Surface Water Regulations Summary

Revised May 2010

PUBLIC WATER SUPPLY SECTION

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List of Acronyms

ARM	Administrative Rules of Montana
BAT	Best Available Technology
CCR	Consumer Confidence Report
CEC	Continuing Education Credit
CFE	Combined Filter Effluent
CPE	Comprehensive Performance Evaluation
CT	Concentration x Time
C	Community (Public Water Supply)
DPD	N, N-diethyl-p-pheneytenediamine
DBP	Disinfection Byproduct
DBPR	Disinfectants and Disinfection Byproducts Rule
DEQ	Montana Department of Environmental Quality
DE Filtration	Diatomaceous Earth Filtration
EPA	United States Environmental Protection Agency
FBRR	Filter Backwash Recycling Rule
GWUDISW	Ground Water Under the Direct Influence of Surface Water
HAA5	Five Haloacetic Acids
IESWTR	Interim Enhanced Surface Water Treatment Rule
IFE	Individual Filter Effluent
LT1ESWTR	Long-Term 1 Enhanced Surface Water Treatment Rule
LT2ESWTR	Long Term 2 Enhanced Surface Water Treatment Rule
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
mg/L	Milligrams per Liter
NCWS	Non-Community Water System
NTNC	Non-Transient Non-Community (Public Water Supply)
NTU	Nephelometric Turbidity Unit
PWS	Public Water System
SWTR	Surface Water Treatment Rule
TCR	Total Coliform Rule
TOC	Total Organic Carbon
TT	Treatment Technique
TTHM	Total Trihalomethane
TNC	Transient Non-Community (Public Water Supply)

1. INTRODUCTION

1.1. PURPOSE OF THIS DOCUMENT

This document provides a summary of the Montana Department of Environmental Quality (DEQ) Drinking Water Regulations that are specific to public water supply systems that use surface water or ground water under the direct influence of surface water. As for all drinking water rules, Montana's regulations for surface water treatment and monitoring must be as stringent as federal rules. While they are no less stringent, some of Montana's surface water requirements differ from the federal regulations. This document summarizes the surface water treatment and monitoring regulations with which Montana surface water systems must comply.

Public water systems must also comply with other regulations related to: monitoring for microbial, chemical, and radiological quality; keeping the public informed through public notification and consumer confidence reports; recordkeeping; obtaining approval for water system improvements; sanitary surveys; and paying service connection fees. For the requirements associated with these other regulations, systems should refer to the *Drinking Water Regulations Summary: Community and Non-Transient Non-Community Water Systems* or the *Drinking Water Regulations Summary: Transient Non-Community Public Water Systems* documents. These documents are available from DEQ.

In any situation in which there is a contradiction between this document and the applicable Administrative Rules of Montana (ARM), the ARM is controlling. For a complete copy of the Montana Drinking Water Regulations please visit http://www.deq.mt.gov/dir/legal/title17.asp or call (406) 444-4400.

1.2. OVERVIEW OF SURFACE WATER TREATMENT REGULATIONS

The public water supply system regulations for the treatment of surface water and ground water under the direct influence of surface water (referred to jointly as "surface water" throughout this document) are designed to provide public health protection through the control of microbial contaminants. In particular, these rules address the protozoans *Cryptosporidium* and *Giardia lamblia*, as well as viruses and pathogenic (disease-causing) bacteria.

Surface water sources are easily contaminated by bacteria, viruses, and protozoa that can cause disease. Many of Montana's surface water sources are known to contain these microbial pathogens, and it is reasonable to assume any surface water source could be contaminated at any time. Public water systems that use surface water must be diligent in ensuring their treatment system consistently and reliably controls disease-causing organisms that are likely to be present in the untreated water.

Because it is not practical to monitor for disease-causing organisms on a routine basis as is done for chemical contaminants, surface water systems are regulated through treatment technique requirements. Treatment technique requirements are established to ensure consumers are receiving water that has been adequately treated to remove or inactivate pathogens if and when they occur in the source water.

The treatment technique requirements for surface water systems have been developed over a period of several years and have been established through a series of specific regulations discussed in section 1.2.1.

