.e., color vision changes and cognitive and reaction time changes) as the critical effects in occupationally exposed humans. The oral exposure point of departure (POD) equivalent to the continuous inhalation exposure NOAELs or LOAELs is estimated via physiologically based pharmacokinetic (PBPK) modeling. The resulting PODs are  $2.6$  mg/kg-d (Cavalleri et al. 1994) and  $9.7$  mg/kg-d (Echeverria et al. 1995). In deriving the RfD, a composite uncertainty factor of 1000 was applied to account for intraspecies differences (10), LOAEL to NOAEL extrapolation (10), and database uncertainty (10) to each of the PODs. The candidate RfDs from these studies range from  $2.6 \times 10^{-3}$  to  $9.7 \times 10^{-3}$  mg/kg-d. The final RfD was selected as the midpoint of this range).

In evaluating criteria based on carcinogenic and noncarcinogenic effects, DEQ followed the current EPA recommendation to use the lower criteria. Because of the decision to base carcinogenic criteria on a risk level of  $1 \times 10^{-5}$ , the noncarcinogenic criteria were lower, and were selected.

### RSC

The EPA default value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA default trophic level-weighted BAF of 62 was used. Previously, the 2006 Idaho criteria for tetrachloroethylene were derived using a BCF of 30.6.

### Summary of previous (2006) and updated human health (HH) criteria for tetrachloroethylene.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	3.3	23
Water + Fish	0.69	15

### Sources

Cavalleri, A., F. Gobba, M. Paltrinieri, G. Fantuzzi, E. Righi, and G. Aggazzotti. 1994. Perchloroethylene exposure can induce colour vision loss. *Neuroscience Letters* 179(1-2):162–166.

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EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002. Human Health Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012.

[http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqctable\\_hh\\_cal\\_c\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqctable_hh_cal_c_matrix.pdf)

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## Toluene

**CAS:** 108-88-3

**Water Quality Standards Number:** 39

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used an RfD of 0.0097 mg/kg-d based on a Health Canada assessment (Health Canada 2015) that identified this dose as a Tolerable Daily Intake (TDI). Health Canada identified studies by Seeber et al. (2004, 2005) as the critical studies and the development of various neurological symptoms as the critical effects in humans occupationally exposed to toluene. The studies had a NOAEL of 26 ppm (98 mg/m<sup>3</sup>). Health Canada used a physiologically based pharmacokinetic (PBPK) model to derive the corresponding human dose of 0.097 mg/kg-d. In deriving the TDI, Health Canada applied a composite uncertainty factor of 10 to account for intraspecies variation (10).

EPA identified three other RfD sources: a 2005 EPA IRIS assessment (EPA 2005), a 2000 ATSDR assessment (ATSDR 2000), and a 1999 California EPA assessment (CalEPA 1999). The 2015 Health Canada assessment is considered the most current available RfD source and is based on more recent critical studies (Seeber et al. 2004; Seeber et al. 2005) than is the IRIS assessment (NTP 1990).

DEQ used this RfD of 0.0097 mg/kg-d to calculate the 2015 proposed human health criteria.

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA default trophic level-weighted BAF of 14 was used. Previously, the 2006 Idaho criteria for toluene were derived using a BCF of 10.7.

### Summary of previous (2006) and updated human health (HH) criteria for toluene.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	15,000	170
Water + Fish	1,300	47

### Sources

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## 1,2-Trans-Dichloroethylene

CAS: 156-60-5

Water Quality Standards Number: 40

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used an RfD of 0.02 mg/kg-d for trans-1,2-DCE based on a 2010 EPA IRIS assessment (EPA 2010). EPA's IRIS program identified a study by Shopp et al. (1985) as the critical study and a decrease in the number of antibody-forming cells against sheep red blood cells as the critical effect in male mice orally exposed to trans-1,2-DCE. The point of departure (POD) in this subchronic study is the lower-bound confidence limit on the benchmark dose (BMDL<sub>1SD</sub>) of 65.0 mg/kg-d. In deriving the RfD, EPA's IRIS program applied a composite uncertainty factor of 3,000 to account for intraspecies variation (10), interspecies extrapolation (10), subchronic-to-chronic exposure duration extrapolation (10), and database deficiencies (3).

EPA identified two other RfD sources: a 1996 ATSDR assessment (ATSDR 1996) and a 2006 California EPA assessment (CalEPA 2006). EPA considers the IRIS RfD to be the preferred value for use in ambient water quality criteria development at this time. The 2010 EPA IRIS assessment is the most current RfD source.

DEQ used this RfD of 0.02 mg/kg-d to calculate the 2015 proposed human health criteria. Previously, the Idaho 2006 human health criteria were also based on this RfD.

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA default trophic level-weighted BAF of 4 was used. Previously, the 2006 Idaho criteria for 1,2-trans-dichloroethylene were derived using a BCF of 1.58.

### Summary of previous (2006) and updated human health (HH) criteria for 1,2-trans-dichloroethylene.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	10,000	1,200
Water + Fish	140	120

### Sources

ATSDR (Agency for Toxic Substances and Disease Registry). 1996. Toxicological Profile for 1,2-Dichloroethene. Atlanta, GA: US Department of Health and Human Services, US Public Health Service, ATSDR. Accessed February 2015. <http://www.atsdr.cdc.gov/toxprofiles/tp87.pdf>.

CalEPA (California Environmental Protection Agency). 2006. Public Health Goals for Chemicals in Drinking Water: cis- and trans-1,2-Dichloroethylene. CalEPA, Office of Environmental Health Hazard Assessment. Accessed March 2015. <http://www.oehha.ca.gov/water/phg/pdf/phgcistrans030306.pdf>.

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EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

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8:393–407.

## 1,1,1-Trichloroethane

**CAS:** 71-55-6

**Water Quality Standards Number:** 41

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used an RfD of 2 mg/kg-d for 1,1,1-trichloroethane based on a 2007 IRIS assessment (EPA 2007). EPA's IRIS program identified a study by the National Toxicology Program (NTP 2000) as the critical study and reduced body weight as the critical effect in mice orally exposed to 1,1,1-trichloroethane. The chronic study has a lower-bound confidence limit on the benchmark dose (BMDL<sub>10</sub>) of 2,155 mg/kg-d. In deriving the RfD, EPA's IRIS program applied a composite uncertainty factor of 1,000 to account for interspecies extrapolation (10), intraspecies variation (10), subchronic-to-chronic study extrapolation (3), and database deficiencies (3).

EPA identified two other RfD sources: a 2006 ATSDR assessment (ATSDR 2006) and a 2006 California EPA assessment (CalEPA 2006). The IRIS RfD was preferred by EPA for use in ambient water quality criteria development at the present time. EPA (2015) noted that the 2007 IRIS assessment is the most current RfD source.

DEQ used this RfD of 2 mg/kg-d to calculate the 2015 proposed human health criteria.

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA default trophic level-weighted BAF of 8.5 was used.

### Summary of previous (2006) and updated human health (HH) criteria for 1,1,1-trichloroethane.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	NA	56,000
Water + Fish	NA	11,000

In 2006, Idaho had no numeric criteria for this contaminant.

### Sources

ATSDR. (Agency for Toxic Substances and Disease Registry). 2006. Toxicological Profile for 1,1,1-Trichloroethane. U.S. Department of Health and Human Services, U.S. Public Health Service, Agency for Toxic Substances and Disease Registry, Atlanta, GA. Accessed February 2015. <http://www.atsdr.cdc.gov/toxprofiles/tp70.pdf>.

CalEPA. (California Environmental Protection Agency). 2006. Public Health Goals for Chemicals in Drinking Water: 1,1,1-Trichloroethane. California Environmental Protection Agency, Office of Environmental Health Hazard Assessment. Accessed March 2015. <http://oehha.ca.gov/water/phg/pdf/PHG111TCA030306.pdf>.

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Public Health Service, National Institutes of Health, NTP. NTP Toxicity Report Series no. 41. Accessed February 2015. [http://ntp.niehs.nih.gov/ntp/htdocs/ST\\_rpts/tox041.pdf](http://ntp.niehs.nih.gov/ntp/htdocs/ST_rpts/tox041.pdf).

## 1,1,2-Trichloroethane (Carcinogen)

CAS: 79-00-5

Water Quality Standards Number: 42

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used a CSF of 0.057 (per mg/kg-d)<sup>-1</sup> for 1,1,2-trichloroethane based on a 1986 IRIS assessment (EPA 1986). EPA's IRIS program calculated the CSF using a principal study by the National Cancer Institute (NCI 1978) based on development of hepatocellular carcinomas in mice orally exposed to 1,1,2-trichloroethane.

In 2003, EPA's IRIS program conducted a screening-level review of the more recent toxicology literature pertinent to the cancer assessment for 1,1,2-trichloroethane and did not identify any critical new studies.

EPA identified one other CSF source: a 2006 California EPA assessment (CalEPA 2006). EPA preferred the 1986 IRIS CSF at the present time. The CalEPA assessment was published more recently; however, it is based on the same principal study and is numerically the same as the 1986 IRIS CSF.

DEQ used this CSF of 0.057 (mg/kg-d)<sup>-1</sup> to calculate the 2015 proposed human health criteria. Previously the same CSF was used by DEQ to calculate the 2006 human health criteria.

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

A trophic level-weighted BAF of 7.4 was used. Previously, the 2006 Idaho criteria for 1,1,2-trichloroethane were derived using a BCF of 4.54.

### Summary of previous (2006) and updated human health (HH) criteria for 1,1,2-trichloroethane.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	16	29
Water + Fish	0.59	4.9

### Sources

CalEPA (California Environmental Protection Agency). 2006. Public Health Goals for Chemicals in Drinking Water: 1,1,2-Trichloroethane. CalEPA, Office of Environmental Health Hazard Assessment. Accessed March 2015.

<http://www.oehha.ca.gov/water/phg/pdf/PHG112TCA030306.pdf>.

EPA (US Environmental Protection Agency). 1986. 1,1,2-Trichloroethane (CASRN 79-00-5). Integrated Risk Information System. Carcinogenicity assessment verification date July 23, 1986. Washington, DC: EPA, Office of Research and Development. Accessed March 2015.

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NCI (National Cancer Institute). 1978. Bioassay of 1,1,2-Trichloroethane for Possible Carcinogenicity (CAS No. 79-00-5). Bethesda, MD: US Department of Health, Education and Welfare, US Public Health Service, National Institutes of Health, NCI. DHEW publication no. (NIH) 78-1324.

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## Trichloroethylene (Carcinogen)

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**CAS:** CAS 79-01-6

**Water Quality Standards Number:** 43

### Toxicity Value

EPA's IRIS program concluded, by a weight-of-evidence evaluation, that TCE is carcinogenic by a mutagenic mode of action for induction of kidney tumors (EPA 2011a). For the EPA updated human health water quality criteria (EPA 2015), EPA selected a CSF of  $0.05 \text{ (mg/kg-d)}^{-1}$  for TCE based on the 2011 IRIS assessment (EPA 2011). EPA's IRIS program identified Charbotel et al. (2006) as the critical study and renal cell carcinoma as the critical effect. The CSF of  $0.05 \text{ (mg/kg-d)}^{-1}$ , calculated from data from adult exposure, does not reflect presumed increased early-life susceptibility to kidney tumors for this chemical (EPA 2011).

EPA identified two other CSF sources: a 2014 EPA Office of Pollution Prevention and Toxics (OPPT) assessment (EPA 2014) and a 2009 California EPA assessment (CalEPA 2009). EPA prefers the IRIS CSF for use in ambient water quality criteria development at the present time. The assessment from OPPT was published more recently; however, it is based on the same principal studies and is numerically the same as the 2011 IRIS CSF.

DEQ used this CSF of  $0.05 \text{ (mg/kg-d)}^{-1}$  to calculate criteria based on carcinogenic effects. Previously, DEQ had used a CSF of  $0.0126 \text{ (mg/kg-d)}^{-1}$  (EPA 2002) based on a 1980 ambient water quality criteria document (EPA 1980). DEQ also calculated criteria based on noncarcinogenic health effects, using an RfD of 0.0005 mg/kg-day, based on a 2011 IRIS assessment (EPA 2011b). The IRIS program developed multiple candidate RfDs ranging 0.0003–0.0008 mg/kg/d based on three principal studies by Keil et al. (2009), Peden-Adams et al. (2006), and Johnson et al. (2003) and two supporting studies from Woolhiser et al. (2006) and the National Toxicology Program (NTP 1988). In deriving the RfDs, EPA's IRIS program applied uncertainty factors as follows:

- Keil et al. (2009): Composite uncertainty factor 100; extrapolation from LOAEL rather than NOAEL (10), interspecies extrapolation (3), and intraspecies variation (3).
- Peden-Adams et al. (2006): Composite uncertainty factor 1000; extrapolation from LOAEL rather than NOAEL (10), interspecies extrapolation (10), and intraspecies variation (10).
- Johnson et al. (2003): Composite uncertainty factor 10; interspecies extrapolation (3) and intraspecies variation (3).
- National Toxicology Program (NTP 1988): Composite uncertainty factor 10; interspecies extrapolation (3) and intraspecies variation (3).
- Woolhiser et al. (2006): Composite uncertainty factor 10; interspecies extrapolation (3) and intraspecies variation (3).

The RfD of 0.0005 mg/kg-d is based on the critical effects of heart malformations (rats), adult immunological effects (mice), and developmental immunotoxicity (mice), all from oral studies (USEPA 2011b). This RfD is further supported by results from an oral study for the effect of toxic nephropathy (rats) and route-to-route extrapolated results from an inhalation study for the effect of increased kidney weight (rats). The RfD (0.0005 mg/kg-d) reflects the midpoint among the candidate RfDs for the critical effects: 0.0004 mg/kg-d for developmental immunotoxicity in mice and 0.0005 mg/kg-d for both heart malformations in rats and decreased thymus weights in mice, and is within 25 percent of each candidate RfD.

In evaluating criteria based on carcinogenic and noncarcinogenic effects, DEQ followed the current EPA recommendation to use the lower criteria. Because of the decision to base carcinogenic criteria on a risk level of  $1 \times 10^{-5}$ , the noncarcinogenic criteria were lower, and were selected.

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA default trophic level-weighted BAF of 11 was used. Previously, the 2006 Idaho criteria for trichloroethylene were derived using a BCF of 10.6.

**Summary of previous (2006) and updated human health (HH) criteria for trichloroethylene.**

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	30	11
Water + Fish	2.5	2.6

**Sources**

- CalEPA (California Environmental Protection Agency). 2009. Public Health Goals for Chemicals in Drinking Water: Trichloroethylene. CalEPA, Office of Environmental Health Hazard Assessment. Accessed March 2015. [http://www.oehha.ca.gov/water/phg/pdf/TCE\\_phg070909.pdf](http://www.oehha.ca.gov/water/phg/pdf/TCE_phg070909.pdf).
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## Vinyl Chloride (Carcinogen)

CAS: 75-01-4

Water Quality Standards Number: 44

### Toxicity Value

IRIS provides two CSF values for continuous lifetime exposure from birth: 1.4 (mg/kg-d)<sup>-1</sup>, based on use of the linearized multistage model (LMS), and 1.5 (mg/kg-d)<sup>-1</sup> based on use of the LED<sub>10</sub>/linear method. The LED<sub>10</sub> is the lower 95% limit on a dose that is estimated to cause a 10% response. EPA (1986) recommended the LMS method, and EPA (1996) recommended the LED 10/linear method. In this case, the derived numbers are nearly identical.

EPA's 2014 draft human health criteria update (EPA 2014) used the SF of 1.4 (mg/kg-d)<sup>-1</sup>. The EPA (2015) final human health criteria used the SF of 1.5 (mg/kg-d)<sup>-1</sup>. DEQ used this SF to calculate the Idaho proposed 2015 human health criteria.

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA default trophic level-weighted BAF of 1.6 was used. Previously, the 2006 Idaho criteria for vinyl chloride were derived using a BCF of 1.17.

### Summary of previous (2006) and updated human health (HH) criteria for vinyl chloride.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	2.4	5.0
Water + Fish	0.025	0.21

### Sources

EPA (US Environmental Protection Agency). 1986. Guidelines for Carcinogen Risk Assessment. Federal Register 51(185):33992-43003.

EPA (US Environmental Protection Agency). 1996. Proposed Guidelines for Carcinogen Risk Assessment. Federal Register 61(79):17960-18011.

EPA (US Environmental Protection Agency). 2014. Draft: Updated National Recommended Water Quality Criteria - Human Health. Washington, DC: EPA. Available from:  
<http://water.epa.gov/scitech/swguidance/standards/criteria/current/hdraft.cfm>.

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA.  
<http://water.epa.gov/scitech/swguidance/standards/criteria/current/hfinal.cfm>

## 2-Chlorophenol

**CAS:** 95-57-8

**Water Quality Standards Number:** 45

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used an RfD of 0.005 mg/kg-d for 2-chlorophenol based on a 1988 EPA IRIS assessment (EPA 1988). EPA's IRIS program identified a study by Exon and Koller (1982) as the critical study and reproductive effects as the critical effects in female rats orally exposed to 2-chlorophenol in drinking water. The subchronic study has a NOAEL of 5 mg/kg-d. In deriving the RfD, the IRIS program applied an uncertainty factor of 1,000 to account for interspecies extrapolation (10), intraspecies variation (10), and subchronic-to-chronic study extrapolation (10).

In 2002 the IRIS program conducted a screening-level review of the more recent toxicology literature pertinent to the RfD for 2-chlorophenol and did not identify any critical new studies.

DEQ used this RfD of 0.005 mg/kg-d to calculate the 2015 proposed human health criteria. Previously, this RfD had also been used by DEQ to calculate the 2006 criteria.

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA default trophic level-weighted BAF of 4.6 was used. Previously, the 2006 Idaho criteria for 2-chlorophenol were derived using a BCF of 134.

### Summary of previous (2006) and updated human health (HH) criteria for 2-chlorophenol.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	150	260
Water + Fish	81	30

### Sources

EPA (US Environmental Protection Agency). 1988. 2-Chlorophenol (CASRN 95-57-8). Integrated Risk Information System. Oral RfD assessment verification date January 20, 1988. Washington, DC: EPA, Office of Research and Development. Accessed February 2015.  
<http://www.epa.gov/iris/subst/0303.htm>.

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA.  
<http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

Exon, J.H., and L.D. Koller. 1982. "Effects of Transplacental Exposure to Chlorinated Phenols." *Environmental Health Perspectives* 46:137–140.

## 2,4-Dichlorophenol

**CAS:** 120-83-2

**Water Quality Standards Number:** 46

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used an RfD of 0.003 mg/kg-d for 2,4-dichlorophenol based on a 1986 EPA IRIS assessment (EPA 1986). The IRIS program identified a study by Exon and Koller (1985) as the critical study and decreased delayed hypersensitivity response as the critical effect in rats orally exposed to 2,4-dichlorophenol. The study has a NOAEL of 0.3 mg/kg-d. In deriving the RfD, EPA's IRIS program applied an uncertainty factor of 100 to account for interspecies extrapolation (10) and intraspecies variation (10).

EPA identified two other RfD sources: a 2007 EPA Office of Research and Development Provisional Peer Reviewed Toxicity Value (EPA 2007) and a 1999 ATSDR assessment (ATSDR 1999). EPA preferred the 1986 IRIS RfD for use in ambient water quality criteria development. Neither of the other assessments included the relevant (chronic oral) toxicity value.

DEQ used this RfD of 0.003 mg/kg-d to calculate the 2015 proposed human health criteria. Previously, DEQ used this same RfD to calculate the 2006 criteria.

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA default trophic level-weighted BAF of 39 was used. Previously, the 2006 Idaho criteria for 2,4-dichlorophenol were derived using a BCF of 40.7.

### Summary of previous (2006) and updated human health (HH) criteria for 2,4-dichlorophenol.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	290	19
Water + Fish	77	9.6

### Sources

ATSDR (Agency for Toxic Substances and Disease Registry). 1999. Toxicological Profile for Chlorophenols. Atlanta, GA: US Department of Health and Human Services, US Public Health Service, ATSDR. Accessed February 2015. <http://www.atsdr.cdc.gov/toxprofiles/tp107.pdf>.

EPA (US Environmental Protection Agency). 1986. 2,4-Dichlorophenol (CASRN 120-83-2). Integrated Risk Information System. Oral RfD assessment verification date January 22, 1986. Washington, DC: EPA, Office of Research and Development. Accessed March 2015. <http://www.epa.gov/iris/subst/0041.htm>.

EPA (US Environmental Protection Agency). 2007. Provisional Peer Reviewed Toxicity Values for 2,4-Dichlorophenol (CASRN 120-83-2). Cincinnati, OH: EPA, Office of Research and Development. Accessed February 2015. [http://hhpprt.v.ornl.gov/issue\\_papers/Dichlorophenol24.pdf](http://hhpprt.v.ornl.gov/issue_papers/Dichlorophenol24.pdf).

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

Exon, J.H., and L.D. Koller. 1985. "Toxicity of 2-chlorophenol, 2,4-dichlorophenol and 2,4,6-trichlorophenol." *In* Water Chlorination: Chemistry, Environmental Impact and Health Effects. Vol. 5, ed. R.L. Jolley, R.J. Bull, W.P. Davis, and K. Sidney.

## 2,4-Dimethylphenol

CAS: 105-67-9

Water Quality Standards Number: 47

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used an RfD of 0.02 mg/kg-d for 2,4-dimethylphenol based on a 1990 EPA IRIS assessment (EPA 1990). EPA's IRIS program identified a study by EPA (EPA 1989) as the critical study and lethargy, prostration, ataxia, and hematological changes as the critical effects in mice orally exposed to 2,4-dimethylphenol. The subchronic study has a NOAEL of 50 mg/kg-d. In deriving the RfD, the IRIS program applied an uncertainty factor of 3,000 to account for interspecies extrapolation (10), intraspecies variation (10), subchronic-to-chronic study extrapolation (10), and database deficiencies (3).

In 2002, the IRIS program conducted a screening-level review of the more recent toxicology literature pertinent to the RfD for 2,4-dimethylphenol and identified one or more significant new studies; however, the IRIS program has not reassessed this chemical.

DEQ used this RfD of 0.02 mg/kg-d to calculate the 2015 proposed human health criteria. Previously, DEQ used the same RfD to calculate the 2006 human health criteria.

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA default trophic level-weighted BAF of 5.9 was used. Previously, the 2006 Idaho criteria for 2,4-dimethylphenol were derived using a BCF of 93.8.

### Summary of previous (2006) and updated human health (HH) criteria for 2,4-dimethylphenol.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	850	820
Water + Fish	380	110

### Sources

EPA (US Environmental Protection Agency). 1989. Ninety-Day Gavage Study in Albino Mice Using 2,4-Dimethylphenol. Rockville, MD: Dynamac Corporation. Prepared for the EPA, Office of Solid Waste and Emergency Response. Study no. 410-2831.

EPA (US Environmental Protection Agency). 1990. 2,4-Dimethylphenol (CASRN 105-67-9). Integrated Risk Information System. Oral RfD assessment verification date February 21, 1990. Washington, DC: EPA, Office of Research and Development. Accessed February 2015.

<http://www.epa.gov/iris/subst/0466.htm>.

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA.

<http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

## 2-Methyl-4,6-Dinitrophenol

CAS: 534-52-1

Water Quality Standards Number: 48

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used an RfD of  $3 \times 10^{-4}$  mg/kg-d for 2-methyl-4,6-dinitrophenol based on a 2010 EPA Office of Research and Development (ORD) Provisional Peer Reviewed Toxicity Value (EPA 2010). EPA ORD identified Ibrahim et al. (1934) as the critical study and reduced body weight, excessive perspiration and fatigue, elevated basal metabolic rate and body temperature, and the development of greenish-yellow coloration of the conjunctivae as the critical effects in humans orally taking 2-methyl-4,6-dinitrophenol. The 5.5-week human study has a LOAEL of 0.8 mg/kg-d.

Based on this human oral toxicity endpoint for 2-methyl-4,6-dinitrophenol, EPA ORD developed a subchronic provisional RfD (subchronic p-RfD). To derive the subchronic p-RfD, an uncertainty factor of 1,000 was applied to account for intraspecies variation (10), use of a LOAEL instead of a NOAEL (10), and database deficiencies (10), resulting in a subchronic p-RfD of  $8 \times 10^{-4}$  mg/kg-d.

For the purpose of updating the ambient water quality criteria for 2-methyl-4,6-dinitrophenol, the EPA Office of Water selected the ORD subchronic p-RfD ( $8 \times 10^{-4}$  mg/kg-d) and applied an additional uncertainty factor of 3 to account for subchronic-to-chronic extrapolation (i.e., composite uncertainty factor of 3,000). The resulting chronic RfD for the purpose of criteria development is  $3 \times 10^{-4}$  mg/kg-d.

Due to low confidence in the database—particularly the lack of chronic toxicity studies—confidence in the subchronic p-RfD for 2-methyl-4,6-dinitrophenol is low (EPA 2010). However, other available RfD sources report values that are similar to the RfD of  $3 \times 10^{-4}$  mg/kg-d. EPA identified two other RfD sources: a 1980 EPA Office of Water assessment (EPA 1980) and a 1995 ATSDR assessment (ATSDR 1995). The EPA assessment, which was based on a NIOSH occupational exposure standard for inhalation of 2-methyl-4,6-dinitrophenol (NIOSH 1978), has an RfD of  $3.9 \times 10^{-4}$  mg/kg-d. ATSDR (1995) published an intermediate-duration MRL of  $4 \times 10^{-3}$  mg/kg-d based on a human study with a LOAEL of 0.35 (Plotz 1936) and a composite uncertainty factor of 100. If an additional uncertainty factor of 10 were applied for subchronic-to-chronic duration exposure, the chronic value would be  $4 \times 10^{-4}$  mg/kg-d.

DEQ used the RfD selected by EPA for the 2015 updated human health water quality criteria,  $3 \times 10^{-4}$  mg/kg-d, to calculate the Idaho 2015 proposed human health criteria. Previously, DEQ used the RfD of  $3.9 \times 10^{-4}$  to calculate the 2006 criteria (EPA 2002) based on the 1980 document discussed previously (EPA 1980).

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA default trophic level-weighted BAF of 8.4 was used. Previously, the 2006 Idaho criteria for 2-methyl-4,6-dinitrophenol were derived using a BCF of 5.5.

### Summary of previous (2006) and updated human health (HH) criteria for 2-methyl-4,6-dinitrophenol.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	280	8.6
Water + Fish	13	1.6

## Sources

- ATSDR (Agency for Toxic Substances and Disease Registry). 1995. Toxicological Profile for Dinitrocresols. Atlanta, GA: US Department of Health and Human Services, US Public Health Service, ATSDR. Accessed February 2015. <http://www.atsdr.cdc.gov/toxprofiles/tp63.pdf>.
- EPA (US Environmental Protection Agency). 1980. Ambient Water Quality Criteria for Nitrophenols. Washington, DC: EPA, Office of Water Regulations and Standards and Office of Research and Development. EPA-440-5-80-063. Accessed February 2015. [http://water.epa.gov/scitech/swguidance/standards/upload/2001\\_10\\_12\\_criteria\\_ambientwqc\\_nitrophenols80.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2001_10_12_criteria_ambientwqc_nitrophenols80.pdf).
- EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015. [http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqctable\\_hh\\_calc\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqctable_hh_calc_matrix.pdf).
- EPA (US Environmental Protection Agency). 2010. Provisional Peer Reviewed Toxicity Values for 4,6 Dinitro-o-Cresols (CASRN 534-52-1). Cincinnati, OH: EPA, Office of Research and Development. Accessed February 2015. [http://hhpprt.v.ornl.gov/issue\\_papers/Dinitroocresol46.pdf](http://hhpprt.v.ornl.gov/issue_papers/Dinitroocresol46.pdf).
- EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.
- Ibrahim, H., H. Avad, and M.A. Mahdi. 1934. "The New Treatment of Obesity with Dinitro-o-Cresol or Dekrysil." *The Journal of the Egyptian Medical Association* 17:969–990.
- NIOSH (National Institute for Occupational Safety and Health). 1978. Criteria for a Recommended Standard: Occupational Exposure to Dinitro-ortho-cresol. Washington, DC: US Department of Health, Education and Welfare, Public Health Service, Center for Disease Control, NIOSH. Accessed April 2014. <http://www.cdc.gov/niosh/docs/1970/78-131.html>.
- Plotz, M. 1936. "Dinitro-ortho-cresol. A Metabolic Stimulator and its Toxic Side-Actions." *New York State Journal of Medicine* 41:266–268.

## 2,4-Dinitrophenol

CAS: 51-28-5

Water Quality Standards Number: 49

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used an RfD of 0.002 mg/kg-d for 2,4-dinitrophenol based on a 1986 EPA IRIS assessment (EPA 1986). EPA identified a study by Horner (1942) as the critical study and the development of cataracts as the critical effect in humans orally exposed to 2,4-dinitrophenol. The study had a LOAEL of 2 mg/kg-d. In deriving the RfD, the IRIS program applied an uncertainty factor of 1,000 to account for intraspecies variation (10), subchronic-to-chronic study extrapolation (10), and uncertainty in the estimation of a NOAEL from a LOAEL (10).

EPA identified two other potential RfD sources: a 2007 EPA Office of Solid Waste and Emergency Response Provisional Peer Reviewed Toxicity Value (EPA 2007) and a 1995 ATSDR assessment (ATSDR 1995). EPA prefers the 1986 IRIS RfD for use in ambient water quality criteria development, as neither of the other assessments includes a chronic oral toxicity value.

DEQ used this RfD of 0.002 mg/kg-d to calculate the 2015 proposed human health criteria. Previously, DEQ used this same RfD to calculate the 2006 criteria.

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

The EPA BCF of 4.4 was used. Previously, the 2006 Idaho criteria for 2,4-dinitrophenol were derived using a BCF of 1.5.

### Summary of previous (2006) and updated human health (HH) criteria for 2,4-dinitrophenol.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	5,300	110
Water + Fish	69	12

### Sources

ATSDR (Agency for Toxic Substances and Disease Registry). 1995. Toxicological Profile for Dinitrophenols. Atlanta, GA: US Department of Health and Human Services, US Public Health Service, ATSDR. Accessed February 2015. <http://www.atsdr.cdc.gov/toxprofiles/tp64.pdf>.

EPA (US Environmental Protection Agency). 1986. 2,4-Dinitrophenol (CASRN 51-28-5). Integrated Risk Information System. Oral RfD assessment verification date February 5, 1986. Washington, DC: EPA, Office of Research and Development. Accessed March 2015. <http://www.epa.gov/iris/subst/0152.htm>.

EPA (US Environmental Protection Agency). 2007. Provisional Peer Reviewed Toxicity Values for 2,4-Dinitrophenol (CASRN 51-28-5). Cincinnati, OH: EPA, Office of Research and Development. Accessed March 2015. [http://hhpprt.v.ornl.gov/issue\\_papers/Dinitrophenol24.pdf](http://hhpprt.v.ornl.gov/issue_papers/Dinitrophenol24.pdf).

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

Horner, W.D. 1942. "Dinitrophenol and its Relation to Formation of Cataracts." *Archives of Ophthalmology* 27:1097-1121.

## 3-Methyl-4-Chlorophenol

CAS: 59-50-7

Water Quality Standards Number: 52

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used an RfD of 0.1 mg/kg-d for 3-methyl-4-chlorophenol (p-chloro-m-cresol), a current-use pesticide, based on a 1997 EPA Office of Pesticide Programs (OPP) Reregistration Eligibility Decision (RED) (EPA 1997). EPA OPP identified a study by Leser (1993) as the critical study and decreased brain weight as the critical effect in female rats orally exposed to 3-methyl-4-chlorophenol. The chronic study had a LOEL of 28 mg/kg-day. In deriving the RfD, EPA OPP applied an uncertainty factor of 300 to account for interspecies extrapolation (10), intraspecies differences (10), and use of a LOEL instead of a NOEL (3).

EPA identified one other source of an RfD: a 2009 EPA Office of Research and Development (ORD) assessment (EPA 2009). The ORD RfD was based on the same study (Leser 1993) and was numerically the same as the EPA OPP RfD. Because this chemical is a current-use pesticide and EPA OPP had an RfD that was used in pesticide registration decision-making, EPA will use the OPP RfD for ambient water quality criteria development.

DEQ used this RfD of 0.1 mg/kg-d to calculate the 2015 proposed human health criteria.

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA default trophic level-weighted BAF of 32 was used.

### Summary of previous (2006) and updated human health (HH) criteria for 3-methyl-4-chlorophenol.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	NA	750
Water + Fish	NA	350

In 2006, Idaho did not have criteria for this contaminant.

### Sources

EPA (US Environmental Protection Agency). 1997. Reregistration Eligibility Decision (RED). p-Chloro-m-cresol. Washington, DC: EPA, Office of Prevention, Pesticides and Toxic Substances. EPA-738-R-96-008. Accessed March 2015.

<http://www.epa.gov/opp00001/reregistration/REDs/3046red.pdf>.

EPA (US Environmental Protection Agency). 2009. Provisional Peer Reviewed Toxicity Values for 4-Chloro-3-Methylphenol (p-Chloro-m-Cresol) (CASRN 59-50-7). Cincinnati, OH: EPA, Office of Research and Development. Accessed February 2015.

[http://hhpprtv.ornl.gov/issue\\_papers/Chloro3Methylphenol4pChloromcresol.pdf](http://hhpprtv.ornl.gov/issue_papers/Chloro3Methylphenol4pChloromcresol.pdf).

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA.

<http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

Leser, K. 1993. *Preventol CMK: Chronic Toxicity and Carcinogenicity Study in Wistar Rats*. Lab Project Number T9030673-22168. MRID no. 42784801. Unpublished study. Prepared by Bayer AG Institute of Industrial Toxicology, Wuppertal, Germany.

## Pentachlorophenol (Carcinogen)

**CAS:** 87-86-5

**Water Quality Standards Number:** 53

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used a CSF of  $0.4 \text{ (mg/kg-d)}^{-1}$  for pentachlorophenol based on a 2010 EPA IRIS assessment (EPA 2010). EPA's IRIS program calculated the CSF using a principal study by the National Toxicology Program (NTP 1989) based on development of hepatocellular adenomas or carcinomas and adrenal benign or malignant pheochromocytomas in male mice with oral exposure to pentachlorophenol.

EPA identified two other CSF sources: a 2008 EPA OPP RED (EPA 2008) and a 2009 California EPA assessment (CalEPA 2009). EPA considers the 2010 EPA IRIS assessment as the most current available CSF source. The OPP RED included a CSF of 0.07 per mg/kg-d based on the incidence of hepatocellular neoplasms, adrenal medullary neoplasms, and hemangiosarcomas in female mice in the same critical study as IRIS (EPA 2008). The OPP RED, which was conducted using the 1986 EPA Guidelines for Carcinogen Risk Assessment (EPA 1986), acknowledged the not-yet-final IRIS reassessment of carcinogenic potential of pentachlorophenol and indicated that OPP would use the existing CSF (0.07 per mg/kg-d) until the ongoing IRIS assessment had been fully peer reviewed and finalized (EPA 2008).

DEQ used the CSF of  $0.4 \text{ (mg/kg-d)}^{-1}$  to calculate the 2015 proposed human health criteria. Previously, DEQ used a CSF of  $0.12 \text{ (mg/kg-d)}^{-1}$  (EPA 2002) to calculate the 2006 human health criteria.

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA default trophic level-weighted BAF of 250 was used. Previously, the 2006 Idaho criteria for pentachlorophenol were derived using a BCF of 11.

### Summary of previous (2006) and updated human health (HH) criteria for pentachlorophenol.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	3.0	0.12
Water + Fish	0.27	0.11

### Sources

CalEPA (California Environmental Protection Agency). 2009. Public Health Goals for Chemicals in Drinking Water: Pentachlorophenol. CalEPA, Office of Environmental Health Hazard Assessment. Accessed March 2015. <http://oehha.ca.gov/water/phg/pdf/PCPFINAL042409.pdf>.

EPA (US Environmental Protection Agency). 1986. Guidelines for Carcinogen Risk Assessment. Risk Assessment Forum. Washington, DC: EPA, Office of Research and Development. EPA-630-R-00-004. Accessed February 2015. [http://ofmpub.epa.gov/eims/eimscomm.getfile?p\\_download\\_id=439779](http://ofmpub.epa.gov/eims/eimscomm.getfile?p_download_id=439779).

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015. [http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqctable\\_hh\\_cal\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqctable_hh_cal_matrix.pdf).

EPA (US Environmental Protection Agency). 2008. Reregistration Eligibility Decision for

- Pentachlorophenol. Washington, DC: EPA, Office of Prevention, Pesticides and Toxic Substances. EPA 739-R-08-008. Accessed May 2015. [http://www.epa.gov/oppsrrd1/reregistration/REDS/pentachlorophenol\\_red.pdf](http://www.epa.gov/oppsrrd1/reregistration/REDS/pentachlorophenol_red.pdf).
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- NTP (National Toxicology Program). 1989. Toxicology and Carcinogenesis Studies of Two Pentachlorophenol Technical-grade Mixtures (CAS No. 87-86-5) in B6C3F1 Mice (Feed Studies). Research Triangle Park, NC: US Department of Health and Human Services, US Public Health Service, National Institutes of Health, NTP. NTP Technical Report Series no. 349. Accessed February 2015. [http://ntp.niehs.nih.gov/ntp/htdocs/lt\\_rpts/tr349.pdf](http://ntp.niehs.nih.gov/ntp/htdocs/lt_rpts/tr349.pdf).

## Phenol

**CAS:** 108-95-2

**Water Quality Standards Number:** 54

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used an RfD of 0.6 mg/kg-d for phenol, a current-use pesticide, based on a 2009 EPA Office of Pesticide Programs (OPP) Reregistration Eligibility Decision (RED) (EPA 2009). EPA OPP identified a study by the Argus Research Laboratories (1997) as the critical study and decreased maternal weight gain as the critical effect in female rats orally exposed to phenol. The developmental toxicity study had a NOAEL of 60 mg/kg-d. EPA OPP applied an uncertainty factor of 100 to account for interspecies extrapolation (10) and intraspecies variation (10).

EPA identified three other RfD sources: a 2002 EPA IRIS assessment (EPA 2002), a 2008 ATSDR assessment (ATSDR 2008), and a 2000 Health Canada assessment (Health Canada and Environment Canada 2000). The current RfD in IRIS is 0.3 mg/kg-d, based on EPA (2002). The OPP RfD was selected by EPA to derive the updated ambient water quality criteria because this chemical is a current-use pesticide.

DEQ used the RfD of 0.6 mg/kg-d to calculate the 2015 proposed human health criteria. Previously, DEQ used the same RfD to calculate the 2006 human health criteria.

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA default trophic level-weighted BAF of 1.7 was used. Previously, the 2006 Idaho criteria for phenol were derived using a BCF of 1.4.

### Summary of previous (2006) and updated human health (HH) criteria for phenol.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	1,700,000	85,000
Water + Fish	21,000	3,800

### Sources

- Argus Research Laboratories. 1997. Oral (Gavage) Developmental Toxicity Study of Phenol in Rats. Horsham, PA: Argus Research Laboratories. Protocol no. 916-011.
- ATSDR (Agency for Toxic Substances and Disease Registry). 2008. Toxicological Profile for Phenol. Atlanta, GA: US Department of Health and Human Services, US Public Health Service, ATSDR. Accessed February 2015. <http://www.atsdr.cdc.gov/toxprofiles/tp115.pdf>.
- EPA (US Environmental Protection Agency). 2002. Toxicological Review of Phenol (CAS No. 108-95-2) in Support of Summary Information on the Integrated Risk Information System (IRIS). Washington, DC: EPA, Office of Research and Development. EPA-635-R-02-006. Accessed February 2015. <http://www.epa.gov/iris/toxreviews/0088tr.pdf>.
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2015. [http://www.hc-sc.gc.ca/ewh-semt/alt\\_formats/hecs-sesc/pdf/pubs/contaminants/psl2-lsp2/phenol/phenol-eng.pdf](http://www.hc-sc.gc.ca/ewh-semt/alt_formats/hecs-sesc/pdf/pubs/contaminants/psl2-lsp2/phenol/phenol-eng.pdf).

## 2,4,6-Trichlorophenol (Carcinogen)

CAS: 88-06-2

Water Quality Standards Number: 55

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used a CSF of  $0.011 \text{ (mg/kg-d)}^{-1}$  for 2,4,6-trichlorophenol based on a 1989 EPA IRIS assessment (EPA 1989). The IRIS program derived the CSF using a principal study by the National Cancer Institute (NCI 1979) based on development of leukemia in rats orally exposed to 2,4,6-trichlorophenol.

DEQ used this CSF of  $0.011 \text{ (mg/kg-d)}^{-1}$  to calculate criteria based on carcinogenic effects. Previously, DEQ used the same CSF to calculate the 2006 human health criteria. DEQ also calculated criteria based on noncarcinogenic health effects, using an RfD of 0.001 mg/kg-day based on a 2007 EPA Office of Solid Waste and Emergency Response (OSWER) Provisional Peer Reviewed Toxicity Value (PPRTV) (EPA 2007). EPA identified a study by Exon and Koller (1985) as the critical study and a decrease in litter size as the critical effect in rats exposed to 2,4,6-trichlorophenol in drinking water for 10 weeks prior to mating and continuing throughout mating and gestation. The study had a NOAEL of 3 mg/kg-d. In deriving the RfD, an uncertainty factor of 3000 was applied to account for intraspecies variation (10), interspecies extrapolation (10), subchronic-to-chronic extrapolation (10), and database deficiencies (3).

In evaluating criteria based on carcinogenic and noncarcinogenic effects, DEQ followed the current EPA recommendation to use the lower criteria. Because of the decision to base carcinogenic criteria on a risk level of  $1 \times 10^{-5}$ , the noncarcinogenic criteria were lower, and were selected.

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA default trophic level-weighted BAF of 120 was used. Previously, the 2006 Idaho criteria for 2,4,6-trichlorophenol were derived using a BCF of 150.

### Summary of previous (2006) and updated human health (HH) criteria for 2,4,6-trichlorophenol.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	2.4	2.0
Water + Fish	1.4	1.5

### Sources

- EPA (US Environmental Protection Agency). 1989. 2,4,6-Trichlorophenol (CASRN 88-06-2). Integrated Risk Information System. Carcinogenicity assessment verification date September 7, 1989. Washington, DC: EPA, Office of Research and Development. Accessed March 2015. <http://www.epa.gov/iris/subst/0122.htm>.
- EPA (US Environmental Protection Agency). 2007. Provisional Peer Reviewed Toxicity Values for 2,4,6-Trichlorophenol (CASRN 88-06-2). U.S. Environmental Protection Agency, Office of Research and Development, Cincinnati, OH. [http://hhpprtv.ornl.gov/issue\\_papers/Trichlorophenol246.pdf](http://hhpprtv.ornl.gov/issue_papers/Trichlorophenol246.pdf).
- EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.
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- NCI (National Cancer Institute). 1979. Bioassay of 2,4,6-Trichlorophenol for Possible Carcinogenicity (CAS No. 88-06-2). Bethesda, MD: US Department of Health, Education and Welfare, US Public

Health Service, National Institutes of Health, NCI. DHEW publication no. (NIH) 79-1711.  
Accessed February 2015. [http://ntp.niehs.nih.gov/ntp/htdocs/lt\\_rpts/tr155.pdf](http://ntp.niehs.nih.gov/ntp/htdocs/lt_rpts/tr155.pdf).

## Acenaphthene

**CAS:** 83-32-9

**Water Quality Standards Number:** 56

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used an RfD of 0.06 mg/kg-d for acenaphthene based on a 1989 EPA IRIS assessment (EPA 1989a). The IRIS program identified a study by EPA (1989b) as the critical study and hepatotoxicity as a critical effect in mice orally exposed to acenaphthene. The subchronic study has a NOAEL of 175 mg/kg-d. In deriving the RfD, the IRIS program applied an uncertainty factor of 3,000 to account for interspecies extrapolation (10), intraspecies variation (10), subchronic-to-chronic study extrapolation (10), and database deficiency (3).

EPA identified two other RfD sources: a 2011 EPA Office Research and Development Provisional Peer Reviewed Toxicity Value (EPA 2011) and a 1995 ATSDR assessment (ATSDR 1995). Neither of these assessments included the relevant (chronic oral) toxicity value.

DEQ used the RfD of 0.06 mg/kg-d to calculate the 2015 proposed human health criteria. Previously, DEQ used the same RfD to calculate the 2006 human health criteria.

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

A BCF of 510 was used. Previously, the 2006 Idaho criteria for acenaphthene were derived using a BCF of 242.

### Summary of previous (2006) and updated human health (HH) criteria for acenaphthene.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	990	28
Water + Fish	670	26

### Sources

ATSDR (Agency for Toxic Substances and Disease Registry). 1995. Toxicological Profile for Polycyclic Aromatic Hydrocarbons. Atlanta, GA: US Department of Health and Human Services, US Public Health Service, ATSDR. Accessed February 2015. <http://www.atsdr.cdc.gov/toxprofiles/tp69.pdf>.

EPA (US Environmental Protection Agency). 1989a. Acenaphthene (CASRN 83-32-9). Integrated Risk Information System. Oral RfD assessment verification date November 15, 1989. Washington, DC: EPA, Office of Research and Development. Accessed March 2015. <http://www.epa.gov/iris/subst/0442.htm>.

EPA (US Environmental Protection Agency). 1989b. Mouse Oral Subchronic Study with Acenaphthene. Prepared for EPA, Office of Solid Waste, by Hazelton Laboratories America, Inc.

EPA (US Environmental Protection Agency). 2011. Provisional Peer Reviewed Toxicity Values for Acenaphthene (CASN 83-32-9). Cincinnati, OH: EPA, Office of Research and Development. Accessed February 2015. [http://hhpprtv.ornl.gov/issue\\_papers/Acenaphthene.pdf](http://hhpprtv.ornl.gov/issue_papers/Acenaphthene.pdf).

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

## Anthracene

**CAS:** 120-12-7

**Water Quality Standards Number:** 58

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used an RfD of 0.3 mg/kg-d for anthracene based on a 1989 EPA IRIS assessment (EPA 1989a). EPA identified a study by EPA (1989b) as the critical study in which there were no observed effects in mice at the highest dose tested. The subchronic no-observed-effect level (NOEL) was 1,000 mg/kg-d. In deriving the RfD, the IRIS program applied an uncertainty factor of 3,000 to account for interspecies extrapolation (10), intraspecies variation (10), subchronic-to-chronic study extrapolation (10), and database deficiency (3).

EPA identified two other potential RfD sources: a 2009 EPA Office of Research and Development Provisional Peer Reviewed Toxicity Value (EPA 2009) and a 1995 ATSDR assessment (ATSDR 1995). Neither of these assessments include the relevant (chronic oral) toxicity endpoint.

DEQ used this RfD of 0.3 mg/kg-d to calculate the 2015 proposed human health criteria. Previously, DEQ used the same RfD to calculate the 2006 human health criteria.

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

A BCF of 610 was used. Previously, the 2006 Idaho criteria for anthracene were derived using a BCF of 30 (the benzo(a)pyrene BCF was used) (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for anthracene.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	40,000	120
Water + Fish	8,300	110

### Sources

ATSDR (Agency for Toxic Substances and Disease Registry). 1995. Toxicological Profile for Polycyclic Aromatic Hydrocarbons. Atlanta, GA: US Department of Health and Human Services, US Public Health Service, ATSDR. Accessed February 2015. <http://www.atsdr.cdc.gov/toxprofiles/tp69.pdf>.

EPA (US Environmental Protection Agency). 1989a. Anthracene (CASRN 120-12-7). Integrated Risk Information System. Oral RfD assessment verification date November 15, 1989. Washington, DC: EPA, Office of Research and Development. Accessed March 2015. <http://www.epa.gov/iris/subst/0434.htm>.

EPA (US Environmental Protection Agency). 1989b. Subchronic Toxicity in Mice with Anthracene. Final report. Prepared for EPA, Office of Solid Waste, by Hazelton Laboratories America, Inc.

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water, EPA-822-R-02-012. Accessed February 2015. [http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqctable\\_hh\\_cal\\_c\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqctable_hh_cal_c_matrix.pdf).

EPA (US Environmental Protection Agency). 2009. Provisional Peer Reviewed Toxicity Values for Anthracene (CASRN 120-12-7). Cincinnati, OH: EPA, Office of Research and Development. Accessed April 2015. [http://hhprt.v.ornl.gov/issue\\_papers/Anthracene.pdf](http://hhprt.v.ornl.gov/issue_papers/Anthracene.pdf).

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA.

<http://water.epa.gov/scitech/swguidance/standards/criteria/current/hfinal.cfm>

## Benzidine (Carcinogen)

**CAS:** 92-87-5

**Water Quality Standards Number:** 59

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used a CSF of 230 (mg/kg-d)<sup>-1</sup> based on a 1986 EPA IRIS assessment (EPA 1986). EPA's IRIS program derived the CSF using a principal study by Zavon et al. (1973) based on development of bladder tumors in humans exposed to benzidine through inhalation and occupational exposure.

DEQ used this CSF of 230 (mg/kg-d)<sup>-1</sup> to calculate the 2015 proposed human health criteria. Previously, DEQ used the same CSF to calculate the 2006 human health criteria.

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA default trophic level-weighted BAF of 1.6 was used. Previously, the 2006 Idaho criteria for benzidine were derived using a BCF of 87.5 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for benzidine.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	0.00020	0.033
Water + Fish	0.000086	0.0014

### Sources

EPA (US Environmental Protection Agency). 1986. Benzidine (CASRN 92-87-5). Integrated Risk Information System. Carcinogenicity assessment verification date December 17, 1986. Washington, DC: EPA, Office of Research and Development. Accessed March 2015.  
<http://www.epa.gov/iris/subst/0135.htm>.

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015.  
[http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqctable\\_hh\\_cal\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqctable_hh_cal_matrix.pdf).

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA.  
<http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

Zavon, M.R., U. Hoegg, and E. Bingham. 1973. "Benzidine Exposure as a Cause of Bladder Tumors." *Archives of Environmental Health: An International Journal* 27(1):1-7.

## Benzo(a)Anthracene (Carcinogen)

CAS: 56-55-3

Water Quality Standards Number: 60

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used a CSF of  $0.73 \text{ (mg/kg-d)}^{-1}$  for benzo(a)anthracene based on a 1991 EPA IRIS assessment for benzo(a)pyrene (EPA 1991). The IRIS program derived a CSF of 7.3 per mg/kg-d using a principal study by Neal and Rigdon (1967), which was based on development of fore-stomach and squamous cell papillomas in mice orally exposed to benzo(a)pyrene. EPA applied a relative potency factor of 0.1 to derive the CSF for benzo(a)anthracene (EPA 1993).

EPA identified one other CSF source for benzo(a)anthracene: a 2005 California EPA assessment (CalEPA 2005). However, due to EPA's ongoing reassessments, EPA decided to use the modified CSF from the 1991 IRIS benzo(a)pyrene assessment to derive ambient water quality criteria at this time.

DEQ used this CSF of  $0.73 \text{ (mg/kg-d)}^{-1}$  to calculate the 2015 proposed human health criteria. Previously, DEQ used a CSF of  $7.3 \text{ (mg/kg-d)}^{-1}$  to calculate the 2006 criteria. The benzo(a)pyrene CSF was used (EPA 2002).

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA BCF of 3,900 was used. Previously, the 2006 Idaho criteria for benzo(a)anthracene were derived using a BCF of 30 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for benzo(a)anthracene.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	0.018	0.0042
Water + Fish	0.0038	0.0042

### Sources

CalEPA (California Environmental Protection Agency). 2005. Air Toxics Hot Spots Program Risk Assessment Guidelines. Part II. Technical Support Document for Describing Available Cancer Potency Factors. CalEPA, Office of Environmental Health Hazard Assessment. Accessed February 2015. [http://oehha.ca.gov/air/hot\\_spots/pdf/May2005Hotspots.pdf](http://oehha.ca.gov/air/hot_spots/pdf/May2005Hotspots.pdf).

EPA (US Environmental Protection Agency). 1991. Benzo[a]pyrene (BaP) (CASRN 50-32-8). Integrated Risk Information System. Carcinogenicity assessment verification date December 4, 1991. Washington, DC: EPA, Office of Research and Development. Accessed March 2015. <http://www.epa.gov/iris/subst/0136.htm>.

EPA (US Environmental Protection Agency). 1993. Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons. Cincinnati, OH: EPA, Office of Health and Environmental Assessment. EPA/600/R-93-089. Accessed March 2015. [http://www.epa.gov/oswer/riskassessment/pdf/1993\\_epa\\_600\\_r-93\\_c89.pdf](http://www.epa.gov/oswer/riskassessment/pdf/1993_epa_600_r-93_c89.pdf).

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015. [http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqtable\\_hh\\_cal\\_c\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqtable_hh_cal_c_matrix.pdf).

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human

Health Criteria. Washington, DC: EPA.

<http://water.epa.gov/scitech/swguidance/standards/criteria/current/hfinal.cfm>.

Neal, J., and R.H. Rigdon. 1967. "Gastric Tumors in Mice Fed Benzo(a)Pyrene: A Quantitative Study." *Texas Reports on Biology and Medicine* 25(4):553–557.

## Benzo(a)Pyrene (Carcinogen)

**CAS:** 50-32-8

**Water Quality Standards Number:** 61

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used a CSF of  $7.3 \text{ (mg/kg-d)}^{-1}$  for benzo(a)pyrene based on a 1991 EPA IRIS assessment (EPA 1991). The IRIS program derived a CSF of 7.3 per mg/kg-d using a principal study by Neal and Rigdon (1967), which was based on development of fore-stomach and squamous cell papillomas in mice orally exposed to benzo(a)pyrene.

EPA identified one other CSF source for benzo(a)pyrene: a 2010 California EPA assessment (CalEPA 2010). However, due to EPA's ongoing reassessments, EPA decided to use the current IRIS CSF to derive ambient water quality criteria.

DEQ used this CSF of  $7.3 \text{ (mg/kg-d)}^{-1}$  to calculate the 2015 proposed human health criteria. Previously, DEQ used the same CSF to calculate the 2006 criteria (EPA 2002).

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA BCF of 3,900 was used. Previously, the 2006 Idaho criteria for benzo(a)pyrene were derived using a BCF of 30 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for benzo(a)pyrene.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	0.018	0.00042
Water + Fish	0.0038	0.00042

### Sources

CalEPA (California Environmental Protection Agency). 2010. Public Health Goals for Chemicals in Drinking Water: Benzo(a)pyrene. CalEPA, Office of Environmental Health Hazard Assessment. Accessed February 2015. <http://www.oehha.ca.gov/water/phg/pdf/091610Benzopyrene.pdf>.

EPA (US Environmental Protection Agency). 1991. Benzo[a]pyrene (BaP) (CASRN 50-32-8). Integrated Risk Information System. Carcinogenicity assessment verification date December 4, 1991. Washington, DC: EPA, Office of Research and Development. Accessed March 2015. <http://www.epa.gov/iris/subst/0136.htm>.

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015. [http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqtable\\_hh\\_cal\\_c\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqtable_hh_cal_c_matrix.pdf).

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

Neal, J., and R.H. Rigdon. 1967. "Gastric Tumors in Mice Fed Benzo(a)Pyrene: A Quantitative Study." *Texas Reports on Biology and Medicine* 25(4):553–557.

## Benzo(b)Fluoranthene (Carcinogen)

CAS: 205-99-2

Water Quality Standards Number: 62

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used a CSF of  $0.73 \text{ (mg/kg-d)}^{-1}$  for benzo(b)fluoranthene based on a 1991 EPA IRIS assessment for benzo(a)pyrene (EPA 1991). EPA's IRIS program derived a CSF of 7.3 per mg/kg-d using a principal study by Neal and Rigdon (1967), which was based on development of fore-stomach and squamous cell papillomas in mice orally exposed to benzo(a)pyrene (EPA 1991). EPA applied a relative potency factor of 0.1 to derive the CSF for benzo(b)fluoranthene (EPA 1993).

EPA identified one other CSF source for benzo(b)fluoranthene: a 2005 California EPA assessment (CalEPA 2005). However, due to EPA's ongoing reassessments, EPA decided to use the current IRIS CSF to derive ambient water quality criteria.

DEQ used this CSF of  $0.73 \text{ (mg/kg-d)}^{-1}$  to calculate the 2015 proposed human health criteria. Previously, DEQ used the benzo(a)pyrene CSF of  $7.3 \text{ (mg/kg-d)}^{-1}$  to calculate the 2006 human health criteria for benzo(b)fluoranthene (EPA 2002).

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA BCF of 3,900 was used. Previously, the 2006 Idaho criteria for benzo(b)fluoranthene were derived using a BCF of 30 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for benzo(b)fluoranthene.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	0.018	0.0042
Water + Fish	0.0038	0.0042

### Sources

CalEPA (California Environmental Protection Agency). 2005. Air Toxics Hot Spots Program Risk Assessment Guidelines. Part II. Technical Support Document for Describing Available Cancer Potency Factors. CalEPA, Office of Environmental Health Hazard Assessment. Accessed February 2015. [http://oehha.ca.gov/air/hot\\_spots/pdf/May2005Hotspots.pdf](http://oehha.ca.gov/air/hot_spots/pdf/May2005Hotspots.pdf).

EPA (US Environmental Protection Agency). 1991. Benzo[a]pyrene (BaP) (CASRN 50-32-8). Integrated Risk Information System. Carcinogenicity assessment verification date December 4, 1991. Washington, DC: EPA, Office of Research and Development. Accessed March 2015. <http://www.epa.gov/iris/subst/0136.htm>.

EPA (US Environmental Protection Agency). 1993. Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons. EPA/600/R-93-089. U.S. Environmental Protection Agency, Office of Health and Environmental Assessment, Cincinnati, OH. Accessed March 2015. [http://www.epa.gov/oswer/riskassessment/pdf/1993\\_epa\\_600\\_r-93\\_c89.pdf](http://www.epa.gov/oswer/riskassessment/pdf/1993_epa_600_r-93_c89.pdf).

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015. [http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqtable\\_hh\\_cal\\_c\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqtable_hh_cal_c_matrix.pdf).

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human

Health Criteria. Washington, DC: EPA.

<http://water.epa.gov/scitech/swguidance/standards/criteria/current/hfinal.cfm>.

Neal, J., and R.H. Rigdon. 1967. "Gastric Tumors in Mice Fed Benzo(a)Pyrene: A Quantitative Study."  
*Texas Reports on Biology and Medicine* 25(4):553–557.

## Benzo(k)Fluoranthene (Carcinogen)

CAS: 207-08-9

Water Quality Standards Number: 64

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used a CSF of  $0.073 \text{ (mg/kg-d)}^{-1}$  for benzo(k)fluoranthene based on a 1991 EPA IRIS assessment for benzo(a)pyrene (EPA 1991). The IRIS program derived a CSF of 7.3 per mg/kg-d using a principal study by Neal and Rigdon (1967), which was based on development of fore-stomach and squamous cell papillomas in mice orally exposed to benzo(a)pyrene. EPA applied a relative potency factor of 0.01 to derive the CSF for benzo(k)fluoranthene (EPA 1993).

DEQ used this CSF of  $0.073 \text{ (mg/kg-d)}^{-1}$  to calculate the 2015 proposed human health criteria. Previously, DEQ used the benzo(a)pyrene CSF of  $7.3 \text{ (mg/kg-d)}^{-1}$  to calculate the 2006 human health criteria for benzo(k)fluoranthene (EPA 2002).

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

AN EPA BCF of 3,900 was used. Previously, the 2006 Idaho criteria for benzo(k)fluoranthene were derived using a BCF of 30 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for benzo(k)fluoranthene.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	0.018	0.042
Water + Fish	0.0038	0.042

### Sources

EPA (US Environmental Protection Agency). 1991. Benzo[a]pyrene (BaP) (CASRN 50-32-8). Integrated Risk Information System. Carcinogenicity assessment verification date December 4, 1991. Washington, DC: EPA, Office of Research and Development. Accessed March 2015. <http://www.epa.gov/iris/subst/0136.htm>.

EPA (US Environmental Protection Agency). 1993. Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons. EPA/600/R-93-089. U.S. Environmental Protection Agency, Office of Health and Environmental Assessment, Cincinnati, OH. Accessed March 2015. [http://www.epa.gov/oswer/riskassessment/pdf/1993\\_epa\\_600\\_r-93\\_c89.pdf](http://www.epa.gov/oswer/riskassessment/pdf/1993_epa_600_r-93_c89.pdf).

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015. [http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqctable\\_hh\\_cal\\_c\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqctable_hh_cal_c_matrix.pdf).

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

Neal, J., and R.H. Rigdon. 1967. "Gastric Tumors in Mice Fed Benzo(a)Pyrene: A Quantitative Study." *Texas Reports on Biology and Medicine* 25(4):553–557.

## Bis(2-Chloroethyl)Ether (Carcinogen)

CAS: 111-44-4

Water Quality Standards Number: 66

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used a CSF of  $1.1 \text{ (mg/kg-d)}^{-1}$  for bis(2-chloroethyl)ether based on a 1986 EPA IRIS assessment (EPA 1986). EPA's IRIS program calculated the CSF using a principal study by Innes et al. (1969) based on development of hepatomas as the critical effect in mice orally exposed to bis(2-chloroethyl)ether.

DEQ used this CSF of  $1.1 \text{ (mg/kg-d)}^{-1}$  to calculate the 2015 proposed human health criteria. Previously, DEQ used the same CSF to calculate the 2006 human health criteria (EPA 2002).

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA default trophic level-weighted BAF of 1.6 was used. Previously, the 2006 Idaho criteria for bis(2-chloroethyl)ether were derived using a BCF of 6.9 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for bis(2-chloroethyl)ether.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	0.53	6.8
Water + Fish	0.030	0.29

### Sources

EPA (US Environmental Protection Agency). 1986. Bis(Chloroethyl) Ether (BCEE) (CASRN 111-44-4). Integrated Risk Information System. Carcinogenicity assessment verification date July 23, 1986. Washington, DC: EPA, Office of Research and Development. Accessed March 2015.  
<http://www.epa.gov/iris/subst/0137.htm>.

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015.  
[http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqctable\\_hh\\_cal\\_c\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqctable_hh_cal_c_matrix.pdf).

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## Bis(2-Chloroisopropyl)Ether

CAS: 108-60-1

Water Quality Standards Number: 67

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used an RfD of 0.04 mg/kg-d for bis(2-chloroisopropyl)ether based on a 1989 EPA IRIS assessment (EPA 1989). The IRIS program identified a study by Mitsumori et al. (1979) as the critical study and a decrease in hemoglobin and possible erythrocyte destruction as the critical effects in mice orally exposed to bis(2-chloroisopropyl)ether. The study has a NOAEL of 35.8 mg/kg-d. In deriving the RfD, the IRIS program applied an uncertainty factor of 1,000 to account for interspecies extrapolation (10), intraspecies variation (10), and database deficiencies (10).

DEQ used this RfD of 0.04 mg/kg-d to calculate the 2015 proposed human health criteria. Previously, DEQ used the same RfD to calculate the 2006 criteria (EPA 2002).

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA default trophic level-weighted BAF of 8.3 was used. Previously, the 2006 Idaho criteria for bis(2-chloroisopropyl)ether were derived using a BCF of 2.47 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for bis(2-chloroisopropyl)ether.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	65,000	1,200
Water + Fish	1,400	220

### Sources

- EPA (US Environmental Protection Agency). 1989. Bis(2-Chloro-1-Methylethyl) Ether (CASRN 108-60-1). Integrated Risk Information System. Oral RfD assessment verification date July 20, 1989. Washington, DC: EPA, Office of Research and Development. Accessed February 2015. <http://www.epa.gov/iris/subst/0407.htm>.
- EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015. [http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqctable\\_hh\\_cal\\_c\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqctable_hh_cal_c_matrix.pdf).
- EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.
- Mitsumori, K., T. Usui, K. Takahashi, and Y. Shirasu. 1979. "Twenty-Four Month Chronic Toxicity Studies of Dichlorodiisopropyl Ether in Mice." *Nippon No Yaku Gakkaishi* 4(3):323–335.

## Bis(2-Ethylhexyl)Phthalate (Carcinogen)

CAS: 117-81-7

Water Quality Standards Number: 68

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used a CSF of  $0.014 \text{ (mg/kg-d)}^{-1}$  for bis(2-ethylhexyl)phthalate based on a 1987 EPA IRIS assessment (EPA 1987). EPA's IRIS program calculated the CSF using a principal study by the National Toxicology Program (NTP 1982) based on development of hepatocellular carcinomas and adenomas in mice orally exposed to bis(2-ethylhexyl)phthalate (EPA 1987).

DEQ used this CSF of  $0.014 \text{ (mg/kg-d)}^{-1}$  to calculate the 2015 proposed human health criteria. Previously, DEQ used the same CSF to calculate the 2006 human health criteria (EPA 2002).

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA BCF of 710 was used. Previously, the 2006 Idaho criteria for bis(2-ethylhexyl)phthalate were derived using a BCF of 130 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for bis(2-ethylhexyl)phthalate.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	2.2	1.2
Water + Fish	1.2	1.2

### Sources

EPA (US Environmental Protection Agency). 1987. Di(2-Ethylhexyl) Phthalate (DEHP) (CASRN 117-81-7). Integrated Risk Information System. Carcinogenicity assessment verification date October 7, 1987. Washington, DC: EPA, Office of Research and Development. Accessed March 2015.  
<http://www.epa.gov/iris/subst/0014.htm>.

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015.  
[http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqctable\\_hh\\_cal\\_c\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqctable_hh_cal_c_matrix.pdf).

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA.  
<http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

NTP (National Toxicology Program). 1982. *Carcinogenesis Bioassay of Di(2-ethylhexyl) Phthalate (CAS No. 117-81-7) in F344 Rats and B6C3F1 Mice (Feed Study)*. Research Triangle Park, NC: US Department of Health and Human Services, US Public Health Service, National Institutes of Health, NTP. NTP Technical Report Series no. 217. Accessed March 2015.  
[https://ntp.niehs.nih.gov/ntp/htdocs/lt\\_rpts/tr217.pdf](https://ntp.niehs.nih.gov/ntp/htdocs/lt_rpts/tr217.pdf).

## Butylbenzyl Phthalate (Carcinogen)

CAS: 85-68-7

Water Quality Standards Number: 70

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used a CSF of  $0.0019 \text{ (mg/kg-d)}^{-1}$  for butylbenzyl phthalate based on a 2002 EPA Office of Research and Development (ORD) Provisional Peer Reviewed Toxicity Value (EPA 2002a). ORD calculated the CSF using principal studies by the National Toxicology Program (NTP 1997) based on the development of pancreatic carcinogenesis in rats orally exposed to butylbenzyl phthalate.

IRIS identified a National Toxicology Program study as the critical study (NTP 1985), and significantly increased liver-to-body weight and liver-to-brain weight ratios as the critical effects in rats orally exposed to butylbenzyl phthalate. The study has a NOAEL of 159 mg/kg-d. In deriving the RfD, the IRIS program applied an uncertainty factor of 1,000 to account for intraspecies sensitivity (10), interspecies variability (10), and extrapolation from subchronic to chronic NOAELs (10).

DEQ used this CSF of  $0.0019 \text{ (mg/kg-d)}^{-1}$  to calculate the 2015 proposed human health criteria. Previously, DEQ used an RfD of 0.2 mg/kg-d, based on a 1989 EPA IRIS assessment (EPA 1989), to calculate the 2006 human health criteria.

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA BCF of 19,000 was used. Previously, the 2006 Idaho criteria for butylbenzyl phthalate were derived using a BCF of 414 (EPA 2002b).

### Summary of previous (2006) and updated human health (HH) criteria for butylbenzyl phthalate.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	1,900	0.33
Water + Fish	1,500	0.33

### Sources

EPA (US Environmental Protection Agency). 1989. Butyl Benzyl Phthalate (CASRN 85-68-7). Integrated Risk Information System. Oral RfD assessment verification date June 15, 1989. Washington, DC: EPA, Office of Research and Development. Accessed March 2015.  
<http://www.epa.gov/iris/subst/0293.htm>.

EPA (US Environmental Protection Agency). 2002a. Provisional Peer Reviewed Toxicity Values for Butyl Benzyl Phthalate (CASRN 85-68-7). Derivation of a Carcinogenicity Assessment. Cincinnati, OH: EPA, Office of Research and Development. Accessed March 2015.  
[http://hhprrtv.ornl.gov/issue\\_papers/Butylbenzylphthalate.pdf](http://hhprrtv.ornl.gov/issue_papers/Butylbenzylphthalate.pdf).

EPA (US Environmental Protection Agency). 2002b. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015.  
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EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA.  
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NTP (National Toxicology Program).1985. Twenty-Six Week Subchronic Study and Modified Mating Trial in F344 Rats. Butyl benzyl phthalate. Final Report. Hazelton Laboratories America, Inc. Unpublished study. Project No. 12307-02, -03.

## 2-Chloronaphthalene

CAS: 91-58-7

Water Quality Standards Number: 71

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used an RfD of 0.08 mg/kg-d for 2-chloronaphthalene based on a 1990 EPA IRIS assessment (EPA 1990). The IRIS program identified a study by EPA (EPA 1989) as the critical study and dyspnea, abnormal appearance, and liver enlargement as the critical effects in mice orally exposed to 2-chloronaphthalene. The subchronic study has a NOAEL of 250 mg/kg-d. In deriving the RfD, the IRIS program applied an uncertainty factor of 3,000 to account for interspecies extrapolation (10), intraspecies variation (10), subchronic-to-chronic study extrapolation (10), and database deficiencies (3).

DEQ used this RfD of 0.08 mg/kg-d to calculate the 2015 proposed human health criteria. Previously, DEQ used the same RfD to calculate the 2006 human health criteria (EPA 2002).

### RSC

An RSC value of 0.8 was used to calculate the criteria.

### BAF/BCF

An EPA default trophic level-weighted BAF of 200 was used. Previously, the 2006 Idaho criteria for 2-chloronaphthalene were derived using a BCF of 202 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for 2-chloronaphthalene.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	1,600	380
Water + Fish	1,000	330

### Sources

EPA (US Environmental Protection Agency). 1989. Subchronic Study in Mice with beta-Chloronaphthalene. Vienna, VA: Hazleton Laboratories America, Inc. Prepared for EPA, Office of Solid Waste. HLA study no. 2399-124.

EPA (US Environmental Protection Agency). 1990. Beta-Chloronaphthalene (CASRN 91-58-7). Integrated Risk Information System. Oral RfD assessment verification date February 21, 1990. Washington, DC: EPA, Office of Research and Development. Accessed February 2015. <http://www.epa.gov/iris/subst/0463.htm>.

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015. [http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqctable\\_hh\\_cal\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqctable_hh_cal_matrix.pdf)

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

## Chrysene (Carcinogen)

**CAS:** 218-01-9

**Water Quality Standards Number:** 73

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used a CSF of  $0.0073 \text{ (mg/kg-d)}^{-1}$  for chrysene based on a 1991 EPA IRIS assessment for benzo(a)pyrene (EPA 1991). EPA's IRIS program derived a CSF of 7.3 per mg/kg-d using a principal study by Neal and Rigdon (1967), which was based on development of fore-stomach and squamous cell papillomas in mice orally exposed to benzo(a)pyrene (EPA 1991). EPA applied a relative potency factor of 0.001 to derive the CSF for chrysene (EPA 1993).

EPA identified one other CSF source for chrysene: a 2005 California EPA assessment (CalEPA 2005). However, due to EPA's ongoing reassessments, EPA chose to use the current IRIS CSF to derive ambient water quality criteria.

DEQ used this CSF of  $0.0073 \text{ (mg/kg-d)}^{-1}$  to calculate the 2015 proposed human health criteria. Previously, DEQ used the benzo(a)pyrene CSF of  $7.3 \text{ (mg/kg-d)}^{-1}$  to calculate the 2006 human health criteria for chrysene (EPA 2002).

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA BCF of 3,900 was used. Previously, the 2006 Idaho criteria for chrysene were derived using a BCF of 30 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for chrysene.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	0.018	0.42
Water + Fish	0.0038	0.42

### Sources

CalEPA (California Environmental Protection Agency). 2005. Air Toxics Hot Spots Program Risk Assessment Guidelines. Part II. Technical Support Document for Describing Available Cancer Potency Factors. CalEPA, Office of Environmental Health Hazard Assessment. Accessed February 2015. [http://oehha.ca.gov/air/hot\\_spots/pdf/May2005Hotspots.pdf](http://oehha.ca.gov/air/hot_spots/pdf/May2005Hotspots.pdf).

EPA (US Environmental Protection Agency). 1991. Benzo[a]pyrene (BaP) (CASRN 50-32-8). Integrated Risk Information System. Carcinogenicity assessment verification date December 4, 1991. Washington, DC: EPA, Office of Research and Development. Accessed March 2015. <http://www.epa.gov/iris/subst/0136.htm>.

EPA (US Environmental Protection Agency). 1993. Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons. Cincinnati, OH: EPA, Office of Health and Environmental Assessment. EPA/600/R-93-089. Accessed March 2015. [http://www.epa.gov/oswer/riskassessment/pdf/1993\\_epa\\_600\\_r-93\\_c89.pdf](http://www.epa.gov/oswer/riskassessment/pdf/1993_epa_600_r-93_c89.pdf).

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015. [http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqtable\\_hh\\_cal\\_c\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqtable_hh_cal_c_matrix.pdf)

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human

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Neal, J., and R.H. Rigdon. 1967. "Gastric Tumors in Mice Fed Benzo(a)Pyrene: A Quantitative Study."  
*Texas Reports on Biology and Medicine* 25(4):553–557.

## Dibenzo(a,h)anthracene (Carcinogen)

CAS: 53-70-3

Water Quality Standards Number: 74

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used a CSF of  $7.3 \text{ (mg/kg-d)}^{-1}$  for dibenzo(a,h)anthracene based on a 1991 EPA IRIS assessment for benzo(a)pyrene (EPA 1991). The IRIS program derived a CSF of 7.3 per mg/kg-d using a principal study by Neal and Rigdon (1967), which was based on development of fore-stomach and squamous cell papillomas in mice orally exposed benzo(a)pyrene (EPA 1991). EPA applied a relative potency factor of 1.0 to derive the CSF for dibenzo(a,h)anthracene (EPA 1993).

