Tenn. Comp. R. & Regs. R. 0400-45-01-.31

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Rules and Regulations of the State of Tennessee > ***RULES OF THE TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION*** > ***DIVISION OF WATER SUPPLY*** > ***CHAPTER 0400-45-01 PUBLIC WATER SYSTEMS***

0400-45-01-.31 FILTRATION AND DISINFECTION

(1) General Requirements

(a) The requirements of this rule constitute national primary drinking water regulations. These regulations establish criteria under which filtration is required as a treatment technique for public water systems supplied by a surface water source or a ground water source under the direct influence of surface water. Each public water system with a surface water source or a ground water source under the direct influence of surface water must provide treatment of that source water that complies with these treatment technique requirements. These regulations establish treatment technique requirements in lieu of maximum contaminant levels for Giardia lamblia, cryptosporidium, viruses, heterotrophic plate count bacteria, Legionella, and turbidity. The treatment technique requirements consist of installing and properly operating water treatment processes which reliably achieve removal of Giardia lamblia cysts, cryptosporidium and viruses as set forth herein.

(b) A public water system using a ground water source under the direct influence of surface water shall:

1. Meet the requirements for avoiding filtration in paragraph (2) of this rule and meet the disinfection requirements in subparagraph (3)(a) of this rule; or

2. Meet the filtration requirements in paragraph (4) of this rule and the disinfection requirements in paragraph (30) of Rule 0400-45-01-.17.

(c) A public water supply using surface water shall meet disinfection requirements in paragraph (30) of Rule 0400-45-01-.17 and filtration requirements in paragraph (4) of this rule to be in compliance with paragraph (a) of this paragraph.

(d) Each public water system using a surface water source or a ground water source under the direct influence of surface water must be operated by certified personnel who meet the requirements of the Tennessee Water Environmental Health Act *T.C.A. §§ 68-221-901* et seq. and Certification Board Regulations contained in Chapter 0400-49-01.

(e) Beginning December 31, 2001, subpart H systems serving 10,000 or more persons shall install treatment which achieve at least 99 percent (2-log) removal of cryptosporidium between a point where the raw water is not subject to recontamination by surface water runoff and a point downstream before or at the first customer for filtered systems, and ground water systems under the direct influence of surface water and serving 10,000 or more persons must have a watershed control plan which controls cryptosporidium. Subpart H systems shall conduct filter and disinfection profiling and benchmarking as required by this rule. Subpart H systems serving 10,000 or more persons shall also comply with the turbidity criteria in subparagraph (4)(c) of this rule.

(f) Subpart H systems that did not conduct optional monitoring under paragraph (8) of this rule [Profiling and Benchmarking] because they served fewer than 10,000 persons in 2002, but serve more than 10,000 persons prior to January 14, 2005, must comply with the filtration, disinfection, and treatment technique requirements of this rule, or meet the criteria to avoid filtration. They shall also comply with the individual filter effluent turbidity monitoring, and other monitoring and

reporting requirements of this rule. These systems must also consult with the Department to establish a disinfection benchmark. A system that decides to make a significant change to its disinfection practice as described in subparagraph (8)(e) of this rule must obtain approval from the department prior to making such change.

(2) Criteria for Avoiding Filtration for Ground Water Systems Impacted by Surface Water.

A public water system that uses a ground water source under the direct influence of surface water must meet all of the conditions of subparagraphs (a) and (b) of this paragraph and is subject to subparagraph (c) of this paragraph, beginning 18 months after the Department determines that it is under the direct influence of surface waters or December 30, 1991, whichever is later, unless the Department has determined, in writing, that filtration is required. If the Department determines in writing before December 30, 1991, that filtration is required, the system must have installed filtration and meet the criteria for filtered systems specified in paragraphs (3) and (4) of this rule by June 29, 1993. A ground water system under the direct influence of surface water that fails to meet all the requirements of subparagraphs (a) and (b) of this paragraph must install filtration by June 29, 1993, or within eighteen (18) months of the failure which ever is later. The treatment techniques used must meet the criteria specified in paragraphs (3) and (4) of this rule.

(a) Source Water Quality Conditions.

1. The fecal coliform concentration must be equal to or less than 20/100 ml, or the total coliform concentration must be equal to or less than 100/100 ml [measured as specified in parts (5)(a)1 and 2 and (5)(b)1 of this rule], in representative samples of the source water immediately prior to the first or only point of ***disinfectant*** application in at least 90 percent of the measurements made for the 6 previous months that the system served water to the public on an ongoing basis. If a system measures both fecal and total coliforms, the fecal coliform criterion, but not the total coliform criterion, in this paragraph must be met.

2. The turbidity level cannot exceed 5 NTU (measured as specified in parts (5)(a)4 and (5)(b)2 of this rule in representative samples of the source water immediately prior to the first or only point of ***disinfectant*** application unless:

(i) the Department determines that any such event was caused by circumstances that were unusual and unpredictable; and

(ii) there have not been more than two such events in the past 12 months the system served water to the public, or more than five events in the past 120 months the system served water to the public, in which the turbidity level exceeded 5 NTU. An "event" is a series of consecutive days during which at least one turbidity measurement each day exceeds 5 NTU.

Unusual and unpredictable circumstances would be events outside the system's control such as, but not limited to, earthquakes, tornados, and hurricanes.

(b) Site Specific Conditions.

1.

