Water: Current Water Quality Criteria

National Recommended Water Quality Criteria

EPA's compilation of national recommended water quality criteria is presented as a summary table containing recommended water quality criteria for the protection of aquatic life and human health in surface water for approximately 150 pollutants. These criteria are published pursuant to Section 304(a) of the Clean Water Act (CWA) and provide guidance for states and tribes to use in adopting water quality standards.

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Aquatic Life Criteria Table

Pollutant	CAS Number	P/NP*	Freshwater CMC[1] (acute) (µg/L)	Freshwater CCC[1] (chronic) (µg/L)	Saltwater CMC[1] (acute) (µg/L)	Saltwater CCC[1] (chronic) (µg/L)	Publication Year
Acrolein	107028	P	3ug/L	3ug/L			2009
Aesthetic Qualities	—	NP	NARRATIVE STATEMENT—SEE DOCUMENT				1986
Aldrin	309002	P	3.0 G		1.3 G		1980
Alkalinity	—	NP		20000 C			1986
alpha-Endosulfan	959988	P	0.22 G, Y	0.056 G, Y	0.034 G, Y	0.0087 G, Y	1980
Aluminum pH 6.5 – 9.0	7429905	NP	750 I	87 I, S			1988
Ammonia	7664417	NP	FRESHWATER CRITERIA ARE pH, Temperature and Life-stage DEPENDENT SALTWATER CRITERIA ARE pH AND TEMPERATURE DEPENDENT				2013
							1989
Arsenic	7440382	P	340 A, D	150 A, D	69 A, D	36 A, D	1995
Bacteria	—	NP	FOR PRIMARY RECREATION AND SHELLFISH USES—SEE DOCUMENT				1986
beta-Endosulfan	33213659	P	0.22 G, Y	0.056 G, Y	0.034 G, Y	0.0087 G, Y	1980
Boron	—	NP	NARRATIVE STATEMENT—SEE DOCUMENT				1986
Carbaryl	63252	NP	2.1	2.1	1.6		2012
Cadmium	7440439	P	2.0 D, E	0.25 D, E	40 D	8.8 D	2001
Chlordane	57749	P	2.4 G	0.0043 G	0.09 G	0.004 G	1980
Chloride	16887006	NP	860000	230000			1986
Chlorine	7782505	NP	19	11	13	7.5	1986
Chloropyrifos	2921882	NP	0.083	0.041	0.011	0.0056	1986
Chromium (III)	16065831	P	570 D, E	74 D, E			1995
Chromium (VI)	18540299	P	16 D	11 D	1,100 D	50 D	1995
Color	—	NP	NARRATIVE STATEMENT—SEE DOCUMENT				1986
Copper	7440508	P	Freshwater criteria calculated using the BLM mm - See Document		4.8 D, cc	3.1 D, cc	2007
Cyanide	57125	P	22 Q	5.2 Q	1 Q	1 Q	1985
Demeton	8065483	NP		0.1 C		0.1 C	1985
Diazinon	333415	NP	0.17ug/L	0.17ug/L	0.82ug/L	0.82ug/L	2005
Dieldrin	60571	P	0.24	0.056 O	0.71 G	0.0019 G	1995

