

ANNEX A

TITLE 25. ENVIRONMENTAL PROTECTION

Subpart C. PROTECTION OF NATURAL RESOURCES

ARTICLE II. WATER RESOURCES

CHAPTER 109. SAFE DRINKING WATER

Subchapter A. GENERAL PROVISIONS

**§ 109.1. Definitions.**

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**Bag filter-Pressure-driven separation devices that remove particulate matter larger than 1 micrometer using an engineered porous filtration media. They are typically constructed of a nonrigid, fabric filtration media housed in a pressure vessel in which the direction of flow is from the inside of the bag to outside.**

**Bank filtration-A water treatment process that uses a well to recover surface water that has naturally infiltrated into ground water through a riverbed or bank(s). Infiltration is typically enhanced by the hydraulic gradient imposed by a nearby pumping water supply or other well.**

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**Bin-A category based on the level of Cryptosporidium present in source water(s). Four potential bins exist, 1 through 4. The higher the bin, the higher the concentration of source water Cryptosporidium.**

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**Cartridge filter-A pressure-driven separation device that removes particulate matter larger than 1 micrometer using an engineered porous filtration media, typically constructed as rigid or semirigid, self-supporting filter elements housed in pressure vessels in which flow is from the outside of the cartridge to the inside.**

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**Conventional filtration—The series of processes for the purpose of substantial particulate removal consisting of coagulation/flocculation, sedimentation and filtration. Any treatment train that includes coagulation/flocculation, clarification, and granular media filtration is regarded as conventional. The clarification step must be a solid/liquid separation process where accumulated solids are removed during this separate component of the treatment system.**

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**Flowing stream -A course of running water flowing in a definite channel.**

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Lake/reservoir-A natural or man made basin or hollow on the Earth's surface in which water collects or is stored that may or may not have a current or single direction of flow.

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Membrane filtration- (i) A pressure or vacuum driven separation process in which particulate matter larger than 1 micrometer is rejected by an engineered barrier, primarily through a size-exclusion mechanism, and which has a measurable removal efficiency of a target organism that can be verified through the application of a direct integrity test. (ii) Includes the common membrane technologies of microfiltration, ultrafiltration, nanofiltration, and reverse osmosis.

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Plant intake-The works or structures at the head of a conduit through which water is diverted from a source (for example, a river or lake) into the treatment plant.

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Presedimentation-A preliminary treatment process used to remove gravel, sand and other particulate material from the source water through settling before the water enters the primary clarification and filtration processes in a treatment plant.

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Significant deficiency- A defect in design, operation, or maintenance, or a failure or malfunction of the sources, treatment, storage, or distribution system that the Department determines to be causing, or has the potential for causing the introduction of contamination into the water delivered to consumers.

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2-stage lime softening-A process in which chemical addition and hardness precipitation occur in each of 2 distinct unit clarification processes in series prior to filtration.

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## Subchapter B. MCLs, MRDLs OR TREATMENT TECHNIQUE REQUIREMENTS

### § 109.202.

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(c)(1)(vi)(D) Monitor source water for Cryptosporidium as specified in § 109.1202(f).

### § 109.204. Disinfection profiling and benchmarking.

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(a) The disinfection profiling and benchmarking requirements, established by the EPA under the National Primary Drinking Water Regulations in 40 CFR 141.172, 141.530,--141.536, 141.540—141.544, 141.570(c) and (d), and 141.708-141.709 are incorporated by reference except as otherwise established by this chapter.

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### Subchapter C. MONITORING REQUIREMENTS

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#### § 109.304. Analytical requirements.

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(d) *Cryptosporidium*. A system shall 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 accredited for *Cryptosporidium* analysis by an equivalent Department laboratory accreditation program.

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### Subchapter D. PUBLIC NOTIFICATION

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#### § 109.417. Special notice for failure to conduct source water *Cryptosporidium* monitoring or failure to determine bin classification.

(a) *Special notice for repeated failure to conduct monitoring of the source water for *Cryptosporidium* and for failure to determine bin classification or *Cryptosporidium* level.* The owner or operator of a community or non-community water system that is required to monitor source water under § 109.1202(a)-(h) (relating to monitoring requirements) shall notify persons served by the water system that monitoring has not been completed as specified no later than 30 days after the system has failed to collect any 3 months of monitoring as specified in § 109.1202(c). The notice shall be repeated as specified in § 109.409(b)(3) (relating to timing for a Tier 2 public notice).

(b) *Delivery of the special notice for failure to determine bin classification or *Cryptosporidium* level.* The owner or operator of a community or non-community water system that is required to determine a bin classification under § 109.1203 (relating to bin classification and treatment technique requirements), or to determine *Cryptosporidium* level under § 109.1203(i) and (j), shall notify persons served by the water system that the determination has not been made as required no later than 30 days after the system has failed to report the determination as specified in § 109.1205(h) (relating to bin classification reporting) or § 109.1203(i) and (j), initial round and second round), respectively. The notice shall be repeated as specified in § 109.409(b)(3). The notice is not required if the system is complying with a Department-approved schedule to address the violation.

(c) *Form and manner of the special notice.*

(1) The form and manner of the public notice shall follow the requirements for a Tier 2 public notice prescribed in § 109.409(c). The public notice shall be presented as required in § 109.411(c) (relating to presentation of a public notice).

(2) Mandatory language contained in the special notice. The notice must contain the following language, including the language necessary to fill in the blanks.

(i) The special notice for repeated failure to conduct monitoring must contain the following language: We are required to monitor the source of your drinking water for *Cryptosporidium*. Results of the monitoring are to be used to determine whether water

treatment at the (treatment plant name) is sufficient to adequately remove Cryptosporidium from your drinking water. We are required to complete this monitoring and make this determination by (required bin determination date). We ``did not monitor or test'' or ``did not complete all monitoring or testing'' on schedule and, therefore, we may not be able to determine by the required date what treatment modifications, if any, must be made to ensure adequate Cryptosporidium removal. Missing this deadline may, in turn, jeopardize our ability to have the required treatment modifications, if any, completed by the deadline required, (date). For more information, please call (name of water system contact) of (name of water system) at (phone number).

