

**Treatment Requirements and Performance Standards for Surface Water, Groundwater Under Direct Influence of Surface Water, and Groundwater**

- (1) General requirements for all public water systems supplied by a surface water source or a groundwater source under the direct influence of surface water.
  - (a) This rule establishes criteria under which filtration and treatment technique requirements are prescribed in lieu of MCLs for the following contaminants: *Giardia lamblia*, viruses, heterotrophic plate count bacteria, *Legionella*, *Cryptosporidium*, and turbidity. At every public water system with a surface water source or a groundwater source under the direct influence of surface water, water suppliers must provide treatment of source water that complies with these treatment technique requirements.
    - (A) The treatment technique requirements specified in this subsection consist of installing and properly operating water treatment processes which reliably achieve:
      - (i) At least 99.9 percent (3-log) removal or inactivation of *Giardia lamblia* cysts between a point where the raw water is not subject to recontamination by surface water runoff and a point downstream before or at the first customer, and
      - (ii) At least 99.99 percent (4-log) removal or inactivation of viruses between a point where the raw water is not subject to recontamination by surface water runoff and a point downstream before or at the first customer.
      - (iii) At least 99 percent (2-log) removal of *Cryptosporidium* between a point where the raw water is not subject to recontamination by surface water runoff and a point downstream before or at the first customer for water systems providing filtration treatment, or for water systems without filtration treatment:
        - (I) *Cryptosporidium* control according to the system's watershed control plan; and
        - (II) *Cryptosporidium* treatment according to subsections (3)(e) through (g) of this rule.
      - (iv) Compliance with any applicable disinfection profiling and benchmark requirements as specified in OAR 333-061-0036(4)(l) and 333-061-0060(1)(e).
    - (B) Sampling and Bin Classification for *Cryptosporidium*:
      - (i) All water suppliers must conduct an initial and second round of source water monitoring, as prescribed in subsection 333-061-0036(5)(e) of these rules, for each plant that treats a surface water or GWUDI source to determine what level, if any, of additional *Cryptosporidium* treatment they must provide.
      - (ii) At water systems with filtration, water suppliers must determine the *Cryptosporidium* treatment bin classification as prescribed in subsection (4)(f) of this rule and provide additional treatment for

*Cryptosporidium*, if required, as prescribed in subsection (4)(g) of this rule. All unfiltered systems must provide treatment for *Cryptosporidium* as prescribed in subsections (3)(e) through (g) of this rule. Filtered and unfiltered systems must implement *Cryptosporidium* treatment according to the schedule in paragraph (1)(a)(F) of this rule.

- (iii) At water systems where additional treatment for *Cryptosporidium* is required, water suppliers must implement microbial toolbox options that are designed and operated as prescribed in sections (12) through (16) of this rule and in OAR 333-061-0036(5)(c), 333-061-0050(4) and 333-061-0050(5)(k).
- (C) Schedule for compliance with *Cryptosporidium* treatment requirements.
  - (i) Following initial bin classification as prescribed in subsection (4)(f) of this rule at filtered water systems, water suppliers must provide the level of treatment for *Cryptosporidium* required under subsection (4)(g) of this rule according to the schedule in subparagraph (1)(a)(F)(iii) of this rule.
  - (ii) Following initial determination of the mean *Cryptosporidium* level as prescribed by subsection (2)(c) of this rule, water suppliers for unfiltered water systems must provide the level of treatment for *Cryptosporidium* required by subsection (3)(e) of this rule according to the schedule in subparagraph (1)(a)(F)(iii) of this rule.
  - (iii) *Cryptosporidium* treatment compliance dates. The Authority may allow up to an additional two years from the date specified below for water systems making capital improvements.
    - (I) Water systems that serve at least 100,000 people must comply with *Cryptosporidium* treatment by April 1, 2012.
    - (II) Water systems that serve from 50,000 to 99,999 people must comply with *Cryptosporidium* treatment by October 1, 2012.
    - (III) Water systems that serve from 10,000 to 49,999 people must comply with *Cryptosporidium* treatment by October 1, 2013.
    - (IV) Water systems that serve fewer than 10,000 people must comply with *Cryptosporidium* treatment by October 1, 2014.
  - (iv) If the bin classification for a filtered water system changes following the second round of source water monitoring as prescribed in subsection (4)(f) of this rule, the water system must provide the level of treatment for *Cryptosporidium* required by subsection (4)(g) of this rule on a schedule approved by the Authority.
  - (v) If the mean *Cryptosporidium* level for an unfiltered water system changes following the second round of monitoring as prescribed by paragraph (2)(c)(A) of this rule, the water system must provide the level of *Cryptosporidium* treatment required by subsection (3)(e)

of this rule, due to the change, following a schedule approved by the Authority.

- (b) Public water systems using a surface water source or a groundwater source under the direct influence of surface water is considered to be in compliance with the requirements of this rule if:
  - (A) The requirements for avoiding filtration in section (2) of this rule, the disinfection requirements in section (3) of this rule and the disinfection benchmarking requirements of OAR 333-061-0060(1)(e) are met; or
  - (B) The filtration requirements in section (4) of this rule, the disinfection requirements in section (5) of this rule and the disinfection benchmarking requirements of OAR 333-061-0060(1)(e) are met.
- (c) At water systems that utilize sources that have been determined to be under the direct influence of surface water according to section (7) of this rule, water suppliers must meet the requirements of sections (2) and (3) of this rule, or the requirements of sections (4) and (5) of this rule within 18 months of the determination. During that time, water suppliers must meet the following interim standards at the system:
  - (A) The turbidity of water entering the distribution system must never exceed 5 NTU. Turbidity measurements must be taken a minimum of once per day. If continuous turbidimeters are in place, measurements should be taken every four hours; and
  - (B) Disinfection must be sufficient to reliably achieve at least 1.0 log inactivation of *Giardia lamblia* cysts prior to the first user. Daily disinfection "CT" values must be calculated and recorded daily, including pH and temperature measurements, and disinfection residuals at the first customer.
  - (C) Reports must be submitted to the Authority monthly as prescribed in OAR 333-061-0040.
  - (D) If these interim standards are not met, the water supplier must notify customers of the failure as required in OAR 333-061-0042(2)(b)(A).
- (2) Requirements for public water systems utilizing surface water or GWUDI sources without filtration.
  - (a) Source water quality conditions.
    - (A) The fecal coliform concentration must be equal to or less than 20/100 ml, or the total coliform concentration must be equal to or less than 100/100 ml, in samples collected as prescribed by OAR 333-061-0036(5)(a)(A) in at least 90 percent of the measurements made for the 6 previous months that a water system served water to the public on an ongoing basis. If a water supplier measures both fecal and total coliform as specified in this paragraph, only the fecal coliform criterion must be met.
    - (B) The turbidity level cannot exceed the MCL prescribed in OAR 333-061-0030(3)(a).
  - (b) Site-specific conditions.

- (A) The disinfection requirements prescribed in section (3) of this rule must be met at least 11 of the 12 previous months that the water system served water to the public on an ongoing basis, unless a system fails to meet the requirements during 2 of the 12 previous months that the system served water to the public and the Authority determines that at least one of these failures was caused by circumstances that were unusual and unpredictable.
- (B) Water suppliers must maintain a comprehensive watershed control program which minimizes the potential for contamination by *Giardia lamblia* cysts, *Cryptosporidium* oocysts, and viruses in the source water. For water systems using GWUDI, and at the discretion of the Authority, a certified drinking water protection plan (OAR 340-040-0160 to 340-040-0180) that addresses both the groundwater and surface water components of the drinking water supply may be substituted for a watershed control program. The watershed control program shall be developed according to guidelines in OAR 333-061-0075. The public water system must demonstrate through ownership or written agreements with landowners within the watershed that it can control all human activities which may have an adverse impact on the microbiological quality of the source water. The system must submit an annual report to the Authority identifying any special concerns about the watershed, the procedures used to resolve the concern, current activities affecting water quality, and projections of future adverse impacts or activities and the means to address them. At a minimum, the watershed control program must:
  - (i) Characterize the watershed hydrology and land ownership;
  - (ii) Identify watershed characteristics and activities which have or may have an adverse effect on source water quality; and
  - (iii) Monitor the occurrence of activities which may have an adverse effect on source water quality.
- (C) Water systems must be subject to an annual on-site inspection of the watershed control program and the disinfection treatment process by the Authority. The on-site inspection must indicate to the Authority's satisfaction that the watershed control program and disinfection treatment process are adequately designed and maintained including the adequacy limiting the potential contamination by *Cryptosporidium* oocysts. The inspection must include:
  - (i) A review of the effectiveness of the watershed control program;
  - (ii) A review of the physical condition of the source intake and how well it is protected;
  - (iii) A review of the system's equipment maintenance program to ensure there is low probability for failure of the disinfection process;