Endrin	72208	P	0.086	0.036 O	0.037 G	0.0023 G	1995
gamma-BHC (Lindane)	58899	P	0.95		0.16 G		1995
Gases, Total Dissolved	—	NP	NARRATIVE STATEMENT—SEE DOCUMENT C				1986
Guthion	86500	NP		0.01 C		0.01 C	1986
Hardness	—	NP	NARRATIVE STATEMENT—SEE DOCUMENT				1986
Heptachlor	76448	P	0.52 G	0.0038 G	0.053 G	0.0036 G	1980
Heptachlor Epoxide	1024573	P	0.52 G, V	0.0038 G, V	0.053 G, V	0.0036 G, V	1981
Iron	7439896	NP		1000 C			1986
Lead	7439921	P	65 D, E	2.5 D, E	210 D	8.1 D	1980
Malathion	121755	NP		0.1 C		0.1 C	1986
Mercury Methylmercury	7439976 22967926	P	1.4 D, hh	0.77 D, hh	1.8 D, ee, hh	0.94 D, ee, hh	1995
Methoxychlor	72435	NP		0.03 C		0.03 C	1986
Mirex	2385855	NP		0.001 C		0.001 C	1986
Nickel	7440020	P	470 D, E	52 D, E	74 D	8.2 D	1995
Nonylphenol	84852153	NP	28ug/L	6.6ug/L	7ug/L	1.7ug/L	2005
Nutrients	—	NP	See EPA's Ecoregional criteria for Total Phosphorus, Total Nitrogen, Chlorophyll *a* and Water Clarity (Secchi depth for lakes; turbidity for streams and rivers) (& Level III Ecoregional criteria)				
Oil and Grease	—	NP	NARRATIVE STATEMENT—SEE DOCUMENT C				1986
Oxygen, Dissolved Freshwater Oxygen, Dissolved Saltwater	7782447	NP	WARMWATER AND COLDWATER MATRIX—SEE DOCUMENT SALTWATER—SEE DOCUMENT				1986
Parathion	56382	NP	0.065 I	0.013 I			1995
Pentachlorophenol	87865	P	19 F	15 F	13	7.9	1995
pH	—	NP		6.5 – 9 C		6.5 – 8.5 C, P	1986
Phosphorus Elemental	7723140	NP					1986
Polychlorinated Biphenyls (PCBs)		P		0.014 N		0.03 N	
Selenium	7782492	P	L, R	5.0 R	290 D, dd	71 D, dd	1999
Silver	7440224	P	3.2 D, E		1.9 D		1980
Solids Suspended and Turbidity	—	NP	NARRATIVE STATEMENT—SEE DOCUMENT C				1986
Sulfide-Hydrogen Sulfide	7783064	NP		2.0 C		2.0 C	1986
Tainting Substances	—	NP	NARRATIVE STATEMENT—SEE DOCUMENT				1986
Temperature	—	NP	SPECIES DEPENDENT CRITERIA—SEE DOCUMENT M				1986
Toxaphene	8001352	P	0.73	0.0002	0.21	0.0002	1986
Tributyltin (TBT)	—	NP	0.46	0.072	0.42	0.0074	2004
Zinc	7440666	P	120 D, E	120 D, E	90 D	81 D	1995
4,4'-DDT	50293	P	1.1 G, ii	0.001 G, ii	0.13 G, ii	0.001 G, ii	1980

***P/NP** – Indicates either a Priority Pollutant (P) or a Non Priority Pollutant (NP).

Footnotes

A This recommended water quality criterion was derived from data for arsenic (III), but is applied here to total arsenic, which might imply that arsenic (III) and arsenic (V) are equally toxic to aquatic life and that their toxicities are additive. No data are known to be available concerning whether the toxicities of the forms of arsenic to aquatic organisms are additive. Please consult the criteria document for details.

C The derivation of this value is presented in the Red Book (EPA 440/9-76-023, July, 1976). The CCC of 20mg/L is a minimum value except where alkalinity is naturally lower, in which case the criterion cannot be lower than 25% of the natural level.

D Freshwater and saltwater criteria for metals are expressed in terms of the dissolved metal in the water column. See "Office of Water Policy and Technical Guidance on Interpretation and Implementation of Aquatic Life Metals Criteria (PDF)," (49 pp, 3MB) October 1, 1993, by Martha G. Prothro, Acting Assistant Administrator for Water, available on NSCEP's web site and 40CFR§131.36(b)(1). Conversion Factors applied in the table can be found in Appendix A to the Preamble- Conversion Factors for Dissolved Metals.

E The freshwater criterion for this metal is expressed as a function of hardness (mg/L) in the water column. The value given here corresponds to a hardness of 100 mg/L. Criteria values for other hardness may be calculated per the equation presented in the criteria document.

F Freshwater aquatic life values for pentachlorophenol are expressed as a function of pH. Values displayed in table correspond to a pH of 7.8.

G This Criterion is based on 304(a) aquatic life criterion issued in 1980, and was issued in one of the following documents: Aldrin/Dieldrin (PDF) (153 pp, 7 3MB) (EPA 440/5-80-019), Chlordane (PDF) (68 pp, 3 1MB) (EPA 440/5-80-027), DDT (PDF) (175 pp, 8 3MB) (EPA 440/5-80-038), Endosulfan (PDF) (155 pp, 7 3MB) (EPA 440/5-80-046), Endrin (PDF) (103 pp, 4 6MB) (EPA 440/5-80-047), Heptachlor (PDF) (114 pp, 5 4MB) (EPA 440/5-80-052), Hexachlorocyclohexane (PDF) (109 pp, 4 8MB) (EPA 440/5-80-054), Silver (EPA 440/5-80-071). The Minimum Data Requirements and derivation procedures were different in the 1980 Guidelines than in the 1985 Guidelines (PDF) (104 pp, 3 3MB). If evaluation is to be done using an averaging period, the acute criteria values given should be divided by 2 to obtain a value that is more comparable to a CMC derived using the 1985 Guidelines.

I This value for aluminum is expressed in terms of total recoverable metal in the water column.

J This value was derived using the GLI Guidelines (60 FR 15393-15399, March 23, 1995; 40CFR132 Appendix A); the differences between the 1985 Guidelines and the GLI Guidelines are explained on page iv of the 1995 Updates. No decision concerning this criterion was affected by any considerations that are specific to the Great Lakes.