(ii) The special notice for failure to determine bin classification or Cryptosporidium level must contain the following language: We are required to monitor the source of your drinking water for Cryptosporidium in order to determine by (date) whether water treatment at the (treatment plant name) is sufficient to adequately remove Cryptosporidium from your drinking water. We have not made this determination by the required date. Our failure to do this may jeopardize our ability to have the required treatment modifications, if any, completed by the required deadline of (date). For more information, please call (name of water system contact) of (name of water system) at (phone number).

(3) Each special notice must also include a description of what the system is doing to correct the violation and when the system expects to return to compliance or resolve the situation.

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## Subchapter G. SYSTEM MANAGEMENT RESPONSIBILITIES

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### § 109.705. Sanitary surveys.

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(d) The following apply to significant deficiencies identified at 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.

(1) For sanitary surveys performed by the Department, a system shall 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.

(2) A system shall correct significant deficiencies identified in sanitary survey reports according to the schedule approved by the Department, or if there is no approved schedule, according to the schedule reported under paragraph (d)(1) if such deficiencies are within the control of the system.

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## Subchapter J. BOTTLED WATER AND VENDED WATER SYSTEMS, RETAIL WATER FACILITIES AND BULK WATER HAULING SYSTEMS

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### § 109.1002. MCLs, MRDLs or treatment techniques.

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(a) Bottled water and vended water systems, retail water facilities and bulk water hauling systems shall supply drinking water that complies with the MCLs, MRDSs, and treatment technique requirements under §§ 109.202 [and] 109.203 **and 109.1203**

**§ 109.1003. Monitoring requirements.**

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(a) *General monitoring requirements.* Bottled water and vended water systems, retail water facilities and bulk water hauling systems shall monitor for compliance with the MCLs and MRDLs in accordance with § 109.301 (relating to general monitoring requirements), with § 109.302 (relating to special monitoring requirements), **and shall comply with § 109.1202(a)-(h) (relating to source water Cryptosporidium monitoring requirements).**

**Subchapter L. LONG TERM 2 ENHANCED SURFACE WATER TREATMENT RULE**

**§ 109.1201. Scope.**

**(a) Scope. This subchapter establishes or extends treatment technique requirements in lieu of maximum contaminant levels for Cryptosporidium. These requirements are in addition to requirements for filtration and disinfection.**

**(b) Applicability. This subchapter applies 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.**

**(1) Wholesale systems shall comply with the requirements of this subchapter based on the population of the largest system in the combined distribution system.**

**(2) The requirements of this subchapter for filtered systems apply to systems required by National Primary Drinking Water Regulations to provide filtration treatment, whether or not the system is currently operating a filtration system.**

**§ 109.1202. Monitoring Requirements.**

**(a) Initial round of source water monitoring. A system shall conduct the following monitoring on the schedule in subsection (c) unless it meets the monitoring exemption criteria in subsection (d).**

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

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

**(3) Filtered systems serving less than 10,000 people E. coli monitoring.**

**(i) A filtered system serving less than 10,000 people shall sample its source water for E. coli at least once every 2 weeks for 12 months.**

**(ii) A filtered system serving less than 10,000 people may avoid E. coli monitoring if the system notifies the Department that it will monitor for Cryptosporidium as described in paragraph (a)(4). The system shall notify the Department no later than 3 months prior to the date the system is otherwise required to start E. coli monitoring under § 109.1202(c) (relating to source water monitoring schedule).**

**(4) Filtered systems serving less than 10,000 people shall 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 subparagraphs, based on monitoring conducted under paragraph (a)(3):

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

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

(iii) The system does not conduct E. coli monitoring as described in paragraph (a)(3)

(iv) Systems using ground water under the direct influence of surface water (GUDI) shall comply with this paragraph based on the E. coli level that applies to the nearest surface water body. If no surface water body is nearby, the system shall comply based on the requirements that apply to systems using lake/reservoir sources.

(5) For filtered systems serving less than 10,000 people, the Department may approve monitoring for an indicator other than E. coli under paragraph (a)(3). The Department also may approve an alternative to the E. coli concentration in subparagraph (a)(4)(i), (ii) or (iv) to trigger Cryptosporidium monitoring. This approval by the Department would be based on EPA-supported research indicating the validity of an alternative to E. coli. The Department will provide this approval to the system 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 § 109.1203(c).

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

(7) 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 shall conduct a second round of source water monitoring that meets the requirements for monitoring parameters, frequency, and duration described in subsection (a), unless they meet the monitoring exemption criteria in subsection (d). Systems shall conduct this monitoring on the schedule in subsection (c).

(c) Source water monitoring schedule. Systems shall begin the monitoring required in subsections (a) and (b) as follows:

(1) At least 100,000 people:

(i) Begin the first round of source water monitoring no later than the month beginning October 1, 2006.

(ii) Begin the second round of source water monitoring no later than the month beginning April 1, 2015.

(2) From 50,000 to 99,999 people:

(i) Begin the first round of source water monitoring no later than the month beginning April 1, 2007.

(ii) Begin the second round of source water monitoring no later than the month beginning October 1, 2015.

(3) From 10,000 to 49,999 people:

(i) Begin the first round of source water monitoring no later than the month beginning April 1, 2008.

(ii) Begin the second round of source water monitoring no later than the month beginning October 1, 2016.

(4) Less than 10,000 people and monitor for E coli:

(i) Begin the first round of source water monitoring no later than the month beginning October 1, 2008.

(ii) Begin the second round of source water monitoring no later than the month beginning October 1, 2017.

(5) Less than 10,000 and monitor for Cryptosporidium:

(i) Begin the first round of source water monitoring no later than the month beginning April 1, 2010.