(i) The public water system must meet the requirements of part (3)(a)1 of this rule at least 11 of the 12 previous months that the system served water to the public, on an ongoing basis, unless the system fails to meet the requirements during 2 of the 12 previous months that the system served water to the public, and the Department determines that at least one of these failures was caused by circumstances that were unusual and unpredictable. Unusual

and unpredictable circumstances would be events outside the system's control such as, but not limited to, earthquakes, tornados and hurricanes.

(ii) The public water system must meet the redundant disinfection components specified by part (3)(a)2 of this rule at all times the system serves water to the public.

(iii) The public water system must meet 0.2 mg/l free chlorine ***residual*** at the point of distribution.

(iv) The public water system must meet 0.2 mg/l free chlorine ***residual*** in the distribution system on an ongoing basis unless the Department determines that failure to meet these requirements was not caused by a deficiency in treatment of the source water. The ***residual disinfectant*** concentration cannot be less than 0.2 mg/l in more than 5 percent of the samples each month, for any two consecutive months that the system serves water to the public.

2. A wellhead protection program that meets the requirements of Section 1428 of the Federal Safe Drinking Water Act and meets the approval of the Department must be developed and implemented by the public water system to protect its watershed. The public water system must develop a wellhead protection program that identifies, monitors and controls activities that might contribute to the release of cryptosporidium organisms inside the wellhead protection area by maximizing land ownership or by zoning ordinances.

3. The public water system shall be subject to an annual on-site inspection to assess the wellhead protection program and disinfection treatment process. Either the Department or a party approved by the Department must conduct the on-site inspection. The inspection must be conducted by competent individuals such as sanitary and civil engineers, sanitarians, or technicians who have experience and knowledge about the operation and maintenance of a public water system, and who have a sound understanding of public health principles and waterborne diseases. A report of the on-site inspection summarizing all findings must be prepared every year. The on-site inspection must indicate to the Department's satisfaction that the wellhead protection program and disinfection treatment process are adequately designed and maintained. The on-site inspection shall include at least the following:

(i) A review of the effectiveness of the wellhead protection program;

(ii) A review of the physical condition of the source intake and how well it is protected;

(iii) A review of the system's equipment maintenance program to ensure there is low probability for failure of the disinfection process;

(iv) An inspection of the disinfection equipment for physical deterioration;

(v) A review of operating procedures;

(vi) A review of data records to ensure that all required tests are being conducted and recorded and disinfection is effectively practiced; and

(vii) Identification of any improvements which are needed in the equipment, system maintenance and operation, or data collection.

4. The public water system must not have been identified as a source of a waterborne disease outbreak, or if it has been so identified, the system must have been modified sufficiently to prevent another such occurrence, as determined by the Department.

5. The public water system must comply with the maximum contaminant level (MCL) for total coliforms in paragraph (4) of Rule 0400-45-01-.06. The system must achieve the standard at a

frequency of at least 11 months of the 12 previous months that the system served water to the public, on an ongoing basis, unless the Department determines that failure to meet this requirement was not caused by a deficiency in treatment of the source water.

6. The public water system must comply with the requirements for trihalomethanes in Rules 0400-45-01-.36 and 0400-45-01-.38. After December 31, 2001, subpart H systems serving 10,000 or more persons shall comply with the trihalomethane, haloacetic acid, bromated, chlorite, chlorine dioxide and chloramines standards described in Rules 0400-45-01-.06 and 0400-45-01-.36.

(c) Treatment Technique Violations.

1. A system is in violation of a treatment technique requirement if it:

(i) fails to meet any one of the criteria in subparagraphs (a) and (b) of this paragraph; or

(ii) is required to have filtration, by written directive of the Department; and

(iii) fails to install filtration by the date specified in the introductory text of this paragraph.

2. A system that has not installed filtration is in violation of a treatment technique requirement if:

(i) The turbidity level (measured as specified in parts (5)(a)4 and (5)(b)2 of this rule) in a representative sample of the source water immediately prior to the first or only point of disinfection application exceeds 5 NTU; or

(ii) The system is identified as a source of a waterborne disease outbreak.

(3) Disinfection.

A public water system that uses a ground water source under the direct influence of surface water and does not provide filtration treatment must provide disinfection treatment within 6 months of being notified by the Department. Failure to meet any requirement of this paragraph after the applicable date specified in this introductory text of this paragraph is a treatment technique violation.

(a) Each public water system using ground water impacted by surface water that does not provide filtration treatment must provide disinfection treatment beginning December 30, 1991 or 6 months following a determination that the system is under the direct influence of surface water whichever is later. The disinfection treatment shall comply with the following:

1. The disinfection treatment must be sufficient to ensure at least 99.9 percent (3-log) inactivation of Giardia lamblia cysts and 99.99 percent (4-log) inactivation of viruses between a point where the raw water is not subject to recontamination by surface water runoff and a point downstream before or at the first customer, every day the system serves water to the public, except any one day each month. Each day a system serves water to the public, the public water system must calculate the CT value(s) from the system's treatment parameters, using the procedure specified in part (5)(b)3 of this rule. It must also determine whether this value(s) is sufficient to achieve the specified inactivation rates for Giardia lamblia cysts and viruses. If a system uses a ***disinfectant*** other than chlorine, the system may demonstrate to the Department, through the use of a Department-approved protocol for on-site disinfection challenge studies or other information satisfactory to the Department, that CT[99.9] values other than those specified in Tables 2.1 and 3.1 in part (5)(b)3 of this rule or other operational parameters are adequate to demonstrate that the system is achieving minimum inactivation rates required by this part.