L The CMC = 1/[(f1/CMC1) + (f2/CMC2)] where f1 and f2 are the fractions of total selenium that are treated as selenite and selenate, respectively, and CMC1 and CMC2 are 185.9 ug/l and 12.82 ug/l, respectively. However, based on findings from a February 2009 SETAC Pellston Workshop on Ecological Assessment of Selenium in the Aquatic Environment, diet is the primary pathway of selenium exposure to aquatic life, and traditional methods for predicting toxicity on the basis of exposure to dissolved concentrations are not appropriate for selenium. (To view a summary of the SETAC Pellston workshop including key findings visit http://www.setac.org/resource/resmgr/publications_and_resources/selsummary.pdf).

M U.S. EPA. 1973. Water Quality Criteria 1972. EPA-R3-73-033. National Technical Information Service, Springfield, VA.; U.S. EPA. 1977. Temperature Criteria for Freshwater Fish: Protocol and Procedures. EPA 600/3-77-061. National Technical Information Service, Springfield, VA.

N This criterion applies to total PCBs, (e.g., the sum of all congener or all isomer or homolog or Aroclor analyses.)

O The derivation of the CCC for this pollutant (Endrin) did not consider exposure through the diet, which is probably important for aquatic life occupying upper trophic levels.

P According to page 181 of the Red Book:

For open ocean waters where the depth is substantially greater than the euphotic zone, the pH should not be changed more than 0.2 units from the naturally occurring variation or any case outside the range of 6.5 to 8.5. For shallow, highly productive coastal and estuarine areas where naturally occurring pH variations approach the lethal limits of some species, changes in pH should be avoided but in any case should not exceed the limits established for fresh water, i.e., 6.5-9.0.

Q This recommended water quality criterion is expressed as ug free cyanide (as CN)/L.

R EPA is in the process of updating this criterion to reflect the latest scientific information. See EPA's Aquatic Life Criterion - Selenium website for more information.

S There are three major reasons why the use of Water-Effect Ratios might be appropriate.

1. The value of 87 µg/l is based on a toxicity test with the striped bass in water with pH = 6.5–6.6 and hardness <10 mg/L. Data in "Aluminum Water-Effect Ratio for the 3M Plant Effluent Discharge, Middleway, West Virginia" (May 1994) indicate that aluminum is substantially less toxic at higher pH and hardness, but the effects of pH and hardness are not well quantified at this time.
2. In tests with the brook trout at low pH and hardness, effects increased with increasing concentrations of total aluminum even though the concentration of dissolved aluminum was constant, indicating that total recoverable is a more appropriate measurement than dissolved, at least when particulate aluminum is primarily aluminum hydroxide particles. In surface waters, however, the total recoverable procedure might measure aluminum associated with clay particles, which might be less toxic than aluminum associated with aluminum hydroxide.
3. EPA is aware of field data indicating that many high quality waters in the U.S. contain more than 87 g aluminum/L, when either total recoverable or dissolved is measured.

V This value was derived from data for heptachlor and the criteria document provides insufficient data to estimate the relative toxicities of heptachlor and heptachlor epoxide.

Y This value was derived from data for endosulfan and is most appropriately applied to the sum of alpha-endosulfan and beta-endosulfan.

cc When the concentration of dissolved organic carbon is elevated, copper is substantially less toxic and use of Water-Effect Ratios might be appropriate.

dd The selenium criteria document (EPA 440/5-87-006, September 1987) provides that if selenium is as toxic to saltwater fishes in the field as it is to freshwater fishes in the field, the status of the fish community should be monitored whenever the concentration of selenium exceeds 5.0 µg/L in salt water because the saltwater CCC does not take into account uptake via the food chain.

ee This recommended water quality criterion was derived on page 43 of the mercury criteria document (PDF) (144 pp, 6 4MB) (EPA 440/5-84-026, January 1985). The saltwater CCC of 0.025 ug/L given on page 23 of the criteria document is based on the Final Residue Value procedure in the 1985 Guidelines. Since the publication of the Great Lakes Aquatic Life Criteria Guidelines in 1995 (60 FR 15393-15399, March 23, 1995), the Agency no longer uses the Final Residue Value procedure for deriving CCCs for new or revised 304(a) aquatic life criteria.

hh This recommended water quality criterion was derived from data for inorganic mercury (II), but is applied here to total mercury. If a substantial portion of the mercury in the water column is methylmercury, this criterion will probably be under protective. In addition, even though inorganic mercury is converted to methylmercury and methylmercury bioaccumulates to a great extent, this criterion does not account for uptake via the food chain because sufficient data were not available when the criterion was derived.

ii This criterion applies to DDT and its metabolites (i.e., the total concentration of DDT and its metabolites should not exceed this value).

mm The available toxicity data, when evaluated using the procedures described in the "Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses" indicate that freshwater aquatic life should be protected if the 24-hour average and four-day average concentrations do not respectively exceed the acute and chronic criteria concentrations calculated by the Biotic Ligand Model.

