

61-58.10

Filtration and Disinfection

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A. Applicability.

(1) This regulation establishes criteria and requirements for the filtration and disinfection of drinking water served to the public. This regulation shall apply to each community and non-community water system, unless the water system meets all of the following conditions:

(a) Consists only of distribution and storage facilities (and does not have any collection and treatment facilities);

(b) Obtains all of its water from, but is not owned or operated by, a public water system to which such regulations apply;

(c) Does not sell water to any person; and

(d) Is not a carrier which conveys passengers in interstate commerce.

(2) The requirements of R.61-58.10.B through R61-58.10.G apply to all public water systems supplied by a surface water source and all public water systems supplied by a ground water source under the direct influence of surface water. In addition to these requirements, all public water systems supplied by a surface water source or a ground water source under the direct influence of surface water which serve at least 10,000 people must also comply with R.61-58.10.H and for all public water systems supplied by a surface water source or a groundwater source under the direct influence of surface water which serve fewer than 10,000 people must also comply with R.61-58.10.I.

B. General Requirements.

(1) The requirements of this regulation 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 and public water systems supplied by a ground water source under the direct influence of surface water. In addition, these regulations establish treatment technique requirements in lieu of maximum contaminant levels for the following contaminants: *Giardia lamblia*, viruses, heterotrophic plate count bacteria, *Legionella*, and turbidity. Each public water system with a surface water source or a ground water source under the direct influence of surface water shall provide treatment of that source water that complies with these treatment technique requirements. The treatment technique requirements consist of installing and properly operating water treatment processes which reliably achieve:

(a) At least 99.9 percent (3-log) removal and/or inactivation of *Giardia lamblia* cysts 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; and

(b) At least 99.99 percent (4-log) removal and/or 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.

(2) A public water system using a surface water source or a ground water source under the direct influence of surface water is considered to be in compliance with the requirements of paragraph (1) of this section if:

(a) It meets the requirements for avoiding filtration in R.61-58.10.C and the disinfection requirements in R.61-58.10.D(1); or,

(b) It meets the filtration requirements in R.61-58.10.E and the disinfection requirements in R.61-58.10.D(2).

(3) Each public water system using a surface water source or a ground water source under the direct influence of surface water shall be operated by qualified personnel who meet the requirements specified by the Department.

C. Criteria for Avoiding Filtration.

A public water system that uses a surface water source shall meet all of the conditions of paragraphs (1) and (2) of this section, and is subject to paragraph (3) of this section, beginning December 30, 1991, unless the Department has determined, in writing, that filtration is required. A public water system that uses a ground water source under the direct influence of surface water shall meet all of the conditions of paragraphs (1) and (2) of this section and is subject to paragraph (3) of this section, beginning 18 months after the Department determines that it is under the direct influence of surface water, 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 shall have installed filtration and meet the criteria for filtered systems specified in R.61-58.10.D(2) and R.61-58.10.E by June 29, 1993. Within 18 months of the failure of a system using surface water or a ground water source under the direct influence of surface water to meet any one of the requirements of paragraphs (1) and (2) of this section or after June 29, 1993, whichever is later, the system shall have installed filtration and meet the criteria for filtered systems specified in R.61-58.10.D(2) and R.61-58.10.E.

(1) Source water quality conditions.

(a) 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 R.61-58.10.F(1)(a) and (b) and (2)(a)], 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.

(b) The turbidity level cannot exceed 5 NTU [measured as specified in R.61-58.10.F(1)(d) and (2)(b)] 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) As a result of any such event, there have not been more than two 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.

(2) Site-specific conditions.

(a) (i) The public water system shall meet the requirements of R.61-58.10.D(1)(a) 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.

(ii) The public water system shall meet the requirements of R.61- 58.10.D(1)(b) at all times the system serves water to the public.

(iii) The public water system shall meet the requirements of R.61- 58.10.D(1)(c) at all times the system serves water to the public unless the Department determines that any such failure was caused by circumstances that were unusual and unpredictable.

(iv) The public water system shall meet the requirements of R.61- 58.10.D(1)(d) 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.

(b) The public water system shall maintain a watershed control program which minimizes the potential for contamination by Giardia lamblia cysts and viruses in the source water. The Department shall determine whether the watershed control program is adequate to meet this goal. The adequacy of a program to limit potential contamination by Giardia lamblia cysts and viruses shall be based on: the comprehensiveness of the watershed review; the effectiveness of the system's program to monitor and control detrimental activities occurring in the watershed; and the extent to which the water system has maximized land ownership and/or controlled land use within the watershed. At a minimum, the watershed control program shall;

(i) Characterize the watershed hydrology and land ownership;

(ii) Identify watershed characteristics and activities which may have an adverse effect on source water quality; and

(iii) Monitor the occurrence of activities which may have an adverse effect on source water quality.

The public water system shall demonstrate through ownership and/or written agreements with landowners within the watershed that it can control all human activities which may have an adverse impact on the microbiological quality of the source water. The public water system shall submit an annual report to the Department that identifies any special concerns about the watershed and how they are being handled; describes activities in the watershed that affect water quality; and projects what adverse activities are expected to occur in the future and describes how the public water system expects to address them. For systems using a ground water source under the direct influence of surface water, an approved wellhead protection program developed under section 1428 of the Federal Safe Drinking Water Act may be used, if the Department deems it appropriate, to meet these requirements.

(c) The public water system shall be subject to an annual on-site inspection to assess the watershed control program and disinfection treatment process. Either the Department or a party approved by the Department shall conduct the on-site inspection. The inspection shall 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 shall be prepared every year. The on-site inspection shall indicate to the Department's satisfaction that the watershed control program and disinfection treatment process are adequately designed and maintained. The on-site inspection shall include:

(i) A review of the effectiveness of the watershed control 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.

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

(e) The public water system shall comply with the maximum contaminant level (MCL) for total coliforms in R.61 58.5.F(1) and (2) and the MCL for E. coli in R.61- 58.5.F(3) 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.

(f) The public water system must comply with the requirements for trihalomethanes in R.61-58.13.

(3) Treatment technique violations.

(a) A system is in violation of a treatment technique requirement if:

(i) it fails to meet any one of the criteria in paragraphs (1) and (2) of this section and/or the Department has determined, in writing, that filtration is required; and

(ii) it fails to install filtration by the date specified in the introductory paragraph of this section.

(b) A system that has not installed filtration is in violation of a treatment technique requirement if:

(i) The turbidity level [measured as specified in R.61-58.10.F(1)(d) and (2)(b)] 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.

D. Disinfection.

A public water system that uses a surface water source and does not provide filtration treatment shall provide the disinfection treatment specified in paragraph (1) of this section beginning December 30, 1991, unless the Department determines, in writing, that filtration is required. A public water system that uses a ground water source under the direct influence of surface water and does not provide filtration treatment

shall provide disinfection treatment specified in paragraph (1) of this section beginning December 30, 1991, or 18 months after the Department determines that the ground water source is under the influence of surface water, whichever is later, unless the Department has determined, in writing, that filtration is required. If the Department has determined that filtration is required, the system shall comply with any interim disinfection requirements the Department deems necessary before filtration is installed. A system that uses a surface water source that provides filtration treatment shall provide the disinfection treatment specified in paragraph (2) of this section beginning June 29, 1993, or beginning when filtration is installed, whichever is later. A system that uses a ground water source under the direct influence of surface water and provides filtration treatment shall provide disinfection treatment as specified in paragraph (2) of this section by June 29, 1993, or beginning when filtration is installed, whichever is later. Failure to meet any requirement of this section after the applicable date specified in this introductory paragraph is a treatment technique violation.

(1) Disinfection requirements for public water systems that do not provide filtration.

Each public water system that does not provide filtration treatment shall provide disinfection treatment as follows:

(a) The disinfection treatment shall 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, 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 shall calculate the CT value(s) from the system's treatment parameters, using the procedure specified in R.61-58.10.F(2)(c), and 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 R.61-58.10.F(2)(c) or other operational parameters are adequate to demonstrate that the system is achieving minimum inactivation rates required by paragraph (1)(a) of this section.

(b) The disinfection system shall 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 disinfectant concentration in the water. If the Department determines that automatic shut-off would cause unreasonable risk to health or interfere with fire protection, the system shall comply with paragraph (1)(b)(i) of this section.

(c) The residual disinfectant concentration in the water entering the distribution system, measured as specified in R.61-58.10.F(1)(e) and (2)(e), cannot be less than 0.2 mg/L for more than 4 hours.

(d) (i) The residual disinfectant concentration in the distribution system, measured as total chlorine, combined chlorine, or chlorine dioxide, as specified in R.61-58.10.F(1) (e) and (2)(f), cannot be undetectable in more than 5 percent of the samples each month, for any two consecutive months that the system serves water to the public. Water in the distribution system with a heterotrophic bacteria concentration less than or equal to 500/ml, measured as heterotrophic plate count (HPC) as specified in R.61-58.10.F(1)(c), is deemed to have a detectable disinfectant residual for purposes of determining compliance with this requirement. Thus, the value "V" in the following formula cannot exceed 5 percent in one month, for any two consecutive months.

$$V = \frac{c + d + e}{a + b} \times 100$$

where:

- a = number of instances where the residual disinfectant concentration is measured;
- b = number of instances where the residual disinfectant concentration is not measured but heterotrophic bacteria plate count (HPC) is measured;
- c = number of instances where the residual disinfectant concentration is measured but not detected and no HPC is measured;
- d = number of instances where the residual disinfectant concentration is measured but not detected and where the HPC is >500/ml; and
- e = number of instances where the residual disinfectant concentration is not measured and HPC is >500/ml.

(ii) If the Department determines, based on site-specific considerations, that a system has no means for having a sample transported and analyzed for HPC by a certified laboratory under the requisite time and temperature conditions specified by R.61-58.10.F(1)(c) and that the system is providing adequate disinfection in the distribution system, the requirements of paragraph (1)(d)(i) of this section do not apply to that system.

(2) Disinfection requirements for public water systems which provide filtration.

Each public water system that provides filtration treatment shall provide disinfection treatment as follows:

(a) The disinfection treatment shall be sufficient to ensure that the total treatment processes of that system achieve at least 99.9 percent (3-log) inactivation and/or removal of *Giardia lamblia* cysts and at least 99.99 percent (4-log) inactivation and/or removal of viruses, as determined by the Department.

(b) The residual disinfectant concentration in the water entering the distribution system, measured as specified in R.61-58.10.F(1)(e) and (3)(b), cannot be less than 0.2 mg/L for more than four (4) hours.

(c) (i) The residual disinfectant concentration in the distribution system, measured as total chlorine, combined chlorine, or chlorine dioxide, as specified in R.61-58.10.F(1) (e) and (3)(c), cannot be undetectable in more than 5 percent of the samples each month, for any two consecutive months that the system serves water to the public. Water in the distribution system with a heterotrophic bacteria concentration less than or equal to 500/ml, measured as heterotrophic plate count (HPC) as specified in R.61-58.10(F)(1)(c), is deemed to have a detectable disinfectant residual for purposes of determining compliance with this requirement. Thus, the value "V" in the following formula cannot exceed 5 percent in one month, for any two consecutive months.

$$V = \frac{c + d + e}{a + b} \times 100$$

where:

- a = number of instances where the residual disinfectant concentration is measured;
- b = number of instances where the residual disinfectant concentration is not measured but heterotrophic bacteria plate count (HPC) is measured;

c = number of instances where the residual disinfectant concentration is measured but not detected and no HPC is measured;
d = number of instances where no residual disinfectant concentration is detected and where the HPC is >500/ml; and
e = number of instances where the residual disinfectant concentration is not measured and HPC is >500/ml.

(ii) If the Department determines, based on site-specific considerations, that a system has no means for having a sample transported and analyzed for HPC by a certified laboratory under the requisite time and temperature conditions specified in R.61-58.10.F(1)(c) and that the system is providing adequate disinfection in the distribution system, the requirements of paragraph (2)(c)(i) of this section do not apply.

E. Filtration.

A public water system that uses a surface water source or a ground water source under the direct influence of surface water, and does not meet all of the criteria in R.61-58.10.C(1) and (2) for avoiding filtration, shall provide treatment consisting of both disinfection, as specified in R.61-58.10.D(2), and filtration treatment which complies with the requirements of paragraphs (1), (2), (3), or (4) of this section by June 29, 1993, or within 18 months of the failure to meet any one of the criteria for avoiding filtration in R.61-58.10.C(1) and (2), whichever is later. Failure to meet any requirement of this section after the date specified in this introductory paragraph is a treatment technique violation.

(1) Conventional filtration treatment or direct filtration.

(a) For systems using conventional filtration or direct filtration, the turbidity level of representative samples of a system's filtered water must be less than or equal to 0.5 NTU in at least 95 percent of the measurements taken each month, measured as specified in R.61-58.10.F(1)(d) and (3)(a), except that if the Department determines that the system is capable of achieving at least 99.9 percent removal and/or inactivation of *Giardia lamblia* cysts at some turbidity level higher than 0.5 NTU in at least 95 percent of the measurements taken each month, the Department may substitute this higher turbidity limit for that system. However, in no case may the Department approve a turbidity limit that allows more than 1 NTU in more than 5 percent of the samples taken each month, measured as specified in R.61-58.10.F(1)(d) and (3)(a).

(b) The turbidity level of representative samples of a system's filtered water must at no time exceed 5 NTU, measured as specified in R.61-58.10.F(1)(d) and (3)(a).

(c) Beginning January 1, 2002, systems serving at least 10,000 people must meet the requirements of R.61-58.10.H(4)(a)

(d) Beginning January 1, 2005, systems serving fewer than 10,000 people must meet the turbidity requirements in Section I(6) below.

(2) Slow sand filtration.

(a) For systems using slow sand filtration, the turbidity level of representative samples of a system's filtered water must be less than or equal to 1 NTU in at least 95 percent of the measurements taken each month, measured as specified in R.61-58.10.F(1)(d) and (3)(a), except that if the Department determines there is no significant interference with disinfection at a higher turbidity level, the Department may substitute this higher turbidity limit for that system.

(b) The turbidity level of representative samples of a system's filtered water must at no time exceed 5 NTU, measured as specified in R.61-58.10.F(1)(d) and (3)(a).

(3) Diatomaceous earth filtration.

(a) For systems using diatomaceous earth filtration, the turbidity level of representative samples of a system's filtered water must be less than or equal to 1 NTU in at least 95 percent of the measurements taken each month, measured as specified in R.61- 58.10.F(1) (d) and (3)(a).

(b) The turbidity level of representative samples of a system's filtered water must at no time exceed 5 NTU, measured as specified in R.61-58.10.F(1)(d) and (3)(a).

(4) Other filtration technologies.

A public water system may use a filtration technology not listed in paragraphs (1) through (3) of this section if it demonstrates to the Department, using pilot plant studies or other means, that the alternative filtration technology, in combination with disinfection treatment that meets the requirements of Section D(2), above, consistently achieves 99.9 percent removal and/or inactivation of *Giardia lamblia* cysts and 99.99 percent removal and/or inactivation of viruses. For a system that makes this demonstration, the requirements of paragraph (2) of this section apply. Beginning January 1, 2002, systems serving at least 10,000 people must meet the requirements for other filtration technologies in R.61-58.10.H(4)(b). Beginning January 1, 2005, systems serving fewer than 10,000 people must meet the requirements for other filtration technologies in Section I(6) below.

F. Analytical and Monitoring Requirements.

(1) Analytical requirements.

Only the analytical method(s) specified in this paragraph, or otherwise approved by EPA, may be used to demonstrate compliance with the requirements of R.61-58.10.C, R.61-58.10.D, and R.61-58.10.E. Measurements for pH, temperature, turbidity and residual disinfectant concentrations shall be conducted by a party approved by the Department. Measurements for total coliforms, fecal coliforms, and HPC shall be conducted by a laboratory certified by the Department or EPA to do such analysis. Until laboratory certification criteria are developed for the analysis of HPC and fecal coliforms, any laboratory certified for total coliform analysis by EPA is deemed certified for HPC and fecal coliform analysis. All procedures shall be performed in accordance with EPA-approved methods outlined in 40 CFR 141 (11-8- 06 edition).

(2) Monitoring requirements for systems that do not provide filtration.

A public water system that uses a surface water source and does not provide filtration treatment shall begin monitoring, as specified in this paragraph, beginning December 31, 1990, 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. A public water system that uses a ground water source under the direct influence of surface water and does not provide filtration treatment shall begin monitoring as specified in this paragraph beginning December 31, 1990, or 6 months after the Department determines 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.

(a) Fecal coliform or total coliform density measurements as required by R.61- 58.10.C(1)(a) shall be performed on representative source water samples immediately prior to the first or only point of

disinfectant application. The system shall sample for fecal or total coliforms at the following minimum frequency each week the system serves water to the public:

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

¹Must be taken on separate days.

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

(b) Turbidity measurements as required by R.61-58.10.C(1)(b) shall 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.

(c) The total inactivation ratio for each day that the system is in operation shall be determined based on the CT_{99,9} values in Table 1.1 - 1.6, 2.1 and 3.1 of this section, as appropriate. The parameters necessary to determine the total inactivation ratio shall be monitored as follows:

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

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

(iii) The disinfectant contact time(s) ("T") shall 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 shall 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 section or other operational parameters are adequate to demonstrate that the system is achieving the minimum inactivation rates required by R.61-58.10.D(1)(a).

TABLE 1.1 - CT VALUES (CT_{99.9}) FOR 99.9 PERCENT INACTIVATION OF GIARDIA LAMBLIA CYSTS BY FREE CHLORINE AT 0.5°C OR LOWER¹

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	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

¹These 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 1.2 - CT VALUES (CT_{99.9}) FOR 99.9 PERCENT INACTIVATION OF GIARDIA LAMBLIA CYSTS BY FREE CHLORINE AT 5.0°C¹

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	146	175	213	258	312	375
2.8	124	148	178	217	263	318	382
3.0	126	151	182	221	268	324	389

¹These 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°C¹

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

¹These 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°C¹

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

¹These 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°C¹

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	119	143
3.0	47	57	68	83	101	122	146

¹These 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°C¹ 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	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

	pH						
Free residual (mg/L)	≤6.0	6.5	7.0	7.5	8.0	8.5	≤9.0
3.0	32	38	46	55	67	81	97

¹These 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 OZONE¹

	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

¹These 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} value 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 CHLORAMINES¹

Temperature						
	≤1°C	5°C	10°C	15°C	20°C	25°C
	3,800	2,200	1,850	1,500	1,100	750

¹These 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 shall demonstrate, based on 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.