- (iv) An inspection of the disinfection equipment for physical deterioration;
  - (v) A review of operating procedures;
  - (vi) A review of data records to ensure that all required tests are being conducted and recorded and disinfection is effectively practiced; and
  - (vii) Identification of any improvements which are needed in the equipment, system maintenance and operation, or data collection.
- (D) Water systems must not have been identified by the Authority as the source of waterborne disease outbreak under the system's current configuration. If such an outbreak occurs, the water system's treatment process must be sufficiently modified, as determined by the Authority, to prevent any future such occurrence.
- (E) Each of the following conditions must be met on an ongoing basis for at least 11 of the 12 previous months that the water system served water to the public unless the Authority determines that failure to meet this requirement was not caused by a deficiency in treatment of the source water.
  - (i) The MCL for *E. coli* as prescribed by OAR 333-061-0030(4) was not exceeded at the water system.
  - (ii) A level one coliform investigation was not triggered according to OAR 333-061-0078(2)(a)(A) or (B) at the water system if applicable.
- (F) Water systems must be in compliance with the requirements for TTHM, HAA5, bromate, chlorite, chlorine, chloramines, and chlorine dioxide as specified in OAR 333-061-0036(4).
- (c) Determination of mean *Cryptosporidium* level.
  - (A) At water systems without filtration, water suppliers must calculate the arithmetic average of all *Cryptosporidium* sample concentrations following completion of the initial and second round of source water monitoring conducted according to OAR 333-061-0036(5)(e). Water suppliers must report this value to the Authority for approval no later than 6 months after the date the system was required to complete the required monitoring.
  - (B) If the frequency of monthly *Cryptosporidium* sampling varies, water suppliers must calculate a monthly average for each month of sampling. Water suppliers must then use these monthly average concentrations rather than individual sample concentrations for the calculation of the mean *Cryptosporidium* level prescribed in paragraph (2)(c)(A) of this rule.
  - (C) The report to the Authority of the mean *Cryptosporidium* levels calculated according to paragraph (2)(c)(A) of this rule must include a summary of the source water monitoring data used for the calculation.

- (d) Failure to comply with any of the conditions or criteria specified in section (2) of this rule is in violation of a treatment technique requirement. The Authority can require filtration to be installed where it determines necessary.
- (3) Disinfection requirements for water systems utilizing surface water or GWUDI sources without filtration.
  - (a) Disinfection treatment must be sufficient to ensure at least 99.9 percent (3-log) inactivation of *Giardia lamblia* cysts and 99.99 percent (4-log) inactivation of viruses, every day a water system serves water to the public, except any one day each month. Each day water systems serve water to the public, water suppliers must calculate the CT value(s) using the procedure specified in OAR 333-061-0036(5)(a)(C) and determine whether this value(s) is sufficient to achieve the specified inactivation rates for *Giardia lamblia* cysts and viruses. If a water system uses a disinfectant other than chlorine, the water supplier must demonstrate to the Authority through the use of an approved protocol for on-site disinfection demonstration studies or other information satisfactory to the Authority that the required inactivation rates are achieved on a daily basis instead of meeting the "CT" values in this rule.
  - (b) Systems for disinfection must have either:
    - (A) Redundant components, including an auxiliary power supply with automatic start-up and alarm or for ultraviolet light (UV) disinfection, at least one additional reactor of at least equal capacity as the largest duty reactor to ensure that disinfectant application is maintained continuously while water is being delivered to the distribution system; or
    - (B) Automatic shut-off of delivery of water to the distribution system whenever there is less than 0.2 mg/l of residual disinfectant concentration in the water, or if the UV system fails. If the Authority determines that automatic shut-off would cause unreasonable risk to health or interfere with fire protection, the system must comply with paragraph (3)(b)(A) of this rule.
  - (c) The residual disinfectant concentration in the water entering the distribution system, measured as specified in OAR 333-061-0036(5)(a)(E), cannot be less than 0.2 mg/l for more than four hours.
  - (d) The residual disinfectant concentration in the distribution system, measured as free chlorine, total chlorine, combined chlorine, or chlorine dioxide as specified in OAR 333-061-0036(5)(a)(F) cannot be undetectable in more than 5 percent of the samples each month, for any two consecutive months that the system serves water to the public.
  - (e) At unfiltered water systems, water suppliers must provide the level of *Cryptosporidium* inactivation specified in this subsection, based on the mean *Cryptosporidium* levels determined according to subsection (2)(c) of this rule and according to the schedule in subsection (1)(a) of this rule.
    - (A) At unfiltered systems with a mean *Cryptosporidium* level of 0.01 oocysts/L or less, at least 2-log *Cryptosporidium* inactivation must be provided.

- (B) At unfiltered systems with a mean *Cryptosporidium* level of greater than 0.01 oocysts/L, at least 3-log *Cryptosporidium* inactivation must be provided.
- (f) Inactivation by chlorine dioxide, ozone or UV as prescribed by OAR 333-061-0036(5)(c) must be utilized at water systems using surface water or GWUDI sources without filtration to meet the *Cryptosporidium* inactivation requirements specified in this section.
  - (A) Water suppliers violate a treatment technique requirement if chlorine dioxide or ozone disinfection fails to achieve the *Cryptosporidium* inactivation required in subsection (3)(e) of this rule on more than one day in a calendar month.
  - (B) Water suppliers violate a treatment technique requirement if UV disinfection fails to achieve the *Cryptosporidium* inactivation required in subsection (3)(e) of this rule because the criteria specified in subsection (17)(c) of this rule are not met.
- (g) At unfiltered water systems, water suppliers must meet the combined *Cryptosporidium* inactivation requirements of subsection (3)(e) of this rule, and the *Giardia lamblia* and virus inactivation requirements of subsection (3)(a) of this rule using a minimum of two disinfectants. Each of the two disinfectants must achieve by itself, the total inactivation required for at least one of the following pathogens: *Cryptosporidium*, *Giardia lamblia*, or viruses.
- (4) Requirements for systems utilizing surface water or GWUDI sources that provide filtration.
  - (a) At public water systems using a surface water source or a groundwater source under the direct influence of surface water, if all of the criteria in sections (1), (2), and (3) of this rule for avoiding filtration is not met, the water supplier violates a treatment technique and must provide treatment consisting of both disinfection, as specified in section (5) of this rule, and filtration treatment which complies with the requirements of either subsection (4)(b), (c), (d), or (e) of this rule within 18 months of the failure to meet the criteria in section (2) of this rule for avoiding filtration. Failure to install a required treatment by the prescribed dates is a violation of this rule.
  - (b) At water systems using conventional or direct filtration treatment, the turbidity requirements as specified in OAR 333-0061-0030(3)(b)(A)(i) and (ii) must be met.
  - (c) At water systems using slow sand filtration treatment, the turbidity requirements specified in OAR 333-061-0030(3)(b)(B) must be met.
  - (d) At water systems using diatomaceous earth filtration treatment, the turbidity requirements specified in OAR 333-061-0030(3)(b)(C) must be met.
  - (e) At water systems using other filtration technologies, the turbidity requirements specified in OAR 333-061-0030(3)(b)(D) must be met.
    - (A) At water systems with GWUDI sources using bank filtration as an alternate filtration technology, water suppliers must meet the requirements listed in section (8) of this rule.