The basis for the removal and/or inactivation requirements of these regulations is described in Section 1.2.2.

1.2.1 Surface Water Treatment Regulations for Public Water Systems

Surface Water Treatment Rule (SWTR)

The Surface Water Treatment Rule went into effect in 1989. It was prompted by a greater understanding of the protozoan pathogen *Giardia lamblia* and the waterborne disease outbreaks that the pathogen had caused in public water systems. It also addressed the inability of common filtration and disinfection practices to reliably remove or inactivate *Giardia* and viruses. The SWTR introduced the treatment technique requirement approach for surface water, reduced the allowable limits for turbidity in finished water, and specified criteria for surface water systems to avoid filtration. The purpose of the rule was to ensure surface water systems have sufficient treatment to reduce the source water concentration of *Giardia lamblia* by at least 99.9 percent (3-log) and viruses by 99.99 percent (4-log). The rule did not address the protozoan *Cryptosporidium* because not enough was known about treatment necessary to control the organism.

Interim Enhanced Surface Water Treatment Rule (IESWTR)

The Interim Enhanced Surface Water Treatment Rule went into effect in 2001 and applies to systems serving more than 10,000 people. It was designed to strengthen microbial protection by addressing *Cryptosporidium.* This rule tightens filtration turbidity performance standards to meet *Cryptosporidium* removal requirements. It requires both combined filter effluent and individual filter effluent turbidity monitoring, and specifies follow-up activities that must be performed when turbidity triggers are exceeded. The rule also addressed the risk trade-offs between reducing disinfection to decrease the formation of disinfection byproducts and the need to maintain adequate microbial disinfection practices. It includes disinfection benchmarking and profiling requirements which enable water systems to make informed decisions regarding changes to their disinfection system if disinfection byproducts are a concern.

Long-Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR)

The Long-term 1 Enhanced Surface Water Treatment Rule went into effect in 2002, with most provisions requiring implementation in 2005. The LT1ESWTR is essentially the same as the IESWTR except that it applies to systems serving fewer than 10,000 people and has slightly different follow-up requirements when turbidity triggers are exceeded.

Filter Backwash Recycling Rule (FBRR)

The Filter Backwash Recycling Rule went into effect in 2004. This rule is intended to reduce the opportunity for waste-stream recycle practices at treatment plants to adversely affect the performance of the plant. The rule requires systems that recycle spent filter backwash water, thickener supernatant, or liquids from dewatering processes to return the recycle flows through all processes of the system's existing conventional or direct filtration system or at an alternate location approved by the DEQ. This rule only applies to surface water systems that practice conventional or direct filtration and recycle one or more of the specified waste streams.

Long-Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR or LT2 Rule)

The Long-term 2 Enhanced Surface Water Treatment Rule was finalized on December 15, 2005. This rule includes: source water monitoring; implementation of additional tools to provide public health protection where the monitoring indicates a high level of *Cryptosporidium* is present; inactivation requirements for *Cryptosporidium* for systems avoiding filtration; and covering uncovered finished water storage facilities or providing treatment of the discharge to protect against any pathogens that may have entered the water during storage. The LT2 Rule also included a disinfection profiling and benchmarking requirement to ensure the risk trade-offs between adequate disinfection and the formation of disinfection byproducts is considered. The requirements for the LT2 Rule phase in between 2008 and 2019. The federal rule requirements are summarized in Section 6 of this document. Public water systems must comply with this regulation even if Montana has not yet adopted it into the Administrative Rules.

1.2.2 Treatment Technique Requirements for Removal and Inactivation

The treatment technique requirements for surface water systems, excluding the LT2 Rule requirements, consist of installing and properly operating water treatment processes which reliably achieve:

- At least 99 percent (2-log) removal of *Cryptosporidium*, or *Cryptosporidium* control under the watershed control plan for systems avoiding filtration;
- At least 99.9 percent (3-log) removal and/or inactivation of *Giardia lamblia* cysts; and
- At least 99.99 percent (4-log) removal and/or inactivation of viruses.

It is notable that to address *Cryptosporidium,* inactivation is not currently considