

Part XXI—Enhanced Filtration and Disinfection

§ 2101 General Requirements

A. These regulations establish requirements for filtration and disinfection that are in addition to Part VIII (Surface Water Treatment) for systems serving fewer than 10,000 people. The regulations in this part establish or extend treatment technique requirements in lieu of maximum contaminant levels (MCLs) 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:

1. At least 99 percent (2 log) removal of *Cryptosporidium* between a point where the raw water is not subject to re-contamination 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
2. Compliance with the profiling and benchmark requirements in §§ 2104(A) through 2105(C).

B. Applicability

1. Compliance with this section is required if a system:
 - a. Is a public water system;
 - b. Uses surface water or GWUDI as a source; and profile as described in §§ 2102(A) and (B);
 - c. Serves fewer than 10,000 persons.

C. Compliance dates.

Part XXI systems must comply with these regulations beginning January 14, 2005 except where otherwise noted.

D. Requirements

1. Any finished water reservoir must be covered. These regulations apply to any public water system project constructed on or after March 15, 2002 as described in §§2102 (A) and (B);
2. If the public water system is an unfiltered system, owners/operators must comply with the updated watershed control requirements described in §§2103 (A), (B), and (C).
3. If the public water system is a community or non-transient non-community water system, owners/operators must develop a disinfection profile as described in §§2104 (A-G)
4. If the public water system is considering making a significant change to its disinfection practices, owners/operators must develop a disinfection benchmark and consult with the Director for approval of the change as described in §§ 2105(A-E);
5. If the public water system is a filtered system, owners/operators must comply with the combined filter effluent requirements as described in §§2106(A)-(D);
6. If the public water system is a filtered system that uses conventional or direct filtration, owners/operators must comply with the individual filter turbidity requirements as described in §§ 2107(A-E), and;
7. Owners/operators must comply with the applicable reporting and recordkeeping requirements as described in §§ 2108(A) and (B).

§ 2102 Finished Water Reservoirs

A. All Part VIII systems which serve fewer than 10,000 are subject to this requirement.

B. Requirements for new finished water reservoirs

If the public water system begins construction of a finished water reservoir on or after March 15, 2002 the reservoir must be covered. Finished water reservoirs for which public water systems

began construction prior to March 15, 2002 are not subject to this requirement.

§ 2103 Additional Watershed Control Requirements for Unfiltered Systems

- A. If the public water system is a Part VIII system serving fewer than 10,000 persons which does not provide filtration, owners/operators must continue to comply with all of the filtration avoidance criteria in § 803, as well as the additional watershed control requirements in § 2103(B).
- B. Updated watershed control requirements for unfiltered systems to continue to avoid filtration
 - 1. Owners/operators must take any additional steps necessary to minimize the potential for contamination by *Cryptosporidium* oocysts in the source water. A public water system's watershed control program must, for *Cryptosporidium*:
 - a. Identify watershed characteristics and activities which may have an adverse effect on source water quality; and
 - b. Monitor the occurrence of activities which may have an adverse effect on source water quality.
- C. Director determination of watershed control requirements

During an onsite inspection conducted under the provisions of § 803(B)(3), the Director must determine whether public water system 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 owner's/operator's program to monitor and control detrimental activities occurring in the watershed; and the extent to which the owner/operator has maximized land ownership and/or controlled land use within the watershed.

§ 2104 Disinfection Profile

- A. A disinfection profile is a graphical representation of the public water system's level of *Giardia lamblia* or virus inactivation measured during the course of a year. If the public water system is a Part VIII CWS or NTNCWS which serves fewer than 10,000 persons, owners/operators must develop a disinfection profile unless the Director determines that the public water system's profile is unnecessary. The Director may approve the use of a more representative data set for disinfection profiling than the data set required under §§ 2104 (C) - (G).
- B. Criteria to determine that a profile is unnecessary