(ii) Begin the second round of source water monitoring no later than the month beginning April 1, 2019.

(d) Source water monitoring avoidance.

(1) 5.5 log treatment. A filtered system is not required to conduct source water monitoring under this subchapter 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 § 109.1203 (relating to bin classification and treatment technique requirements).

(2) If a system chooses to provide the level of treatment in paragraph (d)(1), as applicable, rather than start source water monitoring, the system shall notify the Department in writing no later than the date the system is otherwise required to submit a sampling schedule for monitoring under § 109.1202(i)-(k). 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 shall install and operate technologies to provide this level of treatment by the applicable treatment compliance date in § 109.1203(k)-(o).

(e) Plants operating only part of the year. 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 that operate for only part of the year shall conduct source water monitoring in accordance with this subchapter, but with the following modifications:

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

(2) Systems with plants that operate less than six months per year and that monitor for Cryptosporidium shall collect at least six Cryptosporidium samples per year during each of 2 years of monitoring. Samples must be evenly spaced throughout the period the plant operates or is anticipated to operate.

(f) New sources.

(1) A system that intends to use a new source of surface water or GUDI after the system is required to begin monitoring under subsection (c) shall monitor the new source on a schedule the Department approves. Any source that has not been monitored according to the requirements of this subchapter will be considered to be a new source. Source water monitoring for new sources must meet the requirements of this subchapter. The system shall also meet the bin classification and Cryptosporidium treatment requirements of § 109.1203(a)-(j), as applicable, for the new source on a schedule approved by the Department. Sources that have not been monitored according to the requirements of this subchapter will be considered to be Bin 4 until monitoring is adequately completed. No later than the applicable Cryptosporidium compliance dates specified in § 109.1203(k), systems wishing to use sources that have not been monitored shall meet the Bin 4 treatment requirements of § 109.1203 (a)-(j) unless otherwise indicated by the Department.

(2) The requirements of § 109.1202(f) apply to public water systems supplied by a surface water or ground water source under the direct influence of surface water systems that begin operation after the monitoring start date applicable to the system's size under subsection (c).

(3) The system shall begin a second round of source water monitoring no later than 6 years following initial bin classification under § 109.1203 or determination of the Cryptosporidium level under § 109.1203(i) and (j), as applicable.

(g) *Monitoring violations.* Failure to collect any source water sample required under this section in accordance with the sampling schedule, sampling location, analytical method, approved laboratory, and reporting requirements of § 109.304(c), § 109.1202(i)-(q), § 109.1205(a)-(e), and § 109.1202 is a monitoring violation.

(h) *Grandfathering monitoring data.* Systems may use (grandfather) monitoring data collected prior to the applicable monitoring start date in subsection (c) to meet the initial source water monitoring requirements in subsection (a). Grandfathered data may substitute for an equivalent number of months at the end of the monitoring period. All data submitted under this subsection shall meet the requirements in § 109.1205(f) (relating to grandfathering data).

(i) *Source water sampling schedules.* Systems required to conduct source water monitoring under § 109.1202 (a)-(h) shall submit a sampling schedule that specifies the calendar dates when the system will collect each required sample.

(1) Systems shall submit sampling schedules no later than 3 months prior to the applicable date listed in § 109.1202(c) for each round of required monitoring.

(2) Sampling schedule submissions. A system must comply with the following:

(i) A system serving at least 10,000 people shall submit its sampling schedule for the initial round of source water monitoring under § 109.1202(a) to EPA electronically at <https://intranet.epa.gov/lt2/>.

(ii) 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.

(3) A system serving less than 10,000 people shall submit its sampling schedules for the initial round of source water monitoring under § 109.1202(a) to the Department.

(4) Systems shall submit sampling schedules for the second round of source water monitoring § 109.1202(b) to the Department.

(5) If EPA or the Department does not respond to a system regarding its sampling schedule, the system shall sample at the reported schedule.

(j) *Source water sample collection period.* Systems shall collect samples within 2 days before or 2 days after the dates indicated in their sampling schedule (i.e., within a 5 day period around the schedule date) unless one of the conditions of paragraph (b)(1) or (2) applies.

(1) *Extreme sample collection conditions.* 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 shall sample as close to the scheduled date as is feasible unless the Department approves an alternative sampling date. The system shall submit an explanation for the delayed sampling date to the Department concurrent with the shipment of the sample to the laboratory.

(2) *Replacement samples.* The requirements for replacement samples are as follows:

(i) 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 §



109.304(c) (relating to analytical requirements), or the failure of an approved laboratory to analyze the sample, then the system shall collect a replacement sample.

(ii) The system shall 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 shall submit an explanation for the delayed sampling date to the Department concurrent with the shipment of the sample to the laboratory.

(k) Missed samples. Systems that fail to meet the criteria of subsection (j) for any source water sample required under § 109.1202(a)-(h) shall revise their sampling schedules to add dates for collecting all missed samples. Systems shall submit the revised schedule to the Department for approval prior to when the system begins collecting the missed samples.

(l) Source water sampling locations. Systems required to conduct source water monitoring under § 109.1202(a)-(h) shall collect samples for each plant that treats a surface water or GUDI 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 § 109.1202(a)-(h) for all plants.

(m) Chemical treatment prior to sampling location. Systems shall collect source water samples prior to chemical treatment, such as coagulants, oxidants and disinfectants.

(n) Source water sample location for plants that recycle. Systems that recycle filter backwash water shall collect source water samples prior to the point of filter backwash water addition.

(o) Bank filtration.

(1) Systems that receive Cryptosporidium treatment credit for bank filtration to meet existing treatment technique requirements of § 109.202(c) (relating to treatment technique requirements for pathogenic bacteria, viruses, and protozoan cysts), as applicable, shall collect source water samples in the surface water prior to bank filtration.

(2) Systems that use bank filtration as pretreatment to a filtration plant shall collect source water samples from the well (that is 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 § 109.1204(f) (relating to bank filtration).