EPA identified one other CSF source for dibenzo(a,h)anthracene: a 2005 California EPA assessment (CalEPA 2005). However, due to EPA's ongoing reassessments, EPA chose to use the current IRIS CSF to derive ambient water quality criteria.

DEQ used this CSF of  $7.3 \text{ (mg/kg-d)}^{-1}$  to calculate the 2015 proposed human health criteria. Previously, DEQ used the same CSF to calculate the 2006 human health criteria (EPA 2002).

### RSC

An RSC value was not used, because the criteria are based on cancer risk

### BAF/BCF

An EPA BCF of 3,900 was used. Previously, the 2006 Idaho criteria for dibenzo(a,h)anthracene were derived using a BCF of 30 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for dibenzo(a,h)anthracene.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	0.018	0.00042
Water + Fish	0.0038	0.00042

### Sources

CalEPA (California Environmental Protection Agency). 2005. Air Toxics Hot Spots Program Risk Assessment Guidelines. Part II. Technical Support Document for Describing Available Cancer Potency Factors. CalEPA, Office of Environmental Health Hazard Assessment. Accessed February 2015. [http://oehha.ca.gov/air/hot\\_spots/pdf/May2005Hotspots.pdf](http://oehha.ca.gov/air/hot_spots/pdf/May2005Hotspots.pdf).

EPA (US Environmental Protection Agency). 1991. Benzo[a]pyrene (BaP) (CASRN 50-32-8). Integrated Risk Information System. Carcinogenicity assessment verification date December 4, 1991. Washington, DC: EPA, Office of Research and Development. Accessed March 2015. <http://www.epa.gov/iris/subst/0136.htm>.

EPA (US Environmental Protection Agency). 1993. Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons. Cincinnati, OH: EPA, Office of Health and Environmental Assessment. EPA/600/R-93-089. Accessed March 2015. [http://www.epa.gov/oswer/riskassessment/pdf/1993\\_epa\\_600\\_r-93\\_c89.pdf](http://www.epa.gov/oswer/riskassessment/pdf/1993_epa_600_r-93_c89.pdf).

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015. [http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqtable\\_hh\\_cal\\_c\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqtable_hh_cal_c_matrix.pdf)

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Health Criteria. Washington, DC: EPA.

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Neal, J., and R.H. Rigdon. 1967. "Gastric Tumors in Mice Fed Benzo(a)Pyrene: A Quantitative Study." *Texas Reports on Biology and Medicine* 25(4):553–557.

## 1,2-Dichlorobenzene

**CAS:** 95-50-1

**Water Quality Standards Number:** 75

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used, in place of an RfD, a chronic oral minimal risk level (MRL) of 0.3 mg/kg-d for 1,2-dichlorobenzene based on a 2006 ATSDR assessment for dichlorobenzenes (ATSDR 2006). A chronic oral MRL is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse noncancer health effects for a chronic duration (365 days and longer).

ATSDR identified a study by the National Toxicology Program (NTP 1985) as the critical study and the development of kidney lesions (renal tubular degeneration) as the critical effects in mice orally exposed to 1,2-dichlorobenzene for 103 weeks. The lower-bound confidence limit on the benchmark dose (BMDL<sub>10</sub>) was 30.74 mg/kg-d. In deriving the chronic MRL, ATSDR applied an uncertainty factor of 100 to account for interspecies extrapolation (10) and intraspecies variation (10).

EPA identified two other RfD sources: a 1989 EPA IRIS assessment (EPA 1989) and a 1980 EPA Office of Water assessment (EPA 1980). EPA preferred the 2006 ATSDR chronic oral MRL for use in ambient water quality criteria development. The ATSDR assessment is the most current assessment. ATSDR relied on the same principal study as IRIS (NTP 1985) but used more current benchmark dose (BMD) modeling in order to identify the point of departure for the RfD derivation. According to EPA guidance, when data are amenable to modeling, the BMD approach is the preferred approach (EPA 2012).

DEQ used this MRL of 0.3 mg/kg-d to calculate the 2015 proposed human health criteria. Previously, DEQ used the current IRIS RfD of 0.09 mg/kg-d (EPA 1989) to calculate the 2006 human health criteria (EPA 2002).

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA default trophic level-weighted BAF of 67 was used. Previously, the 2006 Idaho criteria for 1,2-dichlorobenzene were derived using a BCF of 55.6 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for 1,2-dichlorobenzene.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	1,300	1,100
Water + Fish	420	700

The proposed fish only and water + fish criteria are the lower of the corresponding Nez Perce and Idaho general population criteria, each of which was calculated using a probabilistic risk assessment methodology.

### Sources

ATSDR (Agency for Toxic Substances and Disease Registry). 2006. Toxicological Profile for Dichlorobenzenes. Atlanta, GA: US Department of Health and Human Services, US Public Health Service, ATSDR. Accessed February 2015. <http://www.atsdr.cdc.gov/toxprofiles/tp10.pdf>.

NTP (National Toxicology Program). 1985. Toxicology and Carcinogenesis Studies of 1,2-Dichlorobenzene (o-Dichlorobenzene) (CAS No. 95-50-1) in F344/N Rats and B6C3F1 Mice (Gavage Studies). NTP Technical Report Series no. 255. U.S. Department of Health and Human Services, U.S. Public Health Service, National Institutes of Health, National Toxicology Program, Research Triangle Park, NC. Accessed February 2015. [http://ntp.niehs.nih.gov/ntp/htdocs/lt\\_rpts/tr255.pdf](http://ntp.niehs.nih.gov/ntp/htdocs/lt_rpts/tr255.pdf).

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<http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

## 1,3-Dichlorobenzene

**CAS:** 541-73-1

**Water Quality Standards Number:** 76

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) selected, in place of an RfD, an intermediate-duration oral minimal risk level (MRL) of 0.02 mg/kg-d for 1,3-dichlorobenzene from a 2006 ATSDR assessment (ATSDR 2006) and adjusted it to 0.002 mg/kg-d for a chronic (lifetime) exposure (EPA 2000). An intermediate-duration MRL is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse noncancer health effects over an exposure period of 15–364 days.

ATSDR derived an intermediate-duration oral MRL using a principal study by McCauley et al. (1995) based on the development of pituitary lesions, consisting of cytoplasmic vacuolation of the pars distalis in male rats orally exposed to 1,3-dichlorobenzene for 90 consecutive days. A duration-adjusted, lower-bound confidence limit benchmark dose (BMDL<sub>10</sub>) of 2.1 mg/kg-d was derived from this study. In deriving the MRL, ATSDR applied an uncertainty factor of 100 to account for interspecies extrapolation (10) and intraspecies variation (10), resulting in an intermediate-duration oral MRL of 0.02 mg/kg-day. In this particular case, because there are no chronic oral toxicity values available for 1,3-dichlorobenzene, EPA applied an additional uncertainty factor of 10 to account for intermediate-to-chronic duration to derive a chronic-duration oral MRL of 0.002 mg/kg-d for the purpose of ambient water quality criteria development (EPA 2000).

EPA identified one other RfD source: a 1980 EPA Office of Water (OW) assessment (EPA 1980). The 1980 EPA OW RfD is based on toxicity studies for 1,2-dichlorobenzene and 1,4-dichlorobenzene—not for 1,3-dichlorobenzene. Hollingsworth et al. (1956, 1958) exposed several animal species over a period of 6–7 months in separate toxicity tests with 1,2-dichlorobenzene and 1,4-dichlorobenzene (i.e., no toxicity tests were performed with 1,3-dichlorobenzene) (EPA 1980). The OW derived the 1980 RfD based on the lowest NOAEL from those studies as a surrogate for 1,3-dichlorobenzene (EPA 1980). EPA prefers the 2006 ATSDR MRL for use in criteria development at the present time. The 2006 ATSDR assessment used a newer principal study specifically for 1,3-dichlorobenzene (McCauley et al. 1995) and applied more current benchmark dose (BMD) modeling in order to identify the point of departure for the MRL derivation (ATSDR 2006). According to EPA guidance, when data are amenable to modeling, the BMD approach is the preferred approach (EPA 2012). The ATSDR assessment represents the most current available human health assessment for 1,3-dichlorobenzene. In the event that a chronic toxicity value (RfD or chronic-duration MRL) for 1,3-dichlorobenzene becomes available in the future, EPA will update the AWQC ambient water quality criteria to reflect the latest science.

DEQ used this RfD of 0.002 mg/kg-d to calculate the 2015 proposed human health criteria. Previously, DEQ used the acceptable daily intake for 1,2-dichlorobenzene, 0.0134 mg/kg-d, to calculate the 2006 human health criteria (EPA 2002).

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA default trophic level-weighted BAF of 100 was used. Previously, the 2006 Idaho criteria for 1,3-dichlorobenzene were derived using a BCF of 55.6 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for 1,3-dichlorobenzene.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	960	4.8
Water + Fish	320	3.5

### Sources

- ATSDR (Agency for Toxic Substances and Disease Registry). 2006. Toxicological Profile for Dichlorobenzenes. Atlanta, GA: US Department of Health and Human Services, US Public Health Service, ATSDR. Accessed February 2015. <http://www.atsdr.cdc.gov/toxprofiles/tp10.pdf>.
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- Hollingsworth, R.L., H.R. Hoyle, F. Oyen, V.K. Rowe, and H. Spencer. 1956. "Toxicity of Para Dichlorobenzene. Determinations on Experimental Animals and Human Subjects." *AMA Archives of Industrial Health* 14(2):138–147.
- McCauley, P.T., M. Robinson, F.B. Daniel, and G.R. Olson. 1995. "Toxicity Studies of 1,3-Dichlorobenzene in Sprague-Dawley Rats." *Drug and Chemical Toxicology* 18(2 and 3):201–221.

## 1,4-Dichlorobenzene

**CAS:** 106-46-7

**Water Quality Standards Number:** 77

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) selected, in place of an RfD, a chronic oral minimal risk level (MRL) of 0.07 mg/kg-d for 1,4-dichlorobenzene based on a 2006 ATSDR assessment for dichlorobenzenes (ATSDR 2006). A chronic oral MRL is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse noncancer health effects for a chronic duration (365 days and longer).

ATSDR identified a study by Naylor and Stout (1996) as the critical study and increased serum alkaline phosphatase levels as the critical effect in female dogs orally exposed to 1,4-dichlorobenzene for 1 year. The duration-adjusted, lower-bound confidence limit on the benchmark dose (BMDL<sub>10</sub>) was 7 mg/kg-d. In deriving the chronic MRL, ATSDR applied an uncertainty factor of 100 to account for interspecies extrapolation (10) and intraspecies variation (10).

EPA identified three other RfD sources: a 2008 EPA Office of Pesticide Programs (OPP) Reregistration Eligibility Decision (RED) (EPA 2008), a 1980 EPA Office of Water (OW) assessment (EPA 1980), and a 1997 California EPA assessment (CalEPA 1997). EPA prefers the 2006 ATSDR chronic MRL for use in ambient water quality criteria development at the present time. 1,4-Dichlorobenzene is a current use pesticide; however, the EPA OPP assessment does not include a toxicity endpoint for chronic oral exposures (RfD). The ATSDR assessment is the most current source of a chronic oral toxicity value and relies on a newer principal study (Naylor and Stout 1996) and more current benchmark dose modeling than was relied on in the 1980 OW assessment.

DEQ used this MRL of 0.07 mg/kg-d to calculate the 2015 proposed human health criteria. Previously, DEQ used the acceptable daily intake for 1,2-dichlorobenzene, 0.0134 mg/kg-d, to calculate the 2006 human health criteria (EPA 2002).

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA default trophic level-weighted BAF of 56 was developed for the Idaho general population and a trophic level-weighted BAF of 69 was developed for the Nez Perce Tribe. Previously, the 2006 Idaho criteria for 1,4-dichlorobenzene were derived using a BCF of 55.6 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for 1,4-dichlorobenzene.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	190	300
Water + Fish	63	180

### Sources

ATSDR (Agency for Toxic Substances and Disease Registry). 2006. Toxicological Profile for Dichlorobenzenes. Atlanta, GA: US Department of Health and Human Services, US Public Health Service, ATSDR. Accessed February 2015. <http://www.atsdr.cdc.gov/toxprofiles/tp10.pdf>.

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<http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.
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## 3,3'-Dichlorobenzidine (Carcinogen)

CAS: 91-94-1

Water Quality Standards Number: 78

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used a CSF of  $0.45 \text{ (mg/kg-d)}^{-1}$  for 3,3'-dichlorobenzidine based on a 1988 EPA IRIS assessment (EPA 1988). EPA's IRIS program derived the CSF using a principal study by Stula et al. (1975) based on development of mammary adenocarcinomas in female rats orally exposed to 3,3'-dichlorobenzidine.

DEQ used this CSF of  $0.45 \text{ (mg/kg-d)}^{-1}$  to calculate the 2015 proposed human health criteria. Previously, DEQ used the same CSF to calculate the 2006 human health criteria (EPA 2002).

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA default trophic level-weighted BAF of 56 was developed for the Idaho general population and a trophic level-weighted BAF of 62 was developed for the Nez Perce Tribe. Previously, the 2006 Idaho criteria for 3,3'-dichlorobenzidine were derived using a BCF of 312 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for 3,3'-dichlorobenzidine.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	0.028	0.48
Water + Fish	0.021	0.29

### Sources

EPA (US Environmental Protection Agency). 1988. 3,3'-Dichlorobenzidine (CASRN 91-94-1). Integrated Risk Information System. Carcinogenicity assessment verification date November 30, 1988. Washington, DC: EPA, Office of Research and Development. Accessed February 2015.  
<http://www.epa.gov/iris/subst/0504.htm>.

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015.  
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Stula, E.F., H. Sherman, J.A. Zapp, and J.W. Clayton. 1975. "Experimental Neoplasia in Rats from Oral Administration of 3,3'-Dichlorobenzidine, 4,4'-Methylene-bis(2-chloroaniline), and 4,4'-Methylene-bis(2-methylaniline)." *Toxicology and Applied Pharmacology* 31:159–176.

## Diethyl Phthalate

**CAS:** 84-66-2

**Water Quality Standards Number:** 79

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used an RfD of 0.8 mg/kg-d for diethyl phthalate based on a 1987 EPA IRIS assessment (EPA 1987). EPA identified a study by Brown et al. (1978) as the critical study and decreased growth rate and food consumption and altered organ weights as the critical effects in rats orally exposed to diethyl phthalate. The subchronic study had a NOAEL of 750 mg/kg-d. In deriving the RfD, the IRIS program applied an uncertainty factor of 1,000 to account for interspecies extrapolation (10), intraspecies variation (10), and subchronic-to-chronic extrapolation (10). In 2002, EPA's IRIS program conducted a screening-level review of more recent toxicology literature pertinent to the RfD for diethyl phthalate and identified several new studies; however, EPA's IRIS program has not reassessed this chemical.

EPA identified one other RfD source: a 1995 ATSDR assessment (ATSDR 1995). The 1987 IRIS assessment is preferred, as the ATSDR assessment does not include the relevant (chronic oral) toxicity factor.

DEQ used this RfD of 0.8 mg/kg-d to calculate the 2015 proposed human health criteria. Previously, DEQ used the same RfD to calculate the 2006 human health criteria (EPA 2002).

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA BCF of 920 was used. Previously, the 2006 Idaho criteria for diethyl phthalate were derived using a BCF of 73 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for diethyl phthalate.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	44,000	210
Water + Fish	17,000	200

### Sources

ATSDR (Agency for Toxic Substances and Disease Registry). 1995. Toxicological Profile for Diethyl Phthalate. Atlanta, GA: US Department of Health and Human Services, US Public Health Service, ATSDR. Accessed February 2015. <http://www.atsdr.cdc.gov/toxprofiles/tp73.pdf>.

Brown, D., K.R. Butterworth, I.F. Gaunt, P. Grasso, and S.D. Gangolli. 1978. "Short-Term Oral Toxicity Study of Diethyl Phthalate in the Rat." *Food and Cosmetics Toxicology* 16(5):415–422.

EPA (US Environmental Protection Agency). 1987. Diethyl Phthalate (CASRN 84-66-2). Integrated Risk Information System. Oral RfD assessment verification date July 16, 1987. Washington, DC: EPA, Office of Research and Development. Accessed March 2015. <http://www.epa.gov/iris/subst/0226.htm>.

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015. [http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqctable\\_hh\\_cal\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqctable_hh_cal_matrix.pdf)

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

## Dimethyl Phthalate

**CAS:** 131-11-3

**Water Quality Standards Number:** 80

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used an RfD (acceptable daily intake) of 10 mg/kg-d for dimethyl phthalate based on a 1980 EPA Office of Water (OW) assessment for phthalate esters (EPA 1980). EPA OW identified a study by Draize et al. (1948) as the critical study and a growth effect as the critical effect in rats orally exposed to dimethyl phthalate. The chronic (104-week) study has a NOAEL of 1,000 mg/g-d. In deriving the RfD, an uncertainty factor of 100 was applied; individual uncertainty factors were not specified but were presumably applied to account for interspecies extrapolation (10) and intraspecies differences (10).

DEQ used this RfD of 10 mg/kg-d to calculate the 2015 proposed human health criteria. Previously, DEQ used the same RfD to calculate the 2006 human health criteria (EPA 2002).

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA BCF of 4,000 was used. Previously, the 2006 Idaho criteria for dimethyl phthalate were derived using a BCF of 36 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for dimethyl phthalate.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	1,100,000	600
Water + Fish	270,000	600

### Sources

Draize, J.H., E. Alvarez, M.F. Whitesell, G. Woodard, E.C. Hagan, and A.A. Nelson. 1948. "Toxicological Investigations of Compounds Proposed for Use as Insect Repellents: A. Local and Systemic Effects Following Topical Skin Application; B. Acute Oral Toxicity; C. Pathological Examination." *Journal of Pharmacology and Experimental Therapeutics* 93:26–39.

EPA (US Environmental Protection Agency). 1980. Ambient Water Quality Criteria for Phthalate Esters. Washington, DC: EPA, Office of Water Regulations and Standards and Office of Research and Development. EPA-440-5-80-067. Accessed February 2015.

[http://water.epa.gov/scitech/swguidance/standards/criteria/upload/AWQC-for-Phthalate-Esters\\_1980.pdf](http://water.epa.gov/scitech/swguidance/standards/criteria/upload/AWQC-for-Phthalate-Esters_1980.pdf).

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015.

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EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA.

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## Di-n-Butyl Phthalate

**CAS:** 84-74-2

**Water Quality Standards Number:** 81

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used an RfD of 0.1 mg/kg-d for di-n-butyl phthalate based on a 1986 IRIS assessment (EPA 1986). The IRIS program identified a study by Smith (1953) as the critical study and increased mortality as the critical effect in rats orally exposed to di-n-butyl phthalate. The subchronic study had a NOAEL of 125 mg/kg-d. In deriving the RfD, an uncertainty factor of 1,000 was applied to account for interspecies extrapolation (10), intraspecies variation (10), and subchronic-to-chronic extrapolation (10).

EPA identified one other RfD source: a 2001 ATSDR assessment (ATSDR 2001). The 1986 IRIS assessment is preferred by EPA, as the ATSDR assessment does not include the relevant (chronic oral) toxicity factor.

DEQ used this RfD of 0.1 mg/kg-d to calculate the 2015 proposed human health criteria. Previously, DEQ used the same RfD to calculate the 2006 human health criteria (EPA 2002).

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA BCF of 2,900 was used. Previously, the 2006 Idaho criteria for di-n-butyl phthalate were derived using a BCF of 89 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for di-n-butyl phthalate.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	4,500	8.3
Water + Fish	2,000	8.2

### Sources

ATSDR (Agency for Toxic Substances and Disease Registry). 2001. Toxicological Profile for Di-n-Butyl Phthalate. Atlanta, GA: US Department of Health and Human Services, US Public Health Service, ATSDR. Accessed February 2015. <http://www.atsdr.cdc.gov/toxprofiles/tp135.pdf>.

EPA (US Environmental Protection Agency). 1986. Dibutyl Phthalate (CASRN 84-74-2). Integrated Risk Information System. Oral RfD assessment verification date January 22, 1986. Washington, DC: EPA, Office of Research and Development. Accessed March 2015. <http://www.epa.gov/iris/subst/0038.htm>.

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015. [http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqctable\\_hh\\_cal\\_c\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqctable_hh_cal_c_matrix.pdf)

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

Smith, C. 1953. "Toxicity of Butyl Stearate, Dibutyl Sebacate, Dibutyl Phthalate and Methoxyethyl Oleate." *A.M.A. Archives of Industrial Hygiene and Occupational Medicine* 7(4):310–318.

## 2,4-Dinitrotoluene (Carcinogen)

CAS: 121-14-2

Water Quality Standards Number: 82

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used a CSF of  $0.667 \text{ (mg/kg-d)}^{-1}$  for 2,4-dinitrotoluene based on a 2008 EPA Office of Water (OW) assessment (EPA 2008). The OW identified a study by Ellis et al. (1979) as the critical study and development of mammary gland tumors as the critical effect in female rats orally exposed to a mixture of 98% 2,4-dinitrotoluene and 2% 2,6-dinitrotoluene. The benchmark dose (BMD) was estimated using the numbers of female rats with mammary gland tumors. For a benchmark risk (BMR) level of 0.10, the estimated BMD value is 0.25 mg/kg-d with a lower bound (95%) (BMDL) of 0.15 mg/kg-d using the multistage model. The BMDL is used as the point of departure selected for the quantification of cancer risk.

EPA identified one other CSF source: a 1989 EPA IRIS assessment (EPA 1989). The OW assessment is preferred; it uses the same principal study (Ellis et al. 1979) but uses a more current BMD modeling approach than was used in the IRIS assessment.

DEQ used this CSF of  $0.667 \text{ (mg/kg-d)}^{-1}$  to calculate the 2015 proposed human health criteria. Previously, DEQ used a CSF of  $0.311 \text{ (mg/kg-d)}^{-1}$  to calculate the 2006 human health criteria (EPA 2002).

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA default trophic level-weighted BAF of 3.3 was used. Previously, the 2006 Idaho criteria for 2,4-dinitrotoluene were derived using a BCF of 3.8 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for 2,4-dinitrotoluene.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	3.4	5.5
Water + Fish	0.11	0.46

### Sources

Ellis III, H.V., J.H. Hagensen, J.R. Hodgson, J.L. Minor, C. Hong, E.R. Ellis, J.D. Girvin, D.O. Helton, B.L. Herndon, and C. Lee. 1979. Mammalian Toxicity of Munitions Compounds. Phase III: Effects of Lifetime Exposure. Part I. 2,4-Dinitrotoluene. Kansas City, MO: Midwest Research Institute. Prepared for US Army Medical Bioengineering Research and Development Laboratory. Contract No. DAMD 17-74-C-4073, ADA077692. Accessed February 2015. [www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA077692](http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA077692).

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EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015. [http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqctable\\_hh\\_cal\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqctable_hh_cal_matrix.pdf)

EPA (US Environmental Protection Agency). 2008. Drinking Water Health Advisory for 2,4-Dinitrotoluene and 2,6-Dinitrotoluene. Washington, DC: EPA, Office of Water, Office of Science and

Technology. EPA-822-R-08-010. Accessed February 2015.  
[http://www.epa.gov/ogwdw/ccl/pdfs/reg\\_determine2/healthadvisory\\_ccl2-reg2\\_dinitrotoluenes.pdf](http://www.epa.gov/ogwdw/ccl/pdfs/reg_determine2/healthadvisory_ccl2-reg2_dinitrotoluenes.pdf).

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## 1,2-Diphenylhydrazine (Carcinogen)

CAS: 122-66-7

Water Quality Standards Number: 85

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used a CSF of  $0.8 \text{ (mg/kg-d)}^{-1}$  for 1,2-diphenylhydrazine based on a 1986 EPA IRIS assessment (EPA 1986). EPA's IRIS program derived the CSF using a principal study by the National Cancer Institute (NCI 1978) based on development of hepatocellular carcinomas and neoplastic nodules in male rats orally exposed to 1,2-diphenylhydrazine. DEQ used this CSF of  $0.8 \text{ (mg/kg-d)}^{-1}$  to calculate the 2015 proposed human health criteria. Previously, DEQ used the same CSF to calculate the 2006 human health criteria (EPA 2002).

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA default trophic level-weighted BAF of 23 was used. Previously, the 2006 Idaho criteria for 1,2-diphenylhydrazine were derived using a BCF of 24.9 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for 1,2-diphenylhydrazine.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	0.20	0.65
Water + Fish	0.036	0.25

### Sources

EPA (US Environmental Protection Agency). 1986. 1,2-Diphenylhydrazine (CASRN 122-66-7). Integrated Risk Information System. Carcinogenicity assessment verification date October 29, 1986. Washington, DC: EPA, Office of Research and Development. Accessed February 2015. <http://www.epa.gov/iris/subst/0049.htm>.