2. The disinfection system must have either (i) redundant components, including an auxiliary power supply with automatic start-up and alarm to ensure that ***disinfectant*** application is

maintained continuously while water is being delivered to the distribution system, or (ii) automatic shut-off of delivery of water to the distribution system whenever there is less than 0.2 mg/l of ***residual*** is infectant concentration in the water.

3. The free chlorine ***residual*** concentration in the water entering the distribution system, measured as specified in part (5)(a)5 and (5)(b)5 of this rule cannot be less than 0.2 mg/l for more than 4 hours.

4. The ***residual*** ***disinfectant*** concentration in the distribution system, measured as free chlorine shall not be less than 0.2 mg/l in more than 5 percent of the samples each month, for any two consecutive months the system serves water to the public.

(5) Monitoring Requirements

(a) Reserved

(b) A public water system that uses a ground water source under the direct influence of surface water and does not provide filtration treatment must begin monitoring as specified in this subparagraph, beginning December 31, 1990, or 6 months following the determination that the ground water source is under the direct influence of surface water, whichever is later, unless the Department has determined in writing that filtration is required, in which case the Department may specify alternative monitoring requirements, as appropriate, until filtration is in place.

1. Fecal coliform or total coliform density measurements as required by part (2)(a)1 of this rule must be performed on representative source water samples immediately prior to the first or only point of ***disinfectant*** application. The system must sample for fecal or total coliforms at the following minimum frequency each week the system serves water to the public. Fecal coliform or total coliform densities must meet the limits specified in part (2)(a)1 of this rule.

System size (persons served)	Samples/week<1>
</=500	1
501 to 3,300	2
3,301 to 10,000	3
10,001 to 25,000	4
>25,000	5

<1> Must be taken on separate days.

Also one fecal or total coliform density measurement must be made every day the system serves water to the public and the turbidity of the source water exceeds 1 NTU (these samples count toward the weekly coliform sampling requirement) unless the Department determines that the system, for reasons outside the system's control, cannot have the sample analyzed within 30 hours of collection.

2. Turbidity measurements must be performed on representative grab samples of source water immediately prior to the first or only point of ***disinfectant*** application every four hours (or more frequently) that the system serves water to the public. A public water system may substitute continuous turbidity monitoring for grab sample monitoring if it validates the continuous measurement for accuracy on a regular basis using a protocol approved by the Department. Turbidity must comply with the limits specified in part (2)(a)2 of this rule.

3. The total inactivation ratio for each day that the system is in operation must be determined based on the CT[99.9] values in Tables 1.1 through 1.6, 2.1 and 3.1 of this paragraph, as appropriate. The parameters necessary to determine the total inactivation ratio must be monitored as follows:

(i) The temperature of the disinfected water must be measured at least once per day at each chlorine ***residual*** ***disinfectant*** concentration sampling point.

(ii) If the system uses chlorine, the pH of the disinfected water must be measured at least once per day at each chlorine ***residual*** ***disinfectant*** concentration sampling point.

(iii) The ***disinfectant*** contact time(s) ("T") must be determined for each day during peak hourly flow.

(iv) The ***residual*** ***disinfectant*** concentration(s) ("C") of the water before or at the first customer must be measured each day during peak hourly flow.

(v) If a system uses a ***disinfectant*** other than chlorine, the system may demonstrate to the Department, through the use of a Department-approved protocol for on-site disinfection challenge studies or other information satisfactory to the Department, that CT[99.9] values other than those specified in Tables 2.1 and 3.1 in this paragraph or other operational parameters are adequate to demonstrate that the system is achieving the minimum inactivation rates required by part (3)(a)1 of this rule.

Table 1.1 -- CT Values (CT[99.9]) for 99.9 Percent Inactivation of Giardia lamblia Cysts

Free Chlorine at 0.5 [degrees] C or Lower<1>

Free *Residual* (mg/L) ***Disinfectant*** **Concentration**	**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	346	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

<1>These CT values achieve greater than 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[99.9] value at the lower temperature, and at the higher pH.

Table 1.2 -- CT Values (CT[99.9]) for 99.9 Percent Inactivation of Giardia lamblia Cysts by Free Chlorine at 5.0 [degrees] C<1>

Free *Residual* (mg/L) ***Disinfectant*** **Concentration**	**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

Free *Residual* (mg/L) ***Disinfectant*** **Concentration**	**pH**						
	</=6.0	**6.5**	**7.0**	**7.5**	**8.0**	**8.5**	**</=9.0**
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	146	175	213	258	312	375
2.8	124	148	178	217	263	318	382
3.0	126	151	182	221	268	324	389

<1>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[99.9] value at the lower temperature, and at the higher pH.

Table 1.3 -- CT Values (CT[99.9]) for 99.9 Percent Inactivation of Giardia lamblia Cysts by Free Chlorine at 10.0 [degrees] C<1>

Free *Residual* (mg/L) ***Disinfectant*** **Concentration**	**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

<1>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[99.9] value at the lower temperature, and at the higher pH.