The Director 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 the public water system's distribution system.
- C. Requirements for a Disinfection Profile
 - 1. A disinfection profile consists of three steps:
 - a. The owner/operator must first collect data for several parameters from the plant as discussed in § 2104 (D) over the course of 12 months. If the public water system serves between 500 and 9,999 persons, owner/operator must begin to collect data no later than July 1, 2003. If the public water system serves fewer than 500 persons, the owner/operator must begin to collect data no later than January 1, 2004.
 - b. The owner/operator must then use this data to calculate weekly log inactivation as discussed in §§ 2104 (E) and (F); and
 - c. Next, the owner/operator must use these weekly log inactivations to develop a disinfection profile as specified in § 2104 (G).
- D. Required data for a Disinfection Profile
 - 1. Owners/operators must monitor the following parameters to determine the total log inactivation using the analytical methods in Appendix D 801-D, once per week on the same

calendar day, over 12 consecutive months:

- a. The temperature of the disinfected water at each residual disinfectant concentration sampling point during peak hourly flow;
- b. If the owner/operator uses chlorine, the pH of the disinfected water at each residual disinfectant concentration sampling point during peak hourly flow;
- c. The disinfectant contact time(s) ("T") during peak hourly flow; and
- d. 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. Calculation of the inactivation ratio

Calculate the total inactivation ratio as follows, and multiply the value by 3.0 to determine log inactivation of *Giardia lamblia*:

Table 2100.1 Total Inactivation Calculation of *Giardia lamblia*

If the public water system	The owner/operator 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, the owner/operator 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 ($3CT_{calc}/CT_{99.9}$).
(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. Requirements for systems using chloramines, ozone, or chlorine dioxide for primary disinfection

If the owner/operator uses chloramines, ozone, or chlorine dioxide for primary disinfection, the owner/operator must also calculate the logs of inactivation for viruses and develop an additional disinfection profile for viruses using methods approved by the Director.

G. Inactivation ratio reporting requirements.

Each log inactivation serves as a data point in the public water system disinfection profile. The owner/operator will have obtained 52 measurements (one for every week of the year). This will allow the owner/operator and the Director the opportunity to evaluate how microbial inactivation varied over the course of the year by looking at all 52 measurements (the Disinfection Profile). The owner/operator must retain the Disinfection Profile data in graphic form, such as a spreadsheet, which must be available for review by the Director as part of a sanitary survey. The owner/operator must use this data to calculate a benchmark if the owner/operator are considering changes to disinfection practices.

§ 2105 Disinfection Benchmark

A. If the public water system is a Part VIII system, the owners/operators are required to develop a disinfection profile under §§ 2104 (A) through (G). The owner/operator must develop a Disinfection Benchmark if the owner/operator decides to make a significant change to the public water system disinfection practice. Owners/operators must consult with the Director for approval before implementing a significant disinfection practice change.

B. Disinfection practices

- 1. Significant changes to disinfection practice include:
 - a. Changes to the point of disinfection;

- b. Changes to the disinfectant(s) used in the treatment plant;
- c. Changes to the disinfection process; or
- d. Any other modification identified by the Director.

C. Requirements for significant changes to disinfection practices

- 1. If the owner/operator is considering a significant change to its disinfection practice, owners/operators must calculate a disinfection benchmark(s) as described in §§ 2105 (D) and (E) and provide the benchmark(s) to the Director. Owners/operators may only make a significant disinfection practice change after consulting with the Director for approval. Owners/operators must submit the following information to the Director as part of the consultation and approval process:
 - a. A description of the proposed change;
 - b. The disinfection profile for *Giardia lamblia* (and, if necessary, viruses) and disinfection benchmark;
 - c. An analysis of how the proposed change will affect the current levels of disinfection; and
 - d. Any additional information requested by the Director.

D. Disinfection Benchmark Calculations

If owner/operator is making a significant change to its disinfection practice, the owner/operator must calculate a disinfection benchmark using the procedure specified below:

- 1. To calculate a disinfection benchmark owners/operator must perform the following steps
 - a. Step 1: Using the data that owners/operators 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.
 - b. Step 2: Determine the lowest monthly average value out of the twelve values. This value becomes the disinfection benchmark.

E. Requirements for public water systems using chloramines, ozone, or chlorine dioxide for primary disinfection

If the owner/operator uses chloramines, ozone or chlorine dioxide for primary disinfection, the owner/operator must calculate the disinfection benchmark from the data that the owner/operator collected for viruses to develop the disinfection profile in addition to the *Giardia lamblia* disinfection benchmark calculated under § 2105 (D). This viral benchmark must be calculated in the same manner used to calculate the *Giardia lamblia* disinfection benchmark in § 2105 (D).