(d) The total inactivation ratio shall be calculated at 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:

(A) One inactivation ratio ($CT_{calc}/CT_{99.9}$) is determined before or at the first customer during peak hourly flow and if the $CT_{calc}/CT_{99.9} \geq 1.0$, the 99.9 percent *Giardia lamblia* inactivation requirement has been achieved; or

(B) Successive $CT_{calc}/CT_{99.9}$ 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 shall be used to calculate the total inactivation ratio:

Step 1: Determine $\frac{CT_{calc}}{CT_{99.9}}$ for each sequence

Step 2: Add the $\frac{CT_{calc}}{CT_{99.9}}$ values together

$$\sum \frac{CT_{calc}}{CT_{99.9}}$$

Step 3: If $\sum \frac{CT_{calc}}{CT_{99.9}} \geq 1.0$,

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 shall determine the CT value of each disinfection sequence immediately prior to the next point of disinfectant application during peak hourly flow. The $CT_{calc}/CT_{99.9}$ value of each sequence and

$$\sum \frac{CT_{calc}}{CT_{99.9}}$$

shall be calculated using the method in paragraph (2)(d)(i)(B) of this section to determine if the system is in compliance with R.61-58.10.D(1).

(iii) Although not required, the total percent inactivation for a system with one or more points of residual disinfectant concentration monitoring may be calculated by solving the following equation:

$$\text{Percent inactivation} = 100 - \frac{100}{10^z}$$

$$\text{where } z = 3 \times \sum \frac{CT_{calc}}{CT_{99.9}}$$

(e) The residual disinfectant concentration of the water entering the distribution system shall be monitored continuously, and the lowest value shall be recorded each day, except that 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, and 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

System size by population	Samples/day ¹
501 to 1,000	2
1,001 to 2,500	3
2,501 to 3,300	4

¹The 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 residual disinfectant concentration falls below 0.2 mg/L in a system using grab sampling in lieu of continuous monitoring, the system shall take a grab sample every 4 hours until the residual concentration is equal to or greater than 0.2 mg/L.

(f) (i) Until March 31, 2016, the residual disinfectant concentration shall 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 R.61-58.5.G. Beginning April 1, 2016, the residual disinfectant concentration shall 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 R.61-58.17.E through R.61-58.17.I. The Department may allow a public water system which uses both a surface water source or a ground water source under the 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. Heterotrophic bacteria, measured as heterotrophic plate count (HPC) as specified in R.61-58.10.F(1), may be measured in lieu of residual disinfectant concentration.

(ii) If the Department determines, based on site-specific considerations, that a system has no means for having a sample transported and analyzed for HPC by a certified laboratory under the requisite time and temperature conditions specified by paragraph (1)(c) of this section and that the system is providing adequate disinfection in the distribution system, the requirements of paragraph (2)(f)(i) of this section do not apply to that system.

(3) 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 shall monitor in accordance with this paragraph beginning June 29, 1993, or when filtration is installed, whichever is later.

(a) Turbidity measurements as required by R.61-58.10.E shall be performed on representative samples of the system's filtered water 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. For any systems 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.

(b) The residual disinfectant concentration of the water entering the distribution system shall be monitored continuously, and the lowest value shall be recorded each day, except that 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, and systems

serving 3,300 or fewer persons may take grab samples in lieu of providing continuous monitoring on an ongoing basis at the frequencies each day 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

¹The 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 residual disinfectant concentration falls below 0.2 mg/L in a system using grab sampling in lieu of continuous monitoring, the system shall take a grab sample every 4 hours until the residual disinfectant concentration is equal to or greater than 0.2 mg/L.

(c) (i) Until March 31, 2016, the residual disinfectant concentration shall 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 R.61-68.5.G. Beginning April 1, 2016, the residual disinfectant concentration shall 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 R.61-58.17.E through R.61-58.17.I. The Department may allow a public water system which uses both a surface water source or a ground water source under the 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. Heterotrophic bacteria, measured as heterotrophic plate count (HPC) as specified in R.61-58.10.F(1), may be measured in lieu of residual disinfectant concentration.

(ii) If the Department determines, based on site-specific considerations, that a system has no means for having a sample transported and analyzed for HPC by a certified laboratory under the requisite time and temperature conditions specified by paragraph (1)(c) of this section and that the system is providing adequate disinfection in the distribution system, the requirements of paragraph (3)(c)(i) of this section do not apply to that system.

G. Reporting and Recordkeeping Requirements.

(1) A public water system that uses a surface water source and does not provide filtration treatment shall report monthly to the Department the information specified in this paragraph beginning December 31, 1990, 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. A public water system that uses a ground water source under the direct influence of surface water and does not provide filtration treatment shall report monthly to the Department the information specified in this paragraph beginning December 31, 1990, or 6 months after the Department determines 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.

(a) Source water quality information shall be reported to the Department within 10 days after the end of each month the system serves water to the public. Information that shall be reported includes:

(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.

(b) Disinfection information specified in R.61-58.10.F(2) shall be reported to the Department within 10 days after the end of each month the system serves water to the public. Information that shall 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 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 °C following each point of disinfection.

(vi) The daily CT_{calc} and CT_{calc}/CT_{99.9} values for each disinfectant measurement or sequence and the sum of all CT_{calc}/CT_{99.9} values [$\sum(\text{CT}_{\text{calc}}/\text{CT}_{99.9})$] before or at the first customer.

(vii) The daily determination of whether disinfection achieves adequate Giardia cyst and virus inactivation, i.e., whether (CT_{calc}/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 R.61-58.10.D:

(A) Number of instances where the residual disinfectant concentration is measured;

(B) Number of instances where the residual disinfectant concentration is not measured but heterotrophic bacteria plate count (HPC) is measured;

(C) Number of instances where the residual disinfectant concentration is measured but not detected and no HPC is measured;

(D) Number of instances where no residual disinfectant concentration is detected and where HPC is >500/ml;

(E) Number of instances where the residual disinfectant concentration is not measured and HPC is >500/ml;

(F) For the current and previous month the system served water to the public, the value of "V" in the following formula:

$$V = \frac{c + d + e}{a + b} \times 100$$

where:

a = the value in paragraph (1)(b)(viii)(A) of this section;

b = the value in paragraph (1)(b)(viii)(B) of this section;

c = the value in paragraph (1)(b)(viii)(C) of this section;

d = the value in paragraph (1)(b)(viii)(D) of this section; and

e = the value in paragraph (1)(b)(viii)(E) of this section.

(G) If the Department determines, based on site-specific considerations, that a system has no means for having a sample transported and analyzed for HPC by a certified laboratory under the requisite time and temperature conditions specified by R.61- 58.10.F(1)(c) and that the system is providing adequate disinfection in the distribution system, the requirements of paragraph (1)(b)(viii)(A) -(F) of this section do not apply to that system.

(ix) A system need not report the data listed in paragraphs (1)(b)(i), and (iii) -(vi) of this section if all data listed in paragraphs (1)(b)(i) - (viii) of this section remain on file at the system, and the Department determines that:

(A) The system has submitted to the Department all the information required by paragraphs (1)(b)(i) -(viii) of this section for at least 12 months; and

(B) The Department has determined that the system is not required to provide filtration treatment.

(c) No later than October 10 of each year, each system shall provide to the Department a report which summarizes its compliance with all watershed control program requirements specified in R.61-58.10.C(2)(b).

(d) No later than October 10 of each year, each system shall provide to the Department a report on the on-site inspection conducted during that year pursuant to R.61-58.10.C(2)(c), unless the on-site inspection was conducted by the Department. If the inspection was conducted by the Department, the Department shall provide a copy of its report to the public water system.

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

(ii) If at any time the turbidity exceeds 5 NTU, the system shall inform the Department as soon as possible, but no later than the end of the next business day.

(iii) If at any time the residual falls below 0.2 mg/L in the water entering the distribution system, the system shall notify the Department as soon as possible, but no later than by the end of the next business day. The system also shall 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.

(iv) If at any time the turbidity exceeds 5 NTU, the system must consult with the primacy agency as soon as practical, but no later than 24 hours after the exceedance is known, in accordance with the public notification requirements under R.61-58.6.E(3)(b)(iii).

(2) 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 shall report monthly to the Department the information specified in this paragraph beginning June 29, 1993, or when filtration is installed, whichever is later.

(a) Turbidity measurements as required by R.61-58.10.F(3)(a) shall be reported within 10 days after the end of each month the system serves water to the public. Information that shall 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 R.61-58.10.E for the filtration technology being used.

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

(b) Disinfection information specified in R.61-58.10.F(3) shall be reported to the Department within 10 days after the end of each month the system serves water to the public. Information that shall 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 coliform monitoring pursuant to R.61-58.10.D:

(A) Number of instances where the residual disinfectant concentration is measured;

(B) Number of instances where the residual disinfectant concentration is not measured but heterotrophic bacteria plate count (HPC) is measured;

(C) Number of instances where the residual disinfectant concentration is measured but not detected and no HPC is measured;

(D) Number of instances where no residual disinfectant concentration is detected and where HPC is >500/ml;

(E) Number of instances where the residual disinfectant concentration is not measured and HPC is >500/ml;

(F) For the current and previous month the system serves water to the public, the value of "V" in the following formula:

$$V = \frac{c + d + e}{a + b} \times 100$$

where:

a = the value in paragraph (2)(b)(iii)(A) of this section;

b = the value in paragraph (2)(b)(iii)(B) of this section;

c = the value in paragraph (2)(b)(iii)(C) of this section;

d = the value in paragraph (2)(b)(iii)(D) of this section; and

e = the value in paragraph (2)(b)(iii)(E) of this section.

(G) If the Department determines, based on site-specific considerations, that a system has no means for having a sample transported and analyzed for HPC by a certified laboratory within the requisite time and temperature conditions specified by R.61-58.10.F(1)(c) and that the system is providing adequate disinfection in the distribution system, the requirements of paragraph (2)(b)(iii)(A) - (F) of this section do not apply.

(iv) A system need not report the data listed in paragraph (2)(b)(i) of this section if all data listed in paragraphs (2)(b)(i) - (iii) of this section remain on file at the system and the Department determines that the system has submitted all the information required by paragraphs (2)(b)(i) - (iii) of this section for at least 12 months.

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

(ii) If at any time the turbidity exceeds 5 NTU, the system shall inform the Department as soon as possible, but no later than the end of the next business day.

(iii) If at any time the residual falls below 0.2 mg/L in the water entering the distribution system, the system shall notify the Department as soon as possible, but no later than by the end of the next business day. The system also shall 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.

(iv) If at any time the turbidity exceeds 5 NTU, the system must consult with the primacy agency as soon as practical, but no later than 24 hours after the exceedance is known, in accordance with the public notification requirements under R.61-58.6.E(3)(b)(iii).

H. Enhanced Filtration and Disinfection - Systems Serving 10,000 or More People (Interim Enhanced Surface Water Treatment Rule).

(1) General requirements.

(a) The requirements of this regulation constitute national primary drinking water regulations. These regulations establish requirements for filtration and disinfection that are in addition to criteria under which filtration and disinfection are required under Sections B through G above. The requirements of this section are applicable to public water systems supplied by a surface water source and public water systems supplied by a ground water source under the direct influence of surface water serving at least 10,000 people, beginning January 1, 2002 unless otherwise specified. These regulations establish or extend treatment technique requirements in lieu of maximum contaminant levels for the following contaminants: *Giardia lamblia*, viruses, heterotrophic plate count bacteria, *Legionella*, *Cryptosporidium*, and turbidity. Each public water system supplied by a surface water source or a ground water source under the direct influence of surface water system serving at least 10,000 people must provide treatment of its source water that complies with these treatment technique requirements and are in addition to those identified in Sections B through G above. The treatment technique requirements consist of installing and properly operating water treatment processes which reliably achieve:

(i) 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, or *Cryptosporidium* control under the watershed control plan for unfiltered systems.

(ii) Compliance with the profiling and benchmark requirements under the provisions of paragraph (3) of this section.

(b) A public water system subject to the requirements of these regulations is considered to be in compliance with the requirements of paragraph (1) of this section if:

(i) It meets the requirements for avoiding filtration in R.61-58.10.C and R.61-58.10.H(2) and the disinfection requirements in R.61-58.10.D and R.61-58.10.H(3); or

(ii) It meets the applicable filtration requirements in either R.61-58.10.E or R.61-58.10.H(4) and the disinfection requirements in R.61-58.10.D and R.61-58.10.H(3).

(c) Systems are not permitted to begin construction of uncovered finished water storage facilities beginning February, 16, 1999.

(d) Systems with a surface water source or a ground water source under the direct influence of surface water that did not conduct optional monitoring under Section H(3) because they served fewer than 10,000 persons when such monitoring was required, but served at least 10,000 persons prior to January 1, 2005 must comply with Section H. 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 Section H(3)(c)(i) must consult with the Department prior to making such change.

(2) Criteria for avoiding filtration.

In addition to the requirements of R.61-58.10.C, a public water system subject to the requirements of this section that does not provide filtration must meet all of the conditions of paragraphs (2)(a) and (2)(b) of this section.

(a) Site-specific conditions. In addition to site-specific conditions in R.61- 58.10.C(2), systems must maintain the watershed control program under R.61-58.10.C(2)(b) to minimize the potential for contamination by *Cryptosporidium* oocysts in the source water. The watershed control program must, for *Cryptosporidium*:

(i) Identify watershed characteristics and activities which may have an adverse effect on source water quality; and

(ii) Monitor the occurrence of activities which may have an adverse effect on source water quality.

(b) During the onsite inspection conducted under the provisions of R.61- 58.10.C(2)(c), the Department must determine whether the watershed control program established under 58.10.C(2)(b) is adequate to limit potential contamination by *Cryptosporidium* oocysts. The adequacy of the program must be based on the comprehensiveness of the watershed review; the effectiveness of the system's program to monitor and control detrimental activities occurring in the watershed; and the extent to which the water system has maximized land ownership and/or controlled land use within the watershed.

(3) (a) Using data gathered from monitoring conducted by the Department during the time period of January 1, 1999 through March 1, 2000, any system having either a TTHM annual average greater than or equal to 0.064 mg/L or an HAA5 annual average greater than or equal to 0.048 mg/L during this period must comply with paragraph (3)(b) of this section.

(b) Disinfection profiling.

(i) Any system that meets the criteria in paragraph (3)(a) of this section must develop a disinfection profile of its disinfection practice for a period of up to three years.

(ii) The system must monitor daily for a period of twelve (12) consecutive calendar months to determine the total logs of inactivation for each day of operation, based on the $CT_{99,9}$ values in Tables 1.1 - 1.6, 2.1, and 3.1 of R.61-58.10.F(2), as appropriate, through the entire treatment plant. This system must begin this monitoring not later than March 16, 2000. As a minimum, the system with a single point of disinfectant application prior to entrance to the distribution system must conduct the monitoring in paragraphs (3)(b)(ii) (A) through (D) of this section. A system with more than one point of disinfectant application must conduct the monitoring in paragraphs (3)(b)(i) through (iv) of this section for each disinfection segment. The system must monitor the parameters necessary to determine the total inactivation ratio, using EPA approved analytical methods specified in 40 CFR 141, as follows:

(iii) In lieu of the monitoring conducted under the provisions of paragraph (b)(ii) of this section to develop the disinfection profile, the system may elect to meet the requirements of paragraph (b)(iii)(A) of this section. In addition to the monitoring conducted under the provisions of paragraph (b)(ii) of this section to develop the disinfection profile, the system may elect to meet the requirements of paragraph (b)(iii)(B) of this section.

(A) A PWS that has three years of existing operational data may submit those data, a profile generated using those data, and a request that the State approve use of those data in lieu of monitoring under the provisions of paragraph (b)(2) of this section not later than March 16, 2000. The State must determine whether these operational data are substantially equivalent to data collected under the provisions of paragraph (b)(ii) of this section. These data must also be representative of *Giardia lamblia* inactivation through the entire treatment plant and not just of certain treatment segments. Until the State approves this request, the system is required to conduct monitoring under the provisions of paragraph (b)(ii) of this section.

(B) In addition to the disinfection profile generated under paragraph (3)(b)(ii) of this section, a PWS that has existing operational data may use those data to develop a disinfection profile for additional years. Such systems may use these additional yearly disinfection profiles to develop a benchmark under the provisions of paragraph (3)(c) of this section. The State must determine whether these operational data are substantially equivalent to data collected under the provisions of paragraph (3)(b)(ii) of this section. These data must also be representative of inactivation through the entire treatment plant and not just of certain treatment segments.

(iv) If the system uses only one point of disinfectant application, the system may determine the total inactivation ratio for the disinfection segment based on either of the methods in paragraph (3)(b)(iv)(A) or (3)(b)(iv)(B) of this section.

(A) Determine one inactivation ratio ($CT_{calc}/CT_{99.9}$) before or at the first customer during peak hourly flow.

(B) Determine successive $CT_{calc}/CT_{99.9}$ values, representing sequential inactivation ratios, between the point of disinfectant application and a point before or at the first customer during peak hourly flow. Under this alternative, the system must calculate the total inactivation ratio by determining ($CT_{calc}/CT_{99.9}$) for each sequence and then adding the ($CT_{calc}/CT_{99.9}$) values together to determine ($\sigma(CT_{calc}/CT_{99.9})$).

(v) If the system uses more than one point of disinfectant application before the first customer, the system must determine the CT value of each disinfection segment immediately prior to the next point of disinfectant application, or for the final segment, before or at the first customer, during peak hourly flow. The ($CT_{calc}/CT_{99.9}$) value of each segment and ($\sum (CT_{calc}/CT_{99.9})$) must be calculated using the method in paragraph (3)(b)(iv) of this section.

(vi) The system must determine the total logs of inactivation by multiplying the value calculated in paragraph (b)(iv)(A) or (B) of this section by 3.0.

(vii) A system that uses either chloramines or ozone for primary disinfection must also calculate the logs of inactivation for viruses using a method approved by the Department.

(viii) The system must retain disinfection profile data in graphic form, as a spreadsheet, or in some other format acceptable to the Department for review as part of the sanitary survey.

(c) Disinfection Benchmarking

(i) Any system required to develop a disinfection profile under the provisions of paragraphs (3)(a) and (3)(b) of this section and that decides to make a significant change to its disinfection practice must consult with the Department prior to making such change. Significant changes to disinfection practice are:

- (A) Changes to the point of disinfection;
- (B) Changes to the disinfectant(s) used in the treatment plant;
- (C) Changes to the disinfection process; and
- (D) Any other modification identified by the Department.