(p) Multiple sources. Systems with plants that use multiple water sources, including multiple surface water sources and blended surface water and ground water sources, shall collect samples as specified in paragraph (e)(1) or (2). The use of multiple sources during monitoring must be consistent with routine operational practice. Sources not adequately evaluated during the monitoring period will be considered new sources and the requirements under § 109.1202(f) (relating to new sources) will apply. Systems may begin monitoring a new source as soon as a sampling schedule and plan has been approved the Department.

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

(2) If a sampling tap where the sources are combined prior to treatment is not available, systems shall collect samples at each source near the intake on the same day and shall follow either subparagraph (e)(2)(i) or (ii) for sample analysis.

(i) 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 the source in the total plant flow at the time the sample is collected.

(ii) 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 the source contributed to total plant flow at the time the sample was collected and then summing these values.

(q) *Additional requirements.* A system shall submit a description of its sampling location(s) to the Department at the same time as the sampling schedule required under § 109.1202(i)- (k) (relating to source water sampling). This description must address the position of the sampling location in relation to the system's water sources 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 shall sample at the reported locations.

### § 109.1203 Bin classification and treatment technique requirements.

(a) *Bin classification.* Following completion of the initial round of source water monitoring required under § 109.1202(a) (relating to initial round of source water monitoring), filtered systems shall 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 § 109.1202(a) and must follow the procedures in paragraphs (b)(1) through (5).

(b) *Procedures for calculating bin classifications.*

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

(2) 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.

(3) For systems that serve less 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.

(4) For systems with plants operating only part of the year that monitor less than 12 months per year under § 109.1202(e), the bin concentration is equal to the highest arithmetic mean of all sample concentrations during any year of Cryptosporidium monitoring.

(5) If the monthly Cryptosporidium sampling frequency varies, systems shall first calculate a monthly average for each month of monitoring. Systems shall then use these monthly average concentrations, rather than individual sample concentrations, in the applicable calculation for bin classification in paragraphs (b)(1) - (4).

(c) *Cryptosporidium bin concentration thresholds.* Systems required to monitor for Cryptosporidium under 109.1202(a)-(h) shall use Cryptosporidium bin concentration calculated under subsections (a)-(b) to determine their initial bin classification as follows:

(1) With a Cryptosporidium bin concentration of less than 0.075 oocysts/L, the bin classification is Bin 1.

(2) With a Cryptosporidium bin concentration of 0.075 oocysts/L or higher, but less than 1.0 oocysts/L, the bin classification is Bin 2

(3) With a Cryptosporidium bin concentration of 1.0 oocysts/L or higher but less than 3.0 oocysts/L, the bin classification is Bin 3

(4) With a Cryptosporidium bin concentration of 3.0 oocysts/L or higher, the bin classification is Bin 4

(5) Serving less than 10,000 people and not required to monitor for Cryptosporidium under 109.1202(a)(4), the bin classification is Bin 1.

(d) Cryptosporidium bin concentration recalculation requirements. Following completion of the second round of source water monitoring required under § 109.1202(b), filtered systems shall recalculate their Cryptosporidium bin concentration using the Cryptosporidium results reported under § 109.1202(b) and following the procedures in paragraphs (b)(1) - (4) . Systems shall then redetermine their bin classification using this bin concentration and the table in subsection (c) .

(e) Filtered system additional Cryptosporidium treatment requirements. Filtered systems shall provide the level of additional treatment for Cryptosporidium specified in this subsection based on their bin classification as determined under § 109.1203 (a)-(c) and according to the schedule in § 109.1203(k)-(o). The treatment required under § 109.1203(e)(1)-(4) are in addition to existing treatment technique requirements contained in 109.202(c), which still apply. Systems using multiple sources shall establish their bin classification based on the highest bin source in use by the facility.

(1) Bin 1. If the system bin classification is bin 1 and the system is in full compliance with applicable treatment technique requirements under § 109.202(c), the system shall provide additional Cryptosporidium treatment requirements as follows:

(i) For conventional filtration treatment (including softening), slow sand, or diatomaceous earth filtration must provide no additional treatment.

(ii) For direct filtration treatment must provide no additional treatment.

(iii) For alternative filtration technologies must provide no additional treatment.

(2) Bin 2. If the system bin classification is bin 2 and the system is in full compliance with applicable treatment technique requirements under § 109.202(c), the system shall provide additional Cryptosporidium treatment requirements as follows:

(i) For conventional filtration treatment (including softening), slow sand, or diatomaceous earth filtration must provide 1-log additional treatment.

(ii) For direct filtration treatment must provide 1.5 log additional treatment.

(iii) For alternative filtration technologies must provide additional treatment as determined by the Department such that the total Cryptosporidium removal and inactivation is at least 4.0 log.

(3) Bin 3. If the system bin classification is bin 3 and the system is in full compliance with applicable treatment technique requirements under § 109.202(c), the system shall provide additional Cryptosporidium treatment requirements as follows:

(i) For conventional filtration treatment (including softening), slow sand, or diatomaceous earth filtration must provide 2-log additional treatment.

(ii) For direct filtration treatment must provide 2.5 log additional treatment.

(iii) For alternative filtration technologies must provide additional treatment as determined by the Department such that the total Cryptosporidium removal and inactivation is at least 5.0 log.

(4) Bin 4. If the system bin classification is bin 4 and the system is in full compliance with applicable treatment technique requirements under § 109.202(c), the system shall provide additional Cryptosporidium treatment requirements as follows:

(i) For conventional filtration treatment (including softening), slow sand, or diatomaceous earth filtration must provide 2.5-log additional treatment.

(ii) For direct filtration treatment must provide 3 log additional treatment.

(iii) For alternative filtration technologies must provide additional treatment as determined by the Department so that the total Cryptosporidium removal and inactivation is at least 5.5 log.

(f) Treatment and management options for filtered systems, microbial toolbox.