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015. [http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqctable\\_hh\\_cal\\_c\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqctable_hh_cal_c_matrix.pdf)

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

NCI (National Cancer Institute). 1978. Bioassay of Hydrazobenzene for Possible Carcinogenicity (CAS No. 122-66-7). Bethesda, MD: US Department of Health, Education and Welfare, US Public Health Service, National Institutes of Health, NCI. DHEW publication no. (NIH) 78-1342. Accessed February 2015. [http://ntp.niehs.nih.gov/ntp/htdocs/lt\\_rpts/tr092.pdf](http://ntp.niehs.nih.gov/ntp/htdocs/lt_rpts/tr092.pdf).

## Fluoranthene

**CAS:** 206-44-0

**Water Quality Standards Number:** 86

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used an RfD of 0.04 mg/kg-d for fluoranthene based on a 1989 EPA IRIS assessment (EPA 1989). EPA identified an EPA study (EPA 1988) as the critical study and the development of nephropathy, increased liver weights, hematological alterations, and clinical effects as the critical effects in mice orally exposed to fluoranthene. The subchronic study had a NOAEL of 125 mg/kg-d. In deriving the RfD, the IRIS program applied an uncertainty factor of 3,000 to account for interspecies extrapolation (10), intraspecies variation (10), subchronic-to-chronic study extrapolation (10), and database deficiency (3).

EPA identified two other potential RfD sources: a 1995 ATSDR assessment (ATSDR 1995) and a 2012 EPA Office of Research and Development Provisional Peer Reviewed Toxicity Value (EPA 2012). However, neither of these assessments include the relevant (chronic oral) toxicity value.

DEQ used the RfD of 0.04 mg/kg-d to calculate the 2015 proposed human health criteria. Previously, DEQ used the same RfD to calculate the 2006 human health criteria (EPA 2002).

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA BCF of 1,500 was used. Previously, the 2006 Idaho criteria for fluoranthene were derived using a BCF of 1,150 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for fluoranthene.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	140	6.4
Water + Fish	130	6.3

## Sources

- ATSDR (Agency for Toxic Substances and Disease Registry). 1995. Toxicological Profile for Polycyclic Aromatic Hydrocarbons. Atlanta, GA: US Department of Health and Human Services, US Public Health Service, ATSDR. Accessed February 2015. <http://www.atsdr.cdc.gov/toxprofiles/tp69.pdf>
- EPA (US Environmental Protection Agency). 1988. 13-Week Mouse Oral Subchronic Toxicity Study. Muskegon, MI: Toxicity Research Laboratories, Ltd. Prepared for EPA, Office of Solid Waste.
- EPA (US Environmental Protection Agency). 1989. Fluoranthene (CASRN 206-44-0). Integrated Risk Information System. Oral RfD assessment verification date November 15, 1989. Washington, DC: EPA, Office of Research and Development. Accessed March 2015. <http://www.epa.gov/iris/subst/0444.htm>.
- EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015. [http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqctable\\_hh\\_cal\\_c\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqctable_hh_cal_c_matrix.pdf)
- EPA (US Environmental Protection Agency). 2012. Provisional Peer Reviewed Toxicity Values for Fluoranthene (CASRN 206-44-0). Cincinnati, OH: EPA, Office of Research and Development. Accessed April 2015. [http://hhpprt.v.ornl.gov/issue\\_papers/Fluoranthene.pdf](http://hhpprt.v.ornl.gov/issue_papers/Fluoranthene.pdf).
- EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

## Fluorene

**CAS:** 86-73-7

**Water Quality Standards Number:** 87

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used an RfD of 0.04 mg/kg-d for fluorene based on a 1989 EPA IRIS assessment (EPA 1989a). EPA identified an EPA study (EPA 1989b) as the critical study and the development of decreased red blood cell counts, packed cell volume, and hemoglobin as the critical effects in mice orally exposed to fluorene. The subchronic study had a NOAEL of 125 mg/kg-d. In deriving the RfD, an uncertainty factor of 3,000 was applied to account for interspecies extrapolation (10), intraspecies variation (10), subchronic-to-chronic study extrapolation (10), and database deficiency (3).

EPA identified one other potential RfD source: a 1995 ATSDR assessment (ATSDR 1995). However, this assessment does not include the relevant (chronic oral) toxicity value.

DEQ used this RfD of 0.04 mg/kg-d to calculate the 2015 proposed human health criteria. Previously, DEQ used the same RfD to calculate the 2006 human health criteria (EPA 2002).

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA default trophic level-weighted BAF of 430 was used. Previously, the 2006 Idaho criteria for fluorene were derived using a BCF of 30 (the benzo(a)pyrene BCF was used) (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for fluorene.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	5,300	22
Water + Fish	1,100	21

### Sources

ATSDR (Agency for Toxic Substances and Disease Registry). 1995. Toxicological Profile for Polycyclic Aromatic Hydrocarbons. Atlanta, GA: US Department of Health and Human Services, US Public Health Service, ATSDR. Accessed February 2015. <http://www.atsdr.cdc.gov/toxprofiles/tp69.pdf>.

EPA (US Environmental Protection Agency). 1989a. Fluorene (CASRN 86-73-7). Integrated Risk Information System. Oral RfD assessment verification date November 15, 1989. Washington, DC: EPA, Office of Research and Development. Accessed March 2015. <http://www.epa.gov/iris/subst/0435.htm>.

EPA (US Environmental Protection Agency). 1989b. Mouse Oral Subchronic Toxicity Study. Muskegon, MI: Toxicity Research Laboratories, Ltd. Prepared for EPA, Office of Solid Waste.

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015. [http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqctable\\_hh\\_calc\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqctable_hh_calc_matrix.pdf)

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

## Hexachlorobenzene (Carcinogen)

CAS: 118-74-1

Water Quality Standards Number: 88

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used a CSF of  $1.02 \text{ (mg/kg-d)}^{-1}$  for hexachlorobenzene based on a 2008 EPA OPP RED (EPA 2008). OPP derived the CSF by applying the agency's currently recommended cross-species scaling factor based on  $BW^{3/4}$  to a 1989 EPA IRIS CSF (EPA 1989). EPA IRIS derived the 1989 CSF using a principal study by Erturk et al. (1986) based on development of hepatocellular carcinomas in rats orally exposed to hexachlorobenzene.

EPA identified one other CSF source: a 2003 California EPA assessment (CalEPA 2003). However, the OPP assessment is the most current available CSF source.

DEQ used this CSF of  $1.02 \text{ (mg/kg-d)}^{-1}$  to calculate the 2015 proposed human health criteria. Previously, DEQ used a CSF of  $1.6 \text{ (mg/kg-d)}^{-1}$  to calculate the 2006 human health criteria (EPA 2002).

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA default trophic level-weighted BAF of 46,000 was used. Previously, the 2006 Idaho criteria for hexachlorobenzene were derived using a BCF of 8,690 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for hexachlorobenzene.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	0.00029	0.00026
Water + Fish	0.00028	0.00026

### Sources

- CalEPA (California Environmental Protection Agency). 2003. Public Health Goals for Chemicals in Drinking Water: Hexachlorobenzene. CalEPA, Office of Environmental Health Hazard Assessment. Accessed March 2015. <http://oehha.ca.gov/water/phg/pdf/Ph4HCB92603.pdf>.
- EPA (US Environmental Protection Agency). 1989. Hexachlorobenzene (CASRN 118-74-1). Integrated Risk Information System. Carcinogenicity assessment verification date March 1, 1989. Washington, DC: EPA, Office of Research and Development. Accessed February 2015. <http://www.epa.gov/iris/subst/0374.htm>.
- EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015. [http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqctable\\_hh\\_cal\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqctable_hh_cal_matrix.pdf)
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- EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

Erturk, E., R.W. Lambrecht, H.A. Peters, D.J. Cripps, A. Gocmen, C.R. Morris, and G.T. Bryan. 1986. "Oncogenicity of Hexachlorobenzene." *In* Hexachlorobenzene: Proceedings of an International Symposium, eds. C.R. Morris and J.R.P. Cabral. Lyon, France: World Health Organization, International Agency for Research on Cancer. June 24–25, 1985. 417–423. IARC Scientific Publ. 77.

## Hexachlorobutadiene (Carcinogen)

CAS: 87-68-3

Water Quality Standards Number: 89

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used a CSF of  $0.04 \text{ (mg/kg-d)}^{-1}$  for hexachlorobutadiene based on a 2003 EPA Office of Water (OW) assessment (EPA 2003). EPA OW derived the CSF using a principal study by Kociba et al. (1977) based on development of renal tubular adenomas and adenocarcinomas in rats with oral exposure to hexachlorobutadiene.

EPA identified one other CSF source: the 1986 EPA IRIS carcinogenicity assessment (EPA 1986). The 2003 EPA OW assessment evaluated the same principal study (Kociba et al. 1977); however, the OW assessment applied more current guidance and modeling approaches. Specifically, the LED10 (the lower 95% confidence limit on the estimated dose associated with 10% extra risk) was selected by OW as the point of departure for derivation of the slope factor in place of a linear multistage (LMS) slope factor. Additionally, the OW CSF uses a cross-species scaling approach based on  $BW^{3/4}$ , which is consistent with current EPA practice (EPA 2005).

DEQ used this CSF of  $0.04 \text{ (mg/kg-d)}^{-1}$  to calculate the 2015 proposed human health criteria. Previously, DEQ used the current IRIS CSF of  $0.078 \text{ (mg/kg-d)}^{-1}$  (EPA 1986) to calculate the 2006 human health criteria (EPA 2002).

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA default trophic level-weighted BAF of 9,800 was used. Previously, the 2006 Idaho criteria for hexachlorobutadiene were derived using a BCF of 2.78 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for hexachlorobutadiene.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	18	0.031
Water + Fish	0.44	0.031

### Sources

EPA (US Environmental Protection Agency). 1986. Hexachlorobutadiene (CASRN 87-68-3). Integrated Risk Information System. Carcinogenicity assessment verification date November 12, 1986. Washington, DC: EPA, Office of Research and Development. Accessed February 2015.  
<http://www.epa.gov/iris/subst/0058.htm>.

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015.  
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EPA (US Environmental Protection Agency). 2003. Health Effects Support Document for Hexachlorobutadiene. Washington, DC: EPA, Office of Water. EPA-822-R-03-002. Accessed February 2015.  
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Kociba, R.J., D.G. Keyes, G.C. Jersey, J.J. Ballard, D.A. Dittenber, J.F. Quast, C.E. Wade, C.G. Humiston, and B.A. Schwetz. 1977. "Results of a 2-Year Chronic Toxicity Study with Hexachlorobutadiene in Rats." *American Industrial Hygiene Association Journal* 38(11):589–602.

## Hexachlorocyclopentadiene

CAS: 77-47-4

Water Quality Standards Number: 90

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used an RfD of 0.006 mg/kg-d for hexachlorocyclopentadiene based on a 2001 EPA IRIS assessment (EPA 2001). The IRIS program identified Abdo et al. (1984) as the critical study and chronic irritation manifested by fore-stomach pathology as the critical effect in rats orally exposed to hexachlorocyclopentadiene. The subchronic study had a point of departure lower-bound confidence limit on the benchmark dose of 6 mg/kg-d. A composite uncertainty factor of 1,000 was applied to account for interspecies extrapolation (10), intraspecies variation (10), subchronic-to-chronic study extrapolation (3), and database deficiency (3).

EPA identified two other RfD sources: a 2014 California EPA assessment (CalEPA 2014) and a 1999 ATSDR assessment (ATSDR 1999). The CalEPA assessment is more current than the IRIS assessment and uses an updated benchmark modeling approach to derive a different point of departure (POD); however, several aspects of the CalEPA assessment use policies that differ from those currently applied by EPA Office of Water.

DEQ used this RfD of 0.006 mg/kg-d to calculate the 2015 proposed human health criteria. Previously, DEQ used an RfD of 0.007mg/kg-d to calculate the 2006 human health criteria (EPA 2002).

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA default trophic level-weighted BAF of 1,100 was used. Previously, the 2006 Idaho criteria for hexachlorocyclopentadiene were derived using a BCF of 4.34 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for hexachlorocyclopentadiene.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	1,100	1.3
Water + Fish	40	1.3

### Sources

Abdo, K.M., C.A. Montgomery, W.M. Kluwe, D.R. Farnell, and J.D. Prejea. 1984. "Toxicity of Hexachlorocyclopentadiene: Subchronic (13-week) Administration by Gavage to F344 Rats and B6C3F1 Mice." *Journal of Applied Toxicology* 4(2):75–81.

ATSDR (Agency for Toxic Substances and Disease Registry). 1999. Toxicological Profile for Hexachlorocyclopentadiene (HCCPD). Atlanta, GA: US Department of Health and Human Services, US Public Health Service, ATSDR. Accessed February 2015. <http://www.atsdr.cdc.gov/toxprofiles/tp112.pdf>.

CalEPA (California Environmental Protection Agency). 2014. Updated Public Health Goals for Chemicals in California Drinking Water: Chlorobenzene, Endothall, Hexachlorocyclopentadiene, Silvex, Trichlorofluoromethane. CalEPA, Office of Environmental Health Hazard Assessment. Accessed April 2015. <http://www.oehha.ca.gov/water/phg/pdf/042414PHGTechFinal.pdf>.

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EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015.  
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<http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

## Hexachloroethane (Carcinogen)

CAS: 67-72-1

Water Quality Standards Number: 91

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used a CSF of  $0.04 \text{ (mg/kg-d)}^{-1}$  for hexachloroethane based on a 2011 EPA IRIS assessment (EPA 2011a). The IRIS program calculated the CSF using a principal study by the National Toxicology Program (NTP 1989) based on development of renal adenomas and carcinomas in male rats with oral exposure to hexachloroethane.

DEQ used this CSF of  $0.04 \text{ (mg/kg-d)}^{-1}$  to calculate criteria based on carcinogenic effects. Previously, DEQ used a CSF of  $0.014 \text{ (mg/kg-d)}^{-1}$  to calculate the 2006 human health criteria (EPA 2002). DEQ also calculated criteria based on noncarcinogenic health effects, using an RfD of 0.0007 mg/kg-day, based on a 2011 IRIS assessment (EPA 2011b). The IRIS program identified a study by Gorzinski et al. (1985) as the critical study and observed atrophy and degeneration of the renal tubules as the critical effect in male rats in a subchronic (16-week) dietary study. A lower-bound confidence limit on the benchmark dose ( $\text{BMDL}_{10}$ ) of 0.728 mg/kg-d associated with a 10 percent extra risk for nephropathy in male rats is selected as the point of departure (POD). In deriving the RfD, an uncertainty factor of 1000 was applied to account for interspecies extrapolation (10), intraspecies variation (10), subchronic-to-chronic exposure extrapolation (3), and database deficiencies (3).

In evaluating criteria based on carcinogenic and noncarcinogenic effects, DEQ followed the current EPA recommendation to use the lower criteria. Because of the decision to base carcinogenic criteria on a risk level of  $1 \times 10^{-5}$ , the noncarcinogenic criteria were lower, and were selected.

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA default trophic level-weighted BAF of 690 was used. Previously, the 2006 Idaho criteria for hexachloroethane were derived using a BCF of 86.9 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for hexachloroethane.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	3.3	0.24
Water + Fish	1.4	0.23

### Sources

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015.

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EPA (US Environmental Protection Agency). 2011b. Hexachloroethane (CASRN 67-72-1). Integrated Risk Information System. Oral RfD assessment Agency completion date September 23, 2011. U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC. . <http://www.epa.gov/iris/subst/0167.htm>.

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## Indeno(1,2,3-cd)Pyrene (Carcinogen)

CAS: 193-39-5

Water Quality Standards Number: 92

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used a CSF of  $0.73 \text{ (mg/kg-d)}^{-1}$  for indeno(1,2,3-cd)pyrene based on a 1991 EPA IRIS assessment for benzo(a)pyrene (EPA 1991). The IRIS program derived a CSF of 7.3 per mg/kg-d using a principal study by Neal and Rigdon (1967), which was based on development of fore-stomach and squamous cell papillomas in mice orally exposed to benzo(a)pyrene. EPA applied a relative potency factor of 0.1 to derive the CSF for indeno(1,2,3-cd)pyrene (EPA 1993).

EPA identified one other CSF source for indeno(1,2,3-cd)pyrene: a 2005 California EPA assessment (CalEPA 2005). However, due to EPA's ongoing reassessments, EPA decided to use the current IRIS CSF to derive ambient water quality criteria at the present time.

DEQ used this CSF of  $0.73 \text{ (mg/kg-d)}^{-1}$  to calculate the 2015 proposed human health criteria. Previously, DEQ used the CSF for benzo(a) pyrene,  $7.3 \text{ (mg/kg-d)}^{-1}$ , to calculate the 2006 human health criteria for indeno(1,2,3-cd)pyrene (EPA 2002).

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA BCF of 3,900 was used. Previously, the 2006 Idaho criteria for indeno(1,2,3-cd)pyrene were derived using a BCF of 30 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for indeno(1,2,3-cd)pyrene.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	0.018	0.0042
Water + Fish	0.0038	0.0042

### Sources

CalEPA (California Environmental Protection Agency). 2005. Air Toxics Hot Spots Program Risk Assessment Guidelines. Part II. Technical Support Document for Describing Available Cancer Potency Factors. CalEPA, Office of Environmental Health Hazard Assessment. Accessed February 2015. [http://oehha.ca.gov/air/hot\\_spots/pdf/May2005Hotspots.pdf](http://oehha.ca.gov/air/hot_spots/pdf/May2005Hotspots.pdf).

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EPA (US Environmental Protection Agency). 1993. Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons. EPA/600/R-93-089. U.S. Environmental Protection Agency, Office of Health and Environmental Assessment, Cincinnati, OH. Accessed March 2015. [http://www.epa.gov/oswer/riskassessment/pdf/1993\\_epa\\_600\\_r-93\\_c89.pdf](http://www.epa.gov/oswer/riskassessment/pdf/1993_epa_600_r-93_c89.pdf). <http://www.epa.gov/iris/subst/0136.htm>.

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EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human

Health Criteria.” Washington, DC: EPA.

<http://water.epa.gov/scitech/swguidance/standards/criteria/current/hfinal.cfm>.

Neal, J., and R.H. Rigdon. 1967. “Gastric Tumors in Mice Fed Benzo(a)pyrene: A Quantitative Study.”  
*Texas Reports on Biology and Medicine* 25(4):553–557.

## Isophorone (Carcinogen)

**CAS:** 78-59-1

**Water Quality Standards Number:** 93

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used a CSF of  $0.00095 \text{ (mg/kg-d)}^{-1}$  for isophorone based on a 1992 EPA IRIS assessment (EPA 1992). EPA's IRIS program calculated the CSF using a principal study by National Toxicology Program (NTP 1986) based on development of preputial gland carcinomas in male rats exposed orally (via gavage) to isophorone.

DEQ used this CSF of  $0.00095 \text{ (mg/kg-d)}^{-1}$  to calculate the 2015 proposed human health criteria. Previously, DEQ used the same CSF to calculate the 2006 human health criteria (EPA 2002).

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA default trophic level-weighted BAF of 21 was used. Previously, the 2006 Idaho criteria for isophorone were derived using a BCF of 4.38 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for isophorone.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	960	6,000
Water + Fish	35	330

### Sources

EPA (US Environmental Protection Agency). 1992. Isophorone (CASRN 78-59-1). Integrated Risk Information System. Carcinogenicity assessment verification date August 5, 1992. Washington, DC: EPA, Office of Research and Development. Accessed March 2015.  
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EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015.  
[http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqctable\\_hh\\_cal\\_c\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqctable_hh_cal_c_matrix.pdf)

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[http://ntp.niehs.nih.gov/ntp/htdocs/lt\\_rpts/tr291.pdf](http://ntp.niehs.nih.gov/ntp/htdocs/lt_rpts/tr291.pdf).

## Nitrobenzene

**CAS:** 98-95-3

**Water Quality Standards Number:** 95

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used an RfD of 0.002 mg/kg-d for nitrobenzene based on a 2009 EPA IRIS assessment (EPA 2009). The IRIS program identified a study by the National Toxicology Program (NTP 1983) as the critical study and increased methemoglobinemia as the critical effect in rats orally exposed to nitrobenzene. The study has a lower-bound confidence limit on the benchmark dose of 1.8 mg/kg-d. In deriving the RfD, an uncertainty factor of 1,000 was applied to account for interspecies extrapolation (10), intraspecies variation (10), subchronic-to-chronic study extrapolation (3), and database deficiency (3).

DEQ used this RfD of 0.002 mg/kg-d to calculate the 2015 proposed human health criteria. Previously, DEQ used an RfD of 0.0005 mg/kg-d to calculate the 2006 human health criteria (EPA 2002).

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA default trophic level-weighted BAF of 2.7 was used. Previously, the 2006 Idaho criteria for nitrobenzene were derived using a BCF of 2.89 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for nitrobenzene.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	690	180
Water + Fish	17	12

### Sources

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015.

[http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqctable\\_hh\\_cal\\_c\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqctable_hh_cal_c_matrix.pdf)

EPA (US Environmental Protection Agency). 2009. Toxicological Review of Nitrobenzene (CAS No. 98-95-3) in Support of Summary Information on the Integrated Risk Information System (IRIS). Washington, DC: EPA, Office of Research and Development. EPA-635-R-08-004F. Accessed February 2015. <http://www.epa.gov/iris/toxreviews/0079tr.pdf>.

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

NTP (National Toxicology Program). 1983. Report on the Subchronic Toxicity via Gavage of Nitrobenzene (C60082) in Fischer 344 Rats and B6C3F1 Mice. Worcester, MA: EG&G Mason Research Institute. Prepared for the US Department of Health and Human Services, US Public Health Service, National Institute of Environmental Health, NTP. Unpublished report MRI-NTP 08-83-19.

## N-Nitrosodimethylamine (Carcinogen)

CAS: 62-75-9

Water Quality Standards Number: 96

### Toxicity Value

EPA did not update the human health criteria in 2015 for N-nitrosodimethylamine. DEQ used the current IRIS CSF of  $51 \text{ (mg/kg-d)}^{-1}$  (EPA 1986) to calculate the 2015 proposed human health criteria. The IRIS program derived the CSF using a principal study by Peto et al. (1984) based on development of liver tumors in female rats following nitrosamine exposure in drinking water.

Previously, DEQ used the same CSF to calculate the 2006 human health criteria (EPA 2002).

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA BCF of 0.026 was used. Previously, the 2006 Idaho criteria for N-nitrosodimethylamine were derived using the same BCF (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for N-nitrosodimethylamine.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	3.0	9.1
Water + Fish	0.00069	0.0065

### Sources

EPA (US Environmental Protection Agency). 1986. N-Nitrosodimethylamine (CASRN 62-75-9). Integrated Risk Information System. Carcinogenicity assessment verification date October 29, 1986. Washington, DC: EPA, Office of Research and Development. Accessed September 2015. <http://www.epa.gov/iris/subst/0045.htm>

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015. [http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqctable\\_hh\\_cal\\_c\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqctable_hh_cal_c_matrix.pdf)

Peto, R., R. Gray, P. Brantom, and P. Grasso. 1984. Nitrosamine Carcinogenesis in 5120 Rodents: Chronic Administration of Sixteen Different Concentrations of NDEA, NDMA, NPYR and NPIP in the Water of 4440 Inbred Rats, with Parallel Studies on NDEA alone of the Effect of Age of Starting (3, 6 or 20 weeks) and of Species (rats, mice, hamsters). *IARC Sci. Publ.* 57: 627-665.

## N-Nitrosodi-n-Propylamine (Carcinogen)

**CAS:** 621-64-7

**Water Quality Standards Number:** 97

### Toxicity Value

EPA did not update the human health water quality criteria for N-nitrosodi-n-propylamine in 2015. DEQ used the current IRIS CSF of  $7.0 \text{ (mg/kg-d)}^{-1}$  (EPA 1987) to calculate the 2015 proposed human health criteria. The EPA IRIS program derived the CSF using principal studies by Druckrey (1967) and Druckrey et al. (1967) based on development of hepatocellular carcinomas in rats exposed to N-nitrosodi-n-propylamine in drinking water.

Previously, DEQ used the same CSF to calculate the 2006 human health criteria (EPA 2002).

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA BCF of 1.13 was used. Previously, the 2006 Idaho criteria for N-nitrosodi-n-propylamine were derived using the same BCF (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for N-nitrosodi-n-propylamine.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	0.51	1.5
Water + Fish	0.0050	0.046

### Sources

Druckrey, H., R. Preussmann, S. Ivankovic and D. Schmahl. 1967. "Organotropism Carcinogenic Activities of 65 Different N-Nitroso Compounds in BD-Rats." *Z. Krebsforsch* 69(2): 103-201.

Druckrey, H. 1967. "Quantitative Aspects in Chemical Carcinogens." *In Potential Carcinogenic Hazards from Drugs, Evaluation of Risks*, ed. R. Truhart. UICC Monograph, Series 7. Berlin Springer-Verlag. p. 60–78.