(ii) Any system that is modifying its disinfection practice must calculate its disinfection benchmark using the following procedure:

(A) For each year of profiling data collected and calculated under paragraph (b) of this section, the system must determine the lowest average monthly *Giardia lamblia* inactivation in each year of profiling data. The system must determine the average *Giardia lamblia* inactivation for each calendar month for each year of profiling data by dividing the sum of daily *Giardia lamblia* of inactivation by the number of values calculated for that month.

(B) The disinfection benchmark is the lowest monthly average value (for systems with one year of profiling data) or average of lowest monthly average values (for systems with more than one year of profiling data) of the monthly logs of *Giardia lamblia* inactivation in each year of profiling data.

(iii) A system that uses either chloramines or ozone for primary disinfection must also calculate the disinfection benchmark for viruses using a method approved by the Department.

(iv) The system must submit information in paragraphs (3)(c)(iv)(A) through (C) of this section to the Department as part of its consultation process.

- (A) A description of the proposed change;
- (B) The disinfection profile for *Giardia lamblia* (and, if necessary, viruses) under paragraph (b) of this section and benchmark as required by paragraph (c)(2) of this section; and
- (C) An analysis of how the proposed change will affect the current levels of disinfection.

(4) Filtration

A public water system subject to the requirements of this section that does not meet all of the criteria in Section C above and paragraph (2) of this section for avoiding filtration must provide treatment consisting of both disinfection, as specified in Section D above, and filtration treatment which complies with the requirements of paragraph 4(a) or 4(b) of this section or Section E(2) or (3) by December 31, 2001.

- (a) Conventional filtration treatment or direct filtration.

(i) For systems using conventional filtration or direct filtration, the turbidity level of representative samples of a system's filtered water must be less than or equal to 0.3 NTU in at least 95 percent of the measurements taken each month, measured as specified in Section F(1)(d) and (3)(a) above.

(ii) The turbidity level of representative samples of a system's filtered water must at no time exceed 1 NTU, measured as specified in Section F(1)(d) and (3)(a) above.

(iii) A system that uses lime softening may acidify representative samples prior to analysis using a protocol approved by the Department.

(b) Filtration technologies other than conventional filtration treatment, direct filtration, slow sand filtration, or diatomaceous earth filtration.

A public water system may use a filtration technology not listed in paragraph (4)(a) of this section or in Section E(2) or (3) if it demonstrates to the Department, using pilot plant studies or other means, that the alternative filtration technology, in combination with disinfection treatment that meets the requirements of Section D, consistently achieves 99.9 percent removal and/or inactivation of *Giardia lamblia* cysts and 99.99 percent removal and/or inactivation of viruses, and 99 percent removal of *Cryptosporidium* oocysts, and the Department approves the use of the filtration technology. For each approval, the Department will set turbidity performance requirements that the system must meet at least 95 percent of the time and that the system may not exceed at any time at a level that consistently achieves 99.9 percent removal and/or inactivation of *Giardia lamblia* cysts, 99.99 percent removal and/or inactivation of viruses, and 99 percent removal of *Cryptosporidium* oocysts.

(5) Filtration sampling requirements

(a) Monitoring requirements for systems using filtration treatment. In addition to monitoring required by Section F above, a public water system subject to the requirements of this subpart that provides conventional filtration treatment or direct filtration must conduct continuous monitoring of turbidity for each individual filter using an approved method in Section F above, and must calibrate turbidimeters using the procedure specified by the manufacturer. Systems must record the results of individual filter monitoring every fifteen (15) minutes.

(b) 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, but for no more than five working days following the failure of the equipment.

(6) Reporting and recordkeeping requirements.

In addition to the reporting and recordkeeping requirements in Section G above, a public water system subject to the requirements of this subpart that provides conventional filtration treatment or direct filtration must report monthly to the Department the information specified in paragraphs (6)(a) and (6)(b) of this section beginning December 31, 2001. In addition to the reporting and recordkeeping requirements in Section G above, a public water system subject to the requirements of this subpart that provides filtration approved under paragraph (4)(b) of this section must report monthly to the Department the information specified in paragraph (a) of this section beginning December 31, 2001. The reporting in paragraph (6)(a) of this section is in lieu of the reporting specified in Section G above.

(a) Turbidity measurements as required by paragraph (4) of this section 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 paragraph (4)(a) or (4)(b) of this section.
- (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 paragraph (4)(b) of this section.

(b) Systems must maintain the results of individual filter monitoring taken under paragraph (5) of this section for at least three years. Systems must report that they have conducted individual filter turbidity monitoring under paragraph (5) of this section within 10 days after the end of each month the system serves water to the public. Systems must report individual filter turbidity measurement results taken under paragraph (5) of this section within 10 days after the end of each month the system serves water to the public only if measurements demonstrate one or more of the conditions in paragraphs (6)(b)(i) through (iv) of this section. Systems that use lime softening may apply to the Department for alternative exceedance levels for the levels specified in paragraphs (6)(b)(i) through (iv) of this section if they can demonstrate that higher turbidity levels in individual filters are due to lime carryover only and not due to degraded filter performance.

(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.

(c) Additional reporting requirements.

(i) If at any time the turbidity exceeds one (1) NTU in representative samples of filtered water in a system using conventional filtration treatment or direct filtration, the system must inform the Department as soon as possible, but no later than the end of the next business day.

(ii) If at any time the turbidity in representative samples of filtered water exceeds the maximum level set by the Department under paragraph 4(b) of this section for filtration technologies other than conventional filtration treatment, direct filtration, slow sand filtration, or diatomaceous earth filtration, the system must inform the Department as soon as possible, but no later than the end of the next business day.

I. Enhanced Filtration and Disinfection - Systems Serving Fewer Than 10,000 People (Long Term 1 Enhanced Surface Water Treatment Rule).

(1) General Requirements

(a) The requirements of this regulation constitute national primary drinking water regulations. These regulations establish requirements for filtration and disinfection that are in addition to criteria under which filtration and disinfection are required for systems with surface water sources or ground water sources under the influence of surface water. This regulation establishes or extends treatment technique requirements in lieu of maximum contaminant levels for the following contaminants: *Giardia lamblia*, viruses, heterotrophic plate count bacteria, *Legionella*, *Cryptosporidium* and turbidity. The treatment technique requirements consist of installing and properly operating water treatment processes which reliably achieve:

(i) 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, or *Cryptosporidium* control under the watershed control plan for unfiltered systems; and

(ii) Compliance with the profiling and benchmark requirements in paragraphs (4) and (5) of this section.

(b) Who is subject to the requirements of this section? You are subject to these requirements if your system:

(i) Is a public water system;

(ii) Uses surface water or GWUDI as a source; and

(iii) Serves fewer than 10,000 persons.

(c) When must my system comply with these requirements? You must comply with these requirements in this regulation beginning January 1, 2005 except where otherwise noted.

(d) What does this regulation require? There are seven (7) requirements of this subpart, and you must comply with all requirements that are applicable to your system. These requirements are:

(i) You must cover any finished water reservoir that you began to construct on or after March 15, 2002 as described in paragraph (2) of this section;

(ii) If your system is an unfiltered system, you must comply with the updated watershed control requirements described in paragraph (3) of this section;

(iii) If your system is a community or non-transient non-community water systems you must develop a disinfection profile as described in paragraph (4) of this section;

(iv) If your system is considering making a significant change to its disinfection practices, you must develop a disinfection benchmark and consult with the Department for approval of the change as described in paragraph (5) of this section;

(v) If your system is a filtered system, you must comply with the combined filter effluent requirements as described in paragraph (6) of this section;

(vi) If your system is a filtered system that uses conventional or direct filtration, you must comply with the individual filter turbidity requirements as described in paragraph (7) of this section; and,

(vii) You must comply with the applicable reporting and recordkeeping requirements as described in paragraph (8) of this section.

(2) Finished Water Reservoirs

(a) Is my system subject to the new finished water reservoir requirements? All surface water systems and ground water systems under the direct influence of surface water which serve fewer than 10,000 people are subject to this requirement.

(b) What is required of new finished water reservoirs? If your system begins construction of a finished water reservoir on or after March 15, 2002 the reservoir must be covered. Finished water reservoirs for which your system began construction prior to March 15, 2002 are not subject to this requirement.

(3) Additional Watershed Control Requirements for Unfiltered Systems

(a) Is my system subject to the updated watershed control requirements? If you are a surface water system or a ground water system under the direct influence of surface water serving fewer than 10,000 persons which does not provide filtration, you must continue to comply with all of the filtration avoidance criteria in Section C, as well as the additional watershed control requirements in paragraph (3)(b) of this section.

(b) What updated watershed control requirements must my unfiltered system implement to continue to avoid filtration? Your system must take any additional steps necessary to minimize the potential for contamination by *Cryptosporidium* oocysts in the source water. Your system's watershed control program must, for *Cryptosporidium*:

(i) Identify watershed characteristics and activities which may have an adverse effect on source water quality; and

(ii) Monitor the occurrence of activities which may have an adverse effect on source water quality.

(c) How does the Department determine whether my system's watershed control requirements are adequate? During an onsite inspection conducted under the provisions of Section C(2)(c), the Department must determine whether your watershed control program is adequate to limit potential contamination by *Cryptosporidium oocysts*. The adequacy of the program must be based on the comprehensiveness of the watershed review; the effectiveness of your program to monitor and control detrimental activities occurring in the watershed; and the extent to which your system has maximized land ownership and/or controlled land use within the watershed.

(4) Disinfection Profile

(a) What is a Disinfection Profile and who must develop one? A disinfection profile is a graphical representation of your system's level of *Giardia lamblia* or virus inactivation measured during the course of a year. If you are a surface water system or a ground water system under the direct influence of surface water which serves fewer than 10,000 persons, your system must develop a disinfection profile unless the Department determines that your system's profile is unnecessary. The Department may approve the use of a more representative data set for disinfection profiling than the data set required under paragraph (4) (c) through (f) of this section.

(b) What criteria must the Department use to determine that a profile is unnecessary? The Department may only determine that a system's profile is unnecessary if a system's TTHM and HAA5 levels are below 0.064 mg/L and 0.048 mg/L, respectively. To determine these levels, TTHM and HAA5 samples must be collected after January 1, 1998, during the month with the warmest water temperature, and at the point of maximum residence time in your distribution system. The Department may approve a more representative TTHM and HAA5 data set to determine these levels

(c) How does my system develop a Disinfection Profile and when must it begin? A disinfection profile consists of three steps:

(i) First, your system must collect data for several parameters from the plant as discussed in paragraph (4)(d) of this section, over the course of twelve (12) months. If your system serves between 500 and 9,999 persons you must begin to collect data no later than July 1, 2003. If your system serves fewer than 500 persons you must begin to collect data no later than January 1, 2004.

(ii) Second, your system must use this data to calculate weekly log inactivation as discussed in paragraphs (4)(e) and (f) of this section.

(iii) Third, your system must use these weekly log inactivations to develop a disinfection profile as specified in paragraph (4)(g) of this section.

(d) What data must my system collect to calculate a Disinfection Profile? Your system must monitor the following parameters to determine the total log inactivation using the analytical methods in Section F, once per week on the same calendar day, over twelve (12) consecutive months:

(i) The temperature of the disinfected water at each residual disinfectant concentration sampling point during peak hourly flow;

(ii) If your system uses chlorine, the pH of the disinfected water at each residual disinfectant concentration sampling point during peak hourly flow;

(iii) The disinfectant contact time(s) ("T") during peak hourly flow; and

(iv) The residual disinfectant concentration(s) ('C') of the water before or at the first customer and prior to each additional point of disinfection during peak hourly flow.

(e) How does my system use this data to calculate an inactivation ratio? Use the tables in R-61.58.10.F(1)(c)(v) to determine the appropriate $CT_{99.9}$ value. Calculate the total inactivation ratio as follows, and multiply the value by 3.0 to determine log inactivation of *Giardia lamblia*:

If your system * * *	Your system must determine * * *
(a) Uses only one point of disinfectant application	(1) One inactivation ratio ($CT_{calc}/CT_{99.9}$) before or at the first customer during peak hourly flow or (2) Successive $CT_{calc}/CT_{99.9}$ values, representing sequential inactivation ratios, between the point of disinfectant application and a point before or at the first customer during peak hourly flow. Under this alternative, your system must calculate the total inactivation ratio by determining ($CT_{calc}/CT_{99.9}$) for each sequence and then adding the ($CT_{calc}/CT_{99.9}$) values together to determine ($\Sigma CT_{calc}/CT_{99.9}$).
(b) Uses more than one point of disinfectant application before the first customer	The ($CT_{calc}/CT_{99.9}$) value of each disinfection segment immediately prior to the next point of disinfectant application, or for the final segment, before or at the first customer, during peak hourly flow using the procedure specified in paragraph (a)(2) of this section.

(f) What if my system uses chloramines, ozone, or chlorine dioxide for primary disinfection? If your system uses chloramines, ozone, or chlorine dioxide for primary disinfection, you must also calculate the logs of inactivation for viruses and develop an additional disinfection profile for viruses using methods approved by the Department.

(g) My system has developed an inactivation ratio; what must we do now? Each log inactivation serves as a data point in your disinfection profile. Your system will have obtained fifty-two (52) measurements (one (1) for every week of the year). This will allow your system and the Department the opportunity to evaluate how microbial inactivation varied over the course of the year by looking at all fifty-two (52) measurements (your Disinfection Profile). Your system must retain the Disinfection Profile data in graphic form, such as a spreadsheet, which must be available for review by the Department as part of a sanitary survey. Your system must use this data to calculate a benchmark if you are considering changes to disinfection practices.

(5) Disinfection Benchmark

(a) Who has to develop a Disinfection Benchmark? If you are a surface water system or a ground water system under the direct influence of surface water you are required to develop a disinfection profile under paragraphs (4)(a) through (g) of this section. Your system must develop a Disinfection Benchmark if you decide to make a significant change to your disinfection practice. Your system must consult with the Department for approval before you can implement a significant disinfection practice change.

(b) What are significant changes to disinfection practice? Significant changes to disinfection practice include:

- (i) Changes to the point of disinfection;

- (ii) Changes to the disinfectant(s) used in the treatment plant;
- (iii) Changes to the disinfection process; or
- (iv) Any other modification identified by the Department.

(c) What must my system do if we are considering a significant change to disinfection practices? If your system is considering a significant change to its disinfection practice, your system must calculate a disinfection benchmark(s) as described in paragraphs (5)(c) and (d) of this section, and provide the benchmark(s) to the Department. Your system may only make a significant disinfection practice change after consulting with the Department for approval. Your system must submit the following information to the Department as part of the consultation and approval process:

- (i) A description of the proposed change;
- (ii) The disinfection profile for *Giardia lamblia* (and, if necessary, viruses) and disinfection benchmark;
- (iii) An analysis of how the proposed change will affect the current levels of disinfection; and
- (iv) Any additional information requested by the Department.

(d) How is the Disinfection Benchmark calculated? If your system is making a significant change to its disinfection practice, it must calculate a disinfection benchmark using the procedure specified in the following table.

To calculate a disinfection benchmark your system must perform the following steps

- Step 1: Using the data your system collected to develop the Disinfection Profile, determine the average *Giardia lamblia* inactivation for each calendar month by dividing the sum of all *Giardia lamblia* inactivations for that month by the number of values calculated for that month.
- Step 2: Determine the lowest monthly average value out of the twelve (12) values. This value becomes the disinfection benchmark.

(e) What if my system uses chloramines, ozone, or chlorine dioxide for primary disinfection? If your system uses chloramines, ozone or chlorine dioxide for primary disinfection your system must calculate the disinfection benchmark from the data your system collected for viruses to develop the disinfection profile in addition to the *Giardia lamblia* disinfection benchmark calculated under paragraph (5)(d) of this section. This viral benchmark must be calculated in the same manner used to calculate the *Giardia lamblia* disinfection benchmark in paragraph (5)(d) of this section.

(6) Combined Filter Effluent Requirements

(a) Is my system required to meet this regulation's combined filter effluent turbidity limits? All surface water systems and ground water systems under the direct influence of surface water which serve populations fewer than 10,000, and that utilize filtration other than slow sand filtration or diatomaceous earth filtration, must meet the combined filter effluent turbidity requirements of paragraphs (6)(b) through

(d) of this section If your system uses slow sand or diatomaceous earth filtration you are not required to meet the combined filter effluent turbidity limits of this regulation, but you must continue to meet the combined filter effluent turbidity limits in Section E.

(b) What strengthened combined filter effluent turbidity limits must my system meet? Your system must meet two strengthened combined filter effluent turbidity limits.

(i) The first combined filter effluent turbidity limit is a "95th percentile" turbidity limit that your system must meet in at least ninety (95) percent of the turbidity measurements taken each month. Measurements must continue to be taken as described in Section F(1) and (3). Monthly reporting must be completed according to paragraph (8) of this section. The following table describes the required limits for specific filtration technologies.

If your system consists of * * *	Your 95th percentile turbidity value is * * *
(1) Conventional Filtration or Direct Filtration.....	0.3 NTU
(2) All other 'Alternative' Filtration.....	A value determined by the Department (not to exceed 1 NTU) based on the demonstration described in paragraph (6)(c) of this section.

(ii) The second combined filter effluent turbidity limit is a "maximum" turbidity limit which your system may at no time exceed during the month. Measurements must continue to be taken as described in Sections F(1) and C. Monthly reporting must be completed according to paragraph (8) of this section. The following table describes the required limits for specific filtration technologies.

If your system consists of * * *	Your maximum turbidity value is * * *
(1) Conventional Filtration or Direct Filtration.....	1 NTU
(2) All other 'Alternative' Filtration.....	A value determined by the Department (not to exceed 5 NTU) based on the demonstration as described in paragraph (6)(c) of this section.

(c) My system consists of "alternative filtration" and is required to conduct a demonstration--what is required of my system and how does the Department establish my turbidity limits?

(i) If your system consists of alternative filtration (filtration other than slow sand filtration, diatomaceous earth filtration, conventional filtration, or direct filtration) you are required to conduct a demonstration (see tables in paragraph (6)(b) of this section). Your system must demonstrate to the Department, using pilot plant studies or other means, that your system's filtration, in combination with disinfection treatment, consistently achieves:

- (A) 99 percent removal of *Cryptosporidium oocysts*;
- (B) 99.9 percent removal and/or inactivation of *Giardia lamblia* cysts; and
- (C) 99.99 percent removal and/or inactivation of viruses.

(ii) [Reserved]

(d) My system practices lime softening--is there any special provision regarding my combined filter effluent? If your system practices lime softening, you may acidify representative combined filter effluent turbidity samples prior to analysis using a protocol approved by the Department.