Table 1.4 -- CT Values (CT[99.9]) for 99.9 Percent Inactivation of Giardia lamblia Cysts by Free Chlorine at 15.0 [degrees] C<1>

Free ***Residual*** (mg/L) ***Disinfectant*** Concentration	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

<1>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[99.9] value at the lower temperature, and at the higher pH.

Table 1.5 -- CT Values (CT[99.9]) for 99.9 Percent Inactivation of Giardia lamblia Cysts by Free Chlorine at 20.0 [degrees] C<1>

Free ***Residual*** (mg/L) ***Disinfectant*** Concentration	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	119	143
3.0	47	57	68	83	101	122	146

<1>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[99.9] value at the lower temperature, and at the higher pH.

Table 1.6 -- CT Values (CT[99.9]) for 99.9 Percent Inactivation of Giardia lamblia Cysts by Free Chlorine at 25.0 [degrees] C<1>

Free ***Residual*** (mg/L) ***Disinfectant*** Concentration	pH						
	</=6.0	6.5	7.0	7.5	8.0	8.5	</=9.0
</=0.4	24	29	35	42	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

<1>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[99.9] value at the lower temperature, and at the higher pH.

Table 2.1 -- CT Values (CT[99.9]) for 99.9 Percent Inactivation of Giardia lamblia Cysts by Chlorine Dioxide and Ozone<1>

Disinfectant	Temperature		
	<1 [degrees] C	5 [degrees] C	10 [degrees] C
Chlorine Dioxide	63	26	23
Ozone	2.9	1.9	1.4

Disinfectant	Temperature		
	15 [degrees] C	20 [degrees] C	>/=25 [degrees] C
Chlorine Dioxide	19	15	11
Ozone	0.95	0.72	0.48

<1>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[99.9] values at the lower temperature for determining CT[99.9] values between indicated temperatures.

Table 3.1 -- CT Values (CT[99.9]) for 99.9 Percent Inactivation of Giardia lamblia Cysts by Chloramines<1>

Temperature			
<1 [degrees] C	5 [degrees] C	10 [degrees] C	<1 [degrees] C
3,800	2,200	1,850	1,500

Temperature		
<1 [degrees] C	20 [degrees] C	25 [degrees] C
3,800	1,100	750

<1>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 upon on-site studies or other information, as approved by the Department, 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[99.9] value at the lower temperature for determining CT[99.9] values between indicated temperatures.

4. The total inactivation ratio must be calculated as follows:

(i) If the system uses only one point of ***disinfectant*** application, the system may determine the total inactivation ratio based on either of the following two methods:

(I) One inactivation ratio (CTcalc/CT[99.9]) is determined before or at the first customer during peak hourly flow and if the CTcalc/CT[99.9] >1.0, the 99.9 percent Giardia lamblia inactivation requirement has been achieved; or

(II) Successive CTcalc/CT[99.9] values, representing sequential inactivation ratios, are determined between the point of ***disinfectant*** application and a point before or at the first customer during peak hourly flow. Under this alternative, the following method must be used to calculate the total inactivation ratio:

I. Determine CTcalc for each sequence

CT[99.9]

II. Add the CTcalc values together

CT[99.9]

III. If the sum CTcalc is greater than or equal

CT[99.9]

to 1.0 the 99.9 percent Giardia lamblia inactivation requirement has been achieved.

(ii) If the system uses more than one point of ***disinfectant*** application before or at the first customer, the system must determine the CT value of each disinfection sequence immediately prior to the next point of ***disinfectant*** application during peak hourly flow. The CTcalc/CT[99.9] value of each sequence and the sum of

[See illustration in printed version]

must be calculated using the method in item (i)(II) of this part to determine if the system is in compliance with disinfection requirements.

5. The ***residual*** ***disinfectant*** concentration of the water entering the distribution system must be monitored continuously, and the lowest value must be recorded each day. If there is a failure in the continuous monitoring equipment, grab sampling every 4 hours may be conducted in lieu of continuous monitoring, but for no more than 5 working days following the failure of the equipment. Systems serving 3,300 or fewer persons may take grab samples in lieu of providing continuous monitoring on an ongoing basis at the frequencies prescribed below:

System Size by Population	Samples/ day<1>
</=500	1
501 to 1,000	2
1,001 to 2,500	3
2,501 to 3,300	4

<1>The day's samples cannot be taken at the same time. The sampling intervals are subject to Department review and approval.

If at any time the free chlorine concentration falls below 0.2 mg/l in a system using grab sampling in lieu of continuous monitoring, the system must take a grab sample every 4 hours until the free ***residual*** concentration is equal to or greater than 0.2 mg/l.

6. The ***residual*** ***disinfectant*** concentration must be measured at least at the same points in the distribution system and at the same time as total coliforms are sampled, as specified in paragraph (1) of Rule 0400-45-01-.07, except that the Department may allow a public water system which uses a ground water source, to take ***disinfectant*** ***residual*** samples at points other than the total coliform sampling points if the Department determines that such points are more representative of treated (disinfected) water quality within the distribution system.

(c) Monitoring requirements for systems using filtration treatment. A public water system that uses a surface water source or a ground water source under the influence of surface water and provides filtration treatment must monitor in accordance with this subparagraph beginning June 29, 1993, or when filtration is installed, whichever is later.