EPA (US Environmental Protection Agency). 1987. N-Nitrosodi-n-propylamine (CASRN 621-64-7). Integrated Risk Information System. Carcinogenicity assessment verification date February 11, 1987. Washington, DC: EPA, Office of Research and Development. Accessed September 2015. <http://www.epa.gov/iris/subst/0177.htm>

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015. [http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqtable\\_hh\\_cal\\_c\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqtable_hh_cal_c_matrix.pdf)

## N-Nitrosophenylamine (Carcinogen)

**CAS:** 86-30-6

**Water Quality Standards Number:** 98

### Toxicity Value

EPA did not update the human health water quality criteria for N-nitrosophenylamine in 2015. DEQ used the current IRIS CSF of  $0.00493 \text{ (mg/kg-d)}^{-1}$  (EPA 1987) to calculate the 2015 proposed human health criteria. The EPA IRIS program derived the CSF using a principal study by the National Cancer Institute (1979) based on development of transitional cell carcinoma of the bladder in female rats exposed to N-nitrosophenylamine in drinking water.

Previously, DEQ used the same CSF to calculate the 2006 human health criteria (EPA 2002).

### RSC

An RSC value was not used, because the criteria are based on cancer risk

### BAF/BCF

An EPA BCF of 136 was used. Previously, the 2006 Idaho criteria for N-nitrosophenylamine were derived using the same BCF (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for N-nitrosophenylamine.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	6.0	18
Water + Fish	3.3	14

### Sources

EPA (US Environmental Protection Agency). 1987. N-Nitrosodiphenylamine (CASRN 86-30-6). Integrated Risk Information System. Carcinogenicity assessment verification date February 11, 1987. Washington, DC: EPA, Office of Research and Development. Accessed September 2015.  
<http://www.epa.gov/iris/subst/0178.htm>

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015.  
[http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqctable\\_hh\\_cal\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqctable_hh_cal_matrix.pdf)

NCI (National Cancer Institute). 1979. Bioassay of N-Nitrosodiphenylamine for Possible Carcinogenicity. NCI Carcinogenesis Technical Report Series No. 164. NIH 79-1720. NTIS PB 298-275.

## Pyrene

**CAS:** 129-00-0

**Water Quality Standards Number:** 100

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used an RfD of 0.03 mg/kg-d for pyrene based on a 1989 EPA IRIS assessment (EPA 1989a). The IRIS program identified a study by EPA (1989b) as the critical study and renal tubular pathology and decreased kidney weights as the critical effects in mice orally exposed to pyrene. The subchronic study has a NOAEL of 75 mg/kg-d. In deriving the RfD, an uncertainty factor of 3,000 was applied to account for interspecies extrapolation (10), intraspecies variation (10), subchronic-to-chronic study extrapolation (10), and database deficiency (3).

DEQ used this RfD of 0.03 mg/kg-d to calculate the 2015 proposed human health criteria. Previously, DEQ used the same RfD to calculate the 2006 human health criteria (EPA 2002).

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA BCF of 860 was used. Previously, the 2006 Idaho criteria for pyrene were derived using a BCF of 30 (the benzo(a)pyrene BCF was used) (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for pyrene.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	4,000	8.4
Water + Fish	830	8.1

### Sources

EPA (US Environmental Protection Agency). 1989a. Pyrene (CASRN 129-00-0). Integrated Risk Information System. Oral RfD assessment verification date November 15, 1989. Washington, DC: EPA, Office of Research and Development. Accessed February 2015.

<http://www.epa.gov/iris/subst/0445.htm>.

EPA (US Environmental Protection Agency). 1989b. Mouse Oral Subchronic Toxicity of Pyrene. Muskegon, MI: Toxicity Research Laboratories. Prepared for EPA, Office of Solid Waste.

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015.

[http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqctable\\_hh\\_cal\\_c\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqctable_hh_cal_c_matrix.pdf)

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA.

<http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

## 1,2,4-Trichlorobenzene (Carcinogen)

CAS: 120-82-1

Water Quality Standards Number: 101

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used a CSF of  $0.029 \text{ (mg/kg-d)}^{-1}$  for 1,2,4-trichlorobenzene based on a 2009 EPA ORD PPRTV (EPA 2009). The provisional CSF was derived using a principal study by Chemical Manufacturers Association (CMA) (Moore 1994) based on an increase in hepatocellular carcinoma in male mice orally exposed to 1,2,4-trichlorobenzene. EPA ORD obtained a point of departure (POD) for a quantitative assessment of cancer risk using dose-response modeling of the data. The lower-bound confidence limit on the benchmark dose ( $\text{BMDL}_{10 \text{ [HED]}}$ ) for liver tumors in male mice ( $3.50 \text{ mg/kg-day}$ ) was selected as the POD. The provisional CSF was calculated by dividing 0.1 (10%) by the  $\text{BMDL}_{10 \text{ [HED]}}$  of  $3.50 \text{ mg/kg-day}$ .

EPA identified one other CSF source: a 1999 California EPA assessment (CalEPA 1999). EPA prefers the 2009 EPA ORD CSF as it is the most current available CSF source.

DEQ used this CSF of  $0.029 \text{ (mg/kg-d)}^{-1}$  to calculate the 2015 proposed human health criteria. Previously, DEQ used an RfD of  $0.01 \text{ mg/kg-d}$  to calculate the 2006 human health criteria (EPA 2002).

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA default trophic level-weighted BAF of 1,700 was used. Previously, the 2006 Idaho criteria for 1,2,4-trichlorobenzene were derived using a BCF of 114 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for 1,2,4-trichlorobenzene.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	70	0.24
Water + Fish	35	0.24

### Sources

CalEPA (California Environmental Protection Agency). 1999. Public Health Goal for 1,2,4-Trichlorobenzene in Drinking Water. CalEPA, Office of Environmental Health Hazard Assessment. Accessed March 2015. [http://www.oehha.ca.gov/water/phg/pdf/124tcb\\_f.pdf](http://www.oehha.ca.gov/water/phg/pdf/124tcb_f.pdf).

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015. [http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqctable\\_hh\\_cal\\_c\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqctable_hh_cal_c_matrix.pdf)

EPA (US Environmental Protection Agency). 2009. Provisional Peer-Reviewed Toxicity Values for 1,2,4-Trichlorobenzene (CASRN 120-82-1). Cincinnati, OH: EPA, Office of Research and Development. Accessed May 2015. [http://hhpprtv.ornl.gov/issue\\_papers/Trichlorobenzene124.pdf](http://hhpprtv.ornl.gov/issue_papers/Trichlorobenzene124.pdf).

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

Moore, M. 1994. Final report, 104-week dietary carcinogenicity study with 1,2,4-trichlorobenzene in mice, with cover letter dated 6/15/94. Letter from L. Spurlock, Vice President of CHEMSTAR. Submitted

to the US Environmental Protection Agency. June 15, 1994. EPA Document No. OPPTS-44612. OTS0558831.

## Aldrin (Carcinogen)

**CAS:** 309-00-2

**Water Quality Standards Number:** 102

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used a CSF of  $17 \text{ (mg/kg-d)}^{-1}$  for aldrin based on a 1987 EPA IRIS assessment (EPA 1987). The IRIS program calculated the CSF using principal studies by Davis (1965) and the National Cancer Institute (NCI 1978) based on development of liver carcinomas in mice orally exposed to aldrin.

EPA identified one other CSF source: a 2003 EPA Office of Water (OW) assessment (EPA 2003). EPA prefers the 1987 EPA IRIS CSF; the EPA OW assessment is based on the same principal studies (Davis 1965; NCI 1978) and is numerically the same as the 1987 EPA IRIS CSF.

DEQ used this CSF of  $17 \text{ (mg/kg-d)}^{-1}$  to calculate the 2015 proposed human health criteria. Previously, DEQ used the same CSF to calculate the 2006 human health criteria (EPA 2002).

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA default trophic level-weighted BAF of 280,000 was used. Previously, the 2006 Idaho criteria for aldrin were derived using a BCF of 4,670 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for aldrin.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	0.000050	2.5E-06
Water + Fish	0.000049	2.5E-06

### Sources

Davis, K. 1965. Pathology Report on Mice Fed Aldrin, Dieldrin, Heptachlor and Heptachlor Epoxide for Two Years. Internal memorandum from K. Davis, US Department of Health and Human Services, US Food and Drug Administration, to Dr. A.J. Lehman, July 19, 1965.

EPA (US Environmental Protection Agency). 1987. Aldrin (CASRN 309-00-2). Integrated Risk Information System. Carcinogenicity assessment verification date March 22, 1987. Washington, DC: EPA, Office of Research and Development. Accessed March 2015.  
<http://www.epa.gov/iris/subst/0130.htm>.

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015.  
[http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqtable\\_hh\\_cal\\_c\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqtable_hh_cal_c_matrix.pdf).

EPA (US Environmental Protection Agency). 2003. Health Effects Support Document for Aldrin/Dieldrin. Washington, DC: EPA, Office of Water. EPA 822-R-03-001. Accessed April 2015.  
[http://water.epa.gov/action/advisories/drinking/upload/2004\\_1\\_16\\_support\\_cc1\\_aldrin-dieldrin\\_healtheffects.pdf](http://water.epa.gov/action/advisories/drinking/upload/2004_1_16_support_cc1_aldrin-dieldrin_healtheffects.pdf).

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA.  
<http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

NCI (National Cancer Institute). 1978. Bioassays of Aldrin and Dieldrin for Possible Carcinogenicity (CAS No's. 309-00-2 and 60-57-1). Bethesda, MD: US Department of Health, Education and Welfare,

US Public Health Service, National Institutes of Health, NCI. DHEW publication no. (NIH) 78-821. Accessed February 2015. [http://ntp.niehs.nih.gov/ntp/htdocs/lt\\_rpts/tr021.pdf](http://ntp.niehs.nih.gov/ntp/htdocs/lt_rpts/tr021.pdf).

## Alpha-BHC (Carcinogen)

**CAS:** 319-84-6

**Water Quality Standards Number:** 103

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used a CSF of  $6.3 \text{ (mg/kg-d)}^{-1}$  for alpha-BHC based on a 1986 EPA IRIS assessment (EPA 1986). The IRIS program derived the CSF using a principal study by Ito et al. (1973) based on development of hepatic nodules and hepatocellular carcinomas in mice orally exposed to alpha-BHC.

DEQ used this CSF of  $6.3 \text{ (mg/kg-d)}^{-1}$  to calculate the 2015 proposed human health criteria. Previously, DEQ used the same CSF to calculate the 2006 human health criteria (EPA 2002).

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BAF

An EPA default trophic level-weighted BAF of 1,500 was used. Previously, the 2006 Idaho criteria for alpha-BHC were derived using a BCF of 130 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for alpha-BHC.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	0.0049	0.0013
Water + Fish	0.0026	0.0012

### Sources

EPA (US Environmental Protection Agency). 1986. Alpha-Hexachlorocyclohexane (alpha-HCH) (CASRN 319-84-6). Integrated Risk Information System. Carcinogenicity assessment verification date December 17, 1986. Washington, DC: EPA, Office of Research and Development. Accessed March 2015. <http://www.epa.gov/iris/subst/0162.htm>.

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015. [http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqctable\\_hh\\_cal\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqctable_hh_cal_matrix.pdf)

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

Ito, N., H. Nagasaki, M. Arai, S. Sugihara, and S. Makiura. 1973. "Histologic and Ultrastructural Studies on the Hepatocarcinogenicity of Benzene Hexachloride in Mice." *Journal of the National Cancer Institute* 51(3):817–826.

## Beta-BHC (Carcinogen)

CAS: 319-85-7

Water Quality Standards Number: 104

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used a CSF of  $1.8 \text{ (mg/kg-d)}^{-1}$  for beta-BHC based on a 1986 EPA IRIS assessment (EPA 1986). EPA's IRIS program derived the CSF using a principal study by Thorpe and Walker (1973) based on development of hepatic nodules and hepatocellular carcinomas in mice orally exposed to beta-BHC.

In 2002, EPA's IRIS program conducted a screening-level review of the more recent toxicology literature pertinent to the cancer assessment for beta-BHC and identified one or more significant new studies; however, the IRIS program has not reassessed this chemical.

DEQ used this CSF of  $1.8 \text{ (mg/kg-d)}^{-1}$  to calculate the 2015 proposed human health criteria. Previously, DEQ used the same CSF to calculate the 2006 human health criteria (EPA 2002).

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA default trophic level-weighted BAF of 150 was used. Previously, the 2006 Idaho criteria for beta-BHC were derived using a BCF of 130 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for beta-BHC.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	0.017	0.045
Water + Fish	0.0091	0.036

### Sources

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## Gamma-BHC (Lindane)

**CAS:** 58-89-9

**Water Quality Standards Number:** 105

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used an RfD of 0.0047 mg/kg-d for gamma-BHC based on a 2002 EPA Office of Pesticide Programs (OPP) Reregistration Eligibility Decision (RED) (EPA 2002a). The OPP identified a study by Amyes (1989) as the critical study and periacinar hepatocyte hypertrophy, increased liver/spleen weight, and decreased platelets as the critical effects in rats orally exposed to gamma-BHC. The study had a NOAEL of 0.47 mg/kg-d. In deriving the RfD, an uncertainty factor of 100 was applied to account for interspecies extrapolation (10) and intraspecies variation (10).

EPA identified three other potential RfD sources: a 1986 EPA IRIS assessment (EPA 1986), a 1999 California EPA assessment (CalEPA 1999), and a 2005 ATSDR assessment (ATSDR 2005). The ATSDR assessment does not include the relevant (chronic oral) toxicity endpoint. EPA prefers the OPP RED as the most current available RfD source.

DEQ used this RfD of 0.0047 mg/kg-d to calculate the 2015 proposed human health criteria. Previously, DEQ used a CSF of 1.3 (mg/kg-d)<sup>-1</sup> to calculate the 2006 human health criteria (EPA 2002b).

### RSC

Based on the physical properties and available exposure information for gamma-BHC, drinking water and fish and shellfish from inland and nearshore waters are likely to be the most significant sources of exposure. Although gamma-BHC has been detected in food and air in the past, its limited use as a pharmaceutical product is expected to limit exposure from these sources to the general population. Therefore, the most significant routes of exposure to the general population are expected to be from ingestion of fish and shellfish from inland and nearshore waters and drinking water. Limited exposure is also possible from inhalation and dermal contact. Following the Exposure Decision Tree in EPA's 2000 methodology (EPA 2000), there is not likely to be significant potential sources other than fish and shellfish from inland and nearshore waters and water ingestion. Therefore, EPA recommends an RSC of 50% (0.50) for gamma-HCH.

Accordingly, DEQ used an RSC of 0.5 for gamma-BCH.

### BAF/BCF

An EPA default trophic level-weighted BAF of 2,000 was used. Previously, the 2006 Idaho criteria for gamma-BHC were derived using a BCF of 130 (EPA 2002b).

### Summary of previous (2006) and updated human health (HH) criteria for gamma-BHC.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	1.8	1.4
Water + Fish	0.98	1.4

### Sources

Amyes, S. 1989. Lindane: Combined Oncogenicity and Toxicity Study by Dietary Administration to Wistar Rats for 104 Weeks: Final Report. Unpublished study prepared by Life Science Research Ltd. 3451 pp. Laboratory project no. 90/CIL002/0839: CIL/002/LIN.

ATSDR (Agency for Toxic Substances and Disease Registry). 2005. Toxicological Profile for Alpha-, Beta-, Gamma-, and Delta-Hexachlorocyclohexane. Atlanta, GA: US Department of Health and Human Services, US Public Health Service, ATSDR. Accessed February 2015.  
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EPA (US Environmental Protection Agency). 1986. Gamma-Hexachlorocyclohexane (gamma-HCH) (CASRN 58-89-9). Integrated Risk Information System. Oral RfD assessment verification date January 22, 1986. Washington, DC: EPA, Office of Research and Development. Accessed March 2015. <http://www.epa.gov/iris/subst/0065.htm>.

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EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

## Chlordane (Carcinogen)

**CAS:** 57-74-9

**Water Quality Standards Number:** 107

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used a CSF of  $0.35 \text{ (mg/kg-d)}^{-1}$  for chlordane based on a 1997 EPA IRIS assessment (EPA 1997). The IRIS program calculated the CSF using principal studies by International Research and Development Corporation (IRDC 1973), the National Cancer Institute (NCI 1977), and Khasawinah and Grutsch (1989) based on development of hepatocellular carcinomas in mice orally exposed to chlordane.

In 2001, EPA's IRIS program conducted a screening-level review of more recent toxicology literature pertinent to the cancer assessment for chlordane and did not identify any critical new studies.

EPA identified one other CSF source: a 1997 California EPA assessment (CalEPA 1997). The CalEPA, 1997 CSF was numerically the same as the EPA IRIS's previous 1986 assessment. The 1997 EPA IRIS assessment is considered the most current CSF source.

DEQ used this CSF of  $0.35 \text{ (mg/kg-d)}^{-1}$  to calculate the 2015 proposed human health criteria. Previously, DEQ used the same CSF to calculate the 2006 human health criteria (EPA 2002).

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA default trophic level-weighted BAF of 34,000 was used. Previously, the 2006 Idaho criteria for chlordane were derived using a BCF of 14,100 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for chlordane.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	0.00081	0.0010
Water + Fish	0.00080	0.0010

### Sources

CalEPA (California Environmental Protection Agency). 1997. Public Health Goal for Chlordane in Drinking Water. CalEPA, Office of Environmental Health Hazard Assessment. Accessed March 2015. [http://oehha.ca.gov/water/phg/pdf/chlor\\_c.pdf](http://oehha.ca.gov/water/phg/pdf/chlor_c.pdf).

EPA (US Environmental Protection Agency). 1997. Chlordane (Technical) (CASRN 12789-03-6). Integrated Risk Information System. Carcinogenicity assessment Agency consensus review date November 3, 1997. Washington, DC: EPA, Office of Research and Development. Accessed March 2015. <http://www.epa.gov/iris/subst/0142.htm>.

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Test in Mice." *Regulatory Toxicology and Pharmacology* 10(3):244–254.

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## 4,4'-DDT (Carcinogen)

CAS: 50-29-3

Water Quality Standards Number: 108

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used a CSF of  $0.34 \text{ (mg/kg-d)}^{-1}$  for DDT based on a 1987 EPA IRIS assessment (EPA 1987). The IRIS program derived the CSF using the principal studies by Turusov et al. (1973), Terracini et al. (1973), Thorpe and Walker (1973), Tomatis and Turusov (1975), Cabral et al. (1982), and Rossi et al. (1977) based on the development of benign and malignant liver tumors in mice and rats orally exposed to DDT.

In 2002, EPA's IRIS program conducted a screening-level review of the more recent toxicology literature pertinent to the cancer assessment for DDT and identified one or more significant new studies; however, EPA's IRIS program has not reassessed this chemical.

DEQ used this CSF of  $0.34 \text{ (mg/kg-d)}^{-1}$  to calculate the 2015 proposed human health criteria. Previously, DEQ used the same CSF to calculate the 2006 human health criteria (EPA 2002).

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA default trophic level-weighted BAF of 360,000 was used. Previously, the 2006 Idaho criteria for 4,4'-DDT were derived using a BCF of 53,600 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for 4,4'-DDT.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	0.00022	9.8E-05
Water + Fish	0.00022	9.8E-05

### Sources

- Cabral, J.R., R.K. Hall, L. Rossi, S.A. Bronczyk, and P. Shubik. 1982. "Effects of Long-Term Intake of DDT on Rats." *Tumori* 68(1):11–17.
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## 4,4'-DDE (Carcinogen)

CAS: 72-55-9

Water Quality Standards Number: 109

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used a CSF of  $0.167 \text{ (mg/kg-d)}^{-1}$  for DDE based on a 2008 EPA Office of Water (OW) assessment (EPA 2008). The OW derived the CSF using principal studies by the National Cancer Institute (NCI 1978), Tomatis et al. (1974), and Rossi et al. (1983) based on increases in the incidence of liver tumors, including carcinomas, in two strains of mice and in hamsters after dietary exposure to DDE.

EPA identified one other CSF source: a 1987 EPA IRIS assessment (EPA 1987). The 2008 EPA OW assessment evaluated the same principal studies as the IRIS assessment but applied more current guidance and modeling approaches. Specifically, the  $LED_{10}$  (the lower 95% confidence limit on the estimated dose associated with 10% extra risk) was selected by OW as the point of departure for derivation of the slope factor in place of a linear multistage (LMS) slope factor. Additionally, the OW CSF uses a cross-species scaling approach based on  $BW^{3/4}$ , which is consistent with current EPA practice (EPA 2005).

DEQ used this CSF of  $0.167 \text{ (mg/kg-d)}^{-1}$  to calculate the 2015 proposed human health criteria. Previously, DEQ used a CSF of 0.34, based on the 1987 IRIS study, to calculate the 2006 human health criteria (EPA 2002).

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA default trophic level-weighted BAF of 1,300,000 was developed for the Idaho general population and a trophic level-weighted BAF of 2,000,000 was developed for the Nez Perce Tribe. Previously, the 2006 Idaho criteria for 4,4'-DDE were derived using a BCF of 53,600 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for 4,4'-DDE.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	0.00022	5.5E-05
Water + Fish	0.00022	5.5E-05

### Sources

EPA (US Environmental Protection Agency). 1987. p,p'-Dichlorodiphenyldichloroethylene (DDE) (CASRN 72-55-9). Integrated Risk Information System. Carcinogenicity assessment verification date June 24, 1987. Washington, DC: EPA, Office of Research and Development. Accessed March 2015. <http://www.epa.gov/iris/subst/0328.htm>.

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## 4,4'-DDD (Carcinogen)

CAS: 72-54-8

Water Quality Standards Number: 110

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used a CSF of  $0.24 \text{ (mg/kg-d)}^{-1}$  for DDD based on a 1987 EPA IRIS assessment (EPA 1987). The IRIS program derived the CSF using a principal study by Tomatis et al. (1974) based on the development of liver tumors in mice orally exposed to DDD.

In 2001, EPA's IRIS conducted a screening-level review of the more recent toxicology literature pertinent to the cancer assessment for DDD and did not identify any critical new studies.

DEQ used this CSF of  $0.24 \text{ (mg/kg-d)}^{-1}$  to calculate the 2015 proposed human health criteria. Previously, DEQ used the same CSF to calculate the 2006 human health criteria (EPA 2002).

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA default trophic level-weighted BAF of 120,000 was used. Previously, the 2006 Idaho criteria for 4,4'-DDD were derived using a BCF of 53,600 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for 4,4'-DDD.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	0.00031	0.00042
Water + Fish	0.00031	0.00042

### Sources

EPA (US Environmental Protection Agency). 1987. p,p'-Dichlorodiphenyltrichloroethane (DDT) (CASRN 50-29-3). Integrated Risk Information System. Carcinogenicity assessment verification date June 24, 1987. Washington, DC: EPA, Office of Research and Development. Accessed March 2015. <http://www.epa.gov/iris/subst/0147.htm>.

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## Dieldrin (Carcinogen)

**CAS:** CAS 60-57-1

**Water Quality Standards Number:** 111

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used a CSF of  $16 \text{ (mg/kg-d)}^{-1}$  for dieldrin based on a 1987 EPA IRIS assessment (EPA 1987). EPA's IRIS program identified studies by Davis (1965), Walker et al. (1973), Thorpe and Walker (1973), National Cancer Institute (NCI 1978a, 1978b), Tennekes et al. (1981), and Meierhenry et al. (1983) as critical studies and the development of liver carcinomas as the critical effect in mice orally exposed to dieldrin. The slope factor is the geometric mean of 13 slope factors calculated from liver carcinoma data in both sexes of several strains of mice. Inspection of the data indicated no strain or sex specificity of carcinogenic response.

EPA identified one other CSF source: a 2003 EPA Office of Water (OW) assessment (EPA 2003). The OW assessment was based on the same principal studies and was numerically the same as the 1987 IRIS CSF.

DEQ used this CSF of  $16 \text{ (mg/kg-d)}^{-1}$  to calculate the 2015 proposed human health criteria. Previously, DEQ used the same CSF to calculate the 2006 human health criteria (EPA 2002).

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA default trophic level-weighted BAF of 180,000 was used. Previously, the 2006 Idaho criteria for dieldrin were derived using a BCF of 4,670 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for dieldrin.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	0.000054	4.2E-06
Water + Fish	0.000052	4.2E-06

### Sources

Davis, K. 1965. Pathology Report on Mice Fed Aldrin, Dieldrin, Heptachlor and Heptachlor Epoxide for Two Years. Internal memorandum from K. Davis, US Department of Health and Human Services, US Food and Drug Administration, to Dr. A.J. Lehman, July 19, 1965.