(7) Individual Filter Turbidity Requirements

(a) Is my system subject to individual filter turbidity requirements? If your system is a surface water system or a ground water system under the direct influence of surface water serving fewer than 10,000 people and utilizing conventional filtration or direct filtration, you must conduct continuous monitoring of turbidity for each individual filter at your system. The following requirements apply to continuous turbidity monitoring:

- (i) Monitoring must be conducted using an approved method in Section F(1);
- (ii) Calibration of turbidimeters must be conducted using procedures specified by the manufacturer;
- (iii) Results of turbidity monitoring must be recorded at least every fifteen (15) minutes;
- (iv) Monthly reporting must be completed according to paragraph (8) of this section; and
- (v) Records must be maintained according to paragraph (8)(b) of this section.

(b) What happens if my system's turbidity monitoring equipment fails? If there is a failure in the continuous turbidity monitoring equipment, your system must conduct grab sampling every four hours in lieu of continuous monitoring until the turbidimeter is back on-line. Your system has fourteen (14) days to resume continuous monitoring before a violation is incurred.

(c) My system only has two or fewer filters--is there any special provision regarding individual filter turbidity monitoring? Yes, if your system only consists of two (2) or fewer filters, you may conduct continuous monitoring of combined filter effluent turbidity in lieu of individual filter effluent turbidity monitoring. Continuous monitoring must meet the same requirements set forth in paragraphs (7)(a) through (d) of this section.

(d) What follow-up action is my system required to take based on continuous turbidity monitoring? Follow-up action is required according to the following tables:

If * * *	Your system must * * *
(a) The turbidity of an individual filter (or the turbidity of combined filter effluent (CFE) for systems with 2 filters that monitor CFE in lieu of individual filters) exceeds 1.0 NTU in two consecutive recordings 15 minutes apart.	Report to the Department by the 10th of the following month and include the filter number(s), corresponding date(s), turbidity value(s) which exceeded 1.0 NTU, and the cause (if known) for the exceedance(s).
(b) For three months in a row and turbidity exceeded 1.0 NTU in two consecutive recordings 15 minutes apart at the same filter (or CFE for systems with 2 filters that monitor CFE in lieu of individual filters).	Conduct a self-assessment of the filter(s) within 14 days of the day the filter exceeded 1.0 NTU in two consecutive measurements for the third straight month unless a CPE as specified in paragraph (c) of this section was required. Systems with 2 filters that monitor CFE in lieu of individual filters must conduct

If * * *	Your system must * * *
	a self-assessment on both filters. 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.
(c) For two months in a row and turbidity exceeded 2.0 NTU in 2 consecutive recordings 15 minutes apart at the same filter (or CFE for systems with 2 filters that monitor CFE in lieu of individual filters).	Arrange to have a comprehensive performance evaluation (CPE) conducted by the Department or a third party approved by the Department not later than 60 days following the day the filter exceeded 2.0 NTU in two consecutive measurements for the second straight month. If a CPE has been completed by the Department or a third party approved by the Department within the 12 prior months or the system and the Department are jointly participating in an ongoing Comprehensive Technical Assistance (CTA) project at the system, a new CPE is not required. If conducted, a CPE must be completed and submitted to the Department no later than 120 days following the day the filter exceeded 2.0 NTU in two consecutive measurements for the second straight month.

(e) My system practices lime softening--is there any special provision regarding my individual filter turbidity monitoring? If your system utilizes lime softening, you may apply to the Department for alternative turbidity exceedance levels for the levels specified in the table in paragraph (7)(d) of this section. You must be able to demonstrate to the Department that higher turbidity levels are due to lime carryover only, and not due to degraded filter performance.

(8) Reporting and Recordkeeping Requirements

(a) What does this section require that my system report to the Department? This section requires your system to report several items to the Department. The following table describes the items which must be reported and the frequency of reporting. Your system is required to report the information described in the following table, if it is subject to the specific requirement shown in the first column.

Corresponding requirement	Description of information to report	Frequency
(a) Combined Filter Effluent Requirements. (paragraphs (6)(a) through (d) of this section).	(1) The total number of filtered water turbidity measurements taken during the month.	By the 10th of the following month.
	(2) The number and percentage of filtered water turbidity measurements taken during the month which are less than or equal to your system's required 95th percentile limit.	By the 10th of the following month.
	(3) The date and value of any turbidity measurements taken during the month which exceed the maximum turbidity value for your	By the 10th of the following month

Corresponding requirement	Description of information to report	Frequency
	filtration system.	
(b) Individual Turbidity Requirements. (paragraph (7)(a) through (e) of this section).	(1) That your system conducted individual filter turbidity monitoring during the month.	By the 10th of the following month.
	(2) The filter number(s), corresponding date(s), and the turbidity value(s) which exceeded 1.0 NTU during the month, and cause (if known) for the exceedance(s), but only if 2 consecutive measurements exceeded 1.0 NTU.	By the 10th of the following month.
	(3) If a self-assessment is required, the date that it was triggered and the date that it was completed.	By the 10th of the following month (or 14 days after the self-assessment was triggered only if the self-assessment was triggered during the last four days of the month)
	(4) If a CPE is required, that the CPE is required and the date that it was triggered.	By the 10th of the following month.
	(5) Copy of completed CPE report.	Within 120 days after the CPE was triggered.
(c) Disinfection Profiling.....(paragraphs (4)(a) through (g) of this section)	(1) Results of optional monitoring which show TTHM levels 0.064 mg/L and HAA5 levels 0.048 mg/L (only if your system wishes to forgo profiling) or that your system has begun disinfection profiling.	(i) For systems serving 500-9,999 by July 1, 2003; (ii) For systems serving fewer than 500 by January 1, 2004.
(d) Disinfection Benchmarking (paragraph (5)(a) through (e) of this section)	(1) A description of the proposed change in disinfection, your system's disinfection profile for Giardia lamblia (and, if necessary, viruses) and disinfection benchmark, and an analysis of how the proposed change will affect the current levels of disinfection.	Anytime your system is considering a significant change to its disinfection practice.

(b) What records does this regulation require my system to keep? Your system must keep several types of records based on the requirements of this regulation, in addition to recordkeeping requirements under Section G. The following table describes the necessary records, the length of time these records must be kept, and for which requirement the records pertain. Your system is required to maintain records described in this table, if it is subject to the specific requirement shown in the first column.

Corresponding requirement	Description of necessary records	Duration of time records must be kept
(a) Individual Filter Turbidity Requirements (paragraphs (7)(a) through (e) of this section)	Results of individual filter monitoring	At least 3 years.
(b) Disinfection Profiling (paragraphs (4)(a) through (g) of this section)	Results of Profile (including raw data and analysis)	Indefinitely.
(c) Disinfection Benchmarking (paragraphs (5)(a) through (e) of this section)	Benchmark (including raw data and analysis)	Indefinitely.

J. Recycle Provisions (Filter Backwash Recycling Rule).

(1) Applicability.

All community water systems (CWSs) and non-transient, non-community waters systems (NTNCWSs) 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 paragraphs (2) through (4) of this section.

(2) 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 paragraphs (2)(a) and (b) of this section.

(a) 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 reintroduced back into the treatment plant.

(b) 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.

(3) 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 R.61-58.B 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.

(4) Recordkeeping. The system must collect and retain on file recycle flow information specified in paragraphs (4)(a) through (f) of this section for review and evaluation by the Department beginning June 8, 2004.

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

(b) List of all recycle flows and the frequency with which they are returned.

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

(d) Typical filter run length and a written summary of how filter run length is determined.

(e) The type of treatment provided for the recycle flow.

(f) 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.

K. Enhanced Treatment for Cryptosporidium (Long Term 2 Surface Water Treatment Rule).

(1) General Requirements

(a) The requirements of R.61-58.10.K are National Primary Drinking Water Regulations that establish or extend treatment technique requirements in lieu of maximum contaminant levels for Cryptosporidium. These requirements are in addition to requirements for filtration and disinfection in R.61-58.10 A through I.

(b) Applicability.

The requirements of R.61-58.10.K apply to all subpart H systems.

(i) Wholesale systems, as defined in R.61-58.B , must comply with the requirements of R.61-58.10.K based on the population of the largest system in the combined distribution system.

(ii) The requirements of R.61-58.10.K for filtered systems apply to systems required by State Primary Drinking Water Regulations to provide filtration treatment, whether or not the system is currently operating a filtration system.

(iii) The requirements of R.61-58.10.K for unfiltered systems apply only to unfiltered systems that timely met and continue to meet the filtration avoidance criteria in R.61-58.10.A through I, as applicable.

(c) Requirements.

Systems subject to R.61-58.10.K must comply with the following requirements:

(i) Systems must conduct an initial and a second round of source water monitoring for each plant that treats a surface water or ground water under direct influence (GWUDI) source. This monitoring may include sampling for Cryptosporidium, E. coli, and turbidity as described in R.61-58.10.K(2) through R.61-58.10.K(7), to determine what level, if any, of additional Cryptosporidium treatment they must provide.

(ii) Systems that plan to make a significant change to their disinfection practice must develop disinfection profiles and calculate disinfection benchmarks, as described in R.61-58.10.K(9) and (10).

(iii) Filtered systems must determine their Cryptosporidium treatment bin classification as described in R.61-58.10.K(11) and provide additional treatment for Cryptosporidium, if required, as described in R.61-58.10.K(12). All unfiltered systems must provide treatment for Cryptosporidium as

described in R.61-58.10.K(13). Filtered and unfiltered systems must implement Cryptosporidium treatment according to the schedule in R.61-58.10.K(14).

(iv) Systems with uncovered finished water storage facilities must comply with the requirements to cover the storage facility or treat the discharge from the storage facility as described in R.61-58.10.K(15).

(v) Systems required to provide additional treatment for Cryptosporidium must implement microbial toolbox options that are designed and operated as described in R.61-58.10.K(16) through R.61-58.10.K(21).

(vi) Systems must comply with the applicable recordkeeping and reporting requirements described in R.61-58.10.K(22) through R.61-58.10.K(23).

(vii) Systems must address significant deficiencies identified in sanitary surveys performed by EPA as described in R.61-58.10.K(24).

(2) Source Water Monitoring.

(a) Initial Source Monitoring.

Systems must conduct the following monitoring on the schedule in R.61-58.10.K(2)(c) unless they meet the monitoring exemption criteria in R.61-58.10.K(2)(d).

(i) Filtered systems serving at least 10,000 people must sample their source water for Cryptosporidium, E. coli, and turbidity at least monthly for 24 months.

(ii) Unfiltered systems serving at least 10,000 people must sample their source water for Cryptosporidium at least monthly for 24 months.

(iii) E.Coli Monitoring for Filtered Systems Serving Fewer Than 10,000 People.

(A) Filtered systems serving fewer than 10,000 people must sample their source water for E. coli at least once every two weeks for 12 months.

(B) A filtered system serving fewer than 10,000 people may avoid E. coli monitoring if the system notifies the Department that it will monitor for Cryptosporidium as described in R.61-58.10.K(2)(a)(4). The system must notify the Department no later than 3 months prior to the date the system is otherwise required to start E. coli monitoring under R.61-58.10.K(2)(c).

(iv) Filtered systems serving fewer than 10,000 people must sample their source water for Cryptosporidium at least twice per month for 12 months or at least monthly for 24 months if they meet one of the following criteria in (A) through (D) below, based on monitoring conducted under R.61-58.10.K(2)(a)(iii).

(A) For systems using lake/reservoir sources, the annual mean E. coli concentration is greater than 10 E. coli per 100 mL.

(B) For systems using flowing stream sources, the annual mean E. coli concentration is greater than 50 E. coli per 100 mL.

(C) The system does not conduct E. coli monitoring as described in R.61-58.10.K(2)(a)(iii).

(D) Systems using a GWUDI source must comply with the requirements of R.61-58.10.K(2)(a)(iv) based on the E. coli level that applies to the nearest surface water body. If no surface water body is nearby, the system must comply based on the requirements that apply to systems using lake or reservoir sources.

(v) For filtered systems serving fewer than 10,000 people, the Department may approve monitoring for an indicator other than E. coli under R.61-58.10.K(2)(a)(iii). The Department also may approve an alternative to the E. coli concentration in paragraph R.61-58.10.K(2)(a)(iv)(A), (B) or (D) to trigger Cryptosporidium monitoring. This approval by the Department must be in writing and will include the basis for the Department's determination that the alternative indicator and/or trigger level will provide a more accurate identification of whether a system will exceed the Bin 1 Cryptosporidium level in R.61-58.10.K(11).

(vi) Unfiltered systems serving fewer than 10,000 people must sample their source water for Cryptosporidium at least twice per month for 12 months or at least monthly for 24 months.

(vii) Systems may sample more frequently than required under this section if the sampling frequency is evenly spaced throughout the monitoring period.

(b) Second round of source water monitoring.

Systems must conduct a second round of source water monitoring that meets the requirements for monitoring parameters, frequency, and duration described in R.61-58.10.K(2)(a), unless they meet the monitoring exemption criteria in R.61-58.10.K(2)(d). Systems must conduct this monitoring on the schedule in R.61-58.10.K(2)(c).

(c) Monitoring Schedule

Systems must begin the monitoring required in R.61-58.10.K(2)(a) and (b) no later than the month beginning with the date listed in R.61-58.10.K(2)(c)(i) through (v).

(i) Systems that serve at least 100,000 people must begin the first round of source water monitoring no later than the month beginning October 1, 2006, and must begin the second round of source water monitoring no later than the month beginning April 1, 2015.

(ii) Systems that serve from 50,000 to 99,999 people must begin the first round of source water monitoring no later than the month beginning April 1, 2007, and must begin the second round of source water monitoring no later than the month beginning October 1, 2015.

(iii) Systems that serve from 10,000 to 49,999 people must begin the first round of source water monitoring no later than the month beginning April 1, 2008, and must begin the second round of source water monitoring no later than the month beginning October 1, 2016.

(iv) Systems that serve fewer than 10,000 people and monitor for E. coli (applies only to filtered systems) must begin the first round of source water monitoring no later than the month beginning October 1, 2008, and must begin the second round of source water monitoring no later than the month beginning October 1, 2017.

(v) Systems that serve fewer than 10,000 people and monitor for Cryptosporidium must begin the first round of source water monitoring no later than the month beginning April 1, 2010, and must begin the

second round of source water monitoring no later than the month beginning April 1, 2019. (Applies to filtered systems that meet the conditions of R.61-58.10.K(2)(a)(iv) and unfiltered systems).

(d) Monitoring Avoidance.

(i) Filtered systems are not required to conduct source water monitoring under R.61-58.10.K if the system will provide a total of at least 5.5-log of treatment for *Cryptosporidium*, equivalent to meeting the treatment requirements of Bin 4 in R.61-58.10.K(12).

(ii) Unfiltered systems are not required to conduct source water monitoring under R.61-58.10.K if the system will provide a total of at least 3-log *Cryptosporidium* inactivation, equivalent to meeting the treatment requirements for unfiltered systems with a mean *Cryptosporidium* concentration of greater than 0.01 oocysts per L in R.61-58.10.K(13).

(iii) If a system chooses to provide the level of treatment in R.61-58.10.K(2)(d)(1) or (2), as applicable, rather than start source water monitoring, the system must notify the Department in writing no later than the date the system is otherwise required to submit a sampling schedule for monitoring under R.61-58.10.K(3). Alternatively, a system may choose to stop sampling at any point after it has initiated monitoring if it notifies the Department in writing that it will provide this level of treatment. Systems must install and operate technologies to provide this level of treatment by the applicable treatment compliance date in R.61-58.10.K(14).

(e) Plants Operating Only Part of the Year.

Systems with subpart H plants that operate for only part of the year must conduct source water monitoring in accordance with R.61-58.10.K with the following modifications:

(i) Systems must sample their source water only during the months that the plant operates unless the Department specifies another monitoring period based on plant operating practices.

(ii) Systems with plants that operate less than six months per year and that monitor for *Cryptosporidium* must collect at least six *Cryptosporidium* samples per year during each of two years of monitoring. Samples must be evenly spaced throughout the period the plant operates.

(f) New Sources.

(i) A system that begins using a new source of surface water or ground water under the direct influence of surface water after the system is required to begin monitoring under R.61-58.10.K(2)(c) must monitor the new source on a schedule approved by the Department. Source water monitoring must meet the requirements of R.61-58.10.K. The system must also meet the bin classification and *Cryptosporidium* treatment requirements of R.61-58.10.K(11) and R.61-58.10.K(12) or R.61-58.10.K(13), as applicable, for the new source on a schedule approved by the Department.

(ii) The requirements of R.61-58.10.K(2)(f) apply to subpart H systems that begin operation after the monitoring start date applicable to the system's size under R.61-58.10.K(2)(c).

(iii) The system must begin a second round of source water monitoring no later than 6 years following initial bin classification under R.61-58.10.K(11) or determination of the mean *Cryptosporidium* level under R.61-58.10.K(13), as applicable.

(g) Failure to collect any source water sample required under R.61-58.10.K(2) in accordance with the sampling schedule, sampling location, analytical method, approved laboratory, and reporting requirements of R.61-58.10.K(3) through R.61-58.10.K(7) is a monitoring violation.

(h) Grandfathering Monitoring Data.

Systems may use (grandfather) monitoring data collected prior to the applicable monitoring start date in R.61-58.10.K(2)(c) to meet the initial source water monitoring requirements in R.61-58.10.K(2)(a). Grandfathered data may substitute for an equivalent number of months at the end of the monitoring period. All data submitted under this paragraph must meet the requirements in R.61-58.10.K(8).

(3) Sampling Schedules.

(a) Systems required to conduct source water monitoring under R.61-58.10.K(2) must submit a sampling schedule that specifies the calendar dates when the system will collect each required sample.

(i) Systems must submit sampling schedules no later than 3 months prior to the applicable date listed in R.61-58.10.K(2)(c) for each round of required monitoring.

(ii) Electronic Submittal of Sample Schedules for Systems Serving at Least 10,000 People.

(A) Systems serving at least 10,000 people must submit their sampling schedule for the initial round of source water monitoring under R.61-58.10.K(2)(a) to EPA electronically.

(B) If a system is unable to submit the sampling schedule electronically, the system may use an alternative approach for submitting the sampling schedule that EPA approves.

(iii) Systems serving fewer than 10,000 people must submit their sampling schedules for the initial round of source water monitoring under R.61-58.10.K(2)(a) to the Department.

(iv) Systems must submit sampling schedules for the second round of source water monitoring under R.61-58.10.K(2)(b) to the Department.

(v) If EPA or the Department does not respond to a system regarding its sampling schedule, the system must sample according to the submitted schedule.