(1) Filtered systems shall use one or more of the treatment and management options listed in § 109.1204, termed the microbial toolbox, to comply with the additional Cryptosporidium treatment required in subsection (e) .

(2) Systems using sources classified in Bin 3 and Bin 4 shall achieve at least 1-log of the additional Cryptosporidium treatment required under subsection (a) using either one or a combination of the following: bag filters, bank filtration, cartridge filters, chlorine dioxide, membranes, ozone, or UV, as described in §§ 109.1204(b) and (c) and 109.1204(n)-(q) (relating to requirements for microbial toolbox components).

(g) Failure to meet treatment credit. Failure by a system in any month to achieve treatment credit by meeting criteria in §§ 109.1204(b)-(c) and 109.1204(n)-(q) for microbial toolbox options that is at least equal to the level of treatment required in subsection (e) is a violation of the treatment technique requirement.

(h) Increased watershed contamination. If the Department determines during a sanitary survey or an equivalent source water assessment that after a system completed the monitoring conducted under §§ 109.1202(a) or § 109.1202(b), significant changes occurred in the system's watershed that could lead to increased contamination of the source water by Cryptosporidium, the system shall 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 § 109.1204.

(i) Unfiltered systems determination of Cryptosporidium bin level, initial round. Following completion of the initial source water monitoring required under 109.1202(a), unfiltered systems shall calculate their bin classification using the methods listed in 109.1203(b) and (c).

(j) Unfiltered systems determination of Cryptosporidium bin level, second round. Following completion of the second round of source water monitoring required under 109.1202(b), unfiltered systems shall calculate their bin classification using the methods listed in 109.1203(b) and (c).

(k) Schedule for compliance with Cryptosporidium treatment requirements. Following initial bin classification under § 109.1203(c), filtered systems shall provide the level of additional treatment for Cryptosporidium required under § 109.1203(e)-(h) according to the schedule in subsection (m). The treatment required under § 109.1203(e)-(h) are in addition to existing treatment technique requirements contained in 109.202(c), which still apply.

(l) Following initial determination of the Cryptosporidium level under § 109.1203(i), unfiltered systems shall meet all applicable treatment technique requirements of 109.202(c) and provide the additional level of treatment for Cryptosporidium required under § 109.1203(e)-(h) on a schedule approved by the state but no later than the schedule in subsection (m) .

(m) Cryptosporidium treatment compliance dates. Cryptosporidium treatment compliance dates are as follows:

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

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

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

(4) Systems that serve less than 10,000 people shall comply with Cryptosporidium treatment requirements no later than October 1, 2014.

(5) On a case by case basis within an agreed upon timeframe, the Department may allow up to an additional 2 years for complying with the treatment requirement for systems making capital improvements.

(n) Change in cryptosporidium level for filtered system. If the bin classification for a filtered system changes following the second round of source water monitoring, as determined under § 109.1203(d), the system shall provide the level of treatment for Cryptosporidium required under § 109.1203(e)-(h) on a schedule the Department approves.

(o) Change in cryptosporidium level for unfiltered system. If the Cryptosporidium level for an unfiltered system changes following the second round of monitoring, as determined under § 109.1203(j), and if the system shall provide a different level of Cryptosporidium treatment under §§ 109.1203(i) and (j) due to this change, the system shall meet this treatment requirement on a schedule the Department approves.

#### § 109.1204 Requirements for microbial toolbox components.

(a) A system will receive the treatment credits listed Appendix B to Subchapter L. Microbial Toolbox Summary Table: Options, Treatment Credits and Criteria by meeting the conditions for microbial toolbox components described in (b) - (g) of this section. A system shall apply these treatment credits to meet the treatment technique requirements listed in section § 1203.

(b) Watershed control program. Systems receive 0.5-log Cryptosporidium treatment credit for implementing a watershed control program that meets the requirements. This credit may not be used to maintain the additional log removal credits specified in § 109.1203 (relating to bin classification and treatment technique requirements). This credit may only be applied in addition to the toolbox options used to meet the minimum log removal and may apply in lieu of a toolbox option for which credit has been temporarily revoked.

(1) Systems that intend to apply for the watershed control program credit shall notify the Department of this intent no later than 2 years prior to the treatment compliance date applicable to the system in § 109.1203(k)-(o).

(2) Systems shall submit to the Department a proposed watershed control plan no later than one year before the applicable treatment compliance date in § 109.1203(k)-(o). The Department will approve the watershed control plan for the system to receive watershed control program treatment credit. The watershed control plan must include the elements in subparagraphs (b)(2)(i) - (iv) .

(i) 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 subparagraph (b)(5)(ii) .

(ii) 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.

(iii) 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.

(iv) 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.

(3) Existing watershed control programs. 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 paragraph (b)(2) and must specify ongoing and future actions that will reduce source water Cryptosporidium levels.

(4) Systems shall complete the actions in subparagraphs (b)(5)(i) - (iii) to maintain the 0.5-log credit.

(i) 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. The report 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 subparagraph (b)(5)(ii) . 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 shall notify the Department prior to making any such changes. If any change is likely to reduce the level of source water protection, the system shall also list in its notification the actions the system will take to mitigate this effect.

(ii) Undergo a watershed sanitary survey every 3 years for community water systems and every five years for noncommunity water systems and submit the survey report to the Department. The survey must be conducted according to Department guidelines and by persons the Department approves.

(A) The watershed sanitary survey must meet the following criteria:

(I) Encompass the region identified in the Department-approved watershed control plan as the area of influence.

(II) Assess the implementation of actions to reduce source water Cryptosporidium levels.

(III) Identify any significant new sources of Cryptosporidium.

(B) If the Department determines that significant changes may have occurred in the watershed since the previous watershed sanitary survey, systems shall undergo another watershed sanitary survey by a date the Department requires, which may be earlier than the regular date in subparagraph (b)(5)(ii) .

(iii) The system shall 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.

(5) 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.

