

**333-061-0036**

**Sampling and Analytical Requirements**

Table 14

A	B	C	Designation	Sample Location
Y	Y	Y	EP for wellfield	Most susceptible well Entry point
Y	Y	N	Wellfield	Entry point for most susceptible well
N	Y	Y	EP for wellfield	Entry point for wellfield
Y	N	Y	EP for wells (not a wellfield)	Entry point
N	N	Y	EP for wells (not a wellfield)	Entry point
Y	N	N	Separate (not a wellfield)	Each entry point separately
N	Y	N	Separate (not a wellfield)	Each entry point separately
N	N	N	Separate (not a wellfield)	Each entry point separately

Note: A: wells are within 2,500 feet of each other; B: wells are in the same and no other aquifer;  
C: wells have a common entry point to the distribution system and pump simultaneously.

Table 15

Contaminant	Detection Limit (mg/l)
Alachlor	0.0002
Atrazine	0.0001
Benzo(a) pyrene	0.00002
Carbofuran	0.0009
Chlordane	0.0002
Dalapon	0.001
Di(2-ethylhexyl) adipate	0.0006
Di(2-ethylhexyl) phthalate	0.0006
Dibromochloropropane (DBCP)	0.00002
Dinoseb	0.0002
Dioxin (2,3,7,8-TCDD)	0.000000005
Diquat	0.0004
Endothall	0.009
Endrin	0.00001
Ethylene Dibromide (EDB)	0.00001
Glyphosate	0.006

Heptachlor	0.00004
Heptachlor Epoxide	0.00002
Hexachlorobenzene	0.0001
Hexachlorocyclopentadiene	0.0001
Lindane(BHC-g)	0.00002
Methoxychlor	0.0001
Oxamyl (Vydate)	0.002
Picloram	0.0001
Polychlorinated Biphenyls (PCBs), as Decachlorobiphenyl	0.0001
Pentachlorophenol	0.00004
Simazine	0.00007
Toxaphene	0.001
2,4-D	0.0001
2,4,5-TP (Silvex)	0.0002

Table 16

Source water type	Population and category	Monitoring periods and frequency of sampling	Distribution system monitoring locations				
			Total per monitoring period	Near entry points	Average residence time	High TTHM locations	High HAA5 locations
Surface water or GWUDI:	< 500 purchasing water systems	One (during peak historical month) <sup>1</sup>	2	1		1	
	< 500 non-purchasing water systems	One (during peak historical month) <sup>1</sup>	2			1	1
	500-3,300 purchasing water systems	four (every 90 days)	2	1		1	
	500-3,300 non-purchasing water systems	four (every 90 days)	2			1	1
	3,301-9,999	four (every 90 days)	4		1	2	1
	10,000-49,999	six (every 60 days)	8	1	2	3	2
	50,000-249,999	six (every 60 days)	16	3	4	5	4
	250,000-999,999	six (every 60 days)	24	4	6	8	6

	1,000,000-4,999,999	six (every 60 days)	32	6	8	10	8
	≥5,000,000	six (every 60 days)	40	8	10	12	10
Ground-water:	< 500 purchasing water systems	one (during peak historical month) <sup>1</sup>	2	1		1	
	< 500 non-purchasing water systems	one (during peak historical month) <sup>1</sup>	2			1	1
	500-9,999	four (every 90 days)	2			1	1
	10,000-99,999	four (every 90 days)	6	1	1	2	2
	100,000-499,999	four (every 90 days)	8	1	1	3	3
	≥500,000	four (every 90 days)	12	2	2	4	4

<sup>1</sup> Peak historical month refers to the month with the highest TTHM or HAA5 levels, or the month of warmest water temperature.