(b) Systems must collect samples within two days before or two days after the dates indicated in their sampling schedule (i.e., within a five-day period around the schedule date) unless one of the conditions of R.61-58.10.K(3)(b)(i) or (ii) applies.

(i) If an extreme condition or situation exists that may pose danger to the sample collector, or that cannot be avoided and causes the system to be unable to sample in the scheduled five-day period, the system must sample as close to the scheduled date as is feasible unless the Department approves an alternative sampling date. The system must submit an explanation for the delayed sampling date to the Department at the same time the sample is shipped to the laboratory.

(ii) Replacement Samples.

(A) If a system is unable to report a valid analytical result for a scheduled sampling date due to equipment failure, loss of or damage to the sample, failure to comply with the analytical method

requirements, including the quality control requirements in R.61-58.10.K(5), or the failure of an approved laboratory to analyze the sample, then the system must collect a replacement sample.

(B) The system must collect the replacement sample not later than 21 days after receiving information that an analytical result cannot be reported for the scheduled date unless the system demonstrates that collecting a replacement sample within this time frame is not feasible or the Department approves an alternative resampling date. The system must submit an explanation for the delayed sampling date to the Department at the same time the sample is shipped to the laboratory.

(c) Systems that fail to meet the criteria of R.61-58.10.K(3)(b) for any source water sample required under R.61-58.10.K(2) must revise their sampling schedules to add dates for collecting all missed samples. Systems must submit the revised schedule to the Department for approval prior to when the system begins collecting the missed samples.

(4) Sampling Locations.

(a) Systems required to conduct source water monitoring under R.61-58.K(2) must collect samples for each plant that treats a surface water or a GWUDI source. Where multiple plants draw water from the same influent, such as the same pipe or intake, the Department may approve one set of monitoring results to be used to satisfy the requirements of R.61-58.10.K(2) for all plants.

(b) Sampling Prior to Chemical Treatment.

(i) Systems must collect source water samples prior to chemical treatment, such as coagulants, oxidants and disinfectants, unless the system meets the condition of R.61-58.10.K(4)(b)(ii).

(ii) The Department may approve a system to collect a source water sample after chemical treatment if the Department determines that collecting a sample prior to chemical treatment is not feasible for the system and that the chemical treatment is unlikely to have a significant adverse effect on the analysis of the sample.

(c) Systems that recycle filter backwash water must collect source water samples prior to the point of filter backwash water addition.

(d) Bank Filtration.

(i) Systems that receive *Cryptosporidium* treatment credit for bank filtration under R.61-58.10.H(4)(b) or R.61-58.10.I(6)(c), as applicable, must collect source water samples in the source water prior to bank filtration.

(ii) Systems that use bank filtration as pretreatment to a filtration plant must collect source water samples from the well (i.e., after bank filtration). Use of bank filtration during monitoring must be consistent with routine operational practice. Systems collecting samples after a bank filtration process may not receive treatment credit for the bank filtration under R.61-58.10.K(18)(c).

(e) Multiple Sources.

Systems with plants that use multiple water sources, including multiple surface water sources and blended surface water and ground water sources, must collect samples as specified in R.61-58.10.K(4)(e)(i) or (ii). The use of multiple sources during monitoring must be consistent with routine operational practice.

(i) If a sampling tap is available where the sources are combined prior to treatment, systems must collect samples from the tap.

(ii) If a sampling tap where the sources are combined prior to treatment is not available, systems must collect samples at each source near the intake on the same day and must follow either R.61-58.10.K(4)(e)(ii)(A) or (B) for sample analysis.

(A) Systems may composite samples from each source into one sample prior to analysis. The volume of sample from each source must be weighted according to the proportion of flow from each source in the total plant flow at the time the sample is collected.

(B) Systems may analyze samples from each source separately and calculate a weighted average of the analysis results for each sampling date. The weighted average must be calculated by multiplying the analysis result for each source by the fraction that each source contributed to total plant flow at the time the sample was collected and then summing these values.

(f) Additional Requirements.

Systems must submit a description of their sampling location(s) to the Department at the same time as the sampling schedule required under R.61-58.10.K(3). This description must address the position of the sampling location in relation to the system's water source(s) and treatment processes, including pretreatment, points of chemical treatment, and filter backwash recycle. If the Department does not respond to a system regarding sampling location(s), the system must sample at the submitted location(s).

(5) Analytical Methods.

(a) Cryptosporidium. Systems must analyze for Cryptosporidium using EPA- approved methods listed in 40 CFR 141.704 (1-05-06 edition).

(i) Systems must analyze at least a 10 L sample or a packed pellet volume of at least 2 mL. Systems unable to process a 10 L sample must analyze as much sample volume as can be filtered by two filters approved by EPA, up to a packed pellet volume of at least 2 mL.

(ii) (A) Matrix spike (MS) samples, must be spiked and filtered by a laboratory approved for Cryptosporidium analysis under R.61-58.10.K(6).

(B) If the volume of the matrix spike sample is greater than 10 L, the system may filter all but 10 L of the matrix spike sample in the field, and ship the filtered sample and the remaining 10 L of source water to the laboratory. In this case, the laboratory must spike the remaining 10 L of water and filter it through the filter used to collect the balance of the sample in the field.

(iii) Flow cytometer-counted spiking suspensions must be used for matrix spike samples and ongoing precision and recovery (OPR) samples.

(b) E. coli. Systems must use methods for enumeration of E. coli in source water approved in 40 CFR 136.3(a) (1-05-06 edition).

(i) The time from sample collection to initiation of analysis may not exceed 30 hours unless the system meets the condition of R.61-58.10.K(5)(b)(ii).

(ii) The Department may approve on a case-by-case basis the holding of an

E. coli sample for up to 48 hours between sample collection and initiation of analysis if the Department determines that analyzing an E. coli sample within 30 hours is not feasible. E. coli samples held between 30 to 48 hours must be analyzed by the Colilert reagent version of Standard Methods 9223B as listed in 40 CFR 136.3(a) (1-05-06 edition).

(iii) Samples must be maintained between 0 degrees Celsius and 10 degrees Celsius during storage and transit to the laboratory.

(c) Turbidity. Systems must use methods for turbidity measurement approved in 40 CFR 141.74(a)(1) (1-05-06 edition).

(6) Approved Laboratories

(a) Cryptosporidium. Systems must have Cryptosporidium samples analyzed by a laboratory that is approved under EPA's Laboratory Quality Assurance Evaluation Program for Analysis of Cryptosporidium in Water or a laboratory that has been certified for Cryptosporidium analysis by the Department's laboratory certification program.

(b) E. coli. E. coli analyses for compliance with R.61-58.10.K must be performed by a certified laboratory.

(c) Turbidity. Measurements of turbidity must be made by a party approved by the Department.

(7) Reporting Source Water Monitoring Results.

(a) Systems must report results from the source water monitoring required under R.61-58.10.K(2) no later than 10 days after the end of the first month following the month when the sample is collected.

(b) Electronic Reporting for Systems Serving at Least 10,000 People.

(i) All systems serving at least 10,000 people must report the results from the initial source water monitoring required under R.61-58.10.K(2)(a) to EPA electronically.

(ii) If a system serving at least 10,000 people is unable to report monitoring results electronically, the system may use an alternative approach for reporting monitoring results that EPA approves.

(c) Systems serving fewer than 10,000 people must report results from the initial source water monitoring required under R.61-58.10.K(2)(a) to the Department.

(d) All systems must report results from the second round of source water monitoring required under R.61-58.10.K(2)(b) to the Department.

(e) Systems must report the applicable information in R.61-58.10.K(7)(e)(i) and (ii) for the source water monitoring required under R.61-58.10.K(2).

(i) Systems must report the following data elements for Cryptosporidium analysis: PWS ID, Facility ID, Sample collection date, Sample type (field or matrix spike), Sample volume filtered (to nearest one quarter of a L), Whether or not 100 percent of the filtered volume was examined, and the Number of oocysts counted.

(A) For matrix spike samples, systems must also report the sample volume spiked and estimated number of oocysts spiked. These data are not required for field samples.

(B) For samples in which less than 10 L is filtered or less than 100 percent of the sample volume is examined, systems must also report the number of filters used and the packed pellet volume.

(C) For samples in which less than 100 percent of sample volume is examined, systems must also report the volume of resuspended concentrate and volume of this resuspension processed through immunomagnetic separation.

(ii) Systems must report the following data elements for each E. coli analysis: PWS ID, Facility ID, Sample collection date, Analytical method number, Method type, Source type (flowing stream, lake or reservoir, GWUDI), E. coli per 100 mL, and Turbidity. Systems serving fewer than 10,000 people that are not required to monitor for turbidity under R.61-58.10.K(2) are not required to report turbidity with their E. coli results.

(8) Grandfathering Previously Collected Data.

(a) Sample Requirements.

(i) Systems may comply with the initial source water monitoring requirements of R.61-58.10.K(2)(a) by grandfathering sample results collected before the system is required to begin monitoring (i.e., previously collected data). To be grandfathered, the sample results and analysis must meet the criteria in R.61-58.10.K(8) and be approved by the Department.

(ii) A filtered system may grandfather Cryptosporidium samples to meet the requirements of R.61-58.10.K(2)(a) when the system does not have corresponding E. coli and turbidity samples. A system that grandfathers Cryptosporidium samples without E. coli and turbidity samples is not required to collect E. coli and turbidity samples when the system completes the requirements for Cryptosporidium monitoring under R.61-58.10.K(2)(a).

(b) E. coli sample analysis. The analysis of E. coli samples must meet the analytical method and approved laboratory requirements of R.61-58.10.K(5) and R.61-58.10.K(6).

(c) Cryptosporidium sample analysis. Cryptosporidium samples must be analyzed as outlined in 40 CFR 141.707(c) (1-05-06 edition).

(d) Sampling Location. The sampling location must meet the conditions in R.61-58.10.K(4).

(e) Sampling Frequency.

Cryptosporidium samples must have been collected no less frequently than each calendar month on a regular schedule, beginning no earlier than January 1999. Sample collection intervals may vary for the conditions specified in R.61-58.10.K(3)(b)(i) and (ii) if the system provides documentation of the condition when reporting monitoring results.

(i) The Department may approve grandfathering of previously collected data where there are time gaps in the sampling frequency if the system conducts Department-specified additional monitoring to ensure that the data used to comply with R.61-58.10.K(2)(a) are seasonally representative and unbiased.

(ii) Systems may grandfather previously collected data where the sampling frequency within each month varied. If the Cryptosporidium sampling frequency varied, systems must follow the monthly averaging procedure in R.61- 58.10.K(11)(b)(v) or R.61-58.10.K(13)(a)(iii), as applicable, when calculating the bin classification for filtered systems or the mean Cryptosporidium concentration for unfiltered systems.

(f) Reporting Monitoring Results for Grandfathering.

Systems that request to grandfather previously collected monitoring results must report the following information specified in R.61-58.10.K(8)(f)(i) and (ii) by the applicable dates listed. Systems serving at least 10,000 people must report this information to EPA unless the Department approves reporting directly to the Department rather than EPA. Systems serving fewer than 10,000 people must report this information to the Department.

(i) Systems must report that they intend to submit previously collected monitoring results for grandfathering. This report must specify the number of previously collected results the system will submit, the dates of the first and last sample, and whether a system will conduct additional source water monitoring to meet the requirements of R.61-58.10.K(2)(a). Systems must report this information no later than the date the sampling schedule found in R.61- 58.10.K(3) is required.

(ii) Systems must report previously collected monitoring results for grandfathering, along with the associated documentation listed in R.61- 58.10.K(8)(f)(ii)(A) through (D) , no later than two months after the applicable date listed in R.61-58.10.K(2)(c).

(A) For each sample result, systems must report the applicable data elements in R.61-58.10.K(7).

(B) Systems must certify that the reported monitoring results include all results that the system generated during the time period beginning with the first reported result and ending with the final reported result. This applies to samples that were collected from the sampling location specified for source water monitoring, not spiked, and analyzed using the laboratory's routine process for the analytical methods.

(C) Systems must certify that the samples were representative of a plant's source water(s) and the source water(s) have not changed. Systems must report a description of the sampling location(s), which must address the position of the sampling location in relation to the system's water source(s) and treatment processes, including points of chemical addition and filter backwash recycle.

(D) For Cryptosporidium samples, the laboratory or laboratories that analyzed the samples must provide a letter certifying that the quality control criteria specified in the methods listed in 40 CFR 141.707 (1-05- 06 edition) were met for each sample batch associated with the reported results. Alternatively, the laboratory may provide bench sheets and sample examination report forms for each field, matrix spike, IPR, OPR, and method blank sample associated with the reported results.

(g) If the Department determines that a previously collected data set submitted for grandfathering was generated during source water conditions that were not normal for the system, such as a drought, the Department may disapprove the data. Alternatively, the Department may approve the previously collected data if the system reports additional source water monitoring data, as determined by the Department, to ensure that the data set used under R.61-58.10.K(11) or R.61-58.10.K(13) represents average source water conditions for the system.

(h) If a system submits previously collected data that fully meet the number of samples required for initial source water monitoring under R.61-58.10.K(2)(a) and some of the data are rejected due to not

meeting the requirements of R.61-58.10.K(8), systems must conduct additional monitoring to replace rejected data on a schedule the Department approves. Systems are not required to begin this additional monitoring until two months after notification that data have been rejected and additional monitoring is necessary.

(9) Requirements When Making a Significant Change in Disinfection Practice.

(a) Following the completion of initial source water monitoring under R.61-58.10.K(2)(a), a system that plans to make a significant change to its disinfection practice, as defined in R.61-58.10.K(9)(b), must develop a disinfection profile and calculate a disinfection benchmark for *Giardia lamblia* and viruses as described in R.61-58.10.K(10). Prior to changing the disinfection practice, the system must notify the Department and must include in this notice the information listed in R.61-58.10.K(9)(a)(i) through (iii).

(i) A completed disinfection profile and disinfection benchmark for *Giardia lamblia* and viruses as described in R.61-58.10.K(10).

(ii) A description of the proposed change in disinfection practice.

(iii) An analysis of how the proposed change will affect the current level of disinfection.

(b) Significant changes to disinfection practice are defined as follows:

(i) Changes to the point of disinfection;

(ii) Changes to the disinfectant(s) used in the treatment plant;

(iii) Changes to the disinfection process; or

(iv) Any other modification identified by the Department as a significant change to disinfection practice.

(10) Developing the Disinfection Profile and Benchmark.

(a) Systems required to develop disinfection profiles under R.61-58.10.K(9) must follow the requirements of R.61-58.10.K(10). Systems must monitor at least weekly for a period of 12 consecutive months to determine the total log inactivation for *Giardia lamblia* and viruses. If systems monitor more frequently, the monitoring frequency must be evenly spaced. Systems that operate for fewer than 12 months per year must monitor weekly during the period of operation. Systems must determine log inactivation for *Giardia lamblia* through the entire plant, based on CT_{99.9} values in Tables 1.1 through 1.6, 2.1 and 3.1 of R.61-58.10.F as applicable. Systems must determine log inactivation for viruses through the entire treatment plant based on a protocol approved by the Department.

(b) Systems with a single point of disinfectant application prior to the entrance to the distribution system must conduct the monitoring in R.61-58.10(K)(10)(b)(i) through (iv). Systems with more than one point of disinfectant application must conduct the monitoring in R.61-58.10(K)(10)(b)(i) through (iv) for each disinfection segment.

Systems must monitor the parameters necessary to determine the total inactivation ratio, using analytical methods in 40 CFR 141.74(a) (1-05-06 edition).

(i) For systems using a disinfectant other than UV, the temperature of the disinfected water must be measured at each residual concentration sampling point during peak hourly flow or at an alternative location approved by the Department.

(ii) For systems using chlorine, the pH of the disinfected water must be measured at each chlorine residual sampling point during peak hourly flow or at an alternative location approved by the Department.

(iii) The disinfectant contact time(s) (t) must be determined during peak hourly flow.

(iv) The residual disinfectant concentration(s) (C) of the water before or at the first customer and prior to each additional point of disinfectant application must be measured during peak hourly flow.

(c) In lieu of conducting new monitoring under R.61-58.10(K)(10)(b), systems may elect to meet the requirements of R.61-58.10(K)(10)(c)(i) or (ii).

(i) Systems that have at least one year of existing data that are substantially equivalent to data collected under the provisions of R.61-58.10(K)(10)(b) may use these data to develop disinfection profiles if the system has neither made a significant change to its treatment practice nor changed sources since the data were collected. Systems may develop disinfection profiles using up to three years of existing data.

(ii) Systems may use disinfection profile(s) developed under R.61-58.10.H or R.61-58.10.I in lieu of developing a new profile if the system has neither made a significant change to its treatment practice nor changed sources since the profile was developed. Systems that have not developed a virus profile under R.61-58.10.H or R.61-58.10.I must develop a virus profile using the same monitoring data on which the *Giardia lamblia* profile is based.

(d) Systems must calculate the total inactivation ratio for *Giardia lamblia* as specified in R.61-58.10(K)(10)(d)(i) through (iii).

(i) Systems using only one point of disinfectant application may determine the total inactivation ratio for the disinfection segment based on either of the methods in R.61-58.10(K)(10)(d)(i)(A) or (B).

(A) Determine one inactivation ratio ($CT_{calc}/CT_{99.9}$) before or at the first customer during peak hourly flow.

(B) Determine successive $CT_{calc}/CT_{99.9}$ values, representing sequential inactivation ratios, between the point of disinfectant application and a point before or at the first customer during peak hourly flow. The system must calculate the total inactivation ratio by determining ($CT_{calc}/CT_{99.9}$) for each sequence and then adding the ($CT_{calc}/CT_{99.9}$) values together to determine the sum of $CT_{calc}/CT_{99.9}$.

(ii) Systems using more than one point of disinfectant application before the first customer must determine the CT value of each disinfection segment immediately prior to the next point of disinfectant application, or for the final segment, before or at the first customer, during peak hourly flow. The ($CT_{calc}/CT_{99.9}$) value of each segment and the sum of $CT_{calc}/CT_{99.9}$ must be calculated using the method in R.61-58.10.K(10)(d)(i)(B).

(iii) The system must determine the total logs of inactivation by multiplying the value calculated in R.61-58.10.K(10)(d)(i) or (ii) by 3.0.

(iv) Systems must calculate the log of inactivation for viruses using a protocol approved by the Department.

(e) Systems must use the procedures specified in R.61-58.10.K(10)(e)(i) and (ii) to calculate a disinfection benchmark.