(c) Alternative source.

(1) 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 § 109.1203 based on the alternative source monitoring results.

(2) If systems conduct alternative source monitoring under paragraph (b)(1), systems shall also monitor their current plant intake concurrently as described in § 109.1202(a)-(h) (relating to monitoring requirements).

(3) Alternative source monitoring under paragraph (b)(1) must meet the requirements for source monitoring to determine bin classification, as described in § 109.1202(a)-(h) through § 109.1205(a)-(e) (relating to reporting and recordkeeping requirements). Systems shall report the alternative source monitoring results to the Department, along with supporting information documenting the operating conditions under which the samples were collected.

(4) If a system determines its bin classification under § 109.1203 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 shall relocate the intake or permanently adopt the withdrawal procedure, as applicable, no later than the applicable treatment compliance date in § 109.1203(k)-(o) (relating to bin classification and treatment technique requirements).

(d) *Presedimentation.* Systems will receive 0.5-log *Cryptosporidium* treatment credit for a presedimentation basin during any month the process meets the criteria in this subsection.

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

(2) The system shall continuously add a coagulant to the presedimentation basin.

(3) The presedimentation basin must achieve the performance criteria in subparagraph (3)(i) or (ii).

(i) Demonstrates 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:  $\log_{10}(\text{monthly mean of daily influent turbidity}) - \log_{10}(\text{monthly mean of daily effluent turbidity})$ .

(ii) Comply with Department-approved performance criteria that demonstrate at least 0.5-log mean removal of micron-sized particulate material through the presedimentation process.

(e) *2-stage lime softening.* Systems receive an additional 0.5-log *Cryptosporidium* treatment credit for a 2-stage lime softening plant if chemical addition and hardness precipitation occur in 2 separate and sequential softening stages prior to filtration. Both softening stages must treat the entire plant flow taken from a surface water or GUDI source.

(f) *Bank filtration.* Systems receive *Cryptosporidium* treatment credit for bank filtration that serves as pretreatment to a filtration plant by meeting the criteria in this subsection. Systems using bank filtration when they begin source water monitoring under § 109.1202(a) shall collect samples as described in § 109.1202(o) and are not eligible for this credit.

(1) 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 paragraph (f)(4).

(2) 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 shall characterize the aquifer at the well site to determine aquifer properties. Systems shall extract a core from the aquifer and demonstrate that in at least 90% of the core length, grains less than 1.0 mm in diameter constitute at least 10% of the core material.

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

(4) 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.

(5) Systems shall 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 shall 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.

(6) Springs and infiltration galleries are not eligible for treatment credit under this section, but are eligible for credit under § 109.204(i).

(7) 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 paragraphs (f)(1)-(5).

(i) 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.

(ii) 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).

(g) *Combined filter performance.* Systems using conventional filtration treatment or direct filtration treatment receive an additional 0.5-log Cryptosporidium treatment credit during any month the system meets the criteria in this subsection. Combined filter effluent (CFE) turbidity must be less than or equal to 0.15 NTU in at least 95 % of the measurements. Turbidity must be measured as described in § 109.304(c) (relating to analytical requirements).

(h) *Individual filter performance.* Systems using conventional filtration treatment or direct filtration treatment will receive 0.5-log Cryptosporidium treatment credit, which can be in addition to the 0.5-log credit under subsection (a), during any month the system meets the criteria in this subsection. Compliance with these criteria must be based on individual filter turbidity monitoring as described in § 109.301(1)(iv) (relating to general monitoring requirements), as applicable.

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

(2) No individual filter may have a measured turbidity greater than 0.3 NTU in 2 consecutive measurements taken 15 minutes apart.



(3) Any system that has received treatment credit for individual filter performance and fails to meet the requirements of paragraph (h)(1) or (2) during any month does not receive a treatment technique violation under § 109.1203(c) if the Department determines the following:

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

(ii) The system has experienced no more than 2 such failures in any calendar year.

(i) 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 subsection. This treatment credit may be greater than or less than the prescribed treatment credits in § 109.1203(e)-(h) or § 109.1204(d)-(f) through 109.1204(n)-(q) and may be awarded to treatment processes that do not meet the criteria for the prescribed credits.

(1) Systems cannot receive the prescribed treatment credit for any toolbox option in § 109.1204(d)-(f) through 109.1204(n)-(q) if that toolbox option is included in a demonstration of performance study for which treatment credit is awarded under this paragraph.

(2) 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.

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

(i) Bag and cartridge filters. Systems 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 paragraphs (j)(1) - (10). To be eligible for this credit, systems shall report the results of challenge testing that meet the requirements of paragraphs (j)(2) - (9) to the Department. The filters must treat the entire plant flow taken from a surface water or ground water source under the direct influence of surface water source.

(1) The Cryptosporidium treatment credit awarded to bag or cartridge filters will be based on the removal efficiency demonstrated during challenge testing that is conducted according to the criteria in paragraphs (j)(2) - (j)(9) . 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 paragraphs (j)(2) - (9) .

(2) 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.

(3) 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.

(4) 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:

$$\text{Maximum Feed Concentration} = 1 \times 10^4 \times (\text{Filtrate Detection Limit})$$

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

(6) Each filter evaluated must be tested for a duration sufficient to reach 100 % of the terminal pressure drop, which establishes the maximum pressure drop under which the filter may be used to comply with the requirements of this subchapter.

(7) 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<sub>f</sub> = the feed concentration measured during the challenge test; and C<sub>p</sub> = 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<sub>p</sub> must be set equal to the detection limit.

(8) Each filter tested must be challenged with the challenge particulate during three periods over the filtration cycle: within 2 hours of start-up of a new filter; when the pressure drop is between 45 and 55 % of the terminal pressure drop; and at the end of the cycle after the pressure drop has reached 100 % of the terminal pressure drop. An LRV must be calculated for each of these challenge periods for each filter tested. The LRV for the filter (LRV<sub>filter</sub>) must be assigned the value of the minimum LRV observed during the three challenge periods for that filter.