§ 2106 Combined Filter Effluent Requirements

A. All Part VIII systems which serve populations fewer than 10,000, are required to filter, and utilize filtration other than slow sand filtration or diatomaceous earth filtration must meet the combined filter effluent turbidity requirements of §§2106 (B)-(D). If the owner/operator uses slow sand or diatomaceous earth filtration, owners/operators are not required to meet the combined filter effluent turbidity limits of this section, but owner/operator must continue to meet the combined filter effluent turbidity limits in § 805.

B. Requirements for strengthened combined filter effluent turbidity limits

- 1. Public water systems must meet two strengthened combined filter effluent turbidity limits.
 - a. The first combined filter effluent turbidity limit is a "95th percentile" turbidity limit that public water systems must meet in at least 95 percent of the turbidity measurements taken each month. Measurements must continue to be taken as described in Appendix D, 801-D (A) and (C). Monthly reporting must be completed according to § 2108 (A). The following table describes the required limits for specific

filtration technologies.

Table 2100.2 Required Limits for Specific Filtration Technologies
95th Percentile

If the public water system consists of	The 95th percentile turbidity value is:
(1) Conventional Filtration or Direct Filtration	0.3 NTU
(2) All other "Alternative" Filtration	A value determined by the Director (not to exceed 1 NTU) based on the demonstration described in § 2106 (C).

- b. The second combined filter effluent turbidity limit is a "maximum" turbidity limit which the public water system may at no time exceed during the month. Measurements must continue to be taken as described in Appendix D 801-D (A) and (C). Monthly reporting must be completed according to § 2108(A). The following table describes the required limits for specific filtration technologies.

Table 2100.3 Required Limits for Specific Filtration Technologies - Maximum Turbidity Limit

If the public water system consists of	The maximum turbidity value is:
(1) Conventional Filtration or Direct Filtration	1 NTU.
(2) All other "Alternative" Filtration	A value determined by the Director (not to exceed 5 NTU) based on the demonstration as described in § 2106 (C).

C. Requirements for "alternative filtration"

- a. If the public water system consists of alternative filtration (filtration other than slow sand filtration, diatomaceous earth filtration, conventional filtration, or direct filtration), owners/operators are required to conduct a demonstration (see tables in § 2106 (B) (1)). Owners/operators must demonstrate to the Director, using pilot plant studies or other means, that the public water system's filtration, in combination with disinfection treatment, consistently achieves:

1. 99 percent removal of *Cryptosporidium* oocysts;
2. 99.9 percent removal and/or inactivation of *Giardia lamblia* cysts; and
3. 99.99 percent removal and/or inactivation of viruses.

- b. [Reserved]

D. Requirements for lime softening

If lime softening is practiced, the owner/operator may acidify representative combined filter effluent turbidity samples prior to analysis using a protocol approved by the Director.

§ 2107 Individual Filter Turbidity Requirements

- A. If the public water system is a Part VIII system serving fewer than 10,000 people and utilizing conventional filtration or direct filtration, the owner/operator must conduct continuous monitoring of turbidity for each individual filter at the public water system. The following requirements apply to continuous turbidity monitoring:

1. Monitoring must be conducted using an approved method in Appendix D 801-D (A);
2. Calibration of turbidimeters must be conducted using procedures specified by the manufacturer;
3. Results of turbidity monitoring must be recorded at least every 15 minutes;
4. Monthly reporting must be completed according to § 2108(A); and
5. Records must be maintained according to § 2108(B).

B. Requirements for turbidity monitoring if equipment fails

If there is a failure in the continuous turbidity monitoring equipment, the owner/operator must conduct grab sampling every four hours in lieu of continuous monitoring until the turbidimeter is back on-line. The owner/operator has 14 days to resume continuous monitoring before a violation is incurred.

C. Special provisions regarding individual filter turbidity monitoring

If the public water system only consists of two or fewer filters, the owner/operator 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 § 2107 (A) (1) through (5) and (B).