- (B) At water systems using membrane filtration, water suppliers must conduct continuous indirect integrity testing and daily direct integrity testing according to OAR 333-061-0036(5)(d)(B) and (C).
- (f) *Cryptosporidium* Bin classification for filtered water systems. Following completion of the initial round of source water monitoring required by OAR 333-061-0036(5)(e) at filtered water systems, water suppliers must calculate an initial *Cryptosporidium* bin concentration for each water treatment plant where monitoring was required. Calculation of the bin concentration must be based upon the *Cryptosporidium* monitoring completed according to OAR 333-061-0036(5)(e) and must comply with paragraphs (4)(f)(A) through (F) of this rule.
- (A) For water systems where 48 or more samples are collected, the bin concentration is equal to the arithmetic average of all sample concentrations.
- (B) For water systems where at least 24 samples but not more than 47 samples are collected, the bin concentration is equal to the highest arithmetic average of all sample concentrations in any 12 consecutive months during which *Cryptosporidium* samples were collected.
- (C) For water systems that serve fewer than 10,000 people and *Cryptosporidium* samples are only collected for 12 months, that is, 24 samples are collected in 12 months, the bin concentration is equal to the arithmetic average of all sample concentrations.
- (D) For water systems where treatment plants are operated only part of the year and monitoring is less frequent than 12 months per year as prescribed by OAR 333-061-0036(5)(e)(E), the bin concentration is equal to the highest arithmetic average of all sample concentrations during any year of *Cryptosporidium* monitoring.
- (E) If the monthly *Cryptosporidium* sampling frequency varies, water suppliers must first calculate a monthly average for each month of monitoring. Water suppliers must then use these monthly average concentrations, rather than individual sample concentrations, in the applicable calculation for bin classification of this subsection.
- (F) Bin classification table.
- (i) Water suppliers must determine their initial bin classification from Table 8 as follows and using the *Cryptosporidium* bin concentration calculated under subsection (4)(f) of this rule:

Table 8

Bin Classification Table for Filtered Systems	
Mean <i>Cryptosporidium</i> concentration <sup>1</sup>	Bin Classification



< 0.075 <i>Cryptosporidium</i> oocysts/L, including water systems serving fewer than 10,000 people and not required to monitor for <i>Cryptosporidium</i> under OAR 333-061-0036(5)(e)(A).	Bin 1
0.075 oocyst/L to < 1.0 oocysts/L	Bin 2
≥ 1.0 oocysts/L to < 3.0 oocysts/L	Bin 3
≥ 3.0 <i>Cryptosporidium</i> oocysts/L	Bin 4

<sup>1</sup>Based on calculations as prescribed by paragraphs (4)(f)(A) through (E) of this rule, as applicable.

- (ii) Following completion of the second round of source water monitoring required as prescribed by OAR 333-061-0036(5)(e)(B) at filtered water systems, water suppliers must recalculate their *Cryptosporidium* bin concentration based upon the sample results collected according to OAR 333-061-0036(5)(e)(B) and following the procedures specified in paragraphs (4)(f)(A) through (D) of this rule. Water suppliers must then re-determine their bin classification using Table 8 in paragraph (4)(f)(F) of this rule.
- (G) Water suppliers must report their bin classification as prescribed by paragraph (4)(f)(F) of this rule to the Authority for approval no later than 6 months after being required to complete the initial and second round of source water monitoring based on the schedule in OAR 333-061-0036(5)(e)(C).
- (H) The bin classification report to the Authority must include a summary of source water monitoring data and the calculation procedure used to determine bin classification. Failure to comply with the conditions of this paragraph is a violation of treatment technique requirements.
- (g) Additional *Cryptosporidium* treatment requirements.
  - (A) At filtered water systems, water suppliers must provide the level of additional treatment for *Cryptosporidium* specified in Table 9 based on their bin classification as determined according to subsection (4)(f) of this rule, and according to the schedule in paragraph (1)(a)(F) of this rule.

Table 9  
Additional *Cryptosporidium* Treatment Requirements:

Bin Classification	Type of Filtration Treatment			
	Conventional Filtration	Direct Filtration	Slow Sand or Diatomaceous Earth Filtration	Alternative Filtration Technologies
1	No additional Treatment	No additional Treatment	No additional Treatment	No additional Treatment
2	1-log treatment	1.5-log treatment	1-log treatment	<sup>1</sup>
3	2-log treatment	2.5-log treatment	2-log treatment	<sup>2</sup>
4	2.5-log treatment	3-log treatment	2.5-log treatment	<sup>3</sup>

<sup>1</sup> As determined by the Authority such that the total *Cryptosporidium* removal and inactivation is at least 4.0-log.

<sup>2</sup> As determined by the Authority such that the total *Cryptosporidium* removal and inactivation is at least 5.0-log.

<sup>3</sup> As determined by the Authority such that the total *Cryptosporidium* removal and inactivation is at least 5.5-log.

- (B) Water suppliers must use one or more of the treatment and management options listed in section (12) of this rule, termed the microbial toolbox, to comply with the additional *Cryptosporidium* treatment required by paragraph (4)(g)(A) of this rule.
  - (C) At water systems classified in Bin 3 or Bin 4, water suppliers must ensure at least 1-log of the additional *Cryptosporidium* treatment required by paragraph (4)(g)(A) of this rule is provided, using either one or a combination of the following: bag filters, bank filtration, cartridge filters, chlorine dioxide, membranes, ozone, or UV, as described in sections (13) through (17) of this rule and in OAR 333-061-0036(5)(c).
    - (i) Failure at a water system, during any month, to achieve the treatment credit required by sections (13) through (17) of this rule and OAR 333-061-0036(5)(c) that is at least equal to the level of treatment required by paragraph (4)(g)(A) of this rule, is a violation of treatment technique requirements.
    - (ii) If the Authority determines during a sanitary survey or equivalent source water assessment, that after a water supplier completed the monitoring conducted required by OAR 333-061-0036(5)(e)(A) or (B), significant changes occurred in a water system's watershed that could lead to increased contamination of the source water by *Cryptosporidium*, the water supplier must take action as specified by the Authority to address the contamination. These actions may include additional source water monitoring or implementing microbial toolbox options specified in section (12) of this rule.
- (5) Disinfection requirements for water systems utilizing surface water or GWUDI sources with filtration.
- (a) Disinfection treatment must be sufficient to ensure that the total treatment processes at a water system achieve at least 99.9 percent (3-log) inactivation or removal of *Giardia lamblia* cysts and at least 99.99 percent (4-log) inactivation or removal of viruses as determined by the Authority.
  - (b) The residual disinfectant concentration in the water entering the distribution system, measured as specified in OAR 333-061-0036(5)(b)(D), cannot be less than 0.2 mg/l for more than 4 hours.
  - (c) The residual disinfectant concentration in the distribution system, measured as free chlorine, total chlorine, combined chlorine or chlorine dioxide, as specified is OAR 333-061-0036(5)(b)(D) cannot be undetectable in more than 5 percent

of the samples each month, for any two consecutive months that the system serves water to the public.

- (6) Requirements for water systems with groundwater sources.
  - (a) Water suppliers responsible for groundwater systems as defined by OAR 333-061-0020(68) must comply with the requirements of this section when a significant deficiency is identified or a groundwater source sample collected according to OAR 333-061-0036(6)(j) is *E. coli* positive. The Authority may require a water supplier to comply with the provisions of this section when a groundwater source sample collected according to OAR 333-061-0036(6)(i) or (k) is *E. coli* positive.
  - (b) When a significant deficiency is identified at a public water system that uses both groundwater and surface water or GWUDI sources, the water supplier must comply with provisions of this section except in cases where the Authority determines that the significant deficiency is in a portion of the distribution system served solely by surface water or GWUDI sources.
  - (c) Water suppliers must consult with the Authority regarding the appropriate corrective action within 30 days of receiving written notice from the Authority of a significant deficiency, written notice from a laboratory that a groundwater source sample collected in accordance with OAR 333-061-0036(6)(j) was *E. coli* -positive, or direction from the Authority that an *E. coli* -positive collected in accordance with OAR 333-061-0036(6)(i) or (k) requires corrective action.
  - (d) Water suppliers must take action within 120 days (or earlier if directed by the Authority) of receiving written notification from the Authority of a significant deficiency, written notice from a laboratory that a groundwater source sample collected in accordance with OAR 333-061-0036(6)(j) was found to be *E. coli* positive, or direction from the Authority that an *E. coli* -positive sample collected in accordance with OAR 333-061-0036(6)(i) or (k) requires corrective action, and must either:
    - (A) Have completed corrective action in accordance with applicable Authority plan review processes or other Authority guidance, including any Authority-specified interim measures; or
    - (B) Be in compliance with an Authority approved corrective action plan and schedule subject to the following conditions:
      - (i) Any subsequent modifications to an approved corrective action plan and schedule must be approved by the Authority; and
      - (ii) If the Authority specifies interim measures for the protection of public health, pending Authority approval of the corrective action plan and schedule, or pending completion of the corrective action plan, the water supplier must comply with these interim measures as well as with any schedule specified by the Authority.
  - (e) Water suppliers subject to the requirements of this section must, upon approval by the Authority, implement one or more of the following corrective action alternatives:
    - (A) Correct all significant deficiencies;