1. Turbidity as required by paragraph (4) of this rule must be continuously measured and recorded on representative samples of the system's combined filtered water while the system serves water to the public. The highest turbidity value obtained during each four-hour period must be reported. A public water system may substitute grab sample monitoring if approved by the Department. For any system using slow sand filtration or filtration treatment other than conventional treatment, direct filtration, or diatomaceous earth filtration, the Department may reduce the sampling frequency to once per day if it determines that less frequent monitoring is sufficient to indicate effective filtration performance. For systems serving 500 or fewer persons, the Department may reduce the turbidity sampling frequency to once per day, regardless of the type of filtration treatment used, if the Department determines that less frequent monitoring is sufficient to indicate effective filtration performance. The highest turbidity measured each four hours must be reported according to the following four hour segments: 12:01 a.m. to 4:00 a.m., 4:01 to 8:00 a.m., 8:01 to 12 noon, 12:01 to 4:00 p.m., 4:01 p.m. to 8:00 p.m., 8:01 to 12 midnight. The intake of the combined filter effluent turbidity monitor shall be located at or near the entry point to the clearwell or at a location approved by the Department.

2. The ***residual*** ***disinfectant*** concentration of the water entering the distribution system must be monitored continuously, and the lowest value must be recorded each day. If there is a failure in the continuous monitoring equipment, grab sampling every 4 hours may be conducted in lieu of continuous monitoring, but for no more than 5 working days following the failure of the equipment. Systems serving 3,300 or fewer persons may take grab samples each day in lieu of providing continuous monitoring on an ongoing basis at the frequencies prescribed below:

System Size by Population	**Samples/ day<1>**
</=500	1
501 to 1,000	2
1,001 to 2,500	3
2,501 to 3,300	4

<1>The day's samples cannot be taken at the same time. The sampling intervals are subject to Department review and approval.

If at any time the free ***residual*** ***disinfectant*** concentration falls below 0.2 mg/l in a system using grab sampling in lieu of continuous monitoring, the system must take a grab sample every 4 hours until the free ***residual*** ***disinfectant*** concentration is equal to or greater than 0.2 mg/l.

3. The ***residual*** ***disinfectant*** concentration must be measured at least at the same points in the distribution system and at the same time as total coliforms are sampled, as specified in paragraph (1) of Rule 0400-45-01-.07. The Department may allow a public water system which uses both a surface water source or a ground water source under direct influence of surface water, and a ground water source to take ***disinfectant*** ***residual*** samples at points other than the total coliform sampling points if the Department determines that such points are more representative of treated (disinfected) water quality within the distribution system.

4. In addition to monitoring required by parts 1, 2 and 3 of this subparagraph, a subpart H system serving 10,000 or more persons using conventional filtration treatment or direct filtration must conduct continuous monitoring of turbidity for each individual filter using an approved method in subparagraph (10)(b) of Rule 0400-45-01-.14 and must calibrate turbidimeters using the procedure specified in paragraphs (40) and (41) of Rule 0400-45-01-.17. Systems must record the results of individual filter monitoring every 15 minutes. In addition to monitoring required by parts 1, 2 and 3 of this subparagraph by January 14, 2005, a subpart H system serving fewer than 10,000 persons using conventional filtration treatment or direct filtration must conduct continuous monitoring of turbidity for each individual filter using an approved method in subparagraph (10)(b) of Rule 0400-45-01-.14 and must calibrate turbidimeters using the procedure specified in paragraphs (40) and (41) of Rule 0400-45-01-.17. Systems must record the results of individual filter monitoring every 15 minutes.

5. If there is a failure in the continuous turbidity monitoring equipment, the system must conduct grab sampling every four hours in lieu of continuous monitoring until the turbidimeter is repaired and back on-line. A system has a maximum of five working days after failure to repair the equipment or it is in violation.

(6) Reporting and recordkeeping requirements.

(a) A public water system that uses a ground water source under the direct influence of surface water and does not provide filtration treatment must report monthly to the Department the information specified in this subparagraph beginning December 31, 1990, or 6 months after the determination that the ground water source is under the direct influence of surface water, whichever is later, unless the Department has determined in writing that filtration is required, in which case the Department may specify alternative reporting requirements, as appropriate, until filtration is in place.

1. Source water quality information must be reported to the Department within 10 days after the end of each month the system serves water to the public. Information that must be reported includes but is not limited to:

(i) The cumulative number of months for which results are reported.

(ii) The number of fecal and/or total coliform samples, whichever are analyzed during the month (if a system monitors for both, only fecal coliforms must be reported), the dates of sample collection, and the dates when the turbidity level exceeded 1 NTU.

(iii) The number of samples during the month that had equal to or less than 20/100 ml fecal coliforms and/or equal to or less than 100/100 ml total coliforms, whichever are analyzed.

(iv) The cumulative number of fecal or total coliform samples, whichever are analyzed, during the previous six months the system served water to the public.

(v) The cumulative number of samples that had equal to or less than 20/100 ml fecal coliforms or equal to or less than 100/100 ml total coliforms, whichever are analyzed, during the previous six months the system served water to the public.

(vi) The percentage of samples that had equal to or less than 20/100 ml fecal coliforms or equal to or less than 100/100 ml total coliforms, whichever are analyzed, during the previous six months the system served water to the public.

(vii) The maximum turbidity level measured during the month, the date(s) of occurrence for any measurement(s) which exceeded 5 NTU, and the date(s) the occurrence(s) was reported to the Department.