Human Health Criteria Table

DRAFT: Updated National Recommended Water Quality Criteria - Human Health

			Human Health for the consumption of		
Pollutant	**CAS Number**	**P/NP***	**Water + Organism (µg/L)**	**Organism Only (µg/L)**	**Publication Year**
Acenaphthene	83329	P	670 B, U	990 B, U	2002
Acrolein	107028	P	6 ll	9 ll	2009
Acrylonitrile	107131	P	0.051 B, C	0.25 B, C	2002
Aldrin	309002	P	0.000049 B, C	0.000050 B, C	2002
alpha-BHC	319846	P	0.0026 B, C	0.0049 B, C	2002
alpha-Endosulfan	959988	P	62 B	89 B	2002
Anthracene	120127	P	8,300 B	40,000 B	2002
Antimony	7440360	P	5.6 B	640 B	2002
Arsenic	7440382	P	0.018 C, M, S	0.14 C, M, S	1992
Asbestos	1332214	P	7 million fibers/L I		1991
Barium	7440393	NP	1,000 A		1986
Benzene	71432	P	2.2 B, C	51 B, C	2002
Benzidine	92875	P	0.000086 B, C	0.00020 B, C	2002
Benzo(a) Anthracene	56553	P	0.0038 B, C	0.018 B, C	2002
Benzo(a) Pyrene	50328	P	0.0038 B, C	0.018 B, C	2002
Benzo(b) Fluoranthene	205992	P	0.0038 B, C	0.018 B, C	2002
Benzo(k) Fluoranthene	207089	P	0.0038 B, C	0.018 B, C	2002
Beryllium	7440417	P	Z		
beta-BHC	319857	P	0.0091 B, C	0.017 B, C	2002
beta-Endosulfan	33213659	P	62 B	89 B	2002
Bis(2-Chloroethyl) Ether	111444	P	0.030 B, C	0.53 B, C	2002
Bis(2-Chloroisopropyl) Ether	108601	P	1,400 B	65,000 B	2002
Bis(2-Ethylhexyl) Phthalate	117817	P	1.2 B, C	2.2 B, C	2002
Bromoform	75252	P	4.3 B, C	140 B, C	2002
Butylbenzyl Phthalate	85687	P	1,500 B	1,900 B	2002
Cadmium	7440439	P	Z		
Carbon Tetrachloride	56235	P	0.23 B, C	1.6 B, C	2002
Chlordane	57749	P	0.00080 B, C	0.00081 B, C	2002
Chlorobenzene	108907	P	130 Z, U	1,600 U	2003
Chlorodibromomethane	124481	P	0.40 B, C	13 B, C	2002
Chloroform	67663	P	5.7 C, P	470 C, P	2002
	94757	NP	100 Z		1986

Chlorophenoxy Herbicide (2,4-D)					
Chromium (III)	16065831	P	Z Total		
Chromium (VI)	18540299	P	Z Total		
Chrysene	218019	P	0.0038 B, C	0.018 B, C	2002
Copper	7440508	P	1,300 U		1992
Cyanide	57125	P	140 jj	140 jj	2003
Dibenzo(a,h)Anthracene	53703	P	0.0038 B, C	0.018 B, C	2002
Dichlorobromomethane	75274	P	0.55 B, C	17 B,C	2002
Dieldrin	60571	P	0.000052 B, C	0.000054 B, C	2002
Diethyl Phthalate	84662	P	17,000 B	44,000 B	2002
Dimethyl Phthalate	131113	P	270,000	1,100,000	2002
Di-n-Butyl Phthalate	84742	P	2,000 B	4,500 B	2002
Dinitrophenols	25550587	NP	69	5300	2002
Endosulfan Sulfate	1031078	P	62 B	89 B	2002
Endrin	72208	P	0.059	0.060	2003
Endrin Aldehyde	7421934	P	0.29 B	0.30 B, H	2002
Ether, Bis(Chloromethyl)	542881	NP	0.00010 C	0.00029 C	2002
Ethylbenzene	100414	P	530	2,100	2003
Fluoranthene	206440	P	130 B	140 B	2002
Fluorene	86737	P	1,100 B	5,300 B	2002
gamma-BHC (Lindane)	58899	P	0.98	1.8	2003
Heptachlor	76448	P	0.000079 B, C	0.000079 B, C	2002
Heptachlor Epoxide	1024573	P	0.000039 B, C	0.000039 B, C	2002
Hexachlorobenzene	118741	P	0.00028 B, C	0.00029 B, C	2002
Hexachlorobutadiene	87683	P	0.44 B, C	18 B, C	2002
Hexachlorocyclo-hexane-Technical	608731		0.0123 H	0.0414H	
Hexachlorocyclopentadiene	77474	P	40 U	1,100 U	2003
Hexachloroethane	67721	P	1.4 B, C	3.3 B, C	2002
Ideno(1,2,3-cd)Pyrene	193395	P	0.0038 B, C	0.018 B, C	2002
Isophorone	78591	P	35 B, C	960 B, C	2002
Manganese	7439965	NP	50 O	100 A	
Methylmercury	22967926	P		0.3 mg/kg J	2001
Methoxychlor	72435	NP	100 A, Z		1986
Methyl Bromide	74839	P	47 B	1,500 B	2002
Methylene Chloride	75092	P	4.6 B, C	590 B,C	2002
Nickel	7440020	P	610 B	4,600 B	1998
Nitrates	14797558	NP	10,000 A		1986
Nitrobenzene	98953	P	17 B	690 B, H, U	2002
Nitrosamines	—	NP	0.0008	1.24	1980
Nitrosodibutylamine, N	924163	NP	0.0063 C	0.22 C	2002
Nitrosodiethylamine, N	55185	NP	0.0008 C	1.24 C	2002
Nitrosopyrrolidine, N	930552	NP	0.016 C	34 C	2002
N-Nitrosodimethylamine	62759	P	0.00069 B, C	3.0 B, C	2002
N-Nitrosodi-n-Propylamine	621647	P	0.0050 B, C	0.51 B, C	2002

