

## **Appendix D. Reference Standards and Data for Water**



**Table D.1. Reference standards for radionuclides in water**

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

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

<sup>b</sup>40 CFR Part 141 National Primary Drinking Water Regulations Subparts B and G.

<sup>c</sup>Four percent of the derived concentration guide represents the DOE criterion of 4 mrem effective dose equivalent from ingestion of drinking water.

<sup>d</sup>DOE Order 5400.5 Chapter III, "Derived Concentration Guides for Air and Water."

<sup>e</sup>Excludes radon and uranium.

<sup>f</sup>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 <sup>3</sup>H and <sup>90</sup>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."

<sup>g</sup>These values are not maximum contaminant levels (MCLs), but are concentrations that result in the effective dose equivalent of the MCL for gross beta emissions, which is 4 mrem/year.

<sup>h</sup>Applies to combined <sup>226</sup>Ra and <sup>228</sup>Ra.

<sup>i</sup>Minimum of uranium isotopes.

<sup>j</sup>Effective December 8, 2003.

Table D.2. Reference standards for chemicals and metals in water

Parameter	National drinking water standards		Tennessee water quality criteria <sup>c</sup>				
	Primary <sup>a</sup>	Secondary <sup>b</sup>	Domestic water supply	Fish and aquatic life		Recreation	
				CMC	CCC	Organisms	Water and organisms <sup>d</sup>
Anions (mg/L)							
Chloride		250					
Fluoride	4	2					
Nitrate	10						
Nitrite	1						
Sulfate, as SO <sub>4</sub>		250					
<b>Base/neutral/acid extractable organics (µg/L)</b>							
1,2-Dichlorobenzene ( <i>ortho</i> )	600		600			17,000	2,700
1,2-Diphenylhydrazine						2.0	0.36
1,2,4-Trichlorobenzene	70		70			940	260
1,3-Dichlorobenzene ( <i>meta</i> )						960	320
1,4-Dichlorobenzene ( <i>para</i> )	75		75			2,600	400
2,4-Dichlorophenol						290	77
2,4-Dimethylphenol						850	380
2,4-Dinitrophenol						5,300	69
2,4-Dinitrotoluene						34	1.1
2,4,6-Trichlorophenol						24	14
2-Chlorophenol						150	81
2-Chloronaphthalene						1,600	1,000
2-Methyl-4,6-Dinitrophenol						280	13
3,3-Dichlorobenzidine						0.28	0.21
3,4-Benzo(b)fluoranthene						0.18	0.038
Benzo(k)fluoranthene						0.18	0.038
Acenaphthene						990	670
Anthracene						40,000	8,300
Benzidine						0.0020	0.00086
Benzo(a)anthracene						0.18	0.038
Benzo(a)pyrene	0.2		0.2			0.18	0.038
bis-(2-chloroethyl)ether						5.3	0.30
bis-(2-Chloro-isopropyl)ether						65,000	1,400
bis-(2-ethylhexyl)phthalate	6		6			22	12
Butylbenzyl phthalate						1,900	1,500
Chrysene						0.18	0.038
Di-n-butyl phthalate						4,500	2,000
Dibenz(a,h)anthracene						0.18	0.038
Diethyl phthalate						44,000	17,000
Dimethyl phthalate						1,100,000	270,000
Fluoranthene						140	130
Fluorene						5,300	1,100
Hexachlorobenzene	1		1			0.0029	0.0028
Hexachlorobutadiene						180	4.4
Hexachlorocyclopentadiene	50		50			17,000	240

Table D.2 (continued)