- (B) Disconnect the groundwater source from the water system and provide an alternate source of water. If a disconnected well is or will be within 100 feet of a public water supply well, the disconnected well must be abandoned in accordance with 333-061-0050(2)(a)(E);
  - (C) Eliminate the source of contamination; or
  - (D) Provide treatment for the groundwater source that reliably achieves at least 4-log inactivation, removal, or a combination of inactivation and removal of viruses before or at the first customer. If the groundwater source does not meet all of the applicable construction standards specified in OAR 333-061-0050(2)(a) or (b), and the Authority determines that reconstruction of the groundwater source will add a significant measure of public health protection, then the groundwater source must be made to meet all of the applicable construction standards specified in OAR 333-061-0050(2)(a) or (b) before treatment is applied as prescribed by OAR 333-061-0050(5)(b).
- (f) Water suppliers responsible for water systems using fecally contaminated groundwater sources must provide disinfection for pathogen inactivation as prescribed by OAR 333-061-0050(5) when disinfection is approved by the Authority as a corrective action.
- (g) At water systems where three or more coliform investigations are triggered within a rolling 12 month period or four or more coliform investigations are triggered within a rolling two year period, water suppliers must install and utilize treatment for disinfectant residual maintenance. For the purposes of this subsection, only coliform investigations triggered as specified in OAR 333-061-0078(2)(a)(A) or (B) or (2)(b)(A) will be considered.
- (A) The Authority may suspend the requirement to install treatment if a sanitary defect reasonably believed to be the source of contamination is corrected after the requirement to utilize treatment is triggered or if the Authority approves a schedule to correct the defect. The Authority may immediately re-establish the requirement to utilize treatment if one or more coliform investigations are triggered following the correction of the sanitary defect.
  - (B) If the Authority determines a groundwater source is the source of contamination, it may approve the installation of UV disinfection that meets the requirements in OAR 333-061-0050(5)(k)(J) in lieu of disinfectant residual maintenance.
  - (C) Treatment must be installed and operating within six months unless the Authority approves an alternate schedule.
  - (D) For disinfectant residual maintenance, residuals must be monitored as prescribed by OAR 333-061-0036(9).
- (h) A water supplier violates this rule if any of the situations specified in paragraphs (6)(h)(A) through (C) of this rule occur. Violation of this rule is a violation of treatment technique requirements and requires a tier two public notice be published as specified by OAR 333-061-0042.

- (A) Within 120 days (or earlier if directed by the Authority) of receiving written notice from the Authority of a significant deficiency, a water supplier:
  - (i) Fails to complete corrective action in accordance with applicable Authority plan review processes or other Authority guidance, including Authority specified interim actions and measures; or
  - (ii) Fails to be in compliance with an Authority approved corrective action plan and schedule.
- (B) Within 120 days (or earlier if directed by the Authority) of receiving notification of an *E. coli*-positive groundwater source sample collected according to OAR 333-061-0036(6)(j) and not invalidated according to OAR 333-061-0036(6)(l), a water supplier:
  - (i) Fails to complete corrective action according to applicable Authority plan review processes or other Authority guidance, including interim actions and measures; or
  - (ii) Fails to be in compliance with an Authority approved corrective action plan and schedule.
- (i) Water suppliers may discontinue the operation of 4-log treatment for viruses, whether the treatment is source water inactivation, removal, or an Authority-approved combination of the two if the Authority first determines and documents in writing that 4-log treatment of viruses is no longer necessary for a groundwater source. If 4-log treatment of viruses is discontinued, the water supplier must monitor at the applicable groundwater source(s) as specified in OAR 333-061-0036(6).
- (7) Determination of groundwater under the direct influence of surface water (GWUDI).
  - (a) Except for wells using only a handpump, all groundwater sources must be evaluated for the potential of surface water influence if the source is in proximity to perennial or intermittent surface water and meets one of the hydrogeologic setting-surface water setback criteria identified in paragraph (A) and either paragraph (B) or (C). Hydrogeologic setting is identified by the Source Water Assessment or some other hydrogeologic study approved by the Authority.
    - (A) The groundwater source draws water from:
      - (i) A sand aquifer and is within 75 feet of surface water;
      - (ii) A sand and gravel aquifer and is within 100 feet of surface water;
      - (iii) A coarse sand, gravel, and boulder aquifer and is within 200 feet of surface water;
      - (iv) A fractured bedrock aquifer or layered volcanic aquifer and is within 500 feet of surface water; or
      - (v) Greater distances if geologic conditions or historical monitoring data indicate additional risk at the source; and
    - (B) There is a history of microbiological contamination in the source; or
    - (C) The Source Water Assessment or some other hydrogeologic study approved by the Authority determines the source is highly sensitive as a

result of aquifer characteristics, vadose zone characteristics, monitoring history or well construction.

- (b) Except as provided by subsection (7)(c) of this rule, water suppliers must conduct sampling for any groundwater source(s) meeting the criteria specified in subsection (7)(a) of this rule. Sampling must be conducted according to the following criteria:
  - (A) Collection of twelve consecutive monthly source water samples when the source is used year-round, or every month the source provides water to the public during one operational season for water sources used seasonally;
  - (B) Samples must be analyzed for *E. coli* in accordance with all the applicable provisions of OAR 333-061-0036(1); and
  - (C) Samples must be collected at the water source prior to any treatment unless the Authority approves an alternate sampling location that is representative of source water quality.
- (c) Public water systems that are required to evaluate their source(s) for direct influence of surface water may submit results of a hydrogeologic assessment completed by an Oregon registered geologist or other licensed professional with demonstrated experience and competence in hydrogeology in accordance with ORS 672.505 through 672.705 to demonstrate that the source is not potentially under the direct influence of surface water. The assessment must be consistent with the Oregon State Board of Geologist Examiners "Hydrology Report Guidelines," must be completed within a timeframe specified by the Authority and must include the following:
  - (A) Well characteristics: well depth, screened or perforated interval, casing seal placement;
  - (B) Aquifer characteristics: thickness of the vadose zone, hydraulic conductivity (meaning the capacity of the medium, for example, soil, aquifer, or any hydrogeological unit of interest, to transmit water) of the vadose zone and the aquifer, presence of low permeability zones in the vadose zone, degree of connection between the aquifer and surface water;
  - (C) Hydraulic gradient: gradient between the aquifer and surface water source during pumping conditions, variation of static water level and surface water level with time; and
  - (D) Groundwater flow: flow of water from the surface water source to the groundwater source during pumping conditions, estimated TOT for groundwater from the surface water source(s) to the well(s), spring(s), etc.
- (d) If a source water sample collected in accordance with subsection (7)(b) of this rule is reported as *E. coli* positive, then the water supplier must collect five additional source water samples within 24 hours of receiving notification of the positive sample result.
- (e) If any of the five additional source water samples specified in subsection (7)(d) of this rule is *E. coli* positive then the original *E. coli* positive sample is

considered confirmed, and the water supplier must have the groundwater source analyzed for surface water influence according to subsection (7)(h) of this rule. Further *E. coli* monitoring is not required.

- (f) A water supplier may be required to have the groundwater source analyzed for surface water influence according to subsection (7)(h) of this rule at the discretion of the Authority if source water samples are consistently total coliform positive.
- (g) Emergency groundwater sources that meet the criteria of subsection (7)(a) of this rule can either be evaluated as prescribed in subsection (7)(b) or (7)(c) of this rule, or the evaluation can be waived if a Tier 2 public notice as prescribed in OAR 333-061-0042 is issued each time the source is used. The notice must explain that the source has been identified as potentially under the direct influence of surface water, but has not been fully evaluated, and therefore may not be treated sufficiently to inactivate pathogens such as *Giardia lamblia* and *Cryptosporidium*.
- (h) Determination of surface water influence on a groundwater source must be based upon a minimum of two samples conducted according to the "Consensus Method for Determining Groundwaters under the Direct Influence of Surface Water Using Microscopic Particulate Analysis (MPA)." Both water samples must be collected during a period of high runoff or streamflow and separated by a period of at least four weeks, or at other times as determined by the Authority. Scoring for diatoms, other algae, and insects/larvae is partially modified according to Table 10. Scoring for *Giardia lamblia*, coccidia, rotifers, and plant debris remains unchanged.