(i) For each year of profiling data collected and calculated under R.61- 58.10.K(10)(a) through (d), systems must determine the lowest mean monthly level of both Giardia lamblia and virus inactivation. Systems must determine the mean Giardia lamblia and virus inactivation for each calendar month for each year of profiling data by dividing the sum of daily or weekly Giardia lamblia and virus log inactivation by the number of values calculated for that month.

(ii) The disinfection benchmark is the lowest monthly mean value (for systems with one year of profiling data) or the mean of the lowest monthly mean values (for systems with more than one year of profiling data) of Giardia lamblia and virus log inactivation in each year of profiling data.

(11) Bin Classification for Filtered Systems.

(a) Following completion of the initial round of source water monitoring required under R.61-58.10.K(2)(a), filtered systems must calculate an initial Cryptosporidium bin concentration for each plant for which monitoring was required. Calculation of the bin concentration must use the Cryptosporidium results reported under R.61-58.10.K(2)(a) and must follow the procedures in R.61-58.10.K(11)(b)(i) through (v).

(b) Cryptosporidium bin concentrations. Bin concentration is the cryptospridium concentration(s) used to determine bin classification

(i) For systems that collect a total of at least 48 samples, the bin concentration is equal to the arithmetic mean of all sample concentrations.

(ii) For systems that collect a total of at least 24 samples, but not more than 47 samples, the bin concentration is equal to the highest arithmetic mean of all sample concentrations in any 12 consecutive months during which Cryptosporidium samples were collected.

(iii) For systems that serve fewer than 10,000 people and monitor for Cryptosporidium for only one year (i.e., collect 24 samples in 12 months), the bin concentration is equal to the arithmetic mean of all sample concentrations.

(iv) For systems with plants operating only part of the year that monitor fewer than 12 months per year under R.61-58.10.K(2)(e), the bin concentration is equal to the highest arithmetic mean of all sample concentrations during any year of Cryptosporidium monitoring.

(v) If the monthly Cryptosporidium sampling frequency varies, systems must first calculate a monthly average for each month of monitoring. Systems must then use these monthly average concentrations, rather than individual sample concentrations, in the applicable calculation for bin classification in R.61- 58.10.K(11)(b)(i) through (iv).

(c) Filtered systems that are required to monitor under R.61-58.10.K(2) must determine their initial bin classification from the Bin Classification Table that follows and using the Cryptosporidium bin concentration calculated under R.61-58.10.K(11)(a) and (b). The bin classification for filtered systems that serve fewer than 10,000 people and are not required to monitor under R.61-58.10.K(2)(a)(iv) is Bin 1.

Bin Classification Table For Filtered Systems

Cryptosporidium Concentration	Bin Classification
Less than 0.075 oocysts per L	Bin 1
0.075 to less than 1.0 oocysts per L	Bin 2
1.0 to less than 3.0 oocysts per L	Bin 3
Greater than or equal to 3.0 oocysts per L	Bin 4

(d) Following completion of the second round of source water monitoring required under R.61-58.10.K(2)(b), filtered systems must recalculate their Cryptosporidium bin concentration using the Cryptosporidium results reported under R.61-58.10.K(2)(b) and following the procedures in R.61-58.10.K(11)(b)(i) through (iv). Systems must then redetermine their bin classification using this bin concentration and the table in R.61-58.10.K(11)(c).

(e) Reporting Bin Classifications to the Department.

(i) Filtered systems must report their initial bin classification under R.61-58.10.K(11)(c) to the Department for approval no later than 6 months after the system is required to complete initial source water monitoring based on the schedule in R.61-58.10.K(2)(c).

(ii) Systems must report their bin classification under R.61-58.10.K(11)(d) to the Department for approval no later than 6 months after the system is required to complete the second round of source water monitoring based on the schedule in R.61-58.10.K(2)(c).

(iii) The bin classification report to the Department must include a summary of source water monitoring data and the calculation procedure used to determine bin classification.

(f) Failure to comply with the conditions of R.61-58.10.K(11)(e) is a violation of the treatment technique requirement.

(12) Filtered System Additional Cryptosporidium Treatment Requirements.

(a) Filtered systems must provide the level of additional treatment for Cryptosporidium specified in this paragraph (12)(a) based on their bin classification as determined under R.61-58.10.K(11) and according to the schedule in R.61-58.10.K(14).

Bin Classifications According to Treatment Type¹

Bin Classification	Conventional Filtration (includes softening)	Direct Filtration	Slow sand or diatomaceous earth filtration	Alternative filtration technologies
Bin 1	No additional treatment	No additional treatment	No additional treatment	No additional treatment
Bin 2	1-log treatment	1.5-log treatment	1-log treatment	See note 2
Bin 3	2-log treatment	2.5-log treatment	2-log treatment	See note 3
Bin 4	2.5-log treatment	3-log treatment	2.5-log treatment	See note 4

Notes:

1. The treatment requirements are valid provided that the water system is in full compliance with R.61-58.10.H & R.61-58.10.I
2. As determined by the Department such that the total Cryptosporidium removal and inactivation is at least 4.0-log.

3. As determined by the Department such that the total *Cryptosporidium* removal and inactivation is at least 5.0-log.
4. As determined by the Department such that the total *Cryptosporidium* removal and inactivation is at least 5.5-log.

(b) *Cryptosporidium* Treatment Requirements.

(i) Filtered systems must use one or more of the treatment and management options listed in R.61-58.10.K(16), termed the microbial toolbox, to comply with the additional *Cryptosporidium* treatment required in R.61-58.10.K(12)(a).

(ii) Systems classified in Bin 3 and Bin 4 must achieve at least 1-log of the additional *Cryptosporidium* treatment required under R.61-58.10.K(12)(a) of this section using either one or a combination of the following: bag filters, bank filtration, cartridge filters, chlorine dioxide, membranes, ozone, or UV, as described in R.61-58.10.K(17) through (21).

(c) Failure by a system in any month to achieve treatment credit by meeting criteria in R.61-58.10.K(17) through (21) for microbial toolbox options that is at least equal to the level of treatment required in R.61-58.10.K(12)(a) is a violation of the treatment technique requirement.

(d) If the Department determines during a sanitary survey or an equivalent source water assessment that after a system completed the monitoring conducted under R.61-58.10.K(2)(a) or (b), significant changes occurred in the system's watershed that could lead to increased contamination of the source water by *Cryptosporidium*, the system must take actions specified by the Department to address the contamination. These actions may include additional source water monitoring and/or implementing microbial toolbox options listed in R.61-58.10.K(16).

(13) Unfiltered system *Cryptosporidium* Treatment Requirements.

(a) Determination of Mean *Cryptosporidium* Level.

(i) Following completion of the initial source water monitoring required under R.61-58.10.K(2)(a), unfiltered systems must calculate the arithmetic mean of all *Cryptosporidium* sample concentrations reported under R.61-58.10.K(2)(a). Systems must report this value to the Department for approval no later than 6 months after the month the system is required to complete initial source water monitoring based on the schedule in R.61-58.10.K(2)(c).

(ii) Following completion of the second round of source water monitoring required under R.61-58.10.K(2)(b), unfiltered systems must calculate the arithmetic mean of all *Cryptosporidium* sample concentrations reported under R.61-58.10.K(2)(b). Systems must report this value to the Department for approval no later than 6 months after the month the system is required to complete the second round of source water monitoring based on the schedule in R.61-58.10.K(2)(c).

(iii) If the monthly *Cryptosporidium* sampling frequency varies, systems must first calculate a monthly average for each month of monitoring. Systems must then use these monthly average concentrations, rather than individual sample concentrations, in the calculation of the mean *Cryptosporidium* level in R.61-58.10.K(13)(a)(i) or (ii).

(iv) The report to the Department of the mean *Cryptosporidium* levels calculated under R.61-58.10.K(13)(a)(i) and (ii) must include a summary of the source water monitoring data used for the calculation.

(v) Failure to comply with the conditions of R.61-58.10.K(13)(a) is a violation of the treatment technique requirement.

(b) Cryptosporidium Inactivation Requirements.

Unfiltered systems must provide the level of inactivation for Cryptosporidium specified in this paragraph (b), based on their mean Cryptosporidium levels as determined under R.61-58.10.K(13)(a) and according to the schedule in R.61- 58.10.K(14).

(i) Unfiltered systems with a mean Cryptosporidium level of 0.01 oocysts per L or less must provide at least 2-log Cryptosporidium inactivation.

(ii) Unfiltered systems with a mean Cryptosporidium level of greater than 0.01 oocysts per L must provide at least 3-log Cryptosporidium inactivation.

(c) Inactivation Treatment Technology Requirements.

Unfiltered systems must use chlorine dioxide, ozone, or UV as described in R.61- 58.10.K(21) to meet the Cryptosporidium inactivation requirements of R.61-58.10.K(13).

(i) Systems that use chlorine dioxide or ozone and fail to achieve the Cryptosporidium inactivation required in R.61-58.10.K(13)(b) on more than one day in the calendar month are in violation of the treatment technique requirement.

(ii) Systems that use UV light and fail to achieve the Cryptosporidium inactivation required in R.61-58.10.K(13)(b) by meeting the criteria in R.61- 58.10.K(21)(d)(iii)(B) are in violation of the treatment technique requirement.

(d) Use of Two Disinfectants.

Unfiltered systems must meet the combined Cryptosporidium inactivation requirements of R.61-58.10.K(13) and Giardia lamblia and virus inactivation requirements of R.61-58.10.D(1) using a minimum of two disinfectants, and each of two disinfectants must separately achieve the total inactivation required for either Cryptosporidium, Giardia lamblia, or viruses.

(14) Schedule for compliance with Cryptosporidium Treatment Requirements.

(a) Following initial bin classification under R.61-58.10.K(11)(c), filtered systems must provide the level of treatment for Cryptosporidium required under R.61- 58.10.K(12) according to the schedule in R.61-58.10.K(14)(c).

(b) Following initial determination of the mean Cryptosporidium level under R.61- 58.10.K(13)(a)(i), unfiltered systems must provide the level of treatment for Cryptosporidium required under R.61-58.10.K(13) according to the schedule in R.61- 58.10(K)(14)(c).

(c) Cryptosporidium treatment compliance dates.

(i) Systems that serve at least 100,000 people must comply with Cryptosporidium treatment requirements no later than April 1, 2012.

(ii) Systems that serve from 50,000 to 99,999 people must comply with Cryptosporidium treatment requirements no later than October 1, 2012.

(iii) Systems that serve from 10,000 to 49,999 people must comply with Cryptosporidium treatment requirements no later than October 1, 2013.

(iv) Systems that serve fewer than 10,000 people must comply with Cryptosporidium treatment requirements no later than October 1, 2014.

(v) The Department may grant an additional two years for complying with the treatment technique requirements for systems making capital improvements.

(d) If the bin classification for a filtered system changes following the second round of source water monitoring, as determined under R.61-58.10.K(11)(d), the system must provide the level of treatment for Cryptosporidium required under R.61-58.10.K(12) on a schedule the Department approves.

(e) If the mean Cryptosporidium level for an unfiltered system changes following the second round of monitoring, as determined under R.61-58.10.K(13)(a)(ii), and if the system must provide a different level of Cryptosporidium treatment under R.61-58.10.K(13) due to this change, the system must meet this treatment requirement on a schedule the Department approves.

(15) Requirements for uncovered finished water storage facilities.

(a) Systems using uncovered finished water storage facilities must comply with the conditions of R.61-58.10.K(15).

(b) Systems must notify the Department of the use of each uncovered finished water storage facility no later than April 1, 2008.

(c) Systems must meet the conditions of R.61-58.10.K(15)(c)(i) or (ii) for each uncovered finished water storage facility or be in compliance with a Department- approved schedule to meet these conditions no later than April 1, 2009.

(i) Systems must cover any uncovered finished water storage facility.

(ii) Systems must treat the discharge from the uncovered finished water storage facility to the distribution system to achieve inactivation and/or removal of at least 4-log virus, 3-log *Giardia lamblia*, and 2-log Cryptosporidium using a protocol approved by the Department.

(d) Failure to comply with the requirements of R.61-58.10.K(15) is a violation of the treatment technique requirement.

(16) Microbial toolbox options for meeting Cryptosporidium treatment requirements.

(a) Cryptosporidium Treatment Credits.

(i) Systems may receive the treatment credits listed in R.61-58.10.K(16)(b) by meeting the conditions for microbial toolbox options described in R.61-58.10.K(17) through (21). Systems apply these treatment credits to meet the treatment requirements in R.61-58.10(K)(12) or R.61-58.10(K)(13), as applicable.

(ii) Unfiltered systems are eligible for treatment credits for the microbial toolbox options described in R.61-58.10.K(21) only.

(b) Microbial Toolbox Summary Treatment Credits and Criteria

(i) Source Protection and Management Toolbox Options

(A) Watershed control program: 0.5-log credit may be given for Department-approved programs that include the required elements, annual program status report to the Department, and regular watershed surveys. Unfiltered systems are not eligible for this credit. Specific criteria for obtaining and maintaining this credit are detailed in R.61- 58.10.K(17)(a).

(B) Alternative source or intake management: No prescribed credit is given. Systems may conduct simultaneous monitoring for treatment bin classification at alternative intake locations or under alternative intake management strategies. Specific criteria for this credit are detailed in R.61-58.10.K(17)(b).

(ii) Pre Filtration Toolbox Options

(A) Presedimentation basin with coagulation: 0.5-log credit may be given during any month that presedimentation basins achieve a monthly mean reduction of 0.5-log or greater in turbidity or alternative Department-approved performance criteria. To be eligible, basins must be operated continuously with coagulant addition and all plant flow must pass through the basins. Specific criteria for obtaining and maintaining this credit are detailed in R.61-58.10.K(18)(a).

(B) Two-stage lime softening: 0.5-log credit for two-stage softening may be given where chemical addition and hardness precipitation occur in both stages. All plant flow must pass through both stages. Single stage softening is credited as equivalent to conventional treatment. Specific criteria for obtaining and maintaining this credit are detailed in R.61-58.10.K(18)(b).

(C) Bank filtration: 0.5-log credit may be given for a 25-foot setback; 1.0-log credit may be given for a 50-foot setback. The aquifer must be unconsolidated sand consisting of at least 10 percent fines. The average turbidity in the wells must be less than 1 NTU. Systems using wells followed by filtration when conducting source water monitoring must sample the well to determine bin classification and are not eligible for additional credit. Specific criteria for obtaining and maintaining this credit are detailed in R.61-58.10.K(18)(c).

(iii) Treatment Performance Toolbox Options

(A) Combined filter performance: 0.5-log credit may be given for combined filter effluent turbidity less than or equal to 0.15 NTU in at least 95 percent of measurements each month. Specific criteria for obtaining and maintaining this credit are detailed in R.61-58.10.K(19)(a).

(B) Individual filter performance: 0.5-log credit (in addition to 0.5- log combined filter performance credit) may be given if individual filter effluent turbidity is less than or equal to 0.15 NTU in at least 95 percent of samples each month in each filter and is never greater than 0.3 NTU in two consecutive measurements in any filter. Specific criteria for obtaining and maintaining this credit are detailed in R.61-58.10.K(19)(b).

(C) Demonstration of performance: Credit may be given to unit processes or treatment trains based on a demonstration to the Department with a Department-approved protocol. Specific criteria for obtaining and maintaining this credit are detailed in R.61-58.10.K(19)(c).

(iv) Additional Filtration Toolbox Options

(A) Bag or cartridge filters (individual filters): Up to 2-log credit may be given based on the removal efficiency demonstrated during challenge testing with a 1.0-log factor of safety. Specific criteria for obtaining and maintaining this credit are detailed in R.61-58.10.K(20)(a).

(B) Bag or cartridge filters (in series): Up to 2.5-log credit may be given based on the removal efficiency demonstrated during challenge testing with a 0.5-log factor of safety. Specific criteria for obtaining and maintaining this credit are detailed in R.61-58.10.K(20)(a).

(C) Membrane filtration: The log credit that may be given is equal to the removal efficiency demonstrated in challenge testing for a specific device if supported by direct integrity testing. Specific criteria for obtaining and maintaining this credit are detailed in R.61-58.10.K(20)(b).

(D) Second stage filtration: 0.5-log credit may be given for a second separate granular media filtration stage if the treatment train includes coagulation prior to the first filter. Specific criteria for obtaining and maintaining this credit are detailed in R.61-58.10.K(20)(c).

(E) Slow sand filters: 2.5-log credit may be given if it is a secondary filtration step. 3.0-log credit may be given if it is a primary filtration process. Neither option can include chlorination before the filters. Specific criteria for obtaining and maintaining this credit are detailed in R.61-58.10.K(20)(d).

(v) Inactivation Toolbox Options

(A) Chlorine dioxide: Log credit given is based on the measured CT in relation to the CT table. Specific criteria for obtaining and maintaining this credit are detailed in R.61-58.10.K(21)(b).

(B) Ozone: Log credit given is based on the measured CT in relation to the CT table. Specific criteria for obtaining and maintaining this credit are detailed in R.61-58.10.K(21)(b).

(C) UV: Log credit given is based on validated UV dose in relation to UV dose table. Reactor validation testing is required to establish UV dose and associated operating conditions. Specific criteria for obtaining and maintaining this credit are detailed in R.61-58.10.K(21)(d).

(17) Source Toolbox Components.

(a) Watershed Control Program.

Systems receive 0.5-log *Cryptosporidium* treatment credit for implementing a watershed control program that meets the following requirements:

(i) Systems that intend to apply for the watershed control program credit must notify the Department of this intent no later than two years prior to the treatment compliance date applicable to the system in R.61-58.10.K(14).

(ii) Systems must submit to the Department a proposed watershed control plan no later than one year before the applicable treatment compliance date in R.61-58.10.K(14). The Department must approve

the watershed control plan for the system to receive treatment credit. The watershed control plan must include the elements in R.61-58.10.K(17)(a)(ii)(A) through (D).

(A) Identification of an “area of influence” outside of which the likelihood of Cryptosporidium or fecal contamination affecting the treatment plant intake is not significant. This is the area to be evaluated in future watershed surveys under R.61-58.10.K(17)(a)(v)(B).

(B) Identification of both potential and actual sources of Cryptosporidium contamination and an assessment of the relative impact of these sources on the system's source water quality.

(C) An analysis of the effectiveness and feasibility of control measures that could reduce Cryptosporidium loading from sources of contamination to the system's source water.

(D) A statement of goals and specific actions the system will undertake to reduce source water Cryptosporidium levels. The plan must explain how the actions are expected to contribute to specific goals, identify watershed partners and their roles, identify resource requirements and commitments, and include a schedule for plan implementation with deadlines for completing specific actions identified in the plan.