Parameter	National drinking water standards		Tennessee water quality criteria <sup>c</sup>				
	Primary <sup>a</sup>	Secondary <sup>b</sup>	Domestic water supply	Fish and aquatic life		Recreation	
				CMC	CCC	Organisms	Water and organisms <sup>d</sup>
Hexachloroethane						33	14
Ideno(1,2,3-cd)pyrene						0.18	0.038
Isophorone						9,600	350
N-Nitrosodimethylamine				19		30	0.0069
N-Nitrosodi-n-propylamine						5.1	0.05
N-Nitrosodiphenylamine						60	33
Nitrobenzene						690	17
Pentachlorophenol (pH 7.8)	1		1			30	2.7
Phenol						1,700,000	21,000
Pyrene						4,000	830
<b>Field measurements</b>							
Chlorine, (TRC), µg/L				19			
Dissolved oxygen, mg/L				5		(min)	
Temperature, µC			30.5	30.5		30.5	30.5
Turbidity, JTU <sup>e</sup>	1						
pH, standard units		(6.5, 8.5)	(6.0, 9.0)	(6.0, 9.0)		(5.5, 9.0)	(5.5, 9.0)
<b>Metals (mg/L)</b>							
Aluminum		0.05–0.2					
Antimony	0.006		0.006			0.64	0.0056
Arsenic	0.01 <sup>f</sup>		0.010	0.340 (III)	0.15	0.010	0.010
Barium	2		2				
Beryllium	0.004		0.004				
Cadmium	0.005		0.005	0.002 <sup>g</sup>	0.00025		
Chromium, total	0.1		0.1				
Chromium (hexavalent)				0.016	0.010		
Copper	1.3 <sup>h</sup>	1		0.013 <sup>g</sup>	0.009		
Iron		0.3					
Lead	0.015 <sup>h</sup>		0.005	0.065 <sup>g</sup>	0.0025		
Manganese		0.05					
Mercury	0.002		0.002	0.0014	0.00077	0.000051	0.00005
Nickel			0.1	0.470 <sup>g</sup>	0.052	4.6	0.61
Selenium	0.05		0.050	0.02	0.005		
Silver		0.1		0.0032 <sup>g</sup>			
Thallium	0.002		0.002			0.0063	0.0017
Zinc		5		0.120 <sup>g</sup>	0.120		
<b>Others</b>							
Asbestos (fibers/L)	7,000,000						
Chlorine (TRC)				0.019			
Color (color units)		15					
Cyanide (mg/L)	0.2		0.2	0.022		220	0.7
<i>E. coli</i> (no./100 mL, geometric mean)			630	630		126	126
<i>E. coli</i> (no./100 mL, individual sample)				2,880		941	941

Table D.2 (continued)

Parameter	National drinking water standards		Tennessee water quality criteria <sup>c</sup>				
	Primary <sup>a</sup>	Secondary <sup>b</sup>	Domestic water supply	Fish and aquatic life		Recreation	
				CMC	CCC	Organisms	Water and organisms <sup>d</sup>
Odor (threshold odor number)		3					
Total dissolved solids (mg/L)		500	500				
<b>Pesticides/herbicides/PCBs (µg/L)</b>							
2,3,7,8-TCDD (Dioxin)	0.00003		0.00003			0.000001	0.000001
2,4-D	70		70				
2,4,5-TP (Silvex)	50		50				
4,4'-DDT				1.1		0.0022	0.0022
4,4'-DDE						0.0022	0.0022
4,4'-DDD						0.0031	0.0031
a-BHC						0.049	0.026
b-BHC						0.17	0.091
Alachlor	2		2				
Aldrin				3.0		0.00050	0.00049
Atrazine	3		3				
Carbofuran	40		40				
Chlordane	2		2	2.4		0.0081	0.0080
Dalapon	200		200				
1,2-Dibromo-3-chloropropane	0.2		0.2				
Di(ethylhexyl)adipate	400		400				
Dieldrin				0.24		0.00054	0.00052
Di(ethylhexyl)phthalate <sup>i</sup>							
Dinoseb	7		7				
Diquat	20		20				
a-Endosulfan				0.22		89	62
b-Endosulfan				0.22		89	62
Endosulfan sulfate						89	62
Endothall	100		100				
Endrin	2		2	0.086		0.81	0.76
Endrin aldehyde						0.30	0.29
Ethylene dibromide	0.05		0.05				
Glyphosate	700		700				
Heptachlor	0.4		0.4	0.52		0.00079	0.00079
Heptachlor epoxide	0.2		0.2	0.52		0.00039	0.00039
g-BHC (Lindane)	0.2		0.2	2.0		0.63	0.19
Methoxychlor	40		40				
Oxamyl (Vydate)	200		200				
PCB Aroclors (EPA 119-125)						0.00064	0.00064