Table 10  
Modified Scoring of Microscopic Particulate Analyses

Indicators of Surface Water, Oregon Modified Scoring (counted per 100 gal. water)							
Diatoms		Other Algae		Insects / Larvae			
Abundance	Risk Score	Abundance	Risk Score	Abundance	Risk Score		
1-10	6	1-20	4	1-15	3		
11-16	7	21-32	5	16-22	4		
17-22	8	33-48	6	23-30	5		
23-28	9	49-64	7	31-65	6		
29-34	10	65-80	8	66-99	7		
35-40	11	81-95	9	100-130	8		
41-100	12	96-160	10	>130	9		
101-149	13	161-220	11				
150-200	14	221-299	12				
201-250	15	300-360	13				
>251	16	>360	14				
EPA Consensus Method Scoring (counted per 100 gal. water)							
Giardia		Coccidia		Rotifers		Plant Debris	
Abundance	Risk Score	Abundance	Risk Score	Abundance	Risk Score	Abundance	Risk Score

1-5	20	1-5	20	1-20	1	1-25	0
6-15	25	6-15	25	21-60	2	26-70	1
16-30	30	16-30	30	61-149	3	71-200	2
>30	40	>30	35	>150	4	>200	3

- (i) A water source will be classified as groundwater or GWUDI as follows:
  - (A) If the two initial microscopic particulate analyses have a risk score of less than 10, the water system source is classified as groundwater;
  - (B) If any microscopic particulate analysis (MPA) risk score is greater than 19, or each risk score is greater than 14, the water source is classified as GWUDI;
  - (C) If at least one of the two MPA risk scores is between 10 and 19, two additional microscopic particulate analyses must be conducted, and water source classification will be made as follows:
    - (i) If all of the MPA risk scores are less than 15, the water system source is classified as groundwater;
    - (ii) If any MPA risk score is greater than 19, or two or more are greater than 14, the water system source is classified as under the direct influence of surface water; or
    - (iii) If only one of four MPA risk scores is greater than 14, two additional microscopic particulate analyses must be conducted, and water source classification will be based upon further evaluation by the Authority.
- (j) If an infiltration gallery, Ranney well, or dug well has been classified as groundwater under this rule, the turbidity of the source must be monitored and recorded daily and kept by the water system operator. If the turbidity exceeds 5 NTU or if the surface water body changes course such that risk to the groundwater source is increased, an MPA must be conducted at that time. Reevaluation may be required by the Authority at any time.
- (k) The Authority may determine a groundwater source to be under the direct influence of surface water if the criteria in subsection (7)(a) of this rule are met and there are significant or relatively rapid shifts in groundwater characteristics, such as turbidity, which closely correlate to changes in weather or surface water conditions.
- (l) The Authority may require reevaluation of a groundwater source, as specified in this section, if geologic conditions, water quality trends, or other indicators change despite any data previously collected or any determination previously made.
- (m) The Authority may determine that a source is not under direct influence of surface water based on criteria other than MPAs including the Source Water Assessment, source water protection, and other water quality parameters. The determination shall be based on the criteria indicating that the water source has a very low susceptibility to contamination by parasites, including *Giardia*



*lamblia* and *Cryptosporidium*. The Authority may impose additional monitoring or disinfection treatment requirements to ensure that the risk remains low.

- (8) Requirements for groundwater sources under the direct influence of surface water seeking alternative filtration credit through bank filtration:
  - (a) At water systems with all MPA risk scores less than 30, water suppliers may choose the option to evaluate for bank filtration credit. The water supplier must conduct a demonstration of performance study that includes an assessment of the ability of the local hydrogeologic setting to provide a minimum of 2-log reduction in the number of particles and microorganisms in the *Giardia* and *Cryptosporidium* size range between surface water and the groundwater source. The bank filtration study must involve the collection of data on removal of biological surrogates and particles in the *Cryptosporidium* size range of 2–5 microns or other surrogates approved by the Authority, and related hydrogeologic and water quality parameters during the full range of operating conditions. The demonstration study methods shall be reviewed and approved by the Authority prior to implementation. Final assessment of removal credit granted to the well shall be made by the Authority based on the study results.
  - (b) If a GWUDI system using bank filtration as an alternative filtration technology violates the MCL for turbidity specified in OAR 333-061-0030(3)(b)(D), the water system must investigate the cause of the high turbidity within 24 hours of the exceedance. Pending the results of the investigation by the water system, the Authority may require a new bank filtration study.
- (9) Disinfection Byproduct Control Requirements:
  - (a) This rule establishes criteria under which water suppliers for community and NTNC water systems where a chemical disinfectant is added to the water in any part of the drinking water treatment process must modify their practices to meet MCLs and MRDLs in OAR 333-061-0030 and 0031, respectively. This rule also establishes the treatment technique requirements for disinfection byproduct precursors, and the criteria under which TNC water systems that use chlorine dioxide as a disinfectant or oxidant must modify their practices to meet the MRDL for chlorine dioxide as specified in OAR 333-061-0031.
  - (b) Water systems may increase residual disinfectant levels in the distribution system of chlorine or chloramines (but not chlorine dioxide) to a level and for a time necessary to protect public health, to address specific microbiological contamination problems caused by circumstances such as, but not limited to, distribution line breaks, storm run-off events, source water contamination events, or cross connection events.
  - (c) Enhanced coagulation or enhanced softening are authorized treatment techniques to control the level of disinfection byproduct precursors for water systems using surface water or groundwater under the direct influence of surface water and conventional filtration treatment. Community and NTNC water systems using conventional filtration treatment must operate with enhanced coagulation or enhanced softening to achieve the TOC percent removal levels specified in subsection (9)(d) of this rule unless the system

meets at least one of the alternative compliance criteria listed in paragraph (9)(c)(A) or (9)(c)(B) of this rule.

- (A) Alternative compliance criteria for enhanced coagulation and enhanced softening systems. Water systems may use the alternative compliance criteria in subparagraphs (9)(c)(A)(i) through (vi) of this rule in lieu of complying with the performance criteria specified in subsection (e) of this section. Systems must still comply with monitoring requirements specified in OAR 333-061-0036(4)(k).
  - (i) The system's source water TOC level is less than 2.0 mg/L, calculated quarterly as a running annual average (RAA).
  - (ii) The system's treated water TOC level is less than 2.0 mg/L, calculated quarterly as a RAA.
  - (iii) The system's source water TOC is less than 4.0 mg/L, calculated quarterly as a RAA; the source water alkalinity is greater than 60 mg/L (as CaCO<sub>3</sub> calculated quarterly as a RAA; and the TTHM and HAA5 RAAs are no greater than 0.040 mg/L and 0.030 mg/L, respectively.
  - (iv) The TTHM and HAA5 RAAs are no greater than 0.040 mg/L and 0.030 mg/L, respectively, and the system uses only chlorine for primary disinfection and maintenance of a residual in the distribution system.
  - (v) The system's source water SUVA, prior to any treatment and measured monthly is less than or equal to 2.0 L/mg-m, calculated quarterly as a RAA.
  - (vi) The system's finished water SUVA, measured monthly is less than or equal to 2.0 L/mg-m, calculated quarterly as a RAA.
- (B) Additional alternative compliance criteria for softening systems. Systems practicing enhanced softening that cannot achieve the TOC removals required by paragraph (9)(d)(B) of this rule may use the alternative compliance criteria in subparagraphs (9)(c)(B)(i) and (ii) of this rule in lieu of complying with subsection (9)(d) of this rule. Systems must still comply with monitoring requirements in specified in OAR 333-061-0036(4)(k).
  - (i) Softening that results in lowering the treated water alkalinity to less than 60 mg/L (as CaCO<sub>3</sub>), measured monthly and calculated quarterly as a RAA.
  - (ii) Softening that results in removing at least 10 mg/L of magnesium hardness (as CaCO<sub>3</sub>), measured monthly and calculated quarterly as a RAA.
- (d) Enhanced coagulation and enhanced softening performance requirements.
  - (A) Systems must achieve the percent reduction of TOC specified in paragraph (9)(d)(B) in this rule between the source water and the combined filter effluent, unless the Authority approves a system's request

for alternate minimum TOC removal (Step 2) requirements under paragraph (9)(d)(C) of this rule.

- (B) Required Step 1 TOC reductions, specified in Table 11, are based upon specified source water parameters. Systems practicing softening are required to meet the Step 1 TOC reductions in the far-right column (Source water alkalinity >120 mg/L) for the specified source water TOC:

Table 11  
Step 1 Required Removal (in percent) of TOC by Enhanced Coagulation and Enhanced Softening for Systems Using Conventional Treatment<sup>1,2</sup>

Source-water TOC, mg/L	Source-water alkalinity, mg/L as CaCO <sub>3</sub>		
	0-60	61-120	>120 <sup>3</sup>
>2.0-4.0	35.0	25.0	15.0
>4.0-8.0	45.0	35.0	25.0
>8.0	50.0	40.0	30.0

<sup>1</sup> Systems meeting at least one of the conditions in subparagraphs (d)(A)(i)-(vi) of this section are not required to operate with enhanced coagulation.