N-Nitrosodiphenylamine	86306	P	3.3 B, C	6.0 B, C	2002
Nutrients	—	NP	See EPA's Ecoregional criteria for Total Phosphorus, Total Nitrogen, Chlorophyll a and Water Clarity (Secchi depth for lakes; turbidity for streams and rivers) (& Level III Ecoregional criteria)		
Pathogen and Pathogen Indicators	—		See EPA's 2012 Recreational Water Quality Criteria		2012
Pentachlorobenzene	608935	NP	1.4 E	1.5 E	2002
Pentachlorophenol	87865	P	0.27 B, C	3.0 B, C, H	2002
pH	—	NP	5 – 9		1986
Phenol	108952	P	10,000 II, U	860,000 II, U	2009
Polychlorinated Biphenyls (PCBs)		P	0.000064 B, C, N	0.000064 B, C, N	2002
Pyrene	129000	P	830 B	4,000 B	2002
Selenium	7782492	P	170 Z	4200	2002
Solids Dissolved and Salinity	—	NP	250,000 A		1986
Tetrachlorobenzene,1,2,4,5-	95943	NP	0.97 B	1.1 B	2002
Tetrachloroethylene	127184	P	0.69 C	3.3 C	2002
Thallium	7440280	P	0.24	0.47	2003
Toluene	108883	P	1,300 Z	15,000	2003
Toxaphene	8001352	P	0.00028 B, C	0.00028 B, C	2002
Trichloroethylene	79016	P	2.5 C	30 C	2002
Trichlorophenol,2,4,5-	95954	NP	1,800 B	3,600 B	2002
Vinyl Chloride	75014	P	0.025 C, kk	2.4 C, kk	2003
Zinc	7440666	P	7,400 U	26,000 U	2002
1,1,1-Trichloroethane	71556	P	Z		
1,1,2,2-Tetrachloroethane	79345	P	0.17 B, C	4.0 B, C	2002
1,1,2-Trichloroethane	79005	P	0.59 B, C	16 B, C	2002
1,1-Dichloroethylene	75354	P	330	7,100	2003
1,2,4-Trichlorobenzene	120821	P	35	70	2003
1,2-Dichlorobenzene	95501	P	420	1,300	2003
1,2-Dichloroethane	107062	P	0.38 B, C	37 B, C	2002
1,2-Dichloropropane	78875	P	0.50 B, C	15 B, C	2002
1,2-Diphenylhydrazine	122667	P	0.036 B, C	0.20 B, C	2002
1,2-Trans-Dichloroethylene	156605	P	140 Z	10,000	2003
1,3-Dichlorobenzene	541731	P	320	960	2002
1,3-Dichloropropene	542756	P	0.34 C	21 C	2003
1,4-Dichlorobenzene	106467	P	63	190	2003
2,3,7,8-TCDD (Dioxin)	1746016	P	5.0E-9 C	5.1E-9 C	2002
2,4,6-Trichlorophenol	88062	P	1.4 B, C	2.4 B, C, U	2002
2,4-Dichlorophenol	120832	P	77 B, U	290 B, U	2002
2,4-Dimethylphenol	105679	P	380 B	850 B, U	2002
2,4-Dinitrophenol	51285	P	69 B	5,300 B	2002
2,4-Dinitrotoluene	121142	P	0.11 C	3.4 C	2002
2-Chloronaphthalene	91587	P	1,000 B	1,600 B	2002
2-Chlorophenol	95578	P	81 B, U	150 B, U	2002
2-Methyl-4,6-Dinitrophenol	534521	P	13	280	2002
3,3'-Dichlorobenzidine	91941	P	0.021 B, C	0.028 B, C	2002
3-Methyl-4-Chlorophenol	59507	P	U	U	