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## Alpha-Endosulfan

**CAS:** 959-98-8

**Water Quality Standards Number:** 112

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used an RfD of 0.006 mg/kg-d for alpha-endosulfan based on a 2002 EPA Office of Pesticide Programs (OPP) Reregistration Eligibility Decision (RED) for endosulfan (EPA 2002a). Technical grade endosulfan is a mixture of two biologically active isomers: alpha-endosulfan and beta-endosulfan (EPA 2002a). EPA OPP identified a study by Ruckman et al. (1989) as the critical study and reduced body weight gain and increased incidence of marked progressive glomerulonephrosis and blood vessel aneurysms as critical effects in male rats orally exposed to endosulfan. The combined chronic toxicity/carcinogenicity study had a NOAEL of 0.6 mg/kg-d. In deriving the RfD, an uncertainty factor of 100 was applied to account for interspecies extrapolation (10) and intraspecies variation (10).

EPA identified two other RfD sources: a 1993 EPA IRIS assessment (EPA 1993) and a draft 2013 ATSDR assessment (ATSDR 2013). The OPP RfD was selected to derive the updated ambient water quality criteria because this chemical is a current-use pesticide. EPA (2015) noted, however, that this pesticide has been cancelled, and the remaining end-use products have an effective cancellation date of July 31, 2016 (EPA 2010).

DEQ used this RfD of 0.006 mg/kg-d to calculate the 2015 proposed human health criteria. Previously, DEQ used the same RfD to calculate the 2006 human health criteria (EPA 2002b).

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA default trophic level-weighted BAF of 170 was used. Previously, the 2006 Idaho criteria for alpha-endosulfan were derived using a BCF of 270 (EPA 2002b).

### Summary of previous (2006) and updated human health (HH) criteria for alpha-endosulfan.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	89	8.5
Water + Fish	62	7.0

### Sources

ATSDR (Agency for Toxic Substances and Disease Registry). 2013. Draft Toxicological Profile for Endosulfan. Atlanta, GA: US Department of Health and Human Services, US Public Health Service, ATSDR. Accessed February 2015. <http://www.atsdr.cdc.gov/toxprofiles/tp41.pdf>.

EPA (US Environmental Protection Agency). 1993. Endosulfan (CASRN 115-29-7). Integrated Risk Information System. Oral RfD assessment verification date March 31, 1993. Washington, DC: EPA, Office of Research and Development. Accessed March 2015. <http://www.epa.gov/iris/subst/0235.htm>.

EPA (US Environmental Protection Agency). 2002a. Reregistration Eligibility Decision for Endosulfan. Washington, DC: EPA, Office of Prevention, Pesticides and Toxic Substances. EPA 738-R-02-013. Accessed February 2015. [http://www.epa.gov/oppsrrd1/reregistration/REDs/endosulfan\\_red.pdf](http://www.epa.gov/oppsrrd1/reregistration/REDs/endosulfan_red.pdf).

EPA (US Environmental Protection Agency). 2002b. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-

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[http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqctable\\_hh\\_cal\\_c\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqctable_hh_cal_c_matrix.pdf).

EPA (US Environmental Protection Agency). 2010. Endosulfan: Final Product Cancellation Order. EPA. Federal Register, November 10, 2010, 75(217):69065–69069. Accessed March 2015.

<http://www.gpo.gov/fdsys/pkg/FR-2010-11-10/html/2010-28138.htm>.

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA.

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Ruckman, S., L. Waterson, D. Crook, C. Gopinath, S. Majeed, A. Anderson, and D. Chanter. 1989. Endosulfan--Substance Technical: Combined Chronic Toxicity/Carcinogenicity Study: 104-Week Feeding in Rats. MRID no. 410995-02. Project ID HST 289/881076. Unpublished study prepared by Hoechst Celanese Corporation, North Somerville, NJ.

## Beta-Endosulfan

**CAS:** 33213-65-9

**Water Quality Standards Number:** 113

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used an RfD of 0.006 mg/kg-d for beta-endosulfan based on a 2002 EPA Office of Pesticide Programs (OPP) Reregistration Eligibility Decision (RED) for endosulfan (EPA 2002a). Technical grade endosulfan is a mixture of two biologically active isomers: alpha-endosulfan and beta-endosulfan (EPA 2002a). The OPP identified a study by Ruckman et al. (1989) as the critical study and reduced body weight gain and increased incidence of marked progressive glomerulonephrosis and blood vessel aneurysms as critical effects in male rats orally exposed to endosulfan. The combined chronic toxicity/carcinogenicity study had a NOAEL of 0.6 mg/kg-d. In deriving the RfD, an uncertainty factor of 100 was applied to account for interspecies extrapolation (10) and intraspecies variation (10).

EPA identified two other RfD sources: a 1993 EPA IRIS assessment (EPA 1993) and a 2013 draft ATSDR assessment (ATSDR 2013). The OPP RfD was selected to derive the updated ambient water quality criteria because this chemical is a current-use pesticide. EPA (2015) noted, however, that this pesticide has been cancelled, and the remaining end-use products have an effective cancellation date of July 31, 2016 (EPA 2010).

DEQ used this RfD of 0.006 mg/kg-d to calculate the 2015 proposed human health criteria. Previously, DEQ used the same RfD to calculate the 2006 human health criteria (EPA 2002b).

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA default trophic level-weighted BAF of 100 was used. Previously, the 2006 Idaho criteria for beta-endosulfan were derived using a BCF of 270 (EPA 2002b).

### Summary of previous (2006) and updated human health (HH) criteria for beta-endosulfan.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	89	14
Water + Fish	62	11

### Sources

ATSDR (Agency for Toxic Substances and Disease Registry). 2013. Draft Toxicological Profile for Endosulfan. Atlanta, GA: US Department of Health and Human Services, US Public Health Service, ATSDR. Accessed February 2015. <http://www.atsdr.cdc.gov/toxprofiles/tp41.pdf>.

EPA (US Environmental Protection Agency). 1993. Endosulfan (CASRN 115-29-7). Integrated Risk Information System. Oral RfD assessment verification date March 31, 1993. U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC. Accessed March 2015. <http://www.epa.gov/iris/subst/0235.htm>.

EPA (US Environmental Protection Agency). 2002a. Reregistration Eligibility Decision for Endosulfan. Washington, DC: EPA, Office of Prevention, Pesticides and Toxic Substances. EPA 738-R-02-013. Accessed February 2015. [http://www.epa.gov/oppsrrd1/reregistration/REDs/endosulfan\\_red.pdf](http://www.epa.gov/oppsrrd1/reregistration/REDs/endosulfan_red.pdf).

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012. Accessed February 2015.

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EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA.

<http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

Ruckman, S., L. Waterson, D. Crook, C. Gopinath, S. Majeed, A. Anderson, and D. Chanter. 1989. Endosulfan--Substance Technical: Combined Chronic Toxicity/Carcinogenicity Study: 104-Week Feeding in Rats. MRID no. 410995-02. Project ID HST 289/881076. Unpublished study prepared by Hoechst Celanese Corporation, North Somerville, NJ.

## Endosulfan Sulfate

CAS: 1031-07-8

Water Quality Standards Number: 114

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used an RfD of 0.006 mg/kg-d for endosulfan sulfate based on a 2002 EPA Office of Pesticide Programs (OPP) Reregistration Eligibility Decision (RED) for endosulfan (EPA 2002a). Endosulfan sulfate is a transformation product of endosulfan (EPA 2002a). EPA OPP identified a study by Ruckman et al. (1989) as the critical study and reduced body weight gain and increased incidence of marked progressive glomerulonephrosis and blood vessel aneurysms as critical effects in male rats orally exposed to endosulfan. The combined chronic toxicity/carcinogenicity study had a NOAEL of 0.6 mg/kg-d. In deriving the RfD, an uncertainty factor of 100 was applied to account for interspecies extrapolation (10) and intraspecies variation (10).

EPA identified two other RfD sources: a 1993 EPA IRIS assessment (EPA 1993) and a 2013 draft ATSDR assessment (ATSDR 2013). The OPP RfD was selected to derive the updated ambient water quality criteria because this chemical is a current-use pesticide. EPA (2015) noted, however, that endosulfan has been cancelled, and the remaining end-use products have an effective cancellation date of July 16, 2016 (EPA 2010).

DEQ used this RfD of 0.006 mg/kg-d to calculate the 2015 proposed human health criteria. Previously, DEQ used the same RfD to calculate the 2006 human health criteria (EPA 2002b).

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA default trophic level-weighted BAF of 110 was used. Previously, the 2006 Idaho criteria for endosulfan sulfate were derived using a BCF of 270 (EPA 2002b).

### Summary of previous (2006) and updated human health (HH) criteria for endosulfan sulfate.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	89	13
Water + Fish	62	9.9

### Sources

- ATSDR (Agency for Toxic Substances and Disease Registry). 2013. Draft Toxicological Profile for Endosulfan. Atlanta, GA: US Department of Health and Human Services, US Public Health Service, ATSDR. Accessed February 2015. <http://www.atsdr.cdc.gov/toxprofiles/tp41.pdf>.
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<http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

Ruckman, S., L. Waterson, D. Crook, C. Gopinath, S. Majeed, A. Anderson, and D. Chanter. 1989. Endosulfan--Substance Technical: Combined Chronic Toxicity/Carcinogenicity Study: 104-Week Feeding in Rats. MRID no. 410995-02. Project ID HST 289/881076. Unpublished study prepared by Hoechst Celanese Corporation, North Somerville, NJ.

## Endrin

**CAS:** 72-20-8

**Water Quality Standards Number:** 115

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used an RfD of 0.0003 mg/kg-d for endrin based on a 1988 EPA IRIS assessment (EPA 1988). EPA's IRIS program identified a study by the Velsicol Chemical Corporation (1969) as the critical study and mild histological lesions in the liver and occasional convulsions as the critical effects in dogs orally exposed to endrin. The chronic study has a NOAEL of 0.025 mg/kg-d. In deriving the RfD, an uncertainty factor of 100 was applied to account for interspecies extrapolation (10) and intraspecies variation (10).

EPA identified two other RfD sources: a 1996 ATSDR assessment (ATSDR 1996) and a California EPA assessment (CalEPA 1999). Both of the other assessments were based on the same principal study and were numerically the same as the 1988 EPA IRIS RfD.

DEQ used this RfD of 0.0003 mg/kg-d to calculate the 2015 proposed human health criteria. Previously, DEQ used the same RfD to calculate the 2006 human health criteria (EPA 2002).

### RSC

Based on the available exposure information for endrin, and given that the chemical is no longer produced or used in the United States, EPA does not anticipate that there will be significant sources and routes of exposure of endrin other than fish and shellfish from inland and nearshore waters (EPA 2015). Based on EPA's 2000 methodology, "If it can be demonstrated that other sources and routes of exposure are not anticipated for the pollutant in question (based on information about its known/anticipated uses and chemical/physical properties), then EPA would use the 80 percent ceiling" (see section 4.2.3 in EPA 2000). Therefore, EPA recommends an RSC of 80% (0.80) for endrin.

Accordingly, DEQ used an RSC of 0.8 to calculate the criteria for endrin.

### BAF/BCF

An EPA default trophic level-weighted BAF of 27,000 was used. Previously, the 2006 Idaho criteria for endrin were derived using a BCF of 3,970 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for endrin.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	0.060	0.011
Water + Fish	0.059	0.011

### Sources

ATSDR (Agency for Toxic Substances and Disease Registry). 1996. Toxicological Profile for Endrin. Atlanta, GA: US Department of Health and Human Services, US Public Health Service, ATSDR. Accessed February 2015. <http://www.atsdr.cdc.gov/toxprofiles/tp89.pdf>.

CalEPA (California Environmental Protection Agency). 1999. Public Health Goal for Endrin in Drinking Water. CalEPA, Office of Environmental Health Hazard Assessment. Accessed March 2015. [http://www.oehha.ca.gov/water/phg/pdf/endrin\\_f.pdf](http://www.oehha.ca.gov/water/phg/pdf/endrin_f.pdf).

EPA (US Environmental Protection Agency). 1988. Endrin (CASRN 72-20-8). Integrated Risk Information System. Oral RfD assessment verification date April 20, 1988. Washington, DC: EPA, Office of Research and Development. Accessed March 2015. <http://www.epa.gov/iris/subst/0363.htm>.

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-

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EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA.

<http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

Velsicol Chemical Corporation. 1969. MRID no. 00030198. Available from US Environmental Protection Agency. Write FOI, EPA, Washington, DC, 20460.

## Endrin Aldehyde

**CAS:** 7421-93-4

**Water Quality Standards Number:** 116

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used an RfD of 0.0003 mg/kg-d for endrin aldehyde, a degradate of endrin, based on a 1988 EPA IRIS assessment for endrin (EPA 1988). EPA's IRIS program identified a study by the Velsicol Chemical Corporation (1969) as the critical study and mild histological lesions in the liver and occasional convulsions as the critical effects in dogs orally exposed to endrin (EPA 1988). The chronic study has a NOAEL of 0.025 mg/kg-d. In deriving the RfD, EPA's IRIS program applied a composite uncertainty factor of 100 to account for interspecies extrapolation (10) and intraspecies variation (10) (EPA 1988).

In 2001, EPA's IRIS program conducted a screening-level review of the more recent toxicology literature pertinent to the RfD for endrin and did not identify any critical new studies.

EPA identified two other RfD sources: a 1996 ATSDR assessment (ATSDR 1996) and a 1999 California EPA assessment (CalEPA 1999). The 1988 EPA IRIS RfD is preferred for use in ambient water quality criteria development at this time. Both of the other assessments were based on the same principal study and were numerically the same as the 1988 EPA IRIS RfD.

DEQ used this RfD of 0.0003 mg/kg-d to calculate the 2015 proposed human health criteria. Previously, DEQ used the same RfD to calculate the 2006 human health criteria (EPA 2002).

### RSC

Based on the available exposure information for endrin aldehyde, and given that the chemical is no longer produced or used in the United States, EPA does not anticipate that there will be any significant sources and routes of exposure of endrin aldehyde other than consumption of fish and shellfish from inland and nearshore waters. Based on EPA's 2000 methodology, "If it can be demonstrated that other sources and routes of exposure are not anticipated for the pollutant in question (based on information about its known/anticipated uses and chemical/physical properties), then EPA would use the 80 percent ceiling" (see section 4.2.3 of EPA 2000). Therefore, EPA recommends an RSC of 80 percent (0.80) for endrin aldehyde.

### BAF/BCF

An EPA default trophic level-weighted BAF of 730 was used. Previously, the 2006 Idaho criteria for endrin aldehyde were derived using a BCF of 3,970 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for endrin aldehyde.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	0.30	0.40
Water + Fish	0.29	0.38

### Sources

ATSDR (Agency for Toxic Substances and Disease Registry). 1996. Toxicological Profile for Endrin. Atlanta, GA: US Department of Health and Human Services, US Public Health Service, ATSDR. Accessed February 2015. <http://www.atsdr.cdc.gov/toxprofiles/tp89.pdf>.

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- Velsicol Chemical Corporation. 1969. MRID no. 00030198. Available from US Environmental Protection Agency. Write FOI, EPA, Washington, DC, 20460.

## Heptachlor (Carcinogen)

CAS: 76-44-8

Water Quality Standards Number: 117

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used a CSF of  $4.1 \text{ (mg/kg-d)}^{-1}$  for heptachlor based on a 1999 California EPA assessment (CalEPA 1999). CalEPA derived the CSF using four data sets from two strains of mice from studies by the National Cancer Institute (NCI 1977) and Davis (1965) based on development of hepatocellular carcinoma in both sexes of mice orally exposed to heptachlor (CalEPA 1999).

EPA identified two other potential CSFs: a 1987 EPA IRIS assessment (EPA 1987) and a 1992 EPA OPP RED (EPA 1992). The 1999 CalEPA assessment is preferred for use in ambient water quality criteria development at this time. The 1999 CalEPA assessment evaluated the same studies as the IRIS assessment (NCI 1977; Davis 1965) but applied more current guidance and modeling approaches. Specifically, the  $\text{LED}_{10}$  (the lower 95% confidence limit on the estimated dose associated with 10% extra risk) was selected by CalEPA as the point of departure for derivation of the slope factor in place of a linear multistage (LMS) slope factor. Additionally, the CalEPA CSF uses a cross-species scaling approach based on  $\text{BW}^{3/4}$ , which is consistent with current EPA practice (EPA 2005). The 1992 OPP RED does not include the relevant oral CSF.

DEQ used this CSF of  $4.1 \text{ (mg/kg-d)}^{-1}$  to calculate the 2015 proposed human health criteria. Previously, DEQ used the CSF of 4.5 to calculate the 2006 human health criteria (EPA 2002).

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA default trophic level-weighted BAF of 150,000 was used. Previously, the 2006 Idaho criteria for heptachlor were derived using a BCF of 11,200 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for heptachlor.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	7.9E-05	2.0E-05
Water + Fish	7.9E-05	2.0E-05

### Sources

CalEPA (California Environmental Protection Agency). 1999. Public Health Goal for Heptachlor and Heptachlor Epoxide in Drinking Water. California Environmental Protection Agency, Office of Environmental Health Hazard Assessment. Accessed March 2015. <http://www.oehha.ca.gov/water/phg/pdf/hepandox.pdf>.

Davis, K. 1965. Pathology Report on Mice Fed Aldrin, Dieldrin, Heptachlor and Heptachlor Epoxide for Two Years. Internal memorandum from K. Davis, U.S. Department of Health and Human Services, U.S. Food and Drug Administration, to Dr. A.J. Lehman, July 19, 1965.

EPA (US Environmental Protection Agency). 1987. Heptachlor (CASRN 76-44-8). Integrated Risk Information System. Carcinogenicity assessment verification date April 1, 1987. U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC. Accessed February 2015. <http://www.epa.gov/iris/subst/0243.htm>.

EPA (US Environmental Protection Agency). 1992. Registration Eligibility Document: Heptachlor List A Case 0175. U.S. Environmental Protection Agency, Office of Pesticide Programs, Washington,

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<http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.
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## Heptachlor Epoxide (Carcinogen)

**CAS:** 1024-57-3

**Water Quality Standards Number:** 118

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used a CSF of  $5.5 \text{ (mg/kg-d)}^{-1}$  for heptachlor epoxide based on a 1999 CalEPA assessment (CalEPA 1999). CalEPA derived the CSF using four data sets from two strains of mice (Davis 1965; IRDC 1973) based on development of hepatocellular carcinoma in both sexes of mice orally exposed to heptachlor epoxide (CalEPA 1999).

EPA identified two other CSF sources: a 1987 IRIS assessment (EPA 1987) and a 1992 EPA OPP RED (EPA 1992). The 1999 CalEPA CSF is preferred for use in ambient water quality criteria development at this time. The 1999 CalEPA assessment evaluated the same principal studies considered in the IRIS assessment (Davis 1965; IRDC 1973) but applied more current guidance and modeling approaches. Specifically, the  $\text{LED}_{10}$  (the lower 95% confidence limit on the estimated dose associated with 10% extra risk) was selected by CalEPA as the point of departure for derivation of the slope factor in place of a linear multistage (LMS) slope factor. Additionally, the CalEPA CSF uses a cross-species scaling approach based on  $\text{BW}^{3/4}$ , which is consistent with current EPA practice (EPA 2005). The 1992 OPP RED does not include the relevant oral CSF.

DEQ used this CSF of  $5.5 \text{ (mg/kg-d)}^{-1}$  to calculate the 2015 proposed human health criteria. Previously, DEQ used the CSF of 9.1 to calculate the 2006 human health criteria (EPA 2002).

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA default trophic level-weighted BAF of 21,000 was used. Previously, the 2006 Idaho criteria for heptachlor epoxide were derived using a BCF of 11,200 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for heptachlor epoxide.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	3.9E-05	1.0E-04
Water + Fish	3.9E-05	1.0E-04

### Sources

CalEPA (California Environmental Protection Agency). 1999. Public Health Goal for Heptachlor and Heptachlor Epoxide in Drinking Water. CalEPA, Office of Environmental Health Hazard Assessment. Accessed March 2015. <http://www.oehha.ca.gov/water/phg/pdf/hepandox.pdf>.

Davis, K. 1965. Pathology Report on Mice Fed Aldrin, Dieldrin, Heptachlor and Heptachlor Epoxide for Two Years. Internal memorandum from K. Davis, US Department of Health and Human Services, US Food and Drug Administration, to Dr. A.J. Lehman, July 19, 1965.

EPA (US Environmental Protection Agency). 1987. Heptachlor Epoxide (CASRN 1024-57-3). Integrated Risk Information System. Carcinogenicity assessment verification date April 1, 1987. Washington, DC: EPA, Office of Research and Development. Accessed February 2015. <http://www.epa.gov/iris/subst/0160.htm>.

EPA (US Environmental Protection Agency). 1992. Registration Eligibility Document: Heptachlor List A Case 0175. Washington, DC: EPA, Office of Pesticide Programs. Accessed May 2015. [http://www.epa.gov/opp00001/chem\\_search/reg\\_actions/reregistration/red\\_PC-044801\\_1-Mar-92.pdf](http://www.epa.gov/opp00001/chem_search/reg_actions/reregistration/red_PC-044801_1-Mar-92.pdf).

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002

Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015.

[http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqctable\\_hh\\_cal\\_c\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqctable_hh_cal_c_matrix.pdf)

EPA (US Environmental Protection Agency). 2005. Guidelines for Carcinogen Risk Assessment. Washington, DC: EPA. EPA-630-P-03-001F. Accessed February 2015.

[http://www2.epa.gov/sites/production/files/2013-09/documents/cancer\\_guidelines\\_final\\_3-25-05.pdf](http://www2.epa.gov/sites/production/files/2013-09/documents/cancer_guidelines_final_3-25-05.pdf).

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA.

<http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

IRDC (International Research and Development Corporation). 1973. Eighteen Month Oral Carcinogenic Study in Mice. Mattawan, MI: IRDC. Unpublished report prepared for Velsicol Chemical Corporation.

## Polychlorinated Biphenyls (PCBs) (Carcinogen)

CAS: 1336-36-3

Water Quality Standards Number: 119

### Toxicity Value

EPA did not update the human health water quality for PCBs in 2015. PCBs were manufactured as a mixture of various single chemical compounds called PCB congeners. There are 209 congeners of PCBs, with different toxicity, persistence, and tendency to bioaccumulate. PCBs were manufactured and sold under various names, but the most common congener mixtures are the Aroclors. Aroclor nomenclature consists of four digits: the first two digits generally refer to the number of carbon atoms in the phenyl rings and the last two refer to the percentage of chlorine by mass in the mixture. For example, Aroclor 1254 is a mixture of congeners that contains approximately 54% chlorine by weight. PCBs that have the same number of chlorine atoms but at different positions are called PCB isomers. The proposed 2015 Idaho human health criteria apply to total PCBs—the sum of all congeners, isomers, or Aroclors.

The cancer potency of PCB mixtures is determined using a tiered approach, based on risk and persistence (EPA 1996a, 1996b, 1996c). The upper-bound CSF for high risk, highly persistent PCBs is  $2.0 \text{ (mg/kg-d)}^{-1}$  (EPA 1996a). This CSF is appropriate to use when there is food chain exposure (such as fish ingestion).

DEQ used this CSF of  $2.0 \text{ (mg/kg-d)}^{-1}$  to calculate the 2015 proposed human health criteria. Previously, DEQ used the same CSF to calculate the 2006 human health criteria (EPA 2002).

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA BCF of 31,200 was used. Previously, the 2006 Idaho criteria for PCBs were derived using the same BCF (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for PCBs.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	0.000064	0.00019
Water + Fish	0.000064	0.00019

### Sources

EPA (US Environmental Protection Agency). 1996a. Polychlorinated biphenyls (PCBs) (CASRN 1336-36-3). Integrated Risk Information System. Carcinogenicity assessment verification date August 22, 1996. Washington, DC: EPA, Office of Research and Development. Accessed September, 2015. <http://www.epa.gov/iris/subst/0294.htm>

EPA (US Environmental Protection Agency). 1996b. PCBs: Cancer Dose-Response Assessment and Application to Environmental Mixtures. Prepared by the National Center for Environmental Assessment, Washington DC.

EPA (US Environmental Protection Agency). 1996c. Report on peer review workshop on "PCBs: Cancer-Dose Response Assessment and Application to Environmental Mixtures." National Center for Environmental Assessment, Washington, DC.

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015. [http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqtable\\_hh\\_cal\\_c\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqtable_hh_cal_c_matrix.pdf)

## Toxaphene (Carcinogen)

CAS: 8001-35-2

Water Quality Standards Number: 120

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used a CSF of  $1.1 \text{ (mg/kg-d)}^{-1}$  for toxaphene based on a 1987 EPA IRIS assessment (EPA 1987). EPA's IRIS program identified a study by Litton Bionetics (1978) as the critical study and development of hepatocellular carcinomas and neoplastic nodules as the critical effects in mice orally exposed to toxaphene (EPA 1987).

In 2002, EPA's IRIS program conducted a screening-level review of the more recent toxicology literature pertinent to the cancer assessment for toxaphene and identified one or more significant new studies; however, EPA's IRIS program has not reassessed this chemical.