<sup>2</sup> Softening systems meeting one of the alternative compliance criteria in paragraph (d)(B) of this section are not required to operate with enhanced softening.

<sup>3</sup> Systems practicing softening must meet the TOC removal requirements in this column.

- (C) Water systems that cannot achieve the Step 1 TOC removals required by paragraph (9)(d)(B) of this rule due to water quality parameters or operational constraints must apply to the Authority, within three months of failure to achieve the TOC removals required by paragraph (9)(d)(B) of this rule, for approval of alternative minimum TOC (Step 2) removal requirements submitted by the water system. If the Authority approves the alternative minimum TOC removal (Step 2) requirements, the Authority may make those requirements retroactive for the purposes of determining compliance. Until the Authority approves the alternate minimum TOC removal (Step 2) requirements, the water system must meet the Step 1 TOC removals contained in paragraph (9)(d)(B) of this rule.
- (D) Alternate minimum TOC removal (Step 2) requirements. Applications made to the Authority by enhanced coagulation systems for approval of alternative minimum TOC removal (Step 2) requirements under paragraph (9)(d)(C) of this rule must include, as a minimum, results of bench-scale or pilot-scale testing conducted under subparagraph (9)(d)(D)(i) of this rule. The submitted bench-scale or pilot scale testing must be used to determine the alternate enhanced coagulation level.
- (i) Alternate enhanced coagulation level is defined as coagulation at a coagulant dose and pH as determined by the method described in subparagraphs (9)(d)(D)(i) through (v) of this rule such that an incremental addition of 10 mg/L of alum (or equivalent amount of ferric salt) results in a TOC removal of less than or equal to 0.3

mg/ L. The percent removal of TOC at this point on the "TOC removal versus coagulant dose" curve is then defined as the minimum TOC removal required for the system. Once approved by the Authority, this minimum requirement supersedes the minimum TOC removal required by the Table 11 in paragraph (9)(d)(B) of this rule. This requirement will be effective until such time as the Authority approves a new value based on the results of a new bench-scale and pilot-scale test. Failure to achieve Authority-set alternative minimum TOC removal levels is a violation.

- (ii) Bench-scale or pilot-scale testing of enhanced coagulation must be conducted by using representative water samples and adding 10 mg/L increments of alum (or equivalent amounts of ferric salt) until the pH is reduced to a level less than or equal to the enhanced coagulation Step 2 target pH as specified in Table 12:

Table 12

Enhanced Coagulation Step 2 Target pH	
Alkalinity (mg/L as CaCO <sub>3</sub> )	Target pH
0-60	5.5
>60-120	6.3
>120-240	7.0
>240	7.5

- (iii) For waters with alkalinities of less than 60 mg/L for which addition of small amounts of alum or equivalent addition of iron coagulant drives the pH below 5.5 before significant TOC removal occurs, the system must add necessary chemicals to maintain the pH between 5.3 and 5.7 in samples until the TOC removal of 0.3 mg/L per 10 mg/L alum added (or equivalent addition of iron coagulant) is reached.
  - (iv) The system may operate at any coagulant dose or pH necessary, consistent with these rules to achieve the minimum TOC percent removal approved under paragraph (9)(d)(C) of this rule.
  - (v) If the TOC removal is consistently less than 0.3 mg/L of TOC per 10 mg/L of incremental alum dose at all dosages of alum (or equivalent addition of iron coagulant), the water is deemed to contain TOC not amenable to enhanced coagulation. The water system may then apply to the Authority for a waiver of enhanced coagulation requirements.
- (e) Compliance calculations.
- (A) Water systems other than those identified in paragraphs (9)(c)(A) or (d)(B) of this rule must comply with requirements contained in paragraph (9)(d)(B) or (C) of this rule. Systems must calculate compliance quarterly, beginning after the system has collected 12 months of data, by determining an annual average using the following method:

- (i) Determine actual monthly TOC percent removal, equal to:  $\{1 - (\text{treated water TOC} / \text{source water TOC})\} \times 100$ .
  - (ii) Determine the required monthly TOC percent removal (from either Table 11 in paragraph (9)(d)(B) of this rule or from paragraph (9)(d)(C) of this rule).
  - (iii) Divide the value in subparagraph (9)(e)(A)(i) of this rule by the value in subparagraph (9)(e)(A)(ii) of this rule.
  - (iv) Add together the results of subparagraph (9)(e)(A)(iii) of this rule for the last 12 months and divide by 12.
  - (v) If the value calculated in subparagraph (9)(e)(A)(iv) of this rule is less than 1.00, the water system is not in compliance with the TOC percent removal requirements.
- (B) Water systems may use the provisions in subparagraphs (9)(e)(B)(i) through (v) of this rule in lieu of the calculations in subparagraph (9)(e)(A)(i) through (v) of this rule to determine compliance with TOC percent removal requirements.
- (i) In any month that the water system's treated or source water TOC level is less than 2.0 mg/L, the water system may assign a monthly value of 1.0 (in lieu of the value calculated in subparagraph (9)(e)(A)(iii) of this rule) when calculating compliance under the provisions of paragraph (9)(e)(A) of this rule.
  - (ii) In any month that a system practicing softening removes at least 10 mg/L of magnesium hardness (as  $\text{CaCO}_3$ ), the water system may assign a monthly value of 1.0 (in lieu of the value calculated in subparagraph (9)(e)(A)(iii) of this rule) when calculating compliance under the provisions of paragraph (9)(e)(A) of this rule.
  - (iii) In any month that the water system's source water SUVA, prior to any treatment is less than or equal to 2.0 L/mg-m, the water system may assign a monthly value of 1.0 (in lieu of the value calculated in subparagraph (9)(e)(A)(iii) of this rule) when calculating compliance under the provisions of paragraph (9)(e)(A) of this rule.
  - (iv) In any month that the water system's finished water SUVA is less than or equal to 2.0 L/mg-m, the system may assign a monthly value of 1.0 (in lieu of the value calculated in subparagraph (9)(e)(A)(iii) of this rule) when calculating compliance under the provisions of paragraph (9)(e)(A) of this rule.
  - (v) In any month that a system practicing enhanced softening lowers alkalinity below 60 mg/L (as  $\text{CaCO}_3$ ), the water system may assign a monthly value of 1.0 (in lieu of the value calculated in subparagraph (9)(e)(A)(iii) of this rule) when calculating compliance under the provisions of paragraph (9)(e)(A) of this rule.

- (C) Water systems using conventional treatment may also comply with the requirements of this section by meeting the criteria in paragraph (9)(c)(A) or (B) of this rule.
- (10) Requirements for Water Treatment Plant Recycled Water.
  - (a) Any water system using surface water or groundwater under the direct influence of surface water that uses conventional filtration treatment or direct filtration treatment and that recycles spent filter backwash water, thickener, supernatant, or liquids from dewatering processes must meet the requirements of subsections (10)(b) and (c) of this rule and OAR 333-061-0040(2)(i).
  - (b) Water suppliers must notify the Authority in writing within 30 days if it decides to recycle spent filter backwash water, thickener supernatant, or liquids from dewatering processes at a public water system. This notification must include, at a minimum, the information specified in paragraphs (10)(b)(A) and (B) of this rule.
    - (A) A water treatment plant schematic showing the origin of all flows which are recycled (including, but not limited to, spent filter backwash water, thickener supernatant, and liquids from dewatering processes), the hydraulic conveyance used to transport them, and the location where they are re-introduced back into the water treatment plant.
    - (B) Typical recycle flow in gallons per minute (gpm), the highest observed water treatment plant flow experienced in the previous year (gpm), the design flow for the water treatment plant (gpm), and the operating capacity of the water treatment plant (gpm) that has been determined by the Authority where the Authority has made such determinations.
  - (c) Any water system that recycles spent filter backwash water, thickener supernatant, or liquids from dewatering processes must return these flows through the processes of the system's existing filtration treatment as defined by these rules or at an alternate location approved by the Authority. If capital improvements are required to modify the recycle location to meet this requirement, all capital improvements must be completed according to a schedule approved by the Authority.
- (11) Water systems using uncovered finished water storage facilities must comply with the conditions of either subsections (11)(a) or (b) of this rule for each uncovered finished water storage facility, or be in compliance with an Authority approved schedule to meet these conditions no later than April 1, 2009.
  - (a) Water systems must cover any uncovered finished water storage facility; or
  - (b) Treat the discharge from the uncovered finished water storage facility into the distribution system to achieve at least 4-log virus, 3-log *Giardia lamblia*, and 2-log *Cryptosporidium* inactivation or removal using a protocol approved by the Authority.
  - (c) Failure to comply with the requirements of this section is a violation of the treatment technique requirement.
- (12) Summary and General Requirements of Microbial toolbox options for meeting *Cryptosporidium* treatment requirements. Filtered water systems are eligible for the

treatment credits listed in Table 13 of this section by meeting the conditions for microbial toolbox options described in sections (13) through (17) of this rule and in OAR 333-061-0036(5)(c). Unfiltered water systems are eligible only for the treatment credits specified as inactivation toolbox options in Table 13. Water systems apply these treatment credits to meet the requirements of subsections (3)(e) or (4)(g) of this rule, as applicable.

