

Appendix C. Reference Standards and Data for Water

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Table C.1. Reference standards for radionuclides in water

Parameter ^a	National primary drinking water standard ^b	4% of DCS ^c	DCS ^d
²⁴¹ Am		6.8	170
²¹⁴ Bi		10,400	260,000
¹⁰⁹ Cd		640	16,000
¹⁴³ Ce		1,040	26,000
⁶⁰ Co		288	7,200
⁵¹ Cr		31,600	790,000
¹³⁷ Cs		120	3,000
¹⁵⁵ Eu		3480	87,000
Gross alpha ^e	15		
Gross beta (mrem/year)	4		
³ H	20,000 ^f	76,000	1,900,000
¹³¹ I		52	1,300
⁴⁰ K		192	4,800
²³⁷ Np		12.8	320
^{234m} Pa		2,840	71,000
²³⁸ Pu		6	150
^{239/240} Pu		5.6	140
²²⁶ Ra	5 ^g	3.5	87
²²⁸ Ra	5 ^g	1	25
¹⁰⁶ Ru		164	4,100
⁹⁰ Sr	8 ^f	44	1,100
⁹⁹ Tc		1,760	44,000
²²⁸ Th		13.6	340
²³⁰ Th		6.4	160
²³² Th		5.6	140
²³⁴ Th		336	8,400
Thorium, natural		5.6	140
²³⁴ U		27.2	680
²³⁵ U		28.8	720
²³⁶ U		28.8	720
²³⁸ U		30	750
Uranium, natural		30	750
Uranium, total ^h (µg/L)	30	27.2	680

Table C.1. (continued)

^aOnly the radionuclides included in the Oak Ridge Reservation monitoring programs are listed. Unless labeled otherwise, units are pCi/L.

^b40 CFR Part 141, *National Primary Drinking Water Regulations*, Subparts B and G. The drinking water standards are presented strictly for reference purposes and have regulatory applicability only for public water supplies.

^cFour percent of the derived concentration standard represents the DOE criterion of 4 mrem effective dose equivalent from ingestion of drinking water.

^dDOE. "Derived Concentration Technical Standard, DOE-STD-1196-2011, April 2011."

^eExcludes radon and uranium.

^fThese values are not maximum contaminant levels but are concentrations that result in the effective dose equivalent of the maximum contaminant level for gross beta emissions, which is 4 mrem/year.

^gApplies to combined ²²⁶Ra and ²²⁸Ra.

^hMinimum of uranium isotopes.

Table C.2. TDEC and EPA nonradiological water quality standards and criteria (µg/L)

Chemical	TDEC and EPA Drinking Water Standards ^a	TDEC Fish and Aquatic Life Criteria		TDEC recreation criteria water + organisms, organisms only ^b
		Maximum	Continuous	
Acenaphthene				670, 990
Acrolein				6, 9
Acrylonitrile (c)				0.51, 2.5
Alachlor	2 (E1, T)			
Aldrin (c)		3.0	–	0.00049, 0.00050
Aluminum	50 – 200 (E2)			
Anthracene				8300, 40,000
Antimony	6 (E1, T)			5.6, 640
Arsenic (c)	10 (E1, T)			10.0, 10.0
Arsenic(III) ^c		340 ^c	150 ^c	
Asbestos	7 million fibers/L (MFL) (E1)			
Atrazine	3 (E1, T)			
Barium	2000 (E1, T)			
Benzene (c)	5 (E1, T)			22, 510
Benzidine (c)				0.00086, 0.0020
Benzo(a)anthracene (c)				0.038, 0.18
Benzo(a)pyrene (c)	0.2 (E1, T)			0.038, 0.18
Benzo(b)fluoranthene (c)				0.038, 0.18
Benzo(k)fluoranthene (c)				0.038, 0.18
Beryllium	4 (E1, T)			
a-BHC (c)				0.026, 0.049
b-BHC (c)				0.091, 0.17
g-BHC (Lindane)	0.2 (E1, T)	0.95	–	0.98, 1.8
Bis(2-chloroethyl)ether (c)				0.30, 5.3
Bis(2-chloro-isopropyl)ether				1400, 65,000
Bis(2-ethylhexyl)phthalate (c)				12, 22
Bromate	10 (E1)			
Bromoform (c)				43, 1400
Butylbenzyl phthalate				1500, 1900
Cadmium	5 (E1, T)	2.0 ^d	0.25 ^d	
Carbofuran	40 (E1, T)			

Table C.2. (continued)