EPA identified one other CSF source: a 2003 California EPA assessment (CalEPA 2003). The 1987 IRIS CSF is preferred for use in ambient water quality criteria development at this time. The 2003 CalEPA assessment is based on the same principal study (Litton Bionetics 1978) and is numerically the same as the EPA IRIS CSF.

DEQ used this CSF of  $1.1 \text{ (mg/kg-d)}^{-1}$  to calculate the 2015 proposed human health criteria. Previously, DEQ used the same CSF to calculate the 2006 human health criteria (EPA 2002).

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA default trophic level-weighted BAF of 4,800 was used. Previously, the 2006 Idaho criteria for toxaphene were derived using a BCF of 13,100 (EPA 2002).

### Summary of previous (2006) and updated human health (HH) criteria for toxaphene.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	0.00075	0.0023
Water + Fish	0.00073	0.0023

### Sources

CalEPA (California Environmental Protection Agency). 2003. Public Health Goals for Chemicals in Drinking Water: Toxaphene. CalEPA, Office of Environmental Health Hazard Assessment. Accessed March 2015. <http://www.oehha.ca.gov/water/phg/pdf/Ph4Toxap92603.pdf>.

EPA (US Environmental Protection Agency). 1987. Toxaphene (CASRN 8001-35-2). Integrated Risk Information System. Carcinogenicity assessment verification date March 5, 1987. Washington, DC: EPA, Office of Research and Development. Accessed March 2015. <http://www.epa.gov/iris/subst/0346.htm>.

EPA (US Environmental Protection Agency). 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. Washington, DC: EPA, Office of Water. EPA-822-R-02-012. Accessed February 2015. [http://water.epa.gov/scitech/swguidance/standards/upload/2002\\_12\\_30\\_criteria\\_wqctable\\_hh\\_cal\\_matrix.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2002_12_30_criteria_wqctable_hh_cal_matrix.pdf)

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

Litton Bionetics. 1978. Carcinogenic Evaluation in Mice: Toxaphene. Final Report. Kensington, MD: Litton Bionetics, Inc. Prepared for Hercules, Inc. LBI project no. 20602.

## 1,2,4,5-Tetrachlorobenzene

CAS: 95-94-3

Water Quality Standards Number: 122

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used an RfD of 0.0003 mg/kg-d for 1,2,4,5-tetrachlorobenzene based on a 1985 EPA IRIS assessment (EPA 1985). EPA identified a study by Chu et al. (1984) as the critical study and the development of kidney lesions as the critical effect in rats orally exposed to 1,2,4,5-tetrachlorobenzene. The subchronic study had a NOAEL of 0.34 mg/kg-d.

In deriving the RfD, EPA's IRIS program applied a composite uncertainty factor of 1,000 to account for interspecies extrapolation (10), intraspecies variation (10), and subchronic-to-chronic study extrapolation (10) (EPA 1985).

In 2002, EPA's IRIS program conducted a screening-level review of the more recent toxicology literature pertinent to the RfD for 1,2,4,5-tetrachlorobenzene and identified one or more significant new studies; however, EPA's IRIS program has not reassessed this chemical.

EPA identified one other potential RfD source: a 2013 EPA Office of Solid Waste and Emergency Response (OSWER) Provisional Peer Reviewed Toxicity Value (PPRTV) (EPA 2013). The 1985 EPA IRIS RfD is preferred for use in ambient water quality criteria development at this time. The OSWER PPRTV does not include the relevant (chronic oral) toxicity values.

This chemical is a new addition to the DEQ human health criteria, and therefore Idaho has not calculated criteria for this chemical in the past. DEQ followed EPA's lead and used the RfD of 0.0003 mg/kg-d to calculate the 2015 proposed criteria.

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA default trophic level-weighted BAF of 7,700 was used.

### Summary of human health (HH) criteria for 1,2,4,5-tetrachlorobenzene.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	--	0.0094
Water + Fish	--	0.0093

This chemical is a new addition to the DEQ human health criteria.

### Sources

Chu, I., D.C. Villeneuve, V.E. Valli, and V.E. Secours. 1984. "Toxicity of 1,2,3,4-, 1,2,3,5-and 1,2,4,5-Tetrachlorobenzene in the Rat: Results of a 90-day Feeding Study." *Drug and Chemical Toxicology* 7:113–127.

EPA (US Environmental Protection Agency). 1985. 1,2,4,5-Tetrachlorobenzene (CASRN 95-94-3). Integrated Risk Information System. Oral RfD assessment verification date November 6, 1985. Washington, DC: EPA, Office of Research and Development. Accessed March 2015. <http://www.epa.gov/iris/subst/0107.htm>.

EPA (US Environmental Protection Agency). 2013. Provisional Peer Reviewed Toxicity Values for 1,2,4,5-Tetrachlorobenzene (CASRN 95-94-3). Cincinnati, OH: EPA, Office of Research and Development. Accessed March 2015. [http://hhpprtv.ornl.gov/issue\\_papers/Tetrachlorobenzene1245.pdf](http://hhpprtv.ornl.gov/issue_papers/Tetrachlorobenzene1245.pdf).

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

## 2,4,5-Trichlorophenol

CAS: 95-95-4

Water Quality Standards Number: 123

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used an RfD of 0.1 mg/kg-d for 2,4,5-trichlorophenol based on a 1985 EPA IRIS assessment (EPA 1985). EPA identified a study by McCollister et al. (1961) as the critical study and the development of liver and kidney pathologies as the critical effects in rats orally exposed to 2,4,5-trichlorophenol. The subchronic study had a NOAEL of 100 mg/kg-d. In deriving the RfD, EPA's IRIS program applied a composite uncertainty factor of 1,000 to account for intraspecies variation (10), interspecies extrapolation (10), and subchronic-to-chronic study extrapolation (10) (EPA 1985).

In 2002, EPA's IRIS program conducted a screening-level review of the more recent toxicology literature pertinent to the RfD for 2,4,5-trichlorophenol and did not identify any critical new studies.

This chemical is a new addition to the DEQ human health criteria, and therefore Idaho has not calculated criteria for this chemical in the past. DEQ followed EPA's lead and used the RfD of 0.1 mg/kg-d for 2,4,5-trichlorophenol to calculate the 2015 proposed criteria.

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA default trophic level-weighted BAF of 130 was used.

### Summary of human health (HH) criteria for 2,4,5-trichlorophenol.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	--	190
Water + Fish	--	140

This chemical is a new addition to the DEQ human health criteria

### Sources

EPA (US Environmental Protection Agency). 1985. 2,4,5-Trichlorophenol (CASRN 95-95-4). Integrated Risk Information System. Oral RfD assessment verification date May 20, 1985. Washington, DC: EPA, Office of Research and Development. Accessed March 2015.  
<http://www.epa.gov/iris/subst/0121.htm> .

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA.  
<http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

McCollister, D.D., D.T. Lockwood, and V.K. Rowe. 1961. "Toxicologic Information on 2,4,5-Trichlorophenol." *Toxicology and Applied Pharmacology* 3:63–70.

## Bis(Chloromethyl) Ether (Carcinogen)

CAS: 542-88-1

Water Quality Standards Number: 124

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used a CSF of 220 (mg/kg-d)<sup>-1</sup> for bis(chloromethyl)ether based on a 1988 EPA IRIS assessment (EPA 1988). EPA's IRIS program calculated the 1988 CSF using a principal study by Kuschner et al. (1975) based on development of respiratory tract tumors as the critical effect in rats via inhalation exposure to bis(chloromethyl) ether (EPA 1988). This oral estimate is derived from inhalation data. Route-to-route extrapolation was performed.

In 2001, EPA's IRIS program conducted a screening-level review of the more recent toxicology literature pertinent to the cancer assessment for bis(chloromethyl)ether and identified one or more significant new studies; however, EPA's IRIS program has not reassessed this chemical.

EPA identified no other CSF sources.

This chemical is a new addition to the DEQ human health criteria, and therefore Idaho has not calculated criteria for this chemical in the past. DEQ followed EPA's lead and used the CSF of 220 (mg/kg-d)<sup>-1</sup> to calculate the 2015 proposed human health criteria.

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA default trophic level-weighted BAF of 1.0 was used.

### Summary of human health (HH) criteria for bis(chloromethyl) ether.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	--	0.055
Water + Fish	--	0.0015

This chemical is a new addition to the DEQ human health criteria.

### Sources

EPA (US Environmental Protection Agency). 1988. Bis(Chloromethyl)ether (BCME) (CASRN 542-88-1). Integrated Risk Information System. Carcinogenicity assessment verification date May 4, 1988. Washington, DC: EPA, Office of Research and Development. Accessed March 2015. <http://www.epa.gov/iris/subst/0375.htm>.

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

Kuschner, M., S. Laskin, R.T. Drew, V. Cappiello, and N. Nelson. 1975. Inhalation Carcinogenicity of Alpha Halo Ethers. III. Lifetime and Limited Period Inhalation Studies with Bis(chloromethyl)ether at 0.1 ppm." *Archives of Environmental Health: An International Journal* 30(2):73-77.

## Chlorophenoxy Herbicide (2,4,5-TP) [Silvex]

**CAS:** CAS 93-72-1

**Water Quality Standards Number:** 125

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used an RfD of 0.008 mg/kg-d for 2,4,5-TP based on a 1988 EPA IRIS assessment (EPA 1988). EPA's IRIS program identified studies by Mullison (1966) and Gehring and Betso (1978) as the critical studies and histopathological changes in liver tissue as the critical effect above the NOAEL in dogs orally exposed to 2,4,5-TP. The chronic duration study has a NOAEL of 0.75 mg/kg-d. In deriving the RfD, EPA's IRIS program applied a composite uncertainty factor of 100 to the NOAEL to account for interspecies extrapolation (10) and intraspecies variation (10) (EPA 1988). In 2002, EPA's IRIS program conducted a screening-level review of the more recent toxicology literature pertinent to the RfD for 2,4,5-TP and did not identify any critical new studies.

This chemical is a new addition to the DEQ human health criteria, and therefore Idaho has not calculated criteria for this chemical in the past. DEQ followed EPA's lead and used the RfD of 0.008 mg/kg-d to calculate the 2015 proposed criteria.

### RSC

Based on the available exposure information for 2,4,5-TP, and given that the chemical is no longer produced or used in the United States, EPA does not anticipate that there will be significant sources and routes of exposure of 2,4,5-TP other than fish and shellfish from inland and nearshore waters and water ingestion. Based on EPA's 2000 methodology, "If it can be demonstrated that other sources and routes of exposure are not anticipated for the pollutant in question (based on information about its known/anticipated uses and chemical/physical properties), then EPA would use the 80 percent ceiling" (see section 4.2.3 in EPA 2000).

Therefore, DEQ used the EPA recommended RSC of 80% (0.80) for 2,4,5-TP.

### BAF/BCF

An EPA BCF of 58 was used.

### Summary of human health (HH) criteria for chlorophenoxy herbicide (2,4,5-TP) [silvex].

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	--	130
Water + Fish	--	82

This chemical is a new addition to the DEQ human health criteria.

### Sources

EPA (US Environmental Protection Agency). 1988. 2 (2,4,5-Trichlorophenoxy) Propionic Acid (2,4,5-TP) (CASRN 93-72-1). Integrated Risk Information System. Oral RfD assessment verification date January 21, 1988. Washington, DC: EPA, Office of Research and Development. Accessed February 2015. <http://www.epa.gov/iris/subst/0323.htm>

EPA (US Environmental Protection Agency). 2000. Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (2000). EPA-822-B-00-004. U.S. Environmental Protection Agency, Office of Water, Office of Science and Technology, Washington, DC. Accessed February 2015. [http://water.epa.gov/scitech/swguidance/standards/upload/2005\\_05\\_06\\_criteria\\_humanhealth\\_method\\_complete.pdf](http://water.epa.gov/scitech/swguidance/standards/upload/2005_05_06_criteria_humanhealth_method_complete.pdf).

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human

Health Criteria. Washington, DC: EPA.

<http://water.epa.gov/scitech/swguidance/standards/criteria/current/hfinal.cfm>.

Gehring, P.J., and J.E. Betso. 1978. "Phenoxy Acids: Effects and Fate in Mammals." *In* Chlorinated Phenoxy Acids and Their Dioxins. Vol. 27, ed. C. Ramel. Ecological Bulletins, Stockholm, Sweden. pp. 122–133.

Mullison, W.R. 1966. "Some Toxicological Aspects of Silvex." *In* Proceedings of the 19th Annual Meeting of the Southern Weed Conference. Jacksonville, FL, January 18–20, 1966. pp. 420–435.

## Chlorophenoxy Herbicide (2,4-D)

CAS: 94-75-7

Water Quality Standards Number: 126

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used an RfD of 0.21 mg/kg-d for 2,4-D, a current-use pesticide, based on EPA Office of Pesticide Programs (OPP) registration documents. EPA OPP identified a study by Marty et al. (2010) as the critical study and kidney toxicity and decreased body weight as the critical effects in rats exposed orally to 2,4-D. The extended 1-generation reproduction toxicity study had a NOAEL of 21 mg/kg-d. At the study LOAEL of 55.6 mg/kg-d (males) and 46.7 mg/kg-d (females), kidney toxicity—manifested as increased kidney weights and increased incidence of degeneration of the proximal convoluted tubules—was observed and decreased body weight in pups was observed throughout lactation (EPA 2013). In deriving the RfD, EPA OPP applied a composite uncertainty factor of 100 to account for interspecies extrapolation (10) and intraspecies variation (10) (EPA 2013).

EPA identified one other RfD source: a 1986 EPA IRIS assessment (EPA 1986). The 2013 OPP RfD is preferred for use in ambient water quality criteria development at this time. The OPP RfD was selected to derive the updated criteria because this chemical is a current-use pesticide.

This chemical is a new addition to the DEQ human health criteria, and therefore Idaho has not calculated criteria for this chemical in the past. DEQ followed EPA's lead and used the RfD of 0.21 mg/kg-d to calculate the 2015 proposed criteria.

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA BCF of 13 was used.

### Summary of human health (HH) criteria for chlorophenoxy herbicide (2,4-D).

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	--	3,900
Water + Fish	--	1,000

This chemical is a new addition to the DEQ human health criteria.

### Sources

EPA (US Environmental Protection Agency). 1986. 2,4-Dichlorophenoxyacetic Acid (2,4-D) (CASRN 94-75-7). Integrated Risk Information System. Oral RfD assessment verification date February 5, 1986. Washington, DC: EPA, Office of Research and Development. Accessed March 2015. <http://www.epa.gov/iris/subst/0150.htm>.

EPA (US Environmental Protection Agency). 2013. Memorandum: 2,4-D. Human Health Risk Assessment for a Proposed Use of 2,4-D Choline on Herbicide-Tolerant Corn and Soybean. DP Barcode D389455. Washington, DC: EPA, Office of Chemical Safety and Pollution Prevention. Accessed May 2015. <http://www.regulations.gov/contentStreamer?documentId=EPA-HQ-OPP-2014-0195-0007&disposition=attachment&contentType=pdf>.

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

Marty, M.S., C.L. Zabloutny, A.K. Andrus, D.R. Boverhof, J.S. Bus, A.W. Perala, S. Saghir, and B.I. Yano. 2010. 2,4-D: An Extended One-Generation Dietary Toxicity Study in Crl:CD(SD) Rats. Midland, MI: The Dow Chemical Company. Unpublished report. Laboratory project study ID 081104, MRID 47972101.

## Dinitrophenols (Carcinogen)

CAS: 25550-58-7

Water Quality Standards Number: 127

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used an RfD of 0.002 mg/kg-d for dinitrophenols based on a 1986 EPA IRIS assessment for 2,4-dinitrophenol (EPA 1986). EPA identified a study by Horner (1942) as the critical study and the development of cataracts as the critical effect in humans orally exposed to 2,4-dinitrophenol. The study had a LOAEL of 2 mg/kg-d. In deriving the RfD, EPA's IRIS program applied a composite uncertainty factor of 1,000 to account for intraspecies variation (10), subchronic-to-chronic study extrapolation (10), and uncertainty in the estimation of a NOAEL from a LOAEL (10) (EPA 1986).

In 2005, EPA's IRIS conducted a comprehensive review of toxicological studies and identified no new health effects data that would be directly useful in revising the existing RfD for 2,4-dinitrophenol. EPA identified two other RfD sources: a 2007 EPA Office of Solid Waste and Emergency Response Provisional Peer Reviewed Toxicity Value (EPA 2007) and a 1995 ATSDR assessment (ATSDR 1995).

The 1986 EPA IRIS RfD is preferred for use in ambient water quality criteria development at this time. Neither of the other assessments included the relevant (chronic oral) toxicity value.

This chemical is a new addition to the DEQ human health criteria, and therefore Idaho has not calculated criteria for this chemical in the past. DEQ followed EPA's lead and used the RfD of 0.002 mg/kg-d to calculate the 2015 proposed criteria.

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA BCF of 1.51 was used.

### Summary of human health (HH) criteria for dinitrophenols.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	--	320
Water + Fish	--	13

This chemical is a new addition to the DEQ human health criteria.

### Sources

ATSDR (Agency for Toxic Substances and Disease Registry). 1995. Toxicological Profile for Dinitrophenols. U.S. Department of Health and Human Services, U.S. Public Health Service, Agency for Toxic Substances and Disease Registry, Atlanta, GA. Accessed February 2015. <http://www.atsdr.cdc.gov/toxprofiles/tp64.pdf>.

EPA (US Environmental Protection Agency). 1986. 2,4-Dinitrophenol (CASRN 51-28-5). Integrated Risk Information System. Oral RfD assessment verification date February 5, 1986. Washington, DC: EPA, Office of Research and Development. Accessed March 2015. <http://www.epa.gov/iris/subst/0152.htm>.

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## Hexachlorocyclohexane (HCH)-Technical (Carcinogen)

CAS: 608-73-1

Water Quality Standards Number: 128

### Toxicity Value

The EPA updated human health water quality criteria (EPA 2015) used a CSF of  $1.8 \text{ (mg/kg-d)}^{-1}$  for HCH-technical based on a 1986 EPA IRIS assessment (EPA 1986). The IRIS program derived the CSF using a principal study by Munir et al. (1983) based on development of liver nodules and hepatocellular carcinomas in male mice exposed to HCH-technical in their diet (EPA 1986).

In 2003, EPA's IRIS conducted a screening-level review of the more recent toxicology literature pertinent to the cancer assessment for HCH-technical and did not identify any critical new studies.

This chemical is a new addition to the DEQ human health criteria, and therefore Idaho has not calculated criteria for this chemical in the past. DEQ followed EPA's lead and used the CSF of  $1.8 \text{ (mg/kg-d)}^{-1}$  to calculate the 2015 proposed criteria.

### RSC

An RSC value was not used, because the criteria are based on cancer risk.

### BAF/BCF

An EPA default trophic level-weighted BAF of 210 was used.

### Summary of human health (HH) criteria for hexachlorocyclohexane (HCH)-technical.

	Idaho 2006 HH Criteria ( $\mu\text{g/L}$ )	Idaho 2015 Proposed HH Criteria ( $\mu\text{g/L}$ )
Fish Only	--	0.032
Water + Fish	--	0.027

This chemical is a new addition to the DEQ human health criteria.

### Sources

EPA (US Environmental Protection Agency). 1986. Technical Hexachlorocyclohexane (t-HCH) (CASRN 608-73-1). Integrated Risk Information System. Carcinogenicity assessment verification date December 17, 1986. Washington, DC: EPA, Office of Research and Development. Accessed March 2015. <http://www.epa.gov/iris/subst/0165.htm>

EPA (US Environmental Protection Agency). 2015. Final 2015 Updated National Recommended Human Health Criteria. Washington, DC: EPA. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/hfinal.cfm>.

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## Methoxychlor

CAS: 72-43-5

Water Quality Standards Number: 129

### Toxicity Value

The EPA (2015a) updated human health water quality criteria use an RfD of 0.00002 mg/kg-d for methoxychlor based on a 2010 California EPA assessment (EPA 2015b). The California EPA derived the RfD from two sources: a study by Judy et al. (1999) and a CalEPA study (2010). Judy et al. (1999) examined endocrine-disrupting activities of xenobiotic estrogens including methoxychlor and found changes in prostate weight which depended on routes of exposure. According to EPA (2015b), the CalEPA used the Judy et al. (1999) study to derive an RfD; this was not well documented in the CalEPA (2010) document. An RfD of 0.00002 mg/kg-d was reported in CalEPA (2010) as an appropriate RfD for a child-specific dose based on a California Office of Environmental Health Hazard Assessment (OEHHA) risk assessment study (CalEPA 2010). The EPA 2015 update reports an uncertainty factor of 1,000 for the RfD, and a LOAEL of 0.02 mg/kg-d but does not report a specific NOAEL value.

This chemical is a new addition to the DEQ human health criteria, therefore Idaho has not calculated criteria for methoxychlor in the past. DEQ followed EPA's lead and used the RfD of 0.00002 mg/kg-d to calculate the 2015 proposed criteria.

### RSC

An RSC value of 0.8 was used to calculate the criteria.

### BAF/BCF

An EPA default trophic level-weighted BAF of 3,500 was used.

### Summary of human health (HH) criteria for methoxychlor.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	--	0.0055
Water + Fish	--	0.0054

This chemical is a new addition to the DEQ human health criteria.

### Sources

CalEPA (California Environmental Protection Agency). 2010. Public Health Goal for Methoxychlor in Drinking Water. Sacramento, CA: CalEPA, Office of Environmental Health Assessment, Pesticide and Environmental Toxicology Branch. Accessed September 18, 2015.

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<http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.

EPA (US Environmental Protection Agency). 2015b. Update of Human Health Ambient Water Quality Criteria: Methoxychlor 72-43-5. Washington, DC: EPA, Office of Water, Office of Science and Technology. EPA 820-R-15-055. Accessed September 18, 2015.

<http://water.epa.gov/scitech/swguidance/standards/criteria/current/loader.cfm?csModule=security/getfile&PageID=717516>

Judy, B.M., S.C. Nagel, K.A. Thayer, F.S. Vom Saal, W.V. Welshons. 1999. "Low-dose Bioactivity of Xenoestrogens in Animals: Fetal Exposure to Low Doses of Methoxychlor and Other Xenoestrogens Increases Adult Prostate Size in Mice" [Abstract]. *Toxicology and Industrial Health* 15 (1-2): 12-25. Accessed September 18, 2015. <http://tih.sagepub.com/content/15/1-2/12.short>

## Pentachlorobenzene

**CAS:** 608-93-5

**Water Quality Standards Number:** 130

### Toxicity Value

The EPA (2015a) updated human health water quality criteria use an RfD of 0.0008 mg/kg-d for pentachlorobenzene based on a 1985 EPA IRIS risk assessment (EPA 2015b). The critical study cited as the source of the RfD value was Linder et al. (1980) who evaluated the critical effects of oral exposure to pentachlorobenzene in the liver and kidneys of rats (EPA 2015b). In Linder et al. (1980), oral exposure to pentachlorobenzene produced effects such as increased liver and kidney weight as well as other nervous system effects such as tremors; dermal exposure did not produce effects at the maximum dosage of 2,500 mg/kg. Linder et al. (1980) did not report a NOAEL, nor a LOAEL, but EPA estimated a LOAEL of 8.3 mg/kg-d based on the reported data (EPA 2014). The uncertainty factor applied by EPA's IRIS program is 10,000 (EPA 2015b).

This chemical is a new addition to the DEQ human health criteria, and therefore Idaho has not calculated criteria for this chemical in the past. DEQ followed EPA's lead and used the RfD of 0.0008 mg/kg-d to calculate the 2015 proposed criteria.

### RSC

The EPA default RSC value of 0.2 was used to calculate the criteria.

### BAF/BCF

An EPA default trophic level-weighted BAF of 5,400 was used.

### Summary of human health (HH) criteria for pentachlorobenzene.

	Idaho 2006 HH Criteria (µg/L)	Idaho 2015 Proposed HH Criteria (µg/L)
Fish Only	--	0.036
Water + Fish	--	0.035

This chemical is a new addition to the DEQ human health criteria.

### Sources

- EPA (US Environmental Protection Agency). 2014. Integrated Risk Information System: Pentachlorobenzene (CASRN 608-93-5) [webpage]. Washington, DC: EPA, Integrated Risk Information System. Accessed September 18, 2015. <http://www.epa.gov/iris/subst/0085.htm>
- EPA (US Environmental Protection Agency). 2015a. Final 2015 Updated National Recommended Human Health Criteria [webpage]. Washington, DC: EPA, Office of Water, Office of Science and Technology. Accessed September 18, 2015. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/hhfinal.cfm>.
- EPA (US Environmental Protection Agency). 2015b. Update of Human Health Ambient Water Quality Criteria: Pentachlorobenzene 608-93-5. Washington, DC: EPA, Office of Water, Office of Science and Technology. EPA 820-R-15-059. Accessed September 18, 2015. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/upload/Update-of-Human-Health-Ambient-Water-Quality-Criteria-Pentachlorobenzene.pdf>
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