

## Appendix A to Subpart L. Long Term 2 Enhanced Surface Water Treatment Rule.

Table 1. CT VALUES (MG•MIN/L) FOR *Cryptosporidium* INACTIVATION BY CHLORINE DIOXIDE <sup>1</sup>

| Log Credit      | Water Temperature, °C |      |      |      |      |      |     |     |     |     |     |
|-----------------|-----------------------|------|------|------|------|------|-----|-----|-----|-----|-----|
|                 | <=0.5                 | 1    | 2    | 3    | 5    | 7    | 10  | 15  | 20  | 25  | 30  |
| (i) 0.25 .....  | 159                   | 153  | 140  | 128  | 107  | 90   | 69  | 45  | 29  | 19  | 12  |
| (ii) 0.5 .....  | 319                   | 305  | 279  | 256  | 214  | 180  | 138 | 89  | 58  | 38  | 24  |
| (iii) 1.0 ..... | 637                   | 610  | 558  | 511  | 429  | 360  | 277 | 179 | 116 | 75  | 49  |
| (iv) 1.5 .....  | 956                   | 915  | 838  | 767  | 643  | 539  | 415 | 268 | 174 | 113 | 73  |
| (v) 2.0 .....   | 1275                  | 1220 | 1117 | 1023 | 858  | 719  | 553 | 357 | 232 | 150 | 98  |
| (vi) 2.5 .....  | 1594                  | 1525 | 1396 | 1278 | 1072 | 899  | 691 | 447 | 289 | 188 | 122 |
| (vii) 3.0 ..... | 1912                  | 1830 | 1675 | 1534 | 1286 | 1079 | 830 | 536 | 347 | 226 | 147 |

<sup>1</sup> Systems may use the equation to determine log credit between the indicated values:  $\text{Log credit} = (0.001506 \times (1.09116)^{\text{Temp}}) \times \text{CT}$ .

Table 2. CT VALUES (MG•MIN/L) FOR *Cryptosporidium* INACTIVATION BY OZONE <sup>1</sup>

| Log Credit      | Water Temperature, °C |     |     |     |     |     |     |     |     |     |      |
|-----------------|-----------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
|                 | <=0.5                 | 1   | 2   | 3   | 5   | 7   | 10  | 15  | 20  | 25  | 30   |
| (i) 0.25 .....  | 6.0                   | 5.8 | 5.2 | 4.8 | 4.0 | 3.3 | 2.5 | 1.6 | 1.0 | 0.6 | 0.39 |
| (ii) 0.5 .....  | 12                    | 12  | 10  | 9.5 | 7.9 | 6.5 | 4.9 | 3.1 | 2.0 | 1.2 | 0.78 |
| (iii) 1.0 ..... | 24                    | 23  | 21  | 19  | 16  | 13  | 9.9 | 6.2 | 3.9 | 2.5 | 1.6  |
| (iv) 1.5 .....  | 36                    | 35  | 31  | 29  | 24  | 20  | 15  | 9.3 | 5.9 | 3.7 | 2.4  |
| (v) 2.0 .....   | 48                    | 46  | 42  | 38  | 32  | 26  | 20  | 12  | 7.8 | 4.9 | 3.1  |
| (vi) 2.5 .....  | 60                    | 58  | 52  | 48  | 40  | 33  | 25  | 16  | 9.8 | 6.2 | 3.9  |
| (vii) 3.0 ..... | 72                    | 69  | 63  | 57  | 47  | 39  | 30  | 19  | 12  | 7.4 | 4.7  |

<sup>1</sup> Systems may use the equation to determine log credit between the indicated values:  $\text{Log credit} = (0.0397 \times (1.09757)^{\text{Temp}}) \times \text{CT}$ .

Table 3. UV DOSE TABLE FOR *Cryptosporidium*, *Giardia lamblia*, AND VIRUS INACTIVATION CREDIT

| Log Credit       | <i>Cryptosporidium</i><br>UV dose (mJ/cm <sup>2</sup> ) | <i>Giardia lamblia</i><br>UV dose (mJ/cm <sup>2</sup> ) | Virus<br>UV dose (mJ/cm <sup>2</sup> ) |
|------------------|---|---|--|
| (i) 0.5 .....    | 1.6   | 1.5   | 39                                     |
| (ii) 1.0 .....   | 2.5   | 2.1   | 58                                     |
| (iii) 1.5 .....  | 3.9   | 3.0   | 79                                     |
| (iv) 2.0 .....   | 5.8   | 5.2   | 100                                    |
| (v) 2.5 .....    | 8.5   | 7.7   | 121                                    |
| (vi) 3.0 .....   | 12  | 11  | 143                                    |
| (vii) 3.5 .....  | 15  | 15  | 163                                    |
| (viii) 4.0 ..... | 22  | 22  | 186                                    |