Table 17

Source water type	Population	Monitoring frequency <sup>1</sup>	Distribution system monitoring location		
			Total per monitoring period <sup>2</sup>	Highest TTHM locations	Highest HAA5 locations
Surface water systems or GWUDI	< 500	per year	2	1	1
	500-3,300	per quarter	2	1	1
	3,301-9,999	per quarter	2	1	1
	10,000-49,999	per quarter	4	2	2
	50,000-249,999	per quarter	8	4	4
	250,000-999,999	per quarter	12	6	6
	1,000,000-4,999,999	per quarter	16	8	8
	≥5,000,000	per quarter	20	10	10
Groundwater	< 500	per year	2	1	1
	500-9,999	per year	2	1	1
	10,000-99,999	per quarter	4	2	2
	100,000-499,999	per quarter	6	3	3

	≥500,000	per quarter	8	4	4
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<sup>1</sup> All water systems must monitor during month of highest DBP concentrations.

<sup>2</sup> Water systems on quarterly monitoring must collect dual sample sets every 90 days at each monitoring location, except for surface water or groundwater under the direct influence of surface water systems serving 500-3,300. Groundwater systems serving 500-9,999 on annual monitoring must collect dual sample sets at each monitoring location. All other water systems on annual monitoring, and systems using surface water or groundwater under the direct influence of surface water serving 500-3,300 are required to collect individual TTHM and HAA5 samples at the locations with the highest TTHM and HAA5 concentrations. Systems using surface water or groundwater under the direct influence of surface water serving 500-3,300 may collect one dual sample set per monitoring period if the highest TTHM and HAA5 concentrations occur at the same location. For systems serving fewer than 500 people, only one location with a dual sample set per monitoring period is needed if the highest TTHM and HAA5 concentrations occur at the same location, and month.

Table 18			
Source water type	Population size category	Monitoring Frequency <sup>1</sup>	Distribution system monitoring location total per monitoring period <sup>2</sup>
Surface water systems or GWUDI:	< 500	per year	2
	500-3,300	per quarter	2
	3,301-9,999	per quarter	2
	10,000-49,999	per quarter	4
	50,000-249,999	per quarter	8
	250,000-999,999	per quarter	12
	1,000,000-4,999,999	per quarter	16
Groundwater:	≥5,000,000	per quarter	20
	< 500	per year	2
	500-9,999	per year	2
	10,000-99,999	per quarter	4
	100,000-499,999	per quarter	6
	≥500,000	per quarter	8

<sup>1</sup> All systems must monitor during month of highest DBP concentrations.

<sup>2</sup> Water systems on quarterly monitoring must collect dual sample sets every 90 days at each monitoring location, except for surface water or groundwater under the direct influence of surface water systems serving 500-3,300. Groundwater systems serving 500-9,999 on annual monitoring must collect dual sample sets at each monitoring location. All other water systems on annual monitoring, and systems using surface water or groundwater under the direct influence of surface water serving 500-3,300 are required to collect individual TTHM and HAA5 samples at

the locations with the highest TTHM and HAA5 concentrations. Systems using surface water or groundwater under the direct influence of surface water serving 500-3,300 may collect one dual sample set per monitoring period if the highest TTHM and HAA5 concentrations occur at the same location. For systems serving fewer than 500 people, only one location with a dual sample set per monitoring period is needed if the highest TTHM and HAA5 concentrations occur at the same location, and month.

Table 19

Source water type	Population size category	Monitoring frequency <sup>1</sup>	Distribution system monitoring location per monitoring period
Surface water or GWUDI:	< 500		Monitoring may not be reduced.
	500-3,300	per year	One TTHM sample at the location and during the quarter with the highest TTHM single measurement, and one HAA5 sample at the location and during the quarter with the highest HAA5 single measurement; or one dual sample set per year if the highest TTHM and HAA5 measurements occurred at the same location and during the same quarter.
	3,301-9,999	per year	2 dual sample sets, one at the location and during the quarter with the highest TTHM single measurement, one at the location and during the quarter with the highest HAA5 single measurement.
	10,000-49,999	per quarter	2 dual sample sets, one each at the locations with the highest TTHM and highest HAA5 LRAAs.
	50,000-249,999	per quarter	4 dual sample sets at the locations with the two highest TTHM and two highest HAA5 LRAAs.
	250,000-999,999	per quarter	6 dual sample sets at the locations with the three highest TTHM and three highest HAA5 LRAAs.
	1,000,000-4,999,999	per quarter	8 dual sample sets at the locations with the four highest TTHM and four highest HAA5 LRAAs.
	≥5,000,000	per quarter	10 dual sample sets—at the locations with the five highest TTHM and five highest HAA5 LRAAs.
Groundwater:	< 500	every third year	One TTHM sample at the location and during the quarter with the highest TTHM single measurement, and one HAA5 sample at the location and during the quarter with the highest HAA5 single measurement; or one dual sample set per year if the highest TTHM and HAA5 measurements occurred at the same location and during the same quarter.