Chemical	TDEC and EPA Drinking Water Standards ^a	TDEC Fish and Aquatic Life Criteria		TDEC recreation criteria water + organisms, organisms only ^b
		Maximum	Continuous	
Carbon tetrachloride (c)	5 (E1, T)			2.3, 16
Chlordane (c)	2 (E1, T)	2.4	0.0043	0.0080, 0.0081
Chloride	250,000 (E2)			
Chlorine (TRC)	4000 (E1)	19	11	
Chlorite	1000 (E1)			
Chlorobenzene	100 (E1, T)			130, 1600
Chlorodibromomethane (c)				4.0, 130
Chloroform (c)				57, 4700
2-Chloronaphthalene				1000, 1600
2-Chlorophenol				81, 150
Chromium (total)	100 (E1, T)			
Chromium(III)		570 ^d	74 ^d	
Chromium(VI) ^c		16 ^c	11 ^c	
Chrysene (c)				0.038, 0.18
Coliforms	630/100 mL, <i>E. coli</i> , geometric mean (T); no more than 5% of samples per month can be positive for total coliforms (E1)	2880/100 mL, <i>E. coli</i> (single sample)	630/100 mL, <i>E. coli</i> (geometric mean)	126/100 mL, geometric mean, <i>E. coli</i> 487, maximum lakes/reservoirs, <i>E. coli</i> 941, maximum, other water bodies, <i>E. coli</i>
Color	15 color units (E2)			
Copper	1000 (E2) 1300 (E1 "Action Level")	13 ^d	9.0 ^d	
Cyanide (as free cyanide)	200 (E1, T)	22	5.2	140, 140
2,4-D (Dichlorophenoxyacetic acid)	70 (E1, T)			
4,4'-DDT (c)		1.1	0.001	0.0022, 0.0022
4,4'-DDE (c)				0.0022, 0.0022
4,4'-DDD (c)				0.0031, 0.0031
Dalapon	200 (E1, T)			
Demeton			0.1	
Diazinon		0.1	0.1	
Dibenz(a,h)anthracene (c)				0.038, 0.18
1,2-dibromo-3-chloropropane (DBCP)	0.2 (E1, T)			
1,2-Dichlorobenzene (<i>ortho</i> -)	600 (E1, T)			420, 1300
1,3-Dichlorobenzene (<i>meta</i> -)				320, 960
1,4-Dichlorobenzene (<i>para</i> -)	75 (E1, T)			63, 190
3,3-Dichlorobenzidine (c)				0.21, 0.28
Dichlorobromomethane (c)				5.5, 170
1,2-Dichloroethane (c)	5 (E1, T)			3.8, 370
1,1-Dichloroethylene	7 (E1, T)			330, 7100
Cis-1,2-Dichloroethylene	70 (E1, T)			
trans 1,2-Dichloroethylene	100 (E1, T)			140, 10,000
Dichloromethane	5 (E1, T)			
2,4-Dichlorophenol				77, 290
1,2-Dichloropropane (c)	5 (E1, T)			5.0, 150
1,3-Dichloropropene (c)				3.4, 210
Dieldrin (c)		0.24	0.056	0.00052, 0.00054
Diethyl phthalate				17,000, 44,000

Table C.2. (continued)

Chemical	TDEC and EPA Drinking Water Standards ^a	TDEC Fish and Aquatic Life Criteria		TDEC recreation criteria water + organisms, organisms only ^b
		Maximum	Continuous	
Di (2-ethylhexyl) adipate	400 (E1, T)			
Di (2-ethylhexyl) phthalate	6 (E1, T)			
Dinoseb	7 (E1, T)			
Dimethyl phthalate				270,000, 1,100,000
2,4-Dimethylphenol				380, 850
Di-n-butyl phthalate				2000, 4500
2,4-Dinitrophenol				69, 5300
2,4-Dinitrotoluene (c)				1.1, 34
Dioxin (2,3,7,8-TCDD) (c)	3 E-5 (E1, T)			0.000001, 0.000001
Diquat	20 (E1, T)			
1,2-Diphenylhydrazine (c)				0.36, 2.0
a-Endosulfan		0.22	0.056	62, 89
b-Endosulfan		0.22	0.056	62, 89
Endosulfan sulfate				62, 89
Endothall	100 (E1, T)			
Endrin	2 (E1, T)	0.086	0.036	0.059, 0.06
Endrin aldehyde				0.29, 0.30
Ethylbenzene	700 (E1, T)			530, 2100
Ethylene dibromide	0.05 (E1, T)			
Fluoranthene				130, 140
Fluorene				1100, 5300
Fluoride	2000 (E2) 4000 (E1)			
Foaming agents	500 (E2)			
Glyphosate	700 (E1, T)			
Guthion			0.01	
Haloacetic acids (five)	60 (E1)			
Heptachlor (c)	0.4 (E1, T)	0.52	0.0038	0.00079, 0.00079
Heptachlor epoxide (c)	0.2 (E1, T)	0.52	0.0038	0.00039, 0.00039
Hexachlorobenzene (c)	1 (E1, T)			0.0028, 0.0029
Hexachlorobutadiene (c)				4.4, 180
Hexachlorocyclopentadiene	50 (E1, T)			40, 1100
Hexachloroethane (c)				14, 33
Ideno(1,2,3-cd)pyrene (c)				0.038, 0.18
Iron	300 (E2)			
Isophorone (c)				350, 9600
Lead	5 (T) 15 (E1 "Action Level")	65 ^d	2.5 ^d	
Malathion			0.1	
Manganese	50 (E2)			
Mercury (inorganic) ^c	2 (E1, T)	1.4 ^c	0.77 ^c	0.05, 0.051
Methoxychlor			0.03	
Methyl bromide				47, 1500
2-Methyl-4,6-dinitrophenol				13, 280
Methylene chloride (Dichloromethane) (c)				46, 5900
Mirex			0.001	
Nickel	100 (T)	470 ^d	52 ^d	610, 4600
Nitrate as N	10,000 (E1)			
Nitrite as N	1000 (E1, T)			