(iii) Systems with existing watershed control programs (i.e., programs in place on January 5, 2006) are eligible to seek this credit. Their watershed control plans must meet the criteria in R.61-58.10.K(17)(a)(ii) and must specify ongoing and future actions that will reduce source water Cryptosporidium levels.

(iv) If the Department does not respond to a system regarding approval of a watershed control plan submitted under R.61-58.10.K(17) and the system meets the other requirements of R.61-58.10.K(17), the watershed control program will be considered approved and 0.5 log Cryptosporidium treatment credit will be awarded unless and until the Department subsequently withdraws such approval.

(v) Systems must complete the actions in R.61-58.10.K(17)(a)(v)(A) through (C) to maintain the 0.5-log credit.

(A) Submit an annual watershed control program status report to the Department. The annual watershed control program status report must describe the system's implementation of the approved plan and assess the adequacy of the plan to meet its goals. It must explain how the system is addressing any shortcomings in plan implementation, including those previously identified by the Department or as the result of the watershed survey conducted under R.61-58.10.K(17)(a)(v)(B). The report must also describe any significant changes that have occurred in the watershed since the last watershed sanitary survey. If a system determines during implementation that making a significant change to its approved watershed control program is necessary, the system must notify the Department prior to making any such changes. If any change is likely to reduce the level of source water protection, the system must also list in its notification the actions the system will take to mitigate this effect.

(B) Undergo a watershed sanitary survey every three years for community water systems and every five years for non-community water systems and submit the survey report to the Department. The survey must be conducted according to Department guidelines and by persons approved by the Department.

(1) The watershed sanitary survey must meet the following criteria: encompass the region identified in the Department- approved watershed control plan as the area of influence; assess the implementation of actions to reduce source water Cryptosporidium levels; and identify any significant new sources of Cryptosporidium.

(2) If the Department determines that significant changes may have occurred in the watershed since the previous watershed sanitary survey, systems must undergo another watershed sanitary survey by a date the Department requires, which may be earlier than the regular date in R.61-58.10.K(17)(a)(v)(B).

(C) The system must make the watershed control plan, annual status reports, and watershed sanitary survey reports available to the public upon request. These documents must be in a plain language style and include criteria by which to evaluate the success of the program in achieving plan goals. The Department may approve systems to withhold from the public portions of the annual status report, watershed control plan, and watershed sanitary survey based on water supply security considerations.

(vi) If the Department determines that a system is not carrying out the approved watershed control plan, the Department may withdraw the watershed control program treatment credit.

(b) Alternative Source.

(i) A system may conduct source water monitoring that reflects a different intake location (either in the same source or for an alternate source) or a different procedure for the timing or level of withdrawal from the source (alternative source monitoring). If the Department approves, a system may determine its bin classification under R.61-58.10.K(11) based on the alternative source monitoring results.

(ii) If systems conduct alternative source monitoring under R.61-58.10.K(17)(b)(i), systems must also monitor their current plant intake concurrently as described in R.61-58.10.K(2).

(iii) Alternative source monitoring under R.61-58.10.K(17)(b)(i) must meet the requirements for source monitoring to determine bin classification, as described in R.61-58.10.K(2) through (7). Systems must report the alternative source monitoring results to the Department, along with supporting information documenting the operating conditions under which the samples were collected.

(iv) If a system determines its bin classification under R.61-58.10.K(11) using alternative source monitoring results that reflect a different intake location or a different procedure for managing the timing or level of withdrawal from the source, the system must relocate the intake or permanently adopt the withdrawal procedure, as applicable, no later than the applicable treatment compliance date in R.61-58.10.K(14).

(18) Pre-filtration Treatment Toolbox Components.

(a) Presedimentation.

Systems receive 0.5-log *Cryptosporidium* treatment credit for a presedimentation basin during any month the process meets the criteria in R.61-58.10.K(18)(a).

(i) The presedimentation basin must be in continuous operation and must treat the entire plant flow taken from a surface water or GWUDI source.

(ii) The system must continuously add a coagulant to the presedimentation basin.

(iii) The presedimentation basin must achieve the performance criteria in R.61-58.10.K(18)(iii)(A) or (B).

(A) The system must demonstrate at least 0.5-log mean reduction of influent turbidity. This reduction must be determined using daily turbidity measurements in the presedimentation process influent

and effluent and must be calculated as follows: $\log_{10}(\text{monthly mean of daily influent turbidity}) - \log_{10}(\text{monthly mean of daily effluent turbidity})$.

(B) The system must comply with Department-approved performance criteria that demonstrate at least 0.5-log mean removal of micron-sized particulate material through the presedimentation process.

(b) Two-stage Lime Softening.

Systems receive an additional 0.5-log Cryptosporidium treatment credit for a two-stage lime softening plant if chemical addition and hardness precipitation occur in two separate and sequential softening stages prior to filtration. Both softening stages must treat the entire plant flow taken from a surface water or GWUDI source.

(c) Bank Filtration.

Systems receive Cryptosporidium treatment credit for bank filtration that serves as pretreatment to a filtration plant by meeting the criteria in R.61-58.10.K(18)(c). Systems using bank filtration when they begin source water monitoring under R.61-58.10.K(2)(a) must collect samples as described in R.61-58.10.K(4)(d) and are not eligible for this credit.

(i) Wells with a ground water flow path of at least 25 feet receive 0.5-log treatment credit; wells with a ground water flow path of at least 50 feet receive 1.0-log treatment credit. The ground water flow path must be determined as specified in R.61-58.10.K(18)(c)(iv).

(ii) Only wells in granular aquifers are eligible for treatment credit. Granular aquifers are those comprised of sand, clay, silt, rock fragments, pebbles or larger particles, and minor cement. A system must characterize the aquifer at the well site to determine aquifer properties. Systems must extract a core from the aquifer and demonstrate that in at least 90 percent of the core length, grains less than 1.0 mm in diameter constitute at least 10 percent of the core material.

(iii) Only horizontal and vertical wells are eligible for treatment credit.

(iv) For vertical wells, the ground water flow path is the measured distance from the edge of the surface water body under high flow conditions (determined by the 100 year floodplain elevation boundary or by the floodway, as defined in Federal Emergency Management Agency flood hazard maps) to the well screen. For horizontal wells, the ground water flow path is the measured distance from the bed of the river under normal flow conditions to the closest horizontal well lateral screen.

(v) Systems must monitor each wellhead for turbidity at least once every four hours while the bank filtration process is in operation. If monthly average turbidity levels, based on daily maximum values in the well, exceed 1 NTU, the system must report this result to the Department and conduct an assessment within 30 days to determine the cause of the high turbidity levels in the well. If the Department determines that microbial removal has been compromised, the Department may revoke treatment credit until the system implements corrective actions approved by the Department to remediate the problem.

(vi) Springs and infiltration galleries are not eligible for treatment credit under R.61-58.10.K(18), but are eligible for credit under R.61-58.10.K(19)(c).

(vii) Bank Filtration Demonstration of Performance.

The Department may approve *Cryptosporidium* treatment credit for bank filtration based on a demonstration of performance study that meets the criteria in this paragraph. This treatment credit may be greater than 1.0- log and may be awarded to bank filtration that does not meet the criteria in R.61-58.10.K(18)(c)(i) through (v).

(A) The study must follow a Department-approved protocol and must involve the collection of data on the removal of *Cryptosporidium* or a surrogate for *Cryptosporidium* and related hydrogeologic and water quality parameters during the full range of operating conditions.

(B) The study must include sampling both from the production well(s) and from monitoring wells that are screened and located along the shortest flow path between the surface water source and the production well(s).

(19) Treatment Performance Toolbox Components.

(a) Combined Filter Performance.

Systems using conventional filtration treatment or direct filtration treatment may receive an additional 0.5-log *Cryptosporidium* treatment credit during any month the system meets the criteria in this paragraph. Combined filter effluent (CFE) turbidity must be less than or equal to 0.15 NTU in at least 95 percent of the measurements. Turbidity must be measured as described in 40 CFR 141.74(a) and (c) (1-05-06 edition).

(b) Individual Filter Performance.

Systems using conventional filtration treatment or direct filtration treatment may receive 0.5-log *Cryptosporidium* treatment credit, which can be in addition to the 0.5-log credit under R.61-58.10.K(19)(a), during any month the system meets the criteria in this paragraph (b). Compliance with these criteria must be based on individual filter turbidity monitoring as described in R.61-58.10.H(5) or R.61- 58.10.I(7), as applicable.

(i) The filtered water turbidity for each individual filter must be less than or equal to 0.15 NTU in at least 95 percent of the measurements recorded each month.

(ii) No individual filter may have a measured turbidity greater than 0.3 NTU in two consecutive measurements taken 15 minutes apart.

(iii) Any system that has received treatment credit for individual filter performance and fails to meet the requirements of R.61-58.10.K(19)(b)(i) or (ii) during any month does not receive a treatment technique violation under R.61- 58.10.K(12)(c) if the Department determines the following:

(A) The failure was due to unusual and short-term circumstances that could not reasonably be prevented through optimizing treatment plant design, operation, and maintenance.

(B) The system has experienced no more than two such failures in any calendar year.

(c) Demonstration of Performance.

The Department may approve *Cryptosporidium* treatment credit for drinking water treatment processes based on a demonstration of performance study that meets the criteria in this paragraph (c). This treatment credit may be greater than or less than the prescribed treatment credits in R.61-58.10.K(12) or R.61-

58.10.K(18) through (21) and may be awarded to treatment processes that do not meet the criteria for the prescribed credits.

(i) Systems cannot receive the prescribed treatment credit for any toolbox box option in R.61-58.10.K(18) through R.61-58.10.K(21) if that toolbox option is included in a demonstration of performance study for which treatment credit is awarded under this paragraph.

(ii) The demonstration of performance study must follow a Department- approved protocol and must demonstrate the level of Cryptosporidium reduction the treatment process will achieve under the full range of expected operating conditions for the system.

(iii) Approval by the Department must be in writing and may include monitoring and treatment performance criteria that the system must demonstrate and report on an ongoing basis to remain eligible for the treatment credit. The Department may designate such criteria where necessary to verify that the conditions under which the demonstration of performance credit was approved are maintained during routine operation.

(20) Additional Filtration Toolbox Components.

(a) Bag and Cartridge Filters.

With Department approval, systems may receive Cryptosporidium treatment credit of up to 2.0-log for individual bag or cartridge filters and up to 2.5-log for bag or cartridge filters operated in series by meeting the criteria in R.61-58.10.K(20)(a)(i) through (x). To be eligible for this credit, systems must report the results of challenge testing that meets the requirements of R.61-58.10.K(20)(a)(ii) through (ix) to the Department. The filters must treat the entire plant flow taken from a subpart H source.

(i) The Cryptosporidium treatment credit awarded to bag or cartridge filters must be based on the removal efficiency demonstrated during challenge testing that is conducted according to the criteria in R.61-58.10.K(20)(a)(ii) through (ix). A factor of safety equal to 1-log for individual bag or cartridge filters and 0.5- log for bag or cartridge filters in series must be applied to challenge testing results to determine removal credit. Systems may use results from challenge testing conducted prior to January 5, 2006 if the prior testing was consistent with the criteria specified in R.61-58.10.K(20)(a)(ii) through (ix).

(ii) Challenge testing must be performed on full-scale bag or cartridge filters, and the associated filter housing or pressure vessel, that are identical in material and construction to the filters and housings the system will use for removal of Cryptosporidium. Bag or cartridge filters must be challenge tested in the same configuration that the system will use, either as individual filters or as a series configuration of filters.

(iii) Challenge testing must be conducted using Cryptosporidium or a surrogate that is removed no more efficiently than Cryptosporidium. The microorganism or surrogate used during challenge testing is referred to as the challenge particulate. The concentration of the challenge particulate must be determined using a method capable of discreetly quantifying the specific microorganism or surrogate used in the test; gross measurements such as turbidity may not be used.

(iv) The maximum feed water concentration that can be used during a challenge test must be based on the detection limit of the challenge particulate in the filtrate (i.e., filtrate detection limit) and must be calculated using the following equation:

$$\text{Maximum Feed Concentration} = 10,000 \times (\text{Filtrate Detection Limit})$$

(v) Challenge testing must be conducted at the maximum design flow rate for the filter as specified by the manufacturer.

(vi) Each filter evaluated must be tested for a duration sufficient to reach 100 percent of the terminal pressure drop. This maximum pressure drop is the pressure drop under which the filter may be used to comply with the requirements of R.61-58.10(K).

(vii) Removal efficiency of a filter must be determined from the results of the challenge test and expressed in terms of log removal values using the following equation:

$$\text{LRV} = \text{LOG}_{10}(\text{C}_f) - \text{LOG}_{10}(\text{C}_p)$$

Where: LRV = log removal value demonstrated during challenge testing; C_f = the feed concentration measured during the challenge test; and C_p = the filtrate concentration measured during the challenge test. In applying this equation, the same units must be used for the feed and filtrate concentrations. If the challenge particulate is not detected in the filtrate, then the term C_p must be set equal to the detection limit.

(viii) Each filter tested must be challenged with the challenge particulate during three periods over the filtration cycle: within two hours of start-up of a new filter; when the pressure drop is between 45 and 55 percent of the terminal pressure drop; and at the end of the cycle after the pressure drop has reached 100 percent of the terminal pressure drop. A log removal value must be calculated for each of these challenge periods for each filter tested. The log removal value for the filter must be assigned the value of the minimum log removal value observed during the three challenge periods for that filter.

(ix) If fewer than 20 filters are tested, the overall removal efficiency for the filter product line must be set equal to the lowest filter log removal value among the filters tested. If 20 or more filters are tested, the overall removal efficiency for the filter product line must be set equal to the 10th percentile of the set of filter log removal values for the various filters tested. The percentile is defined by $(i/(n+1))$ where i is the rank of n individual data points ordered lowest to highest. If necessary, the 10th percentile may be calculated using linear interpolation.

(x) If a previously tested filter is modified in a manner that could change the removal efficiency of the filter product line, challenge testing to demonstrate the removal efficiency of the modified filter must be conducted and submitted to the Department.

(b) Membrane Filtration.

(i) Systems may receive Cryptosporidium treatment credit for membrane filtration that meets the criteria of this paragraph (b). Membrane cartridge filters that meet the definition of membrane filtration in R.61-58.B are eligible for this credit. The level of treatment credit a system receives is equal to the lower of the values determined under R.61-58.10.K(20)(b)(i)(A) and (B).

(A) The removal efficiency demonstrated during challenge testing conducted under the conditions in R.61-58.10.K(20)(b)(ii).

(B) The maximum removal efficiency that can be verified through direct integrity testing used with the membrane filtration process under the conditions in R.61-58.10.K(20)(b)(iii).

(ii) Challenge Testing. The membrane used by the system must undergo challenge testing to evaluate removal efficiency, and the system must report the results of challenge testing to the Department.

Challenge testing must be conducted according to the criteria in R.61-58.10.K(20)(b)(ii)(A) through (G). Systems may use data from challenge testing conducted prior to January 5, 2006 if the prior testing was consistent with the criteria in R.61-58.10.K(20)(b)(ii)(A) through (G).

(A) Challenge testing must be conducted on either a full-scale membrane module, identical in material and construction to the membrane modules used in the system's treatment facility, or a smaller-scale membrane module, identical in material and similar in construction to the full-scale module. A module is defined as the smallest component of a membrane unit in which a specific membrane surface area is housed in a device with a filtrate outlet structure.

(B) Challenge testing must be conducted using *Cryptosporidium* oocysts or a surrogate that is removed no more efficiently than *Cryptosporidium* oocysts. The organism or surrogate used during challenge testing is referred to as the challenge particulate. The concentration of the challenge particulate, in both the feed and filtrate water, must be determined using a method capable of discretely quantifying the specific challenge particulate used in the test; gross measurements such as turbidity may not be used.

(C) The maximum feed water concentration that can be used during a challenge test is based on the detection limit of the challenge particulate in the filtrate and must be determined according to the following equation:

$$\text{Maximum Feed Concentration} = 3,160,000 \times (\text{Filtrate Detection Limit})$$

(D) Challenge testing must be conducted under representative hydraulic conditions at the maximum design flux and maximum design process recovery specified by the manufacturer for the membrane module. Flux is defined as the throughput of a pressure driven membrane process expressed as flow per unit of membrane area. Recovery is defined as the volumetric percent of feed water that is converted to filtrate over the course of an operating cycle uninterrupted by events such as chemical cleaning or a solids removal process (i.e., backwashing).

(E) Removal efficiency of a membrane module must be calculated from the challenge test results and expressed as a log removal value according to the following equation:

$$\text{LRV} = \text{LOG}_{10}(C_f) - \text{LOG}_{10}(C_p)$$

Where: LRV = log removal value demonstrated during the challenge test; C_f = the feed concentration measured during the challenge test; and C_p = the filtrate concentration measured during the challenge test. Equivalent units must be used for the feed and filtrate concentrations. If the challenge particulate is not detected in the filtrate, the term C_p is set equal to the detection limit for the purpose of calculating the log removal value. A log removal value must be calculated for each membrane module evaluated during the challenge test.

(F) The removal efficiency of a membrane filtration process demonstrated during challenge testing must be expressed as a log removal value. If fewer than 20 modules are tested, then the challenge test log removal value is equal to the lowest of the representative log removal values among the modules tested. If 20 or more modules are tested, then the challenge test log removal value is equal to the 10th percentile of the representative log removal values among the modules tested. The percentile is defined by $(i/(n+1))$ where i is the rank of n individual data points ordered lowest to highest. If necessary, the 10th percentile may be calculated using linear interpolation.

(G) The challenge test must establish a quality control release value for a non-destructive performance test that demonstrates the *Cryptosporidium* removal capability of the membrane filtration

module. This performance test must be applied to each production membrane module used by the system that was not directly challenge tested in order to verify *Cryptosporidium* removal capability. Production modules that do not meet the established quality control release value are not eligible for the treatment credit demonstrated during the challenge test.

(H) If a previously tested membrane is modified in a manner that could change the removal efficiency of the membrane or the applicability of the non-destructive performance test and associated quality control release value, additional challenge testing to demonstrate a new removal efficiency and quality control release value must be conducted and submitted to the Department.

(iii) Direct integrity testing. Systems must conduct direct integrity testing in a manner that demonstrates a removal efficiency equal to or greater than the removal credit awarded to the membrane filtration process and meets the requirements described in R.61-58.10.K(20)(b)(iii)(A) through (F). A direct integrity test is defined as a physical test applied to a membrane unit in order to identify and isolate integrity breaches (i.e., one or more leaks that could result in contamination of the filtrate).