	500-9,999	per year	One TTHM sample at the location and during the quarter with the highest TTHM single measurement, and one HAA5 sample at the location and during the quarter with the highest HAA5 single measurement; or one dual sample set per year if the highest TTHM and HAA5 measurements occurred at the same location and during the same quarter.
	10,000-99,999	per year	2 dual sample sets: one at the location and during the quarter with the highest TTHM single measurement, one at the location and during the quarter with the highest HAA5 single measurement.
	100,000-499,999	per quarter	2 dual sample sets; at the locations with the highest TTHM and highest HAA5 LRAAs.
	≥500,000	per quarter	4 dual sample sets at the locations with the two highest TTHM and two highest HAA5 LRAAs.

<sup>1</sup> Systems on quarterly monitoring must take dual sample sets every 90 days.

Table 20	
Population Served:	Samples Per Week:
500 or less	1
501 to 3,300	2
3,301 to 10,000	3
10,001 to 25,000	4
More than 25,000.	5

Table 21

CT Values (CT <sub>99.9</sub> ) for 99.9 Percent Inactivation of <i>Giardia Lamblia</i> Cysts by Free Chlorine at 0.5 °C(33°F) or Lower <sup>1</sup>							
Free residual (mg/l)	pH						
	≤6.0	6.5	7.0	7.5	8.0	8.5	≤9.0
≤0.4	137	163	195	237	277	329	390
0.6	141	168	200	239	286	342	407
0.8	145	172	205	246	295	354	422
1.0	148	176	210	253	304	365	437
1.2	152	180	215	259	313	376	451
1.4	155	184	221	266	321	387	464
1.6	157	189	226	273	329	397	477
1.8	162	193	231	279	338	407	489
2.0	165	197	236	286	345	417	500

2.2	169	201	242	297	353	426	511
2.4	172	205	247	298	361	435	522
2.6	175	209	252	304	368	444	533
2.8	178	213	257	310	375	452	543
3.0	181	217	261	316	382	460	552

<sup>1</sup> These CT values achieve greater than a 99.99 percent inactivation of viruses. CT values between the indicated pH values may be determined by linear interpolation. CT values between the indicated temperatures of different tables may be determined by linear interpolation. If no interpolation is used, use the CT<sub>99.9</sub> values at the lower temperature and at the higher pH.

Table 22

CT Values (CT <sub>99.9</sub> ) Percent Inactivation of <i>Giardia Lamblia</i> Cysts by Free Chlorine at 5.0 °C(41°F) <sup>1</sup>							
Free residual (mg/l)	pH						
	≤6.0	6.5	7.0	7.5	8.0	8.5	≤9.0
≤0.4	97	117	139	166	198	236	279
0.6	100	120	143	171	204	244	291
0.8	103	122	146	175	210	252	301
1.0	105	125	149	179	216	260	312
1.2	107	127	152	183	221	267	320
1.4	109	130	155	187	227	274	329
1.6	111	132	158	192	232	281	337
1.8	114	135	162	196	238	287	345
2.0	116	138	165	200	243	294	353
2.2	118	140	169	204	248	300	361
2.4	120	143	172	209	253	306	368
2.6	122	149	175	213	258	312	375
2.8	124	148	178	217	263	318	382
3.0	126	151	182	221	268	324	389

<sup>1</sup> These CT values achieve greater than a 99.99 percent inactivation of viruses. CT values between the indicated pH values may be determined by linear interpolation. CT values between the indicated temperatures of different tables may be determined by linear interpolation. If no interpolation is used, use the CT<sub>99.9</sub> value at the lower temperature, and at the higher pH.