(viii) For the first 12 months of recordkeeping, the dates and cumulative number of events during which the turbidity exceeded 5 NTU, and after one year of recordkeeping for turbidity measurements, the dates and cumulative number of events during which the turbidity exceeded 5 NTU in the previous 12 months the system served water to the public.

(ix) For the first 120 months of recordkeeping, the dates and cumulative number of events during which the turbidity exceeded 5 NTU, and after 10 years of recordkeeping for turbidity measurements, the dates and cumulative number of events during which the turbidity exceeded 5 NTU in the previous 120 months the system served water to the public.

2. Disinfection information specified in subparagraph (5)(b) of this rule must be reported to the Department within 10 days after the end of each month the system serves water to the public. Information that must be reported includes but is not limited to:

(i) For each day, the lowest measurement of ***residual*** ***disinfectant*** concentration in mg/l in water entering the distribution system.

(ii) The date and duration of each period when the ***residual*** ***disinfectant*** concentration in water entering the distribution system fell below 0.2 mg/l and when the Department was notified of the occurrence.

(iii) The daily ***residual*** ***disinfectant*** concentration(s) (in mg/l) and ***disinfectant*** contact time(s) (in minutes) used for calculating the CT value(s).

(iv) If chlorine is used, the daily measurement(s) of pH of disinfected water following each point of chlorine disinfection.

(v) The daily measurement(s) of water temperature in [degree] C following each point of disinfection.

(vi) The daily CTcalc and CTcalc/CT[99.9] values for each ***disinfectant*** measurement or sequence and the sum of all CTcalc/CT[99.9] values before or at the first customer.

(vii) The daily determination of whether disinfection achieves adequate Giardia cyst and virus inactivation, i.e., whether (CTcalc/CT[99.9]) is at least 1.0 or, where ***disinfectants*** other than chlorine are used, other indicator conditions that the Department determines are appropriate, are met.

(viii) The following information on the samples taken in the distribution system in conjunction with total coliform monitoring pursuant to paragraph (3) of this rule [Disinfection].

(I) Number of instances where the free ***residual*** ***disinfectant*** concentration is measured and the number of instances where the free ***residual*** is below 0.2 mg/l.

3. No later than ten days after the end of each Federal fiscal year (September 30), each system must provide to the Department a report which summarizes its compliance with all watershed control program requirements specified in part (2)(b)2 of this rule.

4. No later than ten days after the end of each Federal fiscal year (September 30), each system must provide to the Department a report which describes the on-site inspection conducted during that year pursuant to part (2)(b)3 of this rule, unless the on-site inspection was conducted by the Department. If the inspection was conducted by the Department, the Department must provide a copy of its report to the public water system.

5.

(i) Each system, upon discovering that a waterborne disease outbreak potentially attributable to that water system has occurred, must report that occurrence to the Department as soon as possible, but no later than by the close of the following business day.

(ii) If at any time the turbidity exceeds 5 NTU, the system must consult with the department as soon as practical, but no later than 24 hours after the exceedance is known, in accordance with the requirements of Rule 0400-45-01-.19.

(iii) If at any time the ***disinfectant*** ***residual*** falls below 0.2 mg/l in the water entering the distribution system, the system must notify the Department as soon as possible, but no later than by the end of the next business day. The system also must notify the Department by the end of the next business day whether or not the ***residual*** was restored to at least 0.2 mg/l within 4 hours.

(b) A public water system that uses a surface water source or a ground water source under the direct influence of surface water and provides filtration treatment must report monthly to the Department the information specified in this subparagraph beginning June 29, 1993, or when filtration is installed, whichever is later.

1. Turbidity measurements as required by part (5)(c)1 of this rule must be reported within 10 days after the end of each month the system serves water to the public. Information that must be reported includes but is not limited to:

(i) The total number of filtered water turbidity measurements taken during the month.

(ii) The number and percentage of filtered water turbidity measurements taken during the month which are less than or equal to the applicable limits specified in paragraph (4) of this rule.

(iii) The date and value of any turbidity measurements taken during the month which exceed 5 NTU.

2. Disinfection information specified in subparagraph (5)(c) of this rule must be reported to the Department within 10 days after the end of each month the system serves water to the public. Information that must be reported includes:

(i) For each day, the lowest measurement of ***residual*** ***disinfectant*** concentration in mg/l in water entering the distribution system.

(ii) The date and duration of each period when the ***residual*** ***disinfectant*** concentration in water entering the distribution system fell below 0.2 mg/l and when the Department was notified of the occurrence.

(iii) The following information on the samples taken in the distribution system in conjunction with total monitoring pursuant to 0400-45-01-.07;

(I) Number of instances where the free ***residual*** ***disinfectant*** concentration is measured.

(II) The number of instances where the free ***residual*** is below 0.2 mg/l.

3.

(i) Each system, upon discovering that a waterborne disease outbreak potentially attributable to that water system has occurred, must report that occurrence to the Department as soon as possible, but no later than by the close of the following business day.

(ii) If at any time the turbidity exceeds 1 NTU in representative samples of filtered water in a system using conventional filtration treatment or direct filtration, the system must consult with the department as soon as practical, but no later than 24 hours after the exceedance is known, in accordance with the requirements of Rule 0400-45-01-.19. If at any time the turbidity in representative samples of filtered water exceed the maximum level set by the department for filtration technologies other than conventional and direct filtration treatment, the system must consult with the department as soon as practical, but not later than 24 hours after the exceedance is known, in accordance with Rule 0400-45-01-.19.