**Appendix B to Subpart L. Long Term 2 Enhanced Surface Water Treatment Rule.**

MICROBIAL TOOLBOX SUMMARY TABLE: OPTIONS, TREATMENT CREDITS AND CRITERIA

| Toolbox Option  | <i>Cryptosporidium</i> treatment credit with design and implementation criteria   |
|---|---|
| <b>Source Protection and Management Toolbox Options</b> |   |
| (1) Watershed control program .....                     | 0.5-log credit for State-approved program comprising required elements, annual program status report to State, and regular watershed survey. Unfiltered systems are not eligible for credit. Specific criteria are in § 109.1204(b).  |
| (2) Alternative source/intake management .....          | No prescribed credit. Systems may conduct simultaneous monitoring for treatment bin classification at alternative intake locations or under alternative intake management strategies. Specific criteria are in § 109.1204(b).   |
| <b>Pre Filtration Toolbox Options</b>                   |   |
| (3) Presedimentation basin with coagulation .....       | 0.5-log credit during any month that presedimentation basins achieve a monthly mean reduction of 0.5-log or greater in turbidity or alternative State-approved performance criteria. To be eligible, basins must be operated continuously with coagulant addition and all plant flow must pass through basins. Specific criteria are in § 109.1204(d).  |
| (4) 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 § 109.1204(e).   |
| (5) 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. Systems using wells followed by filtration when conducting source water monitoring must sample the well to determine bin classification and are not eligible for additional credit. Specific criteria are in § 109.1204(f). |
| <b>Treatment Performance Toolbox Options</b>            |   |
| (6) 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 § 109.1204(g).   |
| (7) Individual filter performance .....                 | 0.5-log credit (in addition to 0.5-log combined filter performance 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. Specific criteria are in § 109.1204(h).   |
| (8) Demonstration of performance.....                   | Credit awarded to unit process or treatment train based on a demonstration to the State with a State- approved protocol. Specific criteria are in § 109.1204(i).  |
| <b>Additional Filtration Toolbox Options</b>            |   |
| (9) 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 § 109.1204(j).   |
| (10) 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 § 109.1204(j).   |
| (11) Membrane filtration .....                          | Log credit equivalent to removal efficiency demonstrated in challenge test for device if supported by direct integrity testing. Specific criteria are in § 109.1204(k).   |
| (12) 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 § 109.1204(l).   |
| (13) 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 109.1204(m).   |
| <b>Inactivation Toolbox Options</b>                     |   |
| (14) Chlorine dioxide.....                              | Log credit based on measured CT in relation to CT table. Specific criteria in §109.1204(o).   |
| (15) Ozone.....   | Log credit based on measured CT in relation to CT table. Specific criteria in §109.1204(p).   |
| (16) 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 §109.1204(q).  |