Table 23

CT Values (CT <sub>99.9</sub> ) for 99.9 Percent Inactivation of <i>Giardia Lamblia</i> Cysts by Free Chlorine at 10.0 °C(50°F) <sup>1</sup>							
Free residual (mg/l)	pH						
	≤6.0	6.5	7.0	7.5	8.0	8.5	≤9.0
≤0.4	73	88	104	125	149	177	209
0.6	75	90	107	128	153	183	218

0.8	78	92	110	131	158	189	226
1.0	79	94	112	134	162	195	234
1.2	80	95	114	137	166	200	240
1.4	82	98	116	140	170	206	247
1.6	83	99	119	144	174	211	253
1.8	86	101	122	147	179	215	259
2.0	87	104	124	150	182	221	265
2.2	89	105	127	153	186	225	271
2.4	90	107	129	157	190	230	276
2.6	92	110	131	160	194	234	281
2.8	93	111	134	163	197	239	287
3.0	95	113	137	166	201	243	292

<sup>1</sup> These CT values achieve greater than a 99.99 percent inactivation of viruses. CT values between the indicated pH values may be determined by linear interpolation. CT values between the indicated temperatures of different tables may be determined by linear interpolation. If no interpolation is used, use the CT<sub>99.9</sub> value at the lower temperature, and at the higher pH.

Table 24

CT Values (CT <sub>99.9</sub> ) for 99.9 Percent Inactivation of <i>Giardia Lamblia</i> Cysts by Free Chlorine at 15.0 °C(59°F) <sup>1</sup>							
Free residual (mg/l)	pH						
	≤6.0	6.5	7.0	7.5	8.0	8.5	≤9.0
≤0.4	49	59	70	83	99	118	140
0.6	50	60	72	86	102	122	146
0.8	52	61	73	88	105	126	151
1.0	53	63	75	90	108	130	156
1.2	54	64	76	92	111	134	160
1.4	55	65	78	94	114	137	165
1.6	56	66	79	96	116	141	169
1.8	57	68	81	98	119	144	173
2.0	58	69	83	100	122	147	177
2.2	59	70	85	102	124	150	181
2.4	60	72	86	105	127	153	184
2.6	61	73	88	107	129	156	188
2.8	62	74	89	109	132	159	191
3.0	63	76	91	111	134	162	195

<sup>1</sup> These CT values achieve greater than a 99.99 percent inactivation of viruses. CT values between the indicated pH values may be determined by linear interpolation. CT values between the indicated temperatures of different tables may be determined by linear interpolation. If no interpolation is used, use the CT<sub>99.9</sub> value at lower temperature, and at the higher pH.

Table 25

CT Values (CT <sub>99.9</sub> ) for 99.9 Percent Inactivation of <i>Giardia Lamblia</i> Cysts
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by Free Chlorine at 20 °C(68°F) <sup>1</sup>							
Free residual (mg/l)	pH						
	≤6.0	6.5	7.0	7.5	8.0	8.5	≤9.0
≤0.4	36	44	52	62	74	89	105
0.6	38	45	54	64	77	92	109
0.8	39	46	55	66	79	95	113
1.0	39	47	56	67	81	98	117
1.2	40	48	57	69	83	100	120
1.4	41	49	58	70	85	103	123
1.6	42	50	59	72	87	105	126
1.8	43	51	61	74	89	108	129
2.0	44	52	62	75	91	110	132
2.2	44	53	63	77	93	113	135
2.4	45	54	65	78	95	115	138
2.6	46	55	66	80	97	117	141
2.8	47	56	67	81	99	118	143
3.0	47	57	68	83	101	122	146

<sup>1</sup> These CT values achieve greater than a 99.99 percent inactivation of viruses. CT values between the indicated pH values may be determined by linear interpolation. CT values between the indicated temperatures of different tables may be determined by linear interpolation. If no interpolation is used, use the CT<sub>99.9</sub> value at the lower temperature, and at the higher pH.