(iii) If at any time the ***disinfectant residual*** falls below 0.2 mg/l in the water entering the distribution system, the system must notify the Department as soon as possible, but no later than by the end of the next business day. The system also must notify the Department by the end of the next business day whether or not the ***residual*** was restored to at least 0.2 mg/l within 4 hours.

4. In addition to the reporting and recordkeeping requirements in parts 1, 2, and 3 of this subparagraph, water systems serving 10,000 or more persons that provides conventional filtration treatment or direct filtration must report monthly to the Department the information specified in this part beginning January 1, 2002. In addition to the reporting and recordkeeping requirements in parts 1, 2, and 3 of this rule, a public water system serving fewer than 10,000 persons that provides conventional filtration treatment or direct filtration must report monthly to the Department the information specified in this part beginning January 14, 2005. In addition to the reporting and recordkeeping requirements in this paragraph, a public water system serving 10,000 or more persons that provides filtration approved under subparagraph (4)(d) of this rule must report monthly to the Department the information specified in subpart (i) of this part beginning January 1, 2002. In addition to the reporting and recordkeeping requirements in this paragraph, a public water system serving fewer than 10,000 persons that provides filtration approved under subparagraph (4)(d) of this rule must report monthly to the Department the information specified in subpart (i) of this part beginning January 14, 2005. The reporting in subpart (i) of this part is in lieu of the reporting specified in part 1 of this subparagraph.

(i) Turbidity measurements as required by this rule must be reported within 10 days after the end of each month the system serves water to the public. Information that must be reported includes:

(I) The total number of filtered water turbidity measurements taken during the month.

(II) The number and percentage of filtered water turbidity measurements taken during the month which are less than or equal to the turbidity limits specified in subparagraph (4)(c) or (d) of this rule.

(III) The date and value of any turbidity measurements taken during the month which exceed 1 NTU for systems using conventional filtration treatment or direct filtration, or which exceed the maximum level set by the Department under subparagraph (4)(d) of this rule.

(ii) Systems must maintain the results of individual filter monitoring taken for at least five years.

(I) For any individual filter that has a measured turbidity level of greater than 1.0 NTU in two consecutive measurements taken 15 minutes apart, the system must report the filter number, the turbidity measurement, and the date(s) on which the exceedance occurred. In addition, the system must either produce a filter profile for the filter within 7 days of the exceedance (if the system is not able to identify an obvious reason for the abnormal filter performance) and report that the profile has been produced or report the obvious reason for the exceedance.

(II) For any individual filter that has a measured turbidity level of greater than 0.5 NTU in two consecutive measurements taken 15 minutes apart at the end of the first four hours of continuous filter operation after the filter has been backwashed or otherwise taken offline, the system must report the filter number, the turbidity, and the date(s) on which the exceedance occurred. In addition, the system must either produce a filter profile for the filter within 7 days of the exceedance (if the system is not able to identify an obvious reason for the abnormal filter performance) and report that the profile has been produced or report the obvious reason for the exceedance.

(III) For any individual filter that has a measured turbidity level of greater than 1.0 NTU in two consecutive measurements taken 15 minutes apart at any time in each of three consecutive months, the system must

report the filter number, the turbidity measurement, and the date(s) on which the exceedance occurred. In addition, the system must conduct a self-assessment of the filter within 14 days of the exceedance and report that the self-assessment was conducted. The self assessment must consist of at least the following components: assessment of filter performance; development of a filter profile; identification and prioritization of factors limiting filter performance; assessment of the applicability of corrections; and preparation of a filter self-assessment report.

(IV) For any individual filter that has a measured turbidity level of greater than 2.0 NTU in two consecutive measurements taken 15 minutes apart at any time in each of two consecutive months, the system must report the filter number, the turbidity measurement, and the date(s) on which the exceedance occurred. In addition, the system must arrange for the conduct of a comprehensive performance evaluation by the Department or a third party approved by the Department no later than 30 days following the exceedance and have the evaluation completed and submitted to the Department no later than 90 days following the exceedance.

(7) Variances and Exemptions from the Requirements of Filtration and Disinfection

(a) No variance from the requirements in this rule are permitted.

(b) No exemptions from the requirements in part (3)(a)3 of this rule and paragraph (30) of Rule 0400-45-01-.17 to provide disinfection are permitted.

(8) Disinfection Profiling and Benchmarking

(a) Subpart H public water systems serving 10,000 or more persons must conduct monitoring for haloacetic acids and trihalomethanes or conduct disinfection profiling. By January 14, 2005, subpart H public water systems must develop a disinfection profile unless the Department determines it is not necessary. Those systems that exceed 0.064 mg/L of total trihalomethanes or 0.048 mg/L of total haloacetic acids annual arithmetic average based on four quarters of data must calculate disinfection profiles. Subpart H systems that serve between 500 and 9,999 persons must begin to collect data needed to calculate disinfection profiles or demonstrate exemption from the profiling requirements no later than July 1, 2003. Subpart H systems serving fewer than 500 persons must begin to collect data for profiling or demonstrate exemption from the profiling requirements no later than July 1, 2004. Systems that must calculate profiles and that are planning changes in the disinfection process must also calculate disinfection benchmarks and submit the benchmark calculations with engineering plans for Departmental approval prior to making any process changes. Sampling analytical methods, frequency of sampling, and sample locations must be in accordance with procedures described in Rules 0400-45-01-.14 and 0400-45-01-.36. Disinfection profiles and benchmarks must be determined by calculating daily inactivation ratios in accordance with Departmental and EPA rules. Systems may elect to calculate profiles in lieu of conducting trihalomethanes and haloacetic acid monitoring for the purpose of complying with the disinfection and filtration rule.

(b) The department may approve the use of a more representative set of annual data for disinfection profiling. Systems that elect to conduct disinfection profiling rather than monitoring must notify the department. Systems may use existing data if approved by the department to comply with the disinfection byproduct monitoring or profiling required by this rule.

(c) A system that uses chloramines, chlorine dioxide, or ozone for a primary ***disinfectant*** must calculate the logs of inactivation for viruses using a method approved by the department.

(d) The system subject to the profiling requirements must retain disinfection profiles data in graphic form, such as a spreadsheet, or in some other format acceptable to the department for review during sanitary surveys.

(e) Any system that decides to change its disinfection practices must submit plans to the department for approval prior to making any changes. Changes to disinfection practices include but are not limited to:

1. Changes to the point of disinfection application;

2. Change in the ***disinfectant*** used;

3. Change in the ***disinfectant*** process, and

4. Any other modification identified by the department.

(f) Any system subject to the profiling requirements of this rule shall calculate its disinfection benchmark using methods approved by the department. A disinfection benchmark is the lowest monthly average value of the monthly logs of Garidia lamblia inactivation. A system using ozone or chloramines must also calculate the disinfection benchmark for viruses using methods approved by the department.

(9) Recycle Provisions

(a) Applicability. All subpart H systems that employ conventional filtration or direct filtration treatment and that recycle spent filter backwash water, thickener supernatant, or liquids from dewatering processes must meet the requirements in subparagraphs (b) through (d) of this paragraph.

(b) Reporting. A system must notify the department in writing by December 8, 2003, if the system recycles spent filter backwash water, thickener supernatant, or liquids from dewatering processes. This notification must include, at a minimum, the information specified in parts 1 and 2 of this subparagraph.

1. A plant schematic showing the origin of all flows which are recycled (including, but not limited to, spent filter backwash water, thickener supernatant, and liquids from dewatering processes), the hydraulic conveyance used to transport them, and the location where they are re-introduced back into the treatment plant.

2. Typical recycle flow in gallons per minute (gpm), the highest observed plant flow experienced in the previous year (gpm), design flow for the treatment plant (gpm), and department-approved operating capacity for the plant where the department has made such determinations.

(c) Treatment technique requirement. Any system that recycles spent filter backwash water, thickener supernatant, or liquids from dewatering processes must return these flows through the processes of a system's existing conventional or direct filtration system as defined in Rule 0400-45-01-.04 or at an alternate location approved by the Department by June 8, 2004. If capital improvements are required to modify the recycle location to meet this requirement, all capital improvements must be completed no later than June 8, 2006.

(d) Recordkeeping. The system must collect and retain on file recycle flow information specified in parts 1 through 6 of this subparagraph for review and evaluation by the Department beginning June 8, 2004.

1. Copy of the recycle notification and information submitted to the Department under subparagraph (b) of this paragraph.

2. List of all recycle flows and the frequency with which they are returned.

3. Average and maximum backwash flow rate through the filters and the average and maximum duration of the filter backwash process in minutes.

4. Typical filter run length and a written summary of how filter run length is determined.

5. The type of treatment provided for the recycle flow.

6. Data on the physical dimensions of the equalization and/or treatment units, typical and maximum hydraulic loading rates, type of treatment chemicals used and average dose and frequency of use, and frequency at which solids are removed, if applicable.

Statutory Authority

T.C.A. §§ 68-221-701 et seq. and *4-5-201* et seq.

History

ADMINISTRATIVE HISTORY FOR THIS REGULATION:

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RULES AND REGULATIONS OF THE STATE OF TENNESSEE

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Rules and Regulations of the State of Tennessee > ***RULES OF THE TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION*** > ***DIVISION OF WATER SUPPLY*** > ***CHAPTER 0400-45-01 PUBLIC WATER SYSTEMS***

0400-45-01-.17 OPERATION AND MAINTENANCE REQUIREMENTS

Omitted (1)-(3)

(4) Chlorine is the recommended disinfection agent. Other agents will be considered by the Department provided they are effective and testing procedures for their effectiveness are recognized in the latest ition of "Standard Methods for the Examination of Water and Wastewater". All community water systems, using ground water as a raw water source and serving more than 50 connections or 150 persons shall continuously chlorinate (unless other disinfection methods are approved) and shall maintain a free chlorine residual in all parts of the distribution system in the amount of not less than 0.2 mg/l. Public Water Systems using surface water shall continuously chlorinate and maintain a free chlorine residual of 0.2 mg/l in all parts of the distribution system. The residual disinfectant concentration specified by this rule shall not be less than 0.2 mg/l in more than 5 percent of the samples each month, for any two consecutive months the system serves water to the public. All public water systems serving 50 or fewer connections that do not disinfect shall install continuous disinfection if the system fails to comply with the maximum contaminant level for coliform, experiences a disease outbreak or is directed to install disinfection by the department.

Omitted (5)-(30)

Statutory Authority

T.C.A. §§ 68-221-701 et seq. and *4-5-201* et seq.

History

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