D. Requirements for continuous turbidity monitoring

Follow-up action is required according to the following tables:

Table 2100.4 Requirements for Continuous Turbidity Monitoring

If	Owners/operators 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 Director 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).

Table 2100.5 Requirements for Continuous Turbidity Monitoring - Reporting

If a public water system was required to report to the Director	Owners/operators must
(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 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. If a self-assessment is required, the date that it was triggered and the date that it was completed.
(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 Director 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 Director within the 12 prior months or the system and Director 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 Director no later than 120 days following the day the filter exceeded 2.0 NTU in two consecutive measurements for the second straight month.

E. Requirements for lime softening practices for individual filter turbidity monitoring

If the public water system utilizes lime softening, the owner/operator may apply to the Director for alternative turbidity exceedance levels for the levels specified in the table in § 2107 (D).

Owners/operators must be able to demonstrate to the Director that higher turbidity levels are due to lime carryover only, and not due to degraded filter performance.

§ 2108 Reporting and Recordkeeping Requirements

A. This section requires owners/operators to report several items to the Director. The following table describes the items which must be reported and the frequency of reporting. Owners/operators are required to report the information described in the following table, if it is subject to the specific requirement shown in the first column.

Table 2100.6 Reporting Requirements

Corresponding requirement	Description of information to report	Frequency
(a) Combined Filter Effluent Requirements. (§§ 2106 (A)-(D))	<p>(1) The total number of filtered water turbidity measurements taken during the month.</p> <p>(2) The number and percentage of filtered water turbidity measurements taken during the month which are less than or equal to the public water system's required 95th percentile limit.</p> <p>(3) The date and value of any turbidity measurements taken during the month which exceed the maximum turbidity value for the public water system's filtration system.</p>	<p>By the 10th of the following month.</p> <p>By the 10th of the following month.</p> <p>By the 10th of the following month.</p>
(b) Individual Turbidity Requirements. (§§ 2107 (A)-(E))	<p>(1) That the owner/operator conducted individual filter turbidity monitoring during the month.</p> <p>(2) The filter number(s), corresponding date(s), and the turbidity value(s) which exceeded 1.0 NTU during the month, but only if 2 consecutive measurements exceeded 1.0 NTU.</p> <p>(3) If a self-assessment is required, the date that it was triggered and the date that it was completed.</p> <p>(4) If a CPE is required, that the CPE is required and the date that it was triggered.</p> <p>(5) Copy of completed CPE report.</p>	<p>By the 10th of the following month.</p> <p>By the 10th of the following month.</p> <p>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)</p> <p>By the 10th of the following month.</p> <p>Within 120 days after the CPE was triggered.</p>
(c) Disinfection Profiling (§§ 2104 (A)-(G))	(1) Results of optional monitoring which show TTHM levels <0.064 mg/l and HAA5 levels <0.048 mg/l (Only if owner/operator wishes to forgo profiling) or that the owner/operator has begun disinfection profiling.	<p>(i) For systems serving 500-9,999 by July 1, 2003;</p> <p>(ii) For systems serving fewer than 500 by January 1, 2004.</p>

(d) Disinfection Benchmarking (§§ 2105 (A)-(E))	(1) A description of the proposed change in disinfection, the public water 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 the owner/operator is considering a significant change to its disinfection practice.
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B. Recordkeeping

Owners/operators must keep several types of records based on the requirements of this section, in addition to recordkeeping requirements under § 806. The following table describes the necessary records, the length of time these records must be kept, and for which requirement the records pertain. Owners/operators are required to maintain records described in this table, if it is subject to the specific requirement shown in the first column.

Table 2100.7 Recordkeeping Requirements

Corresponding requirement	Description of necessary records	Duration of time records must be kept
(a) Individual Filter Turbidity Requirements (§§ 2107 (A)-(E))	Results of individual filter monitoring	At least 3 years.
(b) Disinfection Profiling (§§ 2104(A)-(G))	Results of Profile (including raw data and analysis)	Indefinitely.
(c) Disinfection Benchmarking (§§ 2105 (A)-(E))	Benchmark (including raw data and analysis)	Indefinitely.