Table 13  
Microbial Toolbox Options

Toolbox Option	<i>Crypto</i> treatment credit with design and implementation criteria summary
Source Protection and Management Toolbox Options	
Watershed Control Program	0.5-log credit for Authority approved program including the required elements, an annual program status report to the Authority, and regular watershed surveys. Specific criteria are in subsection (14)(a) of this rule.
Alternative source/intake management	No prescribed credit. Systems must conduct simultaneous monitoring for treatment bin classification at alternative intake locations or using alternative intake management strategies. Specific criteria are in subsection (14)(b) of this rule.
Pre Filtration Toolbox Options	
Presedimentation basin with coagulation	0.5-log credit during any month that presedimentation basins achieve a monthly mean 0.5-log or greater reduction of turbidity, or alternative Authority approved performance criteria. To be eligible, basins must be operated continuously with coagulant addition and all plant flow must pass through the basins. Specific criteria are in subsection (15)(a) of this rule.
Two-stage lime softening	0.5-log credit for two-stage softening where chemical addition and hardness precipitation occur in both stages. All plant flow must pass through both stages. Single-stage softening is credited as equivalent to conventional treatment. Specific criteria are in subsection (15)(b) of this rule.
Bank filtration	0.5-log credit for 25-foot setback; 1.0-log credit for 50-foot setback; aquifer must be unconsolidated sand containing at least 10 percent fines; average turbidity in wells must be less than 1 NTU. Water systems using wells followed by filtration must sample at the well to determine bin classification when conducting source water monitoring, and are not eligible for additional credit. Specific criteria are in subsection (15)(c) of this rule.
Treatment Performance Toolbox Options	
Combined filter performance	0.5-log credit for combined filter effluent turbidity less than or equal to 0.15 NTU in at least 95 percent

	of measurements each month. Specific criteria are in subsection (16)(a) of this rule.
Individual filter performance	0.5-log credit if individual filter effluent turbidity is less than or equal to 0.15 NTU in at least 95 percent of samples each month in each filter and is never greater than 0.3 NTU in two consecutive measurements in any filter. This credit is cumulative to the 0.5-log combined filter performance credit. Specific criteria are in subsection (16)(b) of this rule.
Demonstration of performance	Credit awarded to unit process or treatment train based on a demonstration to the Authority with an Authority approved protocol. Specific criteria are in subsection (16)(c) of this rule.
Additional Filtration Toolbox Options	
Bag or cartridge filters (individual filters)	Up to 2-log credit based on the removal efficiency demonstrated during challenge testing with a 1.0-log factor of safety. Specific criteria are in subsection (17)(a) of this rule.
Bag or cartridge filters (in series)	Up to 2.5-log credit based on the removal efficiency demonstrated during challenge testing with a 0.5-log factor of safety. Specific criteria are in subsection (17)(a) of this rule.
Membrane filtration	Log credit equivalent to removal efficiency demonstrated in challenge test for device if supported by direct integrity testing. Specific criteria are in subsection (17)(b) of this rule.
Second stage filtration	0.5-log credit for second separate granular media filtration stage if treatment train includes coagulation prior to first filter. Specific criteria are in subsection (17)(c) of this rule.
Slow sand filters	2.5-log credit as a secondary filtration step; 3.0-log credit as a primary filtration process. No prior chlorination for either option. Specific criteria are in subsection (17)(d) of this rule.
Inactivation Toolbox Options	
Chlorine dioxide	Log credit based on measured CT in relation to CT table. Specific criteria in OAR 333-061-0036(5)(c).
Ozone	Log credit based on measured CT in relation to CT table. Specific criteria in OAR 333-061-0036(5)(c).
UV	Log credit based on validated UV dose in relation to UV dose table; reactor validation testing required to establish UV dose and associated operating conditions. Specific criteria in OAR 333-061-0036(5)(c).

- (13) Source toolbox components for meeting *Cryptosporidium* treatment requirements.
- (a) Watershed control program. Water systems receive 0.5-log *Cryptosporidium* treatment credit for implementing a watershed control program that meets the requirements of this subsection.



- (A) Water systems must notify the Authority of the intent to apply for the watershed control program credit no later than two years prior to the treatment compliance date applicable to the system in subsection (1)(a) of this rule.
- (B) Water systems must submit a proposed watershed control plan to the Authority no later than one year before the applicable treatment compliance date in subsection (1)(a) of this rule. The Authority must approve the watershed control plan for the water system to receive the applicable treatment credit. The watershed control plan must include the following elements:
  - (i) Identification of an area of influence, outside of which the likelihood of *Cryptosporidium* or fecal contamination affecting the treatment plant intake, being the works or structures at the head of a conduit through which water is diverted from a source, such as a river or lake, into a treatment plant, is not significant. This is the area to be evaluated in future watershed surveys under subparagraph (13)(a)(E)(ii) of this rule;
  - (ii) Identification of both potential and actual sources of *Cryptosporidium* contamination, and an assessment of the relative impact of these contamination sources on the water 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; and
  - (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.
- (C) Water Systems with existing watershed control programs are eligible to seek this credit, but must meet the requirements prescribed in paragraph (13)(a)(B) of this rule, and must specify ongoing and future actions that will reduce source water *Cryptosporidium* levels.
- (D) If the Authority does not respond to a water system regarding approval of a watershed control plan submitted in accordance with this section, and the system meets the other requirements of this section, the watershed control program will be considered approved and a 0.5 log *Cryptosporidium* treatment credit will be awarded unless the Authority subsequently withdraws such approval.
- (E) Water systems must complete the actions specified in this paragraph to maintain the 0.5-log credit.

- (i) Water systems must submit an annual watershed control program status report to the Authority. The status report must describe the water system's implementation of the approved plan, and assess the adequacy of the plan to meet its goals. It must explain how the water system is addressing any deficiencies in plan implementation, including those previously identified by the Authority, or as the result of the watershed survey conducted in accordance with subparagraph (13)(a)(E)(ii) of this rule. The watershed control program status report must also describe any significant changes that have occurred in the watershed since the last watershed sanitary survey.
- (ii) Water systems must undergo a watershed sanitary survey every three years for community water systems and every five years for non-community water systems and submit the survey report to the Authority. The survey must be conducted according to Authority guidelines and by persons the Authority approves.
  - (I) The watershed sanitary survey must meet the following criteria: encompass the region identified in the Authority approved watershed control plan as the area of influence; assess the implementation of actions to reduce source water *Cryptosporidium* levels; and identify any significant new sources of *Cryptosporidium*.
  - (II) If the Authority determines that significant changes may have occurred in the watershed since the previous watershed sanitary survey, water systems must undergo another watershed sanitary survey by a date determined by the Authority regardless of the regular date specified in subparagraph (13)(a)(E)(ii) of this rule.
- (iii) The water system must make the watershed control plan, annual status reports, and watershed sanitary survey reports available to the public upon request. These documents must be in a plain language style and include criteria by which to evaluate the success of the program in achieving plan goals. The Authority may approve withholding portions of the annual status report, watershed control plan, and watershed sanitary survey from the public based on water supply security considerations.
- (F) If the Authority determines that a water system is not implementing the approved watershed control plan, the Authority may withdraw the watershed control program treatment credit.
- (G) If a water system determines, during implementation, that making a significant change to its approved watershed control program is necessary, the system must notify the Authority prior to making any such changes. If any change is likely to reduce the level of source water

protection, the system must notify the Authority of the actions the water system will take to mitigate this effect.