4,4'-DDD	72548	P	0.00031 B, C	0.00031 B, C	2002
4,4'-DDE	72559	P	0.00022 B, C	0.00022 B, C	2002
4,4'-DDT	50293	P	0.00022 B, C	0.00022 B, C	2002

*P/NP – Indicates either a Priority Pollutant (P) or a Non Priority Pollutant (NP).

Footnotes

A This human health criterion is the same as originally published in the Red Book which predates the 1980 methodology and did not utilize the fish ingestion BCF approach. This same criterion value is now published in the Gold Book.

B This criterion has been revised to reflect The Environmental Protection Agency's q1* or RfD, as contained in the Integrated Risk Information System (IRIS) as of May 17, 2002. The fish tissue bioconcentration factor (BCF) from the 1980 Ambient Water Quality Criteria document used to derive the original criterion was retained in each case.

C This criterion is based on carcinogenicity of 10^{-6} risk. Alternate risk levels may be obtained by moving the decimal point (e.g., for a risk level of 10^{-5}, move the decimal point in the recommended criterion one place to the right).

D According to the procedures described in the *Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses*, except possibly where a very sensitive species is important at a site, freshwater aquatic life should be protected if both conditions specified in Appendix C to the Preamble-Calculation of Freshwater Ammonia Criterion are satisfied.

F The derivation of this value is presented in the Red Book (EPA 440/9-76-023, July, 1976).

H No criterion for protection of human health from consumption of aquatic organisms excluding water was presented in the 1980 criteria document or in the *1986 Quality Criteria for Water*. Nevertheless, sufficient information was presented in the 1980 document to allow the calculation of a criterion, even though the results of such a calculation were not shown in the document.

I This criterion for asbestos is the Maximum Contaminant Level (MCL) developed under the Safe Drinking Water Act (SDWA).

J This fish tissue residue criterion for methylmercury is based on a total fish consumption rate of 0.0175 kg/day.

M EPA is currently reassessing the criteria for arsenic.

N This criterion applies to total pcbs, (e.g., the sum of all congener or all isomer or homolog or Aroclor analyses.)

O This criterion for manganese is not based on toxic effects, but rather is intended to minimize objectionable qualities such as laundry stains and objectionable tastes in beverages.

P Although a new RfD is available in IRIS, the surface water criteria will not be revised until the National Primary Drinking Water Regulations: Stage 2 Disinfectants and Disinfection Byproducts Rule (Stage 2 DBPR) is completed, since public comment on the relative source contribution (RSC) for chloroform is anticipated.

R U.S. EPA. 1973. Water Quality Criteria 1972. EPA-R3-73-033. National Technical Information Service, Springfield, VA.; U.S. EPA. 1977. Temperature Criteria for Freshwater Fish: Protocol and Procedures. EPA 600/3-77-061. National Technical Information Service, Springfield, VA.

S This recommended water quality criterion for arsenic refers to the inorganic form only.

T U.S. EPA. 1986. Ambient Water Quality Criteria for Dissolved Oxygen. EPA 440/5-86-003. National Technical Information Service, Springfield, VA.

U The organoleptic effect criterion is more stringent than the value for priority toxic pollutants.

Z A more stringent Maximum Contaminant Level (MCL) has been issued by EPA under the Safe Drinking Water Act. Refer to drinking water regulations 40CFR141 or Safe Drinking Water Hotline (1-800-426-4791) for values.

jj This recommended water quality criterion is expressed as total cyanide, even though the IRIS RFD we used to derive the criterion is based on free cyanide. The multiple forms of cyanide that are present in ambient water have significant differences in toxicity due to their differing abilities to liberate the CN-moiety. Some complex cyanides require even more extreme conditions than refluxing with sulfuric acid to liberate the CN-moiety. Thus, these complex cyanides are expected to have little or no 'bioavailability' to humans. If a substantial fraction of the cyanide present in a water body is present in a complexed form (e.g., $Fe_4[Fe(CN)_6]_3$), this criterion may be over conservative.

kk This recommended water quality criterion was derived using the cancer slope factor of 1.4 (LMS exposure from birth).

ll This criterion has been revised to reflect the Environmental Protection Agency's cancer slope factor (CSF) or reference dose (RfD), as contained in the Integrated Risk Information System (IRIS) as of (date of publication of Final FR Notice). The fish tissue bioconcentration factor (BCF) from the 1980 Ambient Water Quality Criteria document was retained in each case.

