Appendix D. Reference Standards and Data for Water

Table D.1. Reference standards for radionuclides in water

Parameter[a]	National primary drinking water standard[b]	4% of DCG[c]	DCG[d]
^{241}Am		1.2	30
^{214}Bi		24,000	600,000
^{109}Cd		400	10,000
^{143}Ce		1,200	30,000
^{60}Co		200	5,000
^{51}Cr		40,000	1,000,000
^{137}Cs		120	3,000
^{155}Eu		4,000	100,000
Gross alpha[e]	15		
Gross beta (mrem/year)	4[f]		
^{3}H	20,000[g]	80,000	2,000,000
^{131}I		120	3,000
^{40}K		280	7,000
^{237}Np		1.2	30
^{234m}Pa		2,800	70,000
^{238}Pu		1.6	40
$^{239/240}$Pu		1.2	30
^{226}Ra	5[h]	4	100
^{228}Ra	5[h]	4	100
^{106}Ru		240	6,000
^{90}Sr	8[g]	40	1,000
^{99}Tc		4,000	100,000
^{228}Th		16	400
^{230}Th		12	300
^{232}Th		2	50
^{234}Th		400	10,000
Thorium, natural		2	50
^{234}U		20	500
^{235}U		24	600
^{236}U		20	500
^{238}U		24	600
Uranium, natural		24	600
Uranium, total[i] (μg/L[j])	30	20	500

[a]Only the radionuclides included in the Oak Ridge Reservation monitoring programs are listed. Unless labeled otherwise, units are pCi/L.

[b]40 CFR Part 141, National Primary Drinking Water Regulations Subparts B and G. The drinking water standards are presented strictly for reference purposes and only have regulatory applicability for public water supplies.

[c]Four percent of the derived concentration guide represents the DOE criterion of 4-mrem effective dose equivalent from ingestion of drinking water.

[d]DOE Order 5400.5 Chap. III, "Derived Concentration Guides for Air and Water."

[e]Excludes radon and uranium.

[f]Per the discussion in 40 CFR 141.66(b), compliance with the 4-mrem/year standard can be assumed if the average annual gross beta particle activity is less than 50 pCi/L and if the average annual concentrations of ^{3}H and ^{90}Sr are less than 20,000 pCi/L and 8 pCi/L, respectively, provided that, if both radionuclides are present, the sum of their annual dose equivalents to bone marrow is less than 4 mrem/year. In the text of this document, 50 pCi/L is referred to as the "screening level."

[g]These 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.

[h]Applies to combined ^{226}Ra and ^{228}Ra.

[i]Minimum of uranium isotopes.

[j]Effective December 8, 2003.

Table D.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				190, 290
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 per liter (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
Bromoform (c)				43, 1400
Butylbenzyl phthalate				1500, 1900
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)	4000 (E1)	19	11	
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, *E. coli*, geometric mean (T); No more than 5% of samples per month can be positive for total coliforms (E1)	2880/100 mL, *E. coli*	630/100 mL, *E. coli*	126/100 mL, geometric mean, *E. coli* 487, maximum lakes/reservoirs, *E. coli* 941, maximum, other water bodies, *E. coli*

Table D.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	
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 (Dichlorophennoxyacetic 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)			
Dibenz(a,h)anthracene (c)				0.038, 0.18
1,2-dibromo-3-chloropropane (DBCP)	0.2 (E1, T)			
1,2-Dichlorobenzene (*ortho*-)	600 (E1, T)			420, 1300
1,3-Dichlorobenzene(*meta*-)				320, 960
1,4-Dichlorobenzene(*para*-)	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
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

Table D.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	
Fluoride	2000 (E2) 4000 (E1)			
Foaming agents	500 (E2)			
Glyphosate	700 (E1, T)			
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
Indeno(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]	
Manganese	50 (E2)			
Mercury (inorganic)[c]	2 (E1, T)	1.4[c]	0.77[c]	0.05, 0.051
Methyl bromide				47, 1500
2-Methyl-4,6-dinitrophenol				13, 280
Methylene chloride (Dichloromethane) (c)				46, 5900
Nickel	100 (T)	470[d]	52[d]	610, 4600
Nitrate as N	10,000 (E1)			
Nitrite as N	1000 (E1)			
Nitrobenzene				17, 690
N-Nitrosodimethylamine (c)				0.0069, 30
N-Nitrosodi-n-propylamine (c)				0.05, 5.1
N-Nitrosodiphenylamine (c)				33, 60
Odor	3 threshold odor number (E2)			
Oxamyl (Vydate)	200 (E1, T)			
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				21,000, 1,700,000
PCBs, total (c)	0.5 (E1, T)	–	0.014	0.00064, 0.00064
Pyrene				830, 4000
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

Table D.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	
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]	

[a]E1 = EPA Primary Drinking Water Standards; E2 = EPA Secondary Drinking Water Standards; T = TDEC domestic water supply criteria.

[b]For each parameter, the first recreational criterion is for "water and organisms" and is applicable on the ORR only to the Clinch River because the Clinch is the only stream on the ORR which 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 the 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.]

[c]Criteria are expressed as dissolved.

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

[e]Criteria are expressed as a function of pH; values shown correspond to a pH of 7.8.