(A) The direct integrity test must be independently applied to each membrane unit in service. A membrane unit is defined as a group of membrane modules that share common valving that allows the unit to be isolated from the rest of the system for the purpose of integrity testing or other maintenance.

(B) The direct integrity method must have a resolution of 3 micrometers or less, where resolution is defined as the size of the smallest integrity breach that contributes to a response from the direct integrity test.

(C) The direct integrity test must have a sensitivity sufficient to verify the log treatment credit awarded to the membrane filtration process by the Department, where sensitivity is defined as the maximum log removal value that can be reliably verified by a direct integrity test. Sensitivity must be determined using the approach in either R.61- 58.10.K(20)(b)(iii)(C)(1) or (2) as applicable to the type of direct integrity test the system uses.

(1) For direct integrity tests that use an applied pressure or vacuum, the direct integrity test sensitivity must be calculated according to the following equation:

$$LRV_{DIT} = \text{LOG}_{10} (Q_p / (\text{VCF} \times Q_{\text{breach}}))$$

Where: LRV_{DIT} = the sensitivity of the direct integrity test; Q_p = total design filtrate flow from the membrane unit; Q_{breach} = flow of water from an integrity breach associated with the smallest integrity test response that can be reliably measured, and VCF = volumetric concentration factor. The volumetric concentration factor is the ratio of the suspended solids concentration on the high pressure side of the membrane relative to that in the feed water.

(2) For direct integrity tests that use a particulate or molecular marker, the direct integrity test sensitivity must be calculated according to the following equation:

$$LRV_{DIT} = \text{LOG}_{10}(C_f) - \text{LOG}_{10}(C_p)$$

Where: LRV_{DIT} = the sensitivity of the direct integrity test; C_f = the typical feed concentration of the marker used in the test; and C_p = the filtrate concentration of the marker from an integral membrane unit.

(D) Systems must establish a control limit within the sensitivity limits of the direct integrity test that is indicative of an integral membrane unit capable of meeting the removal credit awarded by the Department.

(E) If the result of a direct integrity test exceeds the control limit established under R.61-58.10.K(20)(b)(iii)(D), the system must remove the membrane unit from service. Systems must conduct a direct integrity test to verify any repairs, and may return the membrane unit to service only if the direct integrity test is within the established control limit.

(F) Systems must conduct direct integrity testing on each membrane unit at a frequency of not less than once each day that the membrane unit is in operation. The Department may approve less frequent testing, based on demonstrated process reliability, the use of multiple barriers effective for *Cryptosporidium*, or reliable process safeguards.

(iv) Indirect integrity monitoring. Systems must conduct continuous indirect integrity monitoring on each membrane unit according to the criteria in R.61-58.10.K(20)(b)(iv)(A) through (E). Indirect integrity monitoring is defined as monitoring some aspect of filtrate water quality that is indicative of the removal of particulate matter. A system that implements continuous direct integrity testing of membrane units in accordance with the criteria in R.61-58.10.K(20)(b)(iii)(A) through (E) is not subject to the requirements for continuous indirect integrity monitoring. Systems must submit a monthly report to the Department summarizing all continuous indirect integrity monitoring results triggering direct integrity testing and the corrective action that was taken in each case.

(A) Unless the Department approves an alternative parameter, continuous indirect integrity monitoring must include continuous filtrate turbidity monitoring.

(B) Continuous monitoring must be conducted at a frequency of no less than once every 15 minutes.

(C) Continuous monitoring must be separately conducted on each membrane unit.

(D) If indirect integrity monitoring includes turbidity and if the filtrate turbidity readings are above 0.15 NTU for a period greater than 15 minutes (i.e., two consecutive 15-minute readings above 0.15 NTU), direct integrity testing must immediately be performed on the associated membrane unit as specified in R.61-58.10.K(20)(b)(iii)(A) through (E).

(E) If indirect integrity monitoring includes a Department-approved alternative parameter and if the alternative parameter exceeds a Department-approved control limit for a period greater than 15 minutes, direct integrity testing must immediately be performed on the associated membrane units as specified in R.61-58.10.K(20)(b)(iii)(A) through (E).

(c) Second stage filtration. With Department approval, systems may receive 0.5-log *Cryptosporidium* treatment credit for a separate second stage of filtration that consists of sand, dual media, GAC, or other fine grain media following granular media filtration. To receive this credit, the first stage of filtration must be preceded by a coagulation step and both filtration stages must treat the entire plant flow taken from a surface water or GWUDI source. A cap, such as GAC, on a single stage of filtration is not eligible for this credit. The Department must approve the treatment credit based on an assessment of the design characteristics of the filtration process.

(d) Slow Sand Filtration (as Secondary Filter).

With Department approval, systems may receive 2.5-log *Cryptosporidium* treatment credit for a slow sand filtration process that follows a separate stage of filtration if both filtration stages treat entire plant flow taken from a surface water or GWUDI source and no disinfectant residual is present in the influent water to the slow sand filtration process. The Department must approve the treatment credit based on an assessment of the design characteristics of the filtration process. This paragraph does not apply to treatment credit awarded to slow sand filtration used as a primary filtration process.

(21) Inactivation Toolbox Components.

(a) Calculation of CT Values.

(i) CT is the product of the disinfectant contact time (T, in minutes) and disinfectant concentration (C, in milligrams per liter). Systems with treatment credit for chlorine dioxide or ozone under R.61-58.10.K(21)(b) or (c) must calculate CT at least once each day, with both C and T measured during peak hourly flow as specified in R.61-58.10.F(1) and (2).

(ii) Systems with several disinfection segments in sequence may calculate CT for each segment, where a disinfection segment is defined as a treatment unit process with a measurable disinfectant residual level and a liquid volume. Under this approach, systems must add the *Cryptosporidium* CT values in each segment to determine the total CT for the treatment plant.

(b) CT values for Chlorine Dioxide and Ozone.

(i) Systems may receive the *Cryptosporidium* treatment credit listed in the following table by meeting the corresponding chlorine dioxide CT value for the applicable water temperature, as described in R.61-58.10.K(21)(a).

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

Log Credit	Water Temperature (degrees C)										
	Less than or equal to 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

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

(ii) Systems may receive the *Cryptosporidium* treatment credit listed in the following table by meeting the corresponding ozone CT values for the applicable water temperature, as described in R.61-58.10.K(21)(a).

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

Log Credit	Water Temperature (degrees C)										
	Less than or equal to 0.5	1	2	3	5	7	10	15	20	25	30
0.25	6	5.8	5.2	4.8	4.0	3.3	2.5	1.6	1.0	0.6	.39
0.5	12	12	10	9.5	7.9	6.5	4.9	3.1	2.0	1.2	.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: $\text{Log credit} = (0.0397 \times (1.09757)^{\text{Temp}}) \times \text{CT}$

(c) Site-Specific Study.

The Department may approve alternative chlorine dioxide or ozone CT values to those listed in R.61-58.10.K(21)(b) on a site-specific basis. The Department must base this approval on a site-specific study a system conducts that follows a Department-approved protocol.

(d) Ultraviolet Light.

Systems may receive Cryptosporidium, Giardia lamblia, and virus treatment credits for ultraviolet (UV) light reactors by achieving the corresponding UV dose values shown in R.61-58.10.K(21)(d)(i). Systems must validate and monitor UV reactors as described in R.61-58.10.K(21)(d)(ii) and (iii) to demonstrate that they are achieving a particular UV dose value for treatment credit.

(i) UV Dose Table.

The treatment credits listed in this table are for UV light at a wavelength of 254 nanometers as produced by a low-pressure mercury vapor lamp. To receive treatment credit for other lamp types, systems must demonstrate an equivalent germicidal dose through reactor validation testing, as described in R.61-58.10.K(21)(d)(ii). The UV dose values in this table are applicable only to post-filter applications of UV in filtered systems and to unfiltered systems.

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

Log Credit	Cryptosporidium UV dose (mJ/cm ²)	Giardia lamblia UV dose (mJ/cm ²)	Virus UV dose (mJ/cm ²)
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

(ii) Reactor Validation Testing.

Systems must use UV reactors that have undergone validation testing to determine the operating conditions under which the reactor delivers the UV dose required in R.61-58.10.K(21)(d)(i) (i.e., validated operating conditions). These operating conditions must include flow rate, UV intensity as measured by a UV sensor, and UV lamp status.

(A) When determining validated operating conditions, systems must account for the following factors: UV absorbance of the water; lamp fouling and aging; measurement uncertainty of on-line sensors; UV dose distributions arising from the velocity profiles through the reactor; failure of UV lamps or other critical system components; and inlet and outlet piping or channel configurations of the UV reactor.

(B) Validation testing must include full scale testing of a reactor that conforms uniformly to the UV reactors used by the system. In addition, the validation testing must include inactivation information on a test microorganism whose dose response characteristics have been quantified with a low-pressure mercury vapor lamp.

(C) The Department may approve an alternative approach to validation testing.

(iii) Reactor Monitoring.

(A) Systems must monitor their UV reactors to determine if the reactors are operating within validated conditions, as determined under R.61-58.10.K(21)(d)(ii). This monitoring must include UV intensity as measured by a UV sensor, flow rate, lamp status, and other parameters the Department designates based on UV reactor operation. Systems must verify the calibration of UV sensors and must recalibrate sensors in accordance with a protocol the Department approves.

(B) To receive treatment credit for UV light, systems must treat at least 95 percent of the water delivered to the public during each month by UV reactors operating within validated conditions for the required UV dose, as described in R.61-58.10.K(21)(d)(i) and (ii). Systems must demonstrate compliance with this condition by the monitoring required under R.61-58.10.K(21)(d)(iii)(A).

(22) Reporting Requirements.

(a) Systems must report sampling schedules under R.61-58.10.K(3) and source water monitoring results under R.61-58.10.K(7) unless they notify the Department that they will not conduct source water monitoring due to meeting the criteria of R.61-58.10.K(2)(d).

(b) Systems must report the use of uncovered finished water storage facilities to the Department as described in R.61-58.10.K(15).

(c) Filtered systems must report their Cryptosporidium bin classification as described in R.61-58.10.K(11).

(d) Unfiltered systems must report their mean source water Cryptosporidium level as described in R.61-58.10.K(13).

(e) Systems must report disinfection profiles and benchmarks to the Department as described in R.61-58.10.K(9) through (10) prior to making a significant change in disinfection practice.

(f) Systems must report to the Department in accordance with R.61-58.10.K(22)(f)(i) through (xv) for any microbial toolbox options used to comply with treatment requirements under R.61-58.10.K(12) or

(13). Alternatively, the Department may approve a system to certify operation within required parameters for treatment credit rather than reporting monthly operational data for toolbox options.

(i) Watershed Control Program

Systems must submit the following information:

(A) A notice of intention to develop a new program or continue an existing watershed control program should be submitted no later than two years before the applicable treatment compliance date in R.61-58.10.K(14).

(B) A watershed control plan should be submitted no later than one year before the applicable treatment compliance date in R.61-58.10.K(14).

(C) An annual status report for the watershed control program must be submitted every 12 months beginning one year after the applicable treatment compliance date in R.61-58.10.K(14).

(D) A watershed sanitary survey report must be submitted for community systems every three years beginning three years after the applicable treatment compliance date in R.61-58.10.K(14). For non-community water systems, the watershed sanitary survey report must be submitted every five years beginning five years after the applicable treatment compliance date in R.61-58.10.K(14).

(ii) Alternative source or intake management: Systems must submit verification that the system has relocated the intake or adopted the intake withdrawal procedure reflected in the monitoring results. The verification must be sent no later than the applicable compliance date in R.61-58.10.K(14).

(iii) Presedimentation: A monthly report must be submitted within 10 days following the month in which the monitoring was conducted that contains verification of continuous basin operation, treatment of 100 percent of the flow, continuous addition of a coagulant, and at least 0.5-log mean reduction of influent turbidity or compliance with alternative Department-approved performance criteria beginning on the applicable treatment compliance date in R.61-58.K(14).

(iv) Two-stage lime softening: A monthly report must be submitted that contains verification that chemical addition and hardness precipitation occurred in two separate and sequential softening stages prior to filtration and verification that both stages treated 100 percent of the plant flow. The monthly report must be submitted within 10 days following the month in which the monitoring was conducted, beginning on the applicable treatment compliance date in R.61- 58.K(14).

(v) Bank Filtration:

(A) Systems must submit information that demonstrates that the aquifer is unconsolidated and predominantly sandy and that the setback distances of at least 25 ft for 0.5-log removal or 50 ft for 1.0-log removal are met. This information must be submitted no later than the applicable treatment compliance date in R.61-58.10.K(14).

(B) If the monthly average of daily maximum turbidity is greater than 1 NTU then the system must report the result and submit an assessment of the cause within 30 days following the month in which the monitoring was conducted beginning on the applicable treatment compliance date in R.61-58.10.K(14).

(vi) Combined filter performance: Systems must submit monthly verification of their combined filter effluent levels within 10 days following the month in which the monitoring was conducted beginning

on the applicable treatment compliance date in R.61-58.10.K(14). The report must verify that the combined filter effluent turbidity levels were less than or equal to 0.15 NTU in at least 95 percent of the 4 hour combined filter effluent measurements taken each month.

(vii) Individual filter performance: Systems must submit a report within 10 days following the month in which the monitoring was conducted beginning on the applicable treatment compliance date in R.61-58.10.K(14). The report must verify that the individual filter effluent turbidity levels were less than or equal to 0.15 in at least 95 percent of samples each month in each filter, and that no individual filter turbidity was greater than 0.3 NTU in two consecutive readings 15 minutes apart.

(viii) Demonstration of Performance.

(A) Systems must submit the results from testing following a Department-approved protocol no later than the applicable treatment compliance date in R.61-58.10.K(14).

(B) As required by the Department, systems must submit monthly verification of operation within conditions of Department approval for demonstration of performance credit. This verification must be submitted within 10 days following the month in which monitoring was conducted, beginning on the applicable treatment compliance date in R.61-58.10.K(14).

(ix) Bag Filters and Cartridge Filters:

(A) Systems must submit information that demonstrates that the process meets the definition of bag or cartridge filtration and that the removal efficiency established through challenge testing meets the criteria in R.61-58.10.K(20). This information must be submitted no later than the applicable treatment compliance date in R.61-58.10.K(14).

(B) Systems must submit monthly verification that 100 percent of the plant flow was filtered. The monthly verification must be submitted within 10 days following the month in which monitoring was conducted, beginning on the applicable treatment compliance date in R.61-58.10.K(14).

(x) Membrane Filtration:

(A) Systems must submit results of verification testing demonstrating that the removal efficiency established through challenge testing meets the requirements in R.61-58.10.K(20), the type of integrity test method, and the associated test parameters (resolution, sensitivity, test frequency, control limits, and associated baseline). This information must be submitted no later than the applicable treatment compliance date in R.61-58.10.K(14).

(B) Systems must submit a monthly report that summarizes all direct integrity tests above the control limit, and, if applicable, any turbidity or alternative Department-approved indirect integrity monitoring results triggering direct integrity testing and the corrective action that was taken. This report must be submitted within 10 days following the month that testing was conducted, beginning on the applicable treatment compliance date in R.61-58.10.K(14).

(xi) Second stage filtration: Systems must submit monthly verification that 100 percent of the flow was filtered through both stages and that the first stage was preceded by coagulation. This verification must be submitted within 10 days following the month that monitoring was conducted, beginning on the applicable treatment compliance date in R.61-58.10.K(14).

(xii) Slow sand filtration (as secondary filter): Systems must submit monthly verification that both a slow sand filter and a preceding separate stage of filtration treated 100 percent of the flow from a subpart H source. This verification must be submitted within 10 days following the month that monitoring was conducted, beginning on the applicable treatment compliance date in R.61-58.10.K(14).

(xiii) Chlorine dioxide: Systems must submit a summary of CT values for each day as described in R.61-58.10.K(21). This summary must be submitted within 10 days following the month that monitoring was conducted, beginning on the applicable treatment compliance date in R.61-58.10.K(14).

(xiv) Ozone: Systems must submit a summary of CT values for each day as described in R.61-58.10.K(21). This summary must be submitted within 10 days following the month that monitoring was conducted, beginning on the applicable treatment compliance date in R.61-58.10.K(14).

(xv) UV:

(A) Systems must submit validation test results demonstrating that the operating conditions achieved the required UV dose. This information must be submitted no later than the applicable treatment compliance date in R.61-58.10.K(14).

(B) Systems must submit a monthly report summarizing the percentage of water entering the distribution system that was not treated by UV reactors operating within validated conditions for the required dose as specified in R.61-58.10.K(22)(d). This report must be submitted within 10 days following the month that monitoring was conducted, beginning on the applicable treatment compliance date in R.61-58.10.K(14).

(23) Recordkeeping Requirements.

(a) Systems must keep results from the initial round of source water monitoring under R.61-58.10.K(2)(a) and the second round of source water monitoring under R.61-58.10.K(2)(b) until 3 years after bin classification under R.61-58.10.K(11) for filtered systems or determination of the mean *Cryptosporidium* level under R.61-58.10.K(11) for unfiltered systems for the particular round of monitoring.

(b) Systems must keep any notification to the Department that they will not conduct source water monitoring due to meeting the criteria of R.61-58.10.K(2)(d) for 3 years.

(c) Systems must keep the results of treatment monitoring associated with microbial toolbox options under R.61-58.10.K(17) through (21) and with uncovered finished water reservoirs under R.61-58.10.K(15), as applicable, for 3 years.

(24) Requirements to Respond to Significant Deficiencies Identified in Sanitary Surveys Performed by EPA.

(a) A sanitary survey is an onsite review of the water source (identifying sources of contamination by using results of source water assessments where available), facilities, equipment, operation, maintenance, and monitoring compliance of a PWS to evaluate the adequacy of the PWS, its sources and operations, and the distribution of safe drinking water.

(b) For the purposes of this section, a significant deficiency includes a defect in design, operation, or maintenance, or a failure or malfunction of the sources, treatment, storage, or distribution system that EPA

determines to be causing, or has the potential for causing the introduction of contamination into the water delivered to consumers.

(c) For sanitary surveys performed by EPA, systems must respond in writing to significant deficiencies identified in sanitary survey reports no later than 45 days after receipt of the report, indicating how and on what schedule the system will address significant deficiencies noted in the survey.

(d) Systems must correct significant deficiencies identified in sanitary survey reports according to the schedule approved by EPA, or if there is no approved schedule, according to the schedule reported under R.61-58.10.K(24)(c) if such deficiencies are within the control of the system.