Table C.2. (continued)

Chemical	TDEC and EPA Drinking Water Standards ^a	TDEC Fish and Aquatic Life Criteria		TDEC recreation criteria water + organisms, organisms only ^b
		Maximum	Continuous	
Nitrobenzene				17, 690
N-Nitrosodimethylamine (c)				0.0069, 30
N-Nitrosodi-n-propylamine (c)				0.05, 5.1
N-Nitrosodiphenylamine (c)				33, 60
Nonylphenol		28.0	6.6	
Odor	3 threshold odor number (E2)			
Oxamyl (Vydate)	200 (E1, T)			
Parathion		0.065	0.013	
Pentachlorophenol (c)	1 (E1, T)	19 ^e	15 ^e	2.7, 30
pH	6.5 to 8.5 units (E2) 6.0 to 9.0 units (T)		6.0 to 9.0 units, wade-able streams 6.5 to 9.0 units, larger rivers, lakes, etc	6.0 to 9.0 units
Phenol				10,000, 860,000
PCBs, total (c)	0.5 (E1, T)	–	0.014	0.00064, 0.00064 830, 4000
Pyrene				
Selenium	50 (E1, T)	20	5	
Silver	100 (E2)	3.2 ^d	–	
Simazine	4 (E1, T)			
Styrene	100 (E1, T)			
Sulfate	250,000 (E2)			
1,1,2,2-Tetrachloroethane (c)				1.7, 40
Tetrachloroethylene (c)	5 (E1, T)			6.9, 33
Thallium	2 (E1, T)			0.24, 0.47
Toluene	1000 (E1, T)			1300, 15,000
Total dissolved solids	500,000 (E2)			
Total trihalomethanes	80 (E1)			
Toxaphene (c)	3 (E1, T)	0.73	0.0002	0.0028, 0.0028
2,4,5-TP (Silvex)	50 (E1, T)			
Tributyltin (TBT)		0.46	0.072	
1,2,4-Trichlorobenzene	70 (E1, T)			35, 70
1,1,1-Trichloroethane	200 (E1, T)			
1,1,2-Trichloroethane (c)	5 (E1, T)			5.9, 160
Trichloroethylene (c)	5 (E1, T)			25, 300
2,4,6-Trichlorophenol (c)				14, 24
Vinyl chloride (c)	2 (E1, T)			0.25, 24
Xylenes (total)	10,000 (E1, T)			
Zinc	5000 (E2)	120 ^d	120 ^d	

Table C.2. (continued)

Chemical	TDEC and EPA Drinking Water Standards ^a	TDEC Fish and Aquatic Life Criteria		TDEC recreation criteria water + organisms, organisms only ^b
		Maximum	Continuous	

^aE1 = EPA Primary Drinking Water Standards; E2 = EPA Secondary Drinking Water Standards; T = TDEC domestic water supply criteria.

^bFor each parameter, the first recreational criterion is for “water and organisms” and is applicable on the Oak Ridge Reservation (ORR) only to the Clinch River because the Clinch is the only stream on ORR that is classified for both domestic water supply and for recreation. The second criterion is for “organisms only” and is applicable to the other streams on ORR. TDEC uses a 10^{-5} risk level for recreational criteria for all carcinogenic pollutants (designated with “(c)” under “Chemical” column). Recreational criteria for noncarcinogenic chemicals are set using a 10^{-6} risk level. (Note: All federal recreational criteria are set at a 10^{-6} risk level.)

^cCriteria are expressed as dissolved.

^dCriteria are expressed as dissolved and are a function of total hardness (mg/L). Criteria displayed correspond to a total hardness of 100 mg/L.

^eCriteria are expressed as a function of pH; values shown correspond to a pH of 7.8.

Abbreviations

TDEC = Tennessee Department of Environment and Conservation

EPA = US Environmental Protection Agency