(9) If less than 20 filters are tested, the overall removal efficiency for the filter product line must be set equal to the lowest LRV<sub>filter</sub> 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 LRV<sub>filter</sub> 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.

(10) 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.

(k) Membrane filtration.

(1) *Cryptosporidium treatment credit.* Systems receive *Cryptosporidium treatment credit* for membrane filtration that meets the criteria of this paragraph. Membrane cartridge filters that meet the definition of membrane filtration in

§ 109.1 are eligible for this credit. The level of treatment credit a system receives is equal to the lower of the values determined under subparagraph (l)(1)(i) and (ii).

(i) The removal efficiency demonstrated during challenge testing conducted under the conditions in paragraph (l)(2) .

(ii) The maximum removal efficiency that can be verified through direct integrity testing used with the membrane filtration process under the conditions in paragraph (l)(3) .

(2) *Challenge Testing.* The membrane used by the system shall undergo challenge testing to evaluate removal efficiency, and the system shall report the results of challenge

testing to the Department. Challenge testing must be conducted according to the criteria in subparagraphs (1)(2)(i) - (vii) . Systems may use data from challenge testing conducted prior to January 5, 2006 if the prior testing was consistent with the criteria in subparagraphs (1)(2)(i) - (vii) .

(i) 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.

(ii) 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.

(iii) 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:

Maximum Feed Concentration =  $3.16 \times 10^6 \times (\text{Filtrate Detection Limit})$

(iv) 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 % 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).

(v) 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:  $LRV = \text{LOG}_{10}(C_f) - \text{LOG}_{10}(C_p)$  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 LRV. An LRV must be calculated for each membrane module evaluated during the challenge test.

(vi) The removal efficiency of a membrane filtration process demonstrated during challenge testing must be expressed as a log removal value (LRVC-Test). If less than 20 modules are tested, then LRVC-Test is equal to the lowest of the representative LRVs among the modules tested. If 20 or more modules are tested, then LRVC-Test is equal to the 10th percentile of the representative LRVs 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.

(vii) The challenge test must establish a quality control release value (QCRV) 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 QCRV are not eligible for the treatment credit demonstrated during the challenge test.

(viii) 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 QCRV, additional challenge testing to demonstrate the removal efficiency of, and determine a new QCRV for, the modified membrane must be conducted and submitted to the Department.

(3) Direct integrity testing. Systems shall 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 subparagraphs (1)(3)(i) - (vi) . 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).

(i) 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.

(ii) 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.

(iii) 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 clause (1)(3)(iii)(A) or (B) as applicable to the type of direct integrity test the system uses.

(A) For direct integrity tests that use an applied pressure or vacuum, the direct integrity test sensitivity must be calculated according to the following equation:  $LRVDIT = \text{LOG}_{10} (Q_p / (VCF \times Q_{breach}))$  Where:  $LRVDIT$  = 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.

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

$LRVDIT = \text{LOG}_{10}(C_f) - \text{LOG}_{10}(C_p)$  Where:  $LRVDIT$  = 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.

(iv) Systems shall 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.

(v) If the result of a direct integrity test exceeds the control limit established under subparagraph (1)(3)(iv) , the system shall remove the membrane unit from service. Systems shall 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.

(vi) Systems shall 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.

(4) Indirect integrity monitoring. Systems shall conduct continuous indirect integrity monitoring on each membrane unit according to the criteria in subparagraphs (l)(4)(i) - (v). 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 subparagraphs (l)(3)(i) - (v) is not subject to the requirements for continuous indirect integrity monitoring. Systems shall 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.

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

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

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

(iv) 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., 2 consecutive 15-minute readings above 0.15 NTU), direct integrity testing must immediately be performed on the associated membrane unit as specified in subparagraphs (l)(3)(i) - (v)

(v) 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 shall immediately be performed on the associated membrane units as specified in subparagraphs (l)(3)(i) - (v).

(l) Second stage filtration. Systems 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 if approved by the Department. To be eligible for 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 GUDI source. A cap, such as GAC, on a single stage of filtration is not eligible for this credit. The Department will approve the treatment credit based on an assessment of the design characteristics of the filtration process.

(m) Slow sand filtration (as secondary filter). Systems are eligible to 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 GUDI source and no disinfectant residual is present in the influent water to the slow sand filtration process. The Department will approve the treatment credit based on an assessment of the design characteristics of the filtration process. This subsection does not apply to treatment credit awarded to slow sand filtration used as a primary filtration process.

(n) Inactivation toolbox components. Calculation of CT values.

(1) Systems with treatment credit for chlorine dioxide or ozone under subsection (b) or (c) must calculate CT at least once each day, with both C and T measured during peak hourly flow as specified in § 141.74(a) - (b).

(2) 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 shall add the Cryptosporidium CT values in each segment to determine the total CT for the treatment plant.

(o) Chlorine dioxide. Systems are eligible to receive the Cryptosporidium treatment credit listed in Table 1. CT Values (mg min/L) for Cryptosporidium Inactivation by Chlorine Dioxide, contained in Appendix A to Subchapter L, by meeting the corresponding chlorine dioxide CT value for the applicable water temperature, as described in subsection (n).

(p) Ozone. Systems receive the Cryptosporidium treatment credit listed in Table 2 CT Values (mg min/L) for Cryptosporidium Inactivation by Ozone, contained in Appendix A to Subchapter L, by meeting the corresponding ozone CT values for the applicable water temperature, as described in subsection (n).

(q) Ultraviolet light. Systems receive Cryptosporidium, Giardia lamblia, and virus treatment credits for ultraviolet (UV) light reactors by achieving the corresponding UV dose values shown in Table 3, UV Dose for Cryptosporidium, Giardia lamblia, and Virus Inactivation, contained in Appendix A to Subchapter L, as described in paragraph (q)(1). Systems shall validate and monitor UV reactors as described in paragraphs (q)(2) and (3) to demonstrate that they are achieving a particular UV dose value for treatment credit.