Table 26

CT Values (CT <sub>99.9</sub> ) for 99.9 Percent Inactivation of <i>Giardia Lamblia</i> Cysts by Free Chlorine at 25 °C(77°F) <sup>1</sup> and Higher							
Free residual (mg/l)	pH						
	≤6.0	6.5	7.0	7.5	8.0	8.5	≤9.0
≤0.4	24	29	35	48	50	59	70
0.6	25	30	36	43	51	61	73
0.8	26	31	37	44	53	63	75
1.0	26	31	37	45	54	65	78
1.2	27	32	38	46	55	67	80
1.4	27	33	39	47	57	69	82
1.6	28	33	40	48	58	70	84
1.8	29	34	41	49	60	72	86
2.0	29	35	41	50	61	74	88
2.2	30	35	42	51	62	75	90
2.4	30	36	43	52	63	77	92
2.6	31	37	44	53	65	78	94
2.8	31	37	45	54	66	80	96
3.0	32	38	46	55	67	81	97

<sup>1</sup> These CT values achieve greater than a 99.99 percent inactivation of viruses. CT values between the indicated pH values may be determined by linear interpolation. CT values between

the indicated temperatures of different tables may be determined by linear interpolation. If no interpolation is used, use the CT<sub>99.9</sub> value at the lower temperature, and at the higher pH.

Table 27

-CT Values (CT <sub>99.9</sub> ) Percent Inactivation of <i>Giardia Lamblia</i> Cysts by Chlorine Dioxide and Ozone <sup>1</sup>						
Temperature						
	<1°C	5 °C	10 °C	15 °C	20 °C	>25 °C
Chlorine dioxide	63	26	23	19	15	11
Ozone	2.9	1.9	1.4	0.95	0.72	0.48

<sup>1</sup> These CT values achieve greater than 99.99 percent inactivation of viruses. CT values between the indicated temperatures may be determined by linear interpolation. If no interpolation is used, use the CT<sub>99.9</sub> value at the lower temperature for determining CT<sub>99.9</sub> values between indicated temperatures.

Table 28

CT Values (CT <sub>99.9</sub> ) for 99.9 Percent Inactivation of <i>Giardia Lamblia</i> Cysts by Chloramines <sup>1</sup>					
Temperature					
<1°C	5 °C	10 °C	15 °C	20 °C	>25 °C
3,800	2,200	1,850	1,500	1,100	750

<sup>1</sup> These values are for pH values of 6 to 9. These CT values may be assumed to achieve greater than 99.99 percent inactivation of viruses only if chlorine is added and mixed in the water prior to the addition of ammonia. If this condition is not met, the system must demonstrate, based on demonstration studies or other information, as approved by the Authority, that the system is achieving at least 99.99 percent inactivation of viruses. CT values between the indicated temperatures may be determined by linear interpolation. If no interpolation is used, use the CT<sub>99.9</sub> value at the lower temperature for determining CT<sub>99.9</sub> values between indicated temperatures.

Table 29

Population	Samples per day
1 to 500	1
501 to 1,000	2
1,001 to 2,500	3
2,501 to 3,300	4

Table 30

CT Values (mg-min/L) for *Cryptosporidium* Inactivation by Chlorine Dioxide\*

Log Credit	Water Temperature, Deg. C										
	≤0.5	1	2	3	5	7	10	15	20	25	30
0.25	159	153	140	128	107	90	69	45	29	19	12
0.5	319	305	279	256	214	180	138	89	58	38	24
1.0	637	610	558	511	429	360	277	179	116	75	49
1.5	956	915	838	767	643	539	415	268	174	113	73
2.0	1275	1220	1117	1023	858	719	553	357	232	150	98
2.5	1594	1525	1396	1278	1072	899	691	447	289	188	122
3.0	1912	1830	1675	1534	1286	1079	830	536	347	226	147

\*Systems may use this equation to determine log credit between the indicated values:  
 $\text{Log credit} = (0.001506 \times (1.09116)^{(\text{temp})}) \times \text{CT}$ .

