

**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	DCS ^c
²⁴¹ Am		170
²¹⁴ Bi		260,000
¹⁰⁹ Cd		16,000
¹⁴³ Ce		26,000
⁶⁰ Co		7,200
⁵¹ Cr		790,000
¹³⁷ Cs		3,000
¹⁵⁵ Eu		87,000
Gross alpha ^d	15	
Gross beta (mrem/year)	4	
³ H		1,900,000
¹³¹ I		1,300
⁴⁰ K		4,800
²³⁷ Np		320
^{234m} Pa		71,000
²³⁸ Pu		150
^{239/240} Pu		140
²²⁶ Ra		87
²²⁸ Ra		25
¹⁰⁶ Ru		4,100
⁹⁰ Sr		1,100
⁹⁹ Tc		44,000
²²⁸ Th		340
²³⁰ Th		160
²³² Th		140
²³⁴ Th		8,400
²³⁴ U		680
²³⁵ U		720
²³⁶ U		720
²³⁸ U		750

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

^b40 *Code of Federal Regulations* 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.

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

^dExcludes radon and uranium.

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
Aldicarb	3 (E1)			
Aldicarb sulfoxide	4 (E1)			
Aldicarb sulfone	2 (E1)			
Aluminum	200 (E2)			
Anthracene				8,300, 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	2,000 (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				1,400, 65,000
Bis(2-ethylhexyl) phthalate (c)				12, 22
Bis (Chloromethyl) ether (c)				12, 22
Bromate	10 (E1)			
Bromoform (c)				43, 1,400
Butylbenzyl phthalate				1,500, 1,900
Cadmium	5 (E1, T)	2.0 ^d	0.25 ^d	
Carbofuran	40 (E1, T)			
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)	4,000 (E1)	19	11	
Chlorite	1,000 (E1)			
Chlorobenzene				130, 1,600
Chlorodibromomethane (c)				4.0, 130
Chloroform (c)				57, 4,700
Chloramines (as Cl2)	4,000 (E1)			
Chlorine dioxide (as Cl2)	800 (E1)			

Table C.2. TDEC and EPA nonradiological water quality standards and criteria (µg/L) (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	
2-Chloronaphthalene				1,000, 1,600
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	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	1,000 (E2) 1,300 (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, 1,300
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, 7,100
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 (b)(c)		0.24	0.056	0.00052, 0.00054
Diethyl phthalate				17,000, 44,000
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

Table C.2. TDEC and EPA nonradiological water quality standards and criteria (µg/L) (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	
Dimethylphenols				380, 850
Di-n-butyl phthalate				2,000, 4,500
2,4-Dinitrophenol				69, 5,300
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)			530, 2100
Ethylene dibromide	0.05 (E1, T)			
Fluoranthene				130, 140
Fluorene				1,100, 5,300
Fluoride	2,000 (E2) 4,000 (E1,T)			
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 (b)(c)	1 (E1, T)			0.0028, 0.0029
Hexachlorobutadiene (b)(c)				4.4, 180
Hexachlorocyclopentadiene	50 (E1, T)			40, 1,100
Hexachloroethane (c)				14, 33
Ideno(1,2,3-cd)pyrene (c)				0.038, 0.18
Iron	300 (E2)			
Isophorone (c)				350, 9,600
Lead	15 (E1 "Action Level")	65 ^d	2.5 ^d	
Lindane	0.2 (T)			
Malathion			0.1	
Manganese	50 (E2)			
Mercury (inorganic) ^c	2 (E1)	1.4 ^c	0.77 ^c	0.05, 0.051
Methoxychlor	40 (E1, T)		0.03	
Methyl bromide				47, 1,500
2-Methyl-4,6-dinitrophenol				13, 280
Methylene chloride (Dichloromethane) (c)				46, 5,900
Mirex (b)			0.001	
Monochlorobenzene	100 (E1, T)			
Nickel	100 (T)	470 ^d	52 ^d	610, 4,600

Table C.2. TDEC and EPA nonradiological water quality standards and criteria (µg/L) (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	
Nitrate as N	10,000 (E1,T)			
Nitrite as N	1,000 (E1, T)			
Nitrobenzene				17, 690
Nitrosamines				0.0008, 1.24
Nitrosodibutylamine (c)				0.063, 2.2
Nitrosodiethylamine (c)				0.008, 12.4
Nitrosopyrrolidine (c)				0.16, 340
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	
Pentachlorobenzene (b)				1.4, 1.5
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, wadeable streams 6.5 to 9.0 units, larger rivers, lakes, etc.	6.0 to 9.0 units
Phenol				10,000, 860,000
Picloram	500 (E1,T)			
PCBs, total (c)	0.5 (E1, T)	–	0.014	0.00064, 0.00064
Pyrene				830, 4,000
Selenium	50 (E1, T)	20	5	170, 4,200
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
1,2,4,5-Tetrachlorobenzene (b)				0.97, 1.1
Tetrachloroethylene (c)	5 (E1, T)			6.9, 33
Thallium	2 (E1, T)			0.24, 0.47
Toluene	1,000 (E1, T)			1,300, 15,000
Total dissolved solids	500,000 (E2)			
Total Nitrate and Nitrite	10,000 as N (E1,T)			
Total trihalomethanes	80 (E1)			
Toxaphene (b)(c)	3 (E1, T)	0.73	0.0002	0.0028, 0.0028
2,4,5-TP (Silvex)	50 (E1, T)			1,800, 3,600
Tributyltin (TBT)		0.46	0.072	
1,2,4-Trichlorobenzene	70 (E1, T)			35, 70
1,1,1-Trichloroethane	200 (E1, T)			

Table C.2. TDEC and EPA nonradiological water quality standards and criteria (µg/L) (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	
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	5,000 (E2)	120 ^d	120 ^d	7,400, 26,000

^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 as (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.

Acronyms:

TDEC = Tennessee Department of Environment and Conservation

EPA = US Environmental Protection Agency