Table D.2 (continued)

Parameter	National drinking water standards		Tennessee water quality criteria <sup>c</sup>				
	Primary <sup>a</sup>	Secondary <sup>b</sup>	Domestic water supply	Fish and aquatic life		Recreation	
				CMC	CCC	Organisms	Water and organisms <sup>d</sup>
PCB, total	0.5		0.5			0.00064	0.00064
Picloram	500		500				
Simazine	4		4				
Toxaphene	3		3	0.73		0.0028	0.0028
1,1,1-Trichloroethane	200		200				
1,1-Dichloroethene	7		7			32	0.57
1,1,2-Trichloroethane	5		5			160	5.9
<b>Volatile organics (µg/L)</b>							
1,1,2,2-Tetrachloroethane						40	1.7
1,2-Dichloroethane	5		5			370	3.8
1,2-Dichloroethene <sup>i</sup>							
<i>cis</i> -1,2-Dichloroethene	70		70				
<i>trans</i> -1,2-Dichloroethene	100		100			140,000	700
1,2-Dichloropropane	5		5			150	5.0
<i>cis</i> -1,3-Dichloropropene						1,700	10
<i>trans</i> -1,3-Dichloropropene						1,700	10
Acrolein						290	190
Acrylonitrile						2.5	0.51
Benzene	5		5			510	22
Bromodichloromethane	80 <sup>k</sup>					170	5.5
Bromoform	80 <sup>k</sup>					1,400	43
Carbon tetrachloride	5		5			16	2.3
Chlorobenzene	100		100			21,000	680
Chloroform	80 <sup>k</sup>					4,700	57
Dibromochloromethane	80 <sup>k</sup>					130	4.0
Ethylbenzene	700		700			29,000	3,100
Methylbromide						1,500	47
Methylene chloride (Dichloromethane)	5		5			5,900	46
Styrene	100		100				
Tetrachloroethene	5		5			33	6.9
Toluene	1,000		1,000			200,000	6,800
Trichloroethene	5		5			300	25

**Table D.2 (continued)**

Parameter	National drinking water standards		Tennessee water quality criteria <sup>c</sup>				
	Primary <sup>a</sup>	Secondary <sup>b</sup>	Domestic water supply	Fish and aquatic life		Recreation	
				CMC	CCC	Organisms	Water and organisms <sup>d</sup>
Trihalomethanes, total	80 <sup>k</sup>						
Vinyl chloride	2		2			5,300	20
Xylene, total	10,000		10,000				

<sup>a</sup>40 CFR Part 141—National Primary Drinking Water Regulations, Subparts B and G, as amended.

<sup>b</sup>40 CFR Part 143—National Secondary Drinking Water Regulations, as amended.

<sup>c</sup>Rules of Tennessee Department of Environment and Conservation, Division of Water Pollution Control, Chapter 1200-4-3, General Water Quality Criteria, as amended. CMC = criterion maximum concentration; CCC= continuous concentration criteria.

<sup>d</sup>These criteria, for the protection of public health, pertain to the consumption of water and organisms. They apply only to waters designated for both recreation and domestic water supply.

<sup>e</sup>Jackson turbidity unit (JTU) and nephelometric turbidity unit (NTU) are roughly equivalent in the range of 25 to 1000 JTU.

<sup>f</sup>As of January 23, 2006.

<sup>g</sup>The standard is a function of total hardness. The values in this table correspond to a total-hardness value of 100 mg/L.

<sup>h</sup>“Action level” for initiation of corrosion-control studies and treatment techniques, applicable to community water systems and nontransient, noncommunity water systems.

<sup>i</sup>See bis(2-ethylhexyl)phthalate.

<sup>j</sup>See cis-1,2-Dichloroethene and trans-1,2-Dichloroethene.

<sup>k</sup>Limit for total trihalomethanes (bromodichloromethane + bromoform + chloroform + dibromochloromethane).