Table 31

CT Values (mg-min/L) for *Cryptosporidium* Inactivation by Ozone\*

Log Credit	Water Temperature, Deg. C										
	≤0.5	1	2	3	5	7	10	15	20	25	30
0.25	6.0	5.8	5.2	4.8	4.0	3.3	2.5	1.6	1.0	0.6	0.39
0.5	12	12	10	9.5	7.9	6.5	4.9	3.1	2.0	1.2	0.78
1.0	24	23	21	19	16	13	9.9	6.2	3.9	2.5	1.6
1.5	36	35	31	29	24	20	15	9.3	5.9	3.7	2.4
2.0	48	46	42	38	32	26	20	12	7.8	4.9	3.1
2.5	60	58	52	48	40	33	25	16	9.8	6.2	3.9
3.0	72	69	63	57	47	39	30	19	12	7.4	4.7

\*Systems may use this equation to determine log credit between the indicated values:  $\text{Log credit} = (0.0397 \times (1.09757)^{(\text{temp})}) \times \text{CT}$ .

Table 32

UV Dose Table for *Cryptosporidium*, *Giardia lamblia*, and Virus Inactivation Credit

Log Credit	<i>Cryptosporidium</i> UV dose (mJ/cm <sup>2</sup> )	<i>Giardia Lamblia</i> UV dose (mJ/cm <sup>2</sup> )	Virus UV dose (mJ/cm <sup>2</sup> )
0.5	1.6	1.5	39
1.0	2.5	2.1	58
1.5	3.9	3.0	79
2.0	5.8	5.2	100
2.5	8.5	7.7	121
3.0	12	11	143
3.5	15	15	163

4.0	22	22	186
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Table 33  
Total Coliform Monitoring Frequency at  
Public Water Systems Serving More Than 1,000 People

Population served	Minimum number of routine samples per month	Population served	Minimum number of routine samples per month
1,001 to 2,500	2	70,001 to 83,000	80
2,501 to 3,300	3	83,001 to 96,000	90
3,301 to 4,100	4	96,001 to 130,000	100
4,101 to 4,900	5	130,001 to 220,000	120
4,901 to 5,800	6	220,001 to 320,000	150
5,801 to 6,700	7	320,001 to 450,000	180
6,701 to 7,600	8	450,001 to 600,000	210
7,601 to 8,500	9	600,001 to 780,000	240
8,501 to 12,900	10	780,001 to 970,000	270
12,901 to 17,200	15	970,001 to 1,230,000	300
17,201 to 21,500	20	1,230,001 to 1,520,000	330
21,501 to 25,000	25	1,520,001 to 1,850,000	360
25,001 to 33,000	30	1,850,001 to 2,270,000	390
33,001 to 41,000	40	2,270,001 to 3,020,000	420
41,001 to 50,000	50	3,020,001 to 3,960,000	450
50,001 to 59,000	60	3,960,001 or more	480
59,001 to 70,000	70		

Table 34

Number of People Served by the Water System	Number of Standard Monitoring Sites	Number of Reduced Monitoring Sites
>100,000	100	<u>50</u>
10,001 to 100,000	60	<u>30</u>
3,301 to 10,000	40	<u>20</u>
501 to 3,300	20	<u>10</u>
101 to 500	10	<u>5</u>
≤100	5	<u>5</u>
Number of People Served by the Water System	Number of Reduced Monitoring Sites	
>100,000	50	
10,001 to 100,000	30	
3,301 to 10,000	20	

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501 to 3,300	10	
101 to 500	5	
≤100	5	

Table 35

Number of people served by the water system	Number of sample locations
>100,000	25
10,001-100,000	10
3,301 to 10,000	3
501 to 3,300	2
101 to 500	1
<100	1

Table 36

Number of People Served by the Water System	Reduced Number of Sample Sites
>100,000	10
10,001-100,000	7
3,301 to 10,000	3
501 to 3,300	2
101 to 500	1
<100	1

Table 37

CT Values for 4-log Inactivation of Viruses (mg/L-minutes) <sup>1, 2</sup>		
Temperature in °C	pH = 6-9	pH = 10
0.5	12	90
5	8	60
10	6	45
15	4	30
20	3	22
25	2	15

1 - Adapted from Table E-7, Appendix E, Guidance Manual for Compliance with the Filtration and Disinfection Requirements for Public Water Systems Using Surface Water Sources, 1990.

2 - Basis for values given in Appendix F, Guidance Manual for Compliance with the Filtration and Disinfection Requirements for Public Water Systems Using Surface Water Sources, 1990.