## Appendix C to Subpart L. Long Term 2 Enhanced Surface Water Treatment Rule.

### MICROBIAL TOOLBOX REPORTING REQUIREMENTS

| Toolbox option                            | Systems must submit the following information  | On the following schedule   |
|---|--|---|
| (1) Watershed control program (WCP).      | (i) Notice of intention to develop a new or continue an existing watershed control program.<br>(ii) Watershed control plan .....<br><br>(iii) Annual watershed control program status report .....<br><br>(iv) Watershed sanitary survey report .....  | No later than two years before the applicable treatment compliance date in § 109.1203<br>No later than one year before the applicable treatment compliance date in § 109.1203<br>Every 12 months, beginning one year after the applicable treatment compliance date in § 109.1203<br>For community water systems, every three years beginning three years after the applicable treatment compliance date in § 109.1203. For noncommunity water systems, every five years beginning five years after the applicable treatment compliance date in § 109.1203. |
| (2) Alternative source/intake management. | Verification that system has relocated the intake or adopted the intake withdrawal procedure reflected in monitoring results.  | No later than the applicable treatment compliance date in § 109.1203.   |
| (3) Presedimentation .....                | Monthly verification of the following: (i) Continuous basin operation (ii) Treatment of 100% of the flow (iii) Continuous addition of a coagulant (iv) At least 0.5-log mean reduction of influent turbidity or compliance with alternative State-approved performance criteria.   | Monthly reporting within 10 days following the month in which the monitoring was conducted, beginning on the applicable treatment compliance date in § 109.1203.  |
| (4) Two-stage lime softening              | Monthly verification of the following: (i) Chemical addition and hardness precipitation occurred in two separate and sequential softening stages prior to filtration (ii) Both stages treated 100% of the plant flow.  | Monthly reporting within 10 days following the month in which the monitoring was conducted, beginning on the applicable treatment compliance date in § 109.1203.  |
| (5) Bank filtration .....                 | (i) Initial demonstration of the following: (A) Unconsolidated, predominantly sandy aquifer (B) Setback distance of at least 25 ft. (0.5-log credit) or 50 ft. (1.0-log credit).<br>(ii) If monthly average of daily max turbidity is greater than 1 NTU then system must report result and submit an assessment of the cause. | No later than the applicable treatment compliance date in § 109.1203.<br><br>Report within 30 days following the month in which the monitoring was conducted, beginning on the applicable treatment compliance date in § 109.1203.  |
| (6) Combined filter performance.          | Monthly verification of combined filter effluent (CFE) turbidity levels less than or equal to 0.15 NTU in at least 95 percent of the 4 hour CFE measurements taken each month.   | Monthly reporting within 10 days following the month in which the monitoring was conducted, beginning on the applicable treatment compliance date in § 109.1203.  |
| (7) Individual filter performance.        | Monthly verification of the following: (i) Individual filter effluent (IFE ) turbidity levels less than or equal to 0.15 NTU in at least 95 percent of samples each month in each filter (ii) No individual filter greater than 0.3 NTU in two consecutive readings 15 minutes apart.  | Monthly reporting within 10 days following the month in which the monitoring was conducted, beginning on the applicable treatment compliance date in § 109.1203.  |
| (8) Demonstration of performance.         | (i) Results from testing following a State approved protocol.<br>(ii) As required by the State, monthly verification of operation within conditions of State approval for demonstration of performance credit.   | No later than the applicable treatment compliance date in § 109.1203.<br>Within 10 days following the month in which monitoring was conducted, beginning on the applicable treatment compliance date in § 109.1203.   |
| (9) Bag filters and cartridge filters.    | (i) Demonstration that the following criteria are met: (A) Process meets the definition of bag or cartridge filtration; (B) Removal efficiency established through challenge testing that meets criteria in this subpart.<br>(ii) Monthly verification that 100% of plant flow was filtered.                                   | No later than the applicable treatment compliance date in § 109.1203.<br><br>Within 10 days following the month in which monitoring was conducted, beginning on the applicable treatment compliance date in § 109.1203.   |

**Appendix C to Subpart L. Long Term 2 Enhanced Surface Water Treatment Rule.**

MICROBIAL TOOLBOX REPORTING REQUIREMENTS — Continued

| Toolbox option                                   | Systems must submit the following information   | On the following schedule   |
|--|---|---|
| (10) Membrane filtration.....                    | (i) Results of verification testing demonstrating the following: (A) Removal efficiency established through challenge testing that meets criteria in this subpart; (B) Integrity test method and parameters, including resolution, sensitivity, test frequency, control limits, and associated baseline.<br>(ii) Monthly report summarizing the following: (A) All direct integrity tests above the control limit; (B) If applicable, any turbidity or alternative state-approved indirect integrity monitoring results triggering direct integrity testing and the corrective action that was taken. | No later than the applicable treatment compliance date in § 109.1203.<br><br>Within 10 days following the month in which monitoring was conducted, beginning on the applicable treatment compliance date in § 109.1203. |
| (11) Second stage filtration ..                  | Monthly verification that 100% of flow was filtered through both stages and that first stage was preceded by coagulation step.  | Within 10 days following the month in which monitoring was conducted, beginning on the applicable treatment compliance date in § 109.1203.  |
| (12) Slow sand filtration (as secondary filter). | Monthly verification that both a slow sand filter and a preceding separate stage of filtration treated 100% of flow from subpart H sources..  | Within 10 days following the month in which monitoring was conducted, beginning on the applicable treatment compliance date in § 109.1203.  |
| (13) Chlorine dioxide .....                      | Summary of CT values for each day as described in §141.720..  | Within 10 days following the month in which monitoring was conducted, beginning on the applicable treatment compliance date in § 109.1203.  |
| (14) Ozone .....                                 | Summary of CT values for each day as described in §141.720..  | Within 10 days following the month in which monitoring was conducted, beginning on the applicable treatment compliance date in § 109.1203.  |
| (15) UV.....                                     | (i) Validation test results demonstrating operating conditions that achieve required UV dose.<br>(ii) Monthly report summarizing the percentage of water entering the distribution system that was not treated by UV reactors operating within validated conditions for the required dose as specified in 141.720(d)..  | No later than the applicable treatment compliance date in § 109.1203.<br>Within 10 days following the month in which monitoring was conducted, beginning on the applicable treatment compliance date in § 109.1203.     |