- (b) Alternative source. A water system may conduct source water monitoring that reflects a different intake location (either in the same source or from an alternate source), or a different procedure for the timing or level of withdrawal from the source. If the Authority approves, a system may determine its bin classification under subsection (4)(f) of this rule based on the alternative source monitoring results.
  - (A) If a water system conducts alternative source monitoring as prescribed by this subsection, the water system must also monitor their current plant intake concurrently as prescribed by OAR 333-061-0036(5)(e).
  - (B) Alternative source monitoring as prescribed by this subsection must meet the requirements for source monitoring to determine bin classification, as described in OAR 333-061-0036(1), 333-061-0036(5)(e) through (g), and 333-061-0040(1)(o). Water systems must report the alternative source monitoring results to the Authority, including supporting information that documents the operating conditions under which the samples were collected.
  - (C) If a system determines its bin classification according to subsection (4)(f) of this rule using alternative source monitoring results that reflect a different intake location or a different procedure for managing the timing or level of withdrawal from the source, the system must relocate the intake or permanently adopt the withdrawal procedure, as applicable, no later than the applicable treatment compliance date in subsection (1)(a) of this rule.
- (14) Pre-filtration treatment toolbox components for meeting *Cryptosporidium* treatment requirements.
  - (a) Presedimentation. Systems receive 0.5-log *Cryptosporidium* treatment credit for a presedimentation basin during any month the process meets the criteria specified in this paragraph:
    - (A) The presedimentation basin must be in continuous operation, and must treat the entire plant flow taken from a surface water or GWUDI source;
    - (B) The water system must continuously add a coagulant to the presedimentation basin; and
    - (C) The presedimentation basin must achieve the performance criteria specified in this paragraph.
      - (i) The basin must demonstrate at least 0.5-log mean reduction of influent turbidity. This reduction must be determined using daily turbidity measurements of 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) The basin must also comply with Authority-approved performance criteria that demonstrates at least 0.5-log mean removal of micron-sized particulate material through the presedimentation process.
- (b) Two-stage lime softening. Systems receive an additional 0.5-log *Cryptosporidium* treatment credit for a two-stage lime softening plant if chemical addition and hardness precipitation occur in two separate and sequential softening stages prior to filtration. Both softening stages must treat the entire plant flow taken from a surface water or GWUDI source.
- (c) Bank filtration. Water systems receive *Cryptosporidium* treatment credit for bank filtration that serves as pretreatment to a filtration plant by meeting the criteria specified in this section. Water systems using bank filtration when they begin source water monitoring according to OAR 333-061-0036(5)(e) must collect samples as prescribed by OAR 333-061-0036(5)(g) and are not eligible for this credit.
  - (A) Wells with a groundwater flow path of at least 25 feet receive 0.5-log treatment credit. Wells with a groundwater flow path of at least 50 feet receive 1.0-log treatment credit. The groundwater flow path must be determined as specified in paragraph (D) of this subsection.
  - (B) 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 water system must characterize the aquifer at the well site by extracting a core from the aquifer and demonstrating that in at least 90 percent of the core length, grains less than 1.0 mm in diameter constitute at least 10 percent of the core material.
  - (C) Only horizontal and vertical wells are eligible for treatment credit.
  - (D) For vertical wells, the groundwater flow path is the measured distance from the edge of the surface water body under high flow conditions (as 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 groundwater flow path is the measured distance from the bed of the river under normal flow conditions to the closest horizontal well lateral screen.
  - (E) Water systems must monitor each wellhead for turbidity at least once every four hours while the bank filtration process is in operation. If monthly average turbidity levels, based on daily maximum values in the well, exceed 1 NTU, the system must report this result to the Authority and conduct an assessment within 30 days to determine the cause of the high turbidity levels in the well. If the Authority determines that microbial removal has been compromised, the Authority may revoke treatment credit until the water system implements Authority-approved corrective actions to remediate the problem.

- (F) Springs and infiltration galleries are not eligible for treatment credit under this section, but are eligible for a treatment credit in accordance with subsection (15)(c) of this rule.
  - (G) Bank filtration demonstration of performance. The Authority 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 paragraph (14)(c)(A) through (E) of this rule.
    - (i) The study must follow an Authority approved protocol, and must include 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 from both the production well(s) and monitoring wells that are screened and located along the shortest flow path between the surface water source and the production well(s).
- (15) Treatment performance toolbox components for meeting *Cryptosporidium* treatment requirements.
- (a) Combined filter performance. Water systems using conventional filtration treatment or direct filtration treatment receive an additional 0.5-log *Cryptosporidium* treatment credit during any month that the water 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 percent of the measurements. Turbidity must be measured as described in OAR 333-061-0036(5)(a)(B).
  - (b) Individual filter performance. Water systems using conventional filtration treatment or direct filtration treatment receive 0.5-log *Cryptosporidium* treatment credit, which can be in addition to the 0.5-log credit under subsection (15)(a) of this rule, during any month the system meets the criteria in this subsection. Compliance with this criteria must be based on individual filter turbidity monitoring as described in OAR 333-061-0036(5)(d).
    - (A) The filtered water turbidity for each individual filter must be less than or equal to 0.15 NTU in at least 95 percent of the measurements recorded each month.
    - (B) No individual filter may have a measured turbidity greater than 0.3 NTU in two consecutive measurements taken 15 minutes apart.
    - (C) Any system that has received treatment credit for individual filter performance and fails to meet the requirements of paragraphs (15)(b)(A) or (B) of this rule, during any month, is in violation of treatment technique requirements as prescribed by subsection (4)(g) of this rule unless the Authority 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, or maintenance; and
  - (ii) The system has experienced no more than two such failures in any calendar year.
- (c) Demonstration of performance. The Authority may approve *Cryptosporidium* treatment credit for 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 subsection (4)(g) or sections (14) through (17) of this rule and may be awarded to treatment processes that do not meet the criteria for the prescribed credits.
  - (A) Water systems cannot receive the prescribed treatment credit for any toolbox option in sections (14) through (17) of this rule, if that toolbox option is included in a demonstration of performance study for which treatment credit is awarded under this subsection.
  - (B) The demonstration of performance study must follow an Authority approved protocol, and must demonstrate the level of *Cryptosporidium* reduction achieved by the treatment process under the full range of expected operating conditions for the water system.
  - (C) Approval by the Authority must be in writing, and may include monitoring and treatment performance criteria that the system must demonstrate and report on an ongoing basis to remain eligible for the treatment credit. The Authority may require such criteria where necessary to verify that the conditions under which the demonstration of performance credit was approved are maintained during routine operation.
- (16) Additional filtration toolbox components for meeting *Cryptosporidium* treatment requirements.
  - (a) 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 requirements in OAR 333-061-0050(4)(c)(J). To be eligible for this credit, water systems must report to the Authority, the results of challenge testing conducted in accordance with OAR 333-061-0050(4)(c)(J). The filters must treat the entire plant flow.
  - (b) Membrane filtration. Systems receive *Cryptosporidium* treatment credit for membrane filtration that meets the requirements of this paragraph. Filters that meet the definition of membrane filtration in OAR 333-061-0020(59)(f) are eligible for this credit. The level of treatment credit a system receives is equal to the lower of the values determined under OAR 333-061-0050(4)(c)(H)(i) and (ii).
  - (c) Second stage filtration. Water systems receive 0.5-log *Cryptosporidium* treatment credit for a separate second stage of Authority-approved filtration that consists of sand, dual media, GAC, or other fine grain media following granular media filtration. 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 GWUDI source. The Authority must assign the treatment credit based on an assessment of the design characteristics of the filtration process. A cap (added layer of filter media), such as GAC, on a single stage of filtration is not eligible for this credit.

- (d) Slow sand filtration (as secondary filter). Water 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 the entire plant flow taken from a surface water or GWUDI source, and no disinfectant residual is present in the influent water to the slow sand filtration process. The Authority must assign 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.

(17) Inactivation toolbox components for meeting *Cryptosporidium* treatment requirements.

- (a) If Chlorine Dioxide is used, CT values in OAR 333-061-0036, Table 30 must be met.
- (b) If Ozone is used, CT values in OAR 333-061-0036, Table 31 must be met.
- (c) To receive treatment credit for UV light, water systems must treat at least 95 percent of the water delivered to the public during each month by UV reactors operating within validated conditions for the required UV dose, as prescribed by OAR 333-061-0036(5)(c)(D) and 333-061-0050(5)(k)(I). Systems must demonstrate compliance with this condition by the monitoring required in OAR 333-061-0036(5)(c)(D)(ii).

Stat. Auth.: ORS 448.131

Stats. Implemented: ORS 448.131, 448.175 & 448.273