Organoleptic Effects (e.g., taste and odor)

Pollutant	CAS Number	Organoleptic Effect Criteria (µg/L)	FR Cite/ Source
Acenaphthene	83329	20	Gold Book

Color		NP	Gold Book
Iron	7439896	300	Gold Book Red Book
Monochlorobenzene	108907	20	Gold Book
Tainting Substance		NP	Gold Book
3-Chlorophenol	—	0.1	Gold Book
4-Chlorophenol	106489	0.1	Gold Book
2,3-Dichlorophenol	—	0.04	Gold Book
2,5-Dichlorophenol	—	0.5	Gold Book
2,6-Dichlorophenol	—	0.2	Gold Book
3,4-Dichlorophenol	—	0.3	Gold Book
2,4,5-Trichlorophenol	95954	1	Gold Book
2,4,6-Trichlorophenol	88062	2	Gold Book
2,3,4,6-Tetrachlorophenol	—	1	Gold Book
2-Methyl-4-Chlorophenol	—	1800	Gold Book
3-Methyl-4-Chlorophenol	59507	3000	Gold Book
3-Methyl-6-Chlorophenol	—	20	Gold Book
2-Chlorophenol	95578	0.1	Gold Book
Copper	7440508	1000	Gold Book
2,4-Dichlorophenol	120832	0.3	Gold Book
2,4-Dimethylphenol	105679	400	Gold Book
Hexachlorocyclopentadiene	77474	1	Gold Book
Manganese	7439965		
Nitrobenzene	98953	30	Gold Book
Pentachlorophenol	87865	30	Gold Book
Phenol	108952	300	Gold Book
Zinc	7440666	5000	45 FR79341

Notes:

1. These criteria are based on organoleptic (taste and odor) effects. Because of variations in chemical nomenclature systems, this listing of pollutants does not duplicate the listing in Appendix A of 40 CFR Part 423. Also listed are the Chemical Abstracts Service (CAS) registry numbers, which provide a unique identification for each chemical.

Additional Notes

1. **Criteria Maximum Concentration and Criterion Continuous Concentration**

   The Criteria Maximum Concentration (CMC) is an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed briefly without resulting in an unacceptable effect. The Criterion Continuous Concentration (CCC) is an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect. The CMC and CCC are just two of the six parts of an aquatic life criterion; the other four parts are the acute averaging period, chronic averaging period, acute frequency of allowed exceedence, and chronic frequency of allowed exceedence. Because 304(a) aquatic life criteria are national guidance, they are intended to be protective of the vast majority of the aquatic communities in the United States.

2. **Criteria Recommendations for Priority Pollutants, Non Priority Pollutants and Organoleptic Effects**

   This compilation lists all priority toxic pollutants and some non priority toxic pollutants, and both human health effect and organoleptic effect criteria issued pursuant to CWA §304(a). Blank spaces indicate that EPA has no CWA §304(a) criteria recommendations. For a number of non-priority toxic pollutants not listed, CWA §304(a) "water + organism" human health criteria are not available, but EPA has published MCLs under the SDWA that may be used in establishing water quality standards to protect water supply designated uses. Because of variations in chemical nomenclature systems, this listing of toxic pollutants does not duplicate the listing in Appendix A of 40 CFR Part 423. Also listed are the Chemical Abstracts Service CAS registry numbers, which provide a unique identification for each chemical.

3. **Human Health Risk**

   The human health criteria for the priority and non priority pollutants are based on carcinogenicity of 10^{-6} risk. Alternate risk levels may be obtained by moving the decimal point (e.g., for a risk level of 10^{-5}, move the decimal point in the recommended criterion one place to the right).

4. **Water Quality Criteria published pursuant to Section 304(a) or Section 303(c) of the CWA**

Many of the values in the compilation were published in the California Toxics Rule. Although such values were published pursuant to Section 303(c) of the CWA, they represent the Agency's most recent calculation of water quality criteria and are thus the Agency's 304(a) criteria.

5. **Calculation of Dissolved Metals Criteria**

The 304(a) criteria for metals, shown as dissolved metals, are calculated in one of two ways. For freshwater metals criteria that are hardness-dependent, the dissolved metal criteria were calculated using a hardness of 100 mg/l as CaCO3 for illustrative purposes only. Saltwater and freshwater metals' criteria that are not hardness-dependent are calculated by multiplying the total recoverable criteria before rounding by the appropriate conversion factors. The final dissolved metals' criteria in the table are rounded to two significant figures. Information regarding the calculation of hardness dependent conversion factors are included in the footnotes.

6. **Maximum Contaminant Levels**

The compilation includes footnotes for pollutants with Maximum Contaminant Levels (MCLs) more stringent than the recommended water quality criteria in the compilation. MCLs for these pollutants are not included in the compilation, but can be found in the appropriate drinking water regulations (40 CFR 141.11-16 and 141.60-63), or can be accessed through the Safe Drinking Water Hotline (800-426-4791) or online.