(1) UV dose table. The treatment credits listed in this table are for UV light at a wavelength of 254 nm as produced by a low pressure mercury vapor lamp. To receive treatment credit for other lamp types, systems shall demonstrate an equivalent germicidal dose through reactor validation testing, as described in paragraph (q)(2). The UV dose values in this table are applicable only to post-filter applications of UV in filtered systems.

(2) Reactor validation testing. Systems shall use UV reactors that have undergone validation testing, conducted by a party acceptable to the Department, to determine the operating conditions under which the reactor delivers the UV dose required in paragraph (q)(1) (i.e., validated operating conditions). These operating conditions must include flow rate, UV intensity as measured by a UV sensor, and UV lamp status.

(i) When determining validated operating conditions, systems shall account for the following factors:

(A) UV absorbance of the water.

(B) Lamp fouling and aging.

(C) Measurement uncertainty of on-line sensors.

(D) UV dose distributions arising from the velocity profiles through the reactor.

(E) Failure of UV lamps or other critical system components.

(F) Inlet and outlet piping or channel configurations of the UV reactor.

(ii) Validation testing must include the following: Full scale testing of a reactor that conforms uniformly to the UV reactors used by the system and inactivation of a test microorganism whose dose response characteristics have been quantified with a low pressure mercury vapor lamp.

(iii) The Department may accept alternative validation testing approaches, if these approaches are first approved by EPA.

(3) Reactor monitoring.

(i) Systems shall monitor their UV reactors to determine if the reactors are operating within validated conditions, as determined under paragraph (q)(2) . 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 shall verify the calibration of UV sensors and shall recalibrate sensors in accordance with a protocol the Department approves.

(ii) To receive treatment credit for UV light, systems shall treat at least 95% 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 paragraphs (q)(1) and (2). Systems shall demonstrate compliance with this condition by the monitoring required under subparagraph (q)(3)(i).

#### § 109.1205 Reporting and record keeping requirements.

(a) Source water reporting time frame. Systems shall report results from the source water monitoring required under § 109.1202(a)-(h) no later than 10 days after the end of the first month following the month when the sample is collected.

(b) Methods for reporting initial source water monitoring results to EPA. Systems serving at least 10,000 people shall report as follows:

(1) All systems serving at least 10,000 people shall report the results from the initial source water monitoring required under § 109.1202(a) to EPA electronically at <https://intranet.epa.gov/lt2/>.

(2) If a system is unable to report monitoring results electronically, the system may use an alternative approach for reporting monitoring results that EPA approves.

(c) Methods for reporting initial source water monitoring results to the Department. Systems serving less than 10,000 people shall report results from the initial source water monitoring required under § 109.1202(a) to the Department using a method approved by the Department.

(d) Methods for reporting second round of source water monitoring results to the Department. All systems shall report results from the second round of source water monitoring required under § 109.1202(b) to the Department using a method approved by the Department

(e) Source water reporting data elements. Systems shall report the applicable information in paragraphs (e)(1) and (2) for the source water monitoring required under § 109.1202(a)-(h).

(1) Cryptosporidium data elements. Systems shall report data elements (i)-(vii) for each Cryptosporidium analysis. Systems shall report data elements (viii)-(x) as applicable.

(i) PWS ID.

(ii) Facility ID.

(iii) Sample collection date.

(iv) Sample type (field or matrix spike).

(v) Sample volume filtered (L), to nearest 1/4 L.

(vi) Indicate whether 100% of filtered volume was examined.

(vii) Number of oocysts counted.

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

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

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

(2) *E. coli* data elements. Systems shall report the following data elements for each *E. coli* analysis:

(i) PWS ID.

(ii) Facility ID.

(iii) Sample collection date.

(iv) Analytical method number.

(v) Method type.

(vi) Source type (flowing stream, lake/reservoir, GUDI).

(vii) *E. coli*/100 mL.

(viii) Turbidity.

(f) *Grandfathering data.* Grandfathering previously collected data requirements, established by the EPA under the National Primary Drinking Water regulations in 40 CFR 141.707 are incorporated by reference except as otherwise established by this chapter.

(g) *Sampling schedule reporting.* Systems shall report sampling schedules under § 109.1202(i)- (k) and source water monitoring results under § 109.1205(a)-(e) unless they notify the Department that they will not conduct source water monitoring due to meeting the criteria of § 109.1202(d).

(h) *Bin classification reporting.* Systems shall report their *Cryptosporidium* bin classification as follows:

(1) Systems shall report their initial bin classification under subsection (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 § 109.1202(c).

(2) Systems shall report their bin classification under § 109.1203(c) 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 § 109.1202(c).

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

(4) Failure to comply with the conditions of subsection (h) is a violation of the treatment technique requirement.

(i) *Microbial toolbox reporting requirements.* Systems are required to report items specified § 109.1204 for all toolbox components for which they are requesting treatment credit. Systems must report to the State in accordance with Appendix C to subpart L. *Microbial Toolbox Reporting Requirements.*

(j) *Reporting significant change in disinfection practices.* Prior to making a significant change in disinfection practice, systems shall report disinfection profiles and benchmarks to the Department as established by the EPA under the National Primary Drinking Water regulations in 40 CFR § 141.708 - §141.709, which are incorporated by reference in § 109.204.

(k) *Source water monitoring record keeping requirements.* Systems shall keep results from the initial round of source water monitoring under § 109.1202(a) and the second round of source water monitoring under § 109.1202(b) until 3 years after bin classification under § 109.1203 (b) and (c).

(l) Systems shall keep any notification to the Department that they will not conduct source water monitoring due to meeting the criteria of § 109.1202(d) for 3 years.



**(m) Systems shall keep the results of treatment monitoring associated with microbial toolbox options under § 109.1204, as applicable, for 3 years.**