7. **Organoleptic Effects**

The compilation contains 304(a) criteria for pollutants with toxicity-based criteria as well as non-toxicity based criteria. The basis for the non-toxicity based criteria are organoleptic effects (e.g., taste and odor) which would make water and edible aquatic life unpalatable but not toxic to humans. The table includes criteria for organoleptic effects for 23 pollutants. Pollutants with organoleptic effect criteria more stringent than the criteria based on toxicity (e.g., included in both the priority and non-priority pollutant tables) are footnoted as such.

8. **Gold Book**

The "Gold Book" is Quality Criteria for Water: 1986. EPA 440/5-86-001.

9. **Correction of Chemical Abstract Services Number**

The Chemical Abstract Services number (CAS) for Bis(2-Chlorisoprpyl) Ether, has been revised in IRIS and in the table. The correct CAS number for this chemical is 108-60-1. The previous CAS number for this pollutant was 39638-32-9.

10. **Contaminants with Blanks**

EPA has not calculated criteria for contaminants with blanks. However, permit authorities should address these contaminants in NPDES permit actions using the States' existing narrative criteria for toxics.

11. **Specific Chemical Calculations**

Selenium—Aquatic Life
This compilation contains aquatic life criteria for selenium that are the same as those published in the proposed CTR. In the CTR, EPA proposed an acute criterion for selenium based on the criterion proposed for selenium in the Water Quality Guidance for the Great Lakes System (61 FR 58444). The GLI and CTR proposals take into account data showing that selenium's two prevalent oxidation states in water, selenite and selenate, present differing potentials for aquatic toxicity, as well as new data indicating that various forms of selenium are additive. The new approach produces a different selenium acute criterion concentration, or CMC, depending upon the relative proportions of selenite, selenate, and other forms of selenium that are present.
EPA is currently undertaking a reassessment of selenium, and expects the 304(a) criteria for selenium will be revised based on the final reassessment (63 FR 26186). However, until such time as revised water quality criteria for selenium are published by the Agency, the recommended water quality criteria in this compilation are EPA's current 304(a) criteria.

Appendix A—Conversion Factors for Dissolved Metals

Metal	Conversion Factor			
	freshwater CMC	freshwater CCC	saltwater CMC	saltwater CCC[1]
Arsenic	1.000	1.000	1.000	1.000
Cadmium	1.136672-[(ln hardness)(0.041838)]	1.101672-[(ln hardness)(0.041838)]	0.994	0.994
Chromium III	0.316	0.860	—	—
Chromium VI	0.982	0.962	0.993	0.993
Copper	0.960	0.960	0.83	0.83
Lead	1.46203-[(ln hardness)(0.145712)]	1.46203-[(ln hardness)(0.145712)]	0.951	0.951
Mercury	0.85	0.85	0.85	0.85
Nickel	0.998	0.997	0.990	0.990
Selenium	—	—	0.998	0.998

Metal	Conversion Factor			
	freshwater CMC	freshwater CCC	saltwater CMC	saltwater CCC[1]
Silver	0.85	—	0.85	—
Zinc	0.978	0.986	0.946	0.946

Appendix B—Parameters for Calculating Freshwater Dissolved Metals Criteria That Are Hardness-Dependent

Chemical	m_A	b_A	m_C	b_C	Freshwater Conversion Factors (CF)	
					CMC	CCC
Cadmium	1.0166	-3.924	0.7409	-4.719	1.136672-[(*ln*hardness)(0.041838)]	1.101672-[(*ln*hardness)(0.041838)]
Chromium III	0.8190	3.7256	0.8190	0.6848	0.316	0.860
Copper	0.9422	-1.700	0.8545	-1.702	0.960	0.960
Lead	1.273	-1.460	1.273	-4.705	1.46203-[(*ln*hardness)(0.145712)]	1.46203-[(*ln*hardness)(0.145712)]
Nickel	0.8460	2.255	0.8460	0.0584	0.998	0.997
Silver	1.72	-6.59	—	—	0.85	—
Zinc	0.8473	0.884	0.8473	0.884	0.978	0.986

Hardness-dependant metals' criteria may be calculated from the following:

CMC (dissolved) = $\exp\{m_A [ln(\text{hardness})] + b_A\}$ (CF)

CCC (dissolved) = $\exp\{m_C [ln(\text{hardness})] + b_C\}$ (CF)

The Gold Book

Quality Criteria for Water, 1986 (PDF) (477 pp, 4.6 MB) May 1986

The Red Book

Quality Criteria for Water, 1976 (PDF) (534 pp, 6.2 MB) July 1976

Chemical Specific Criteria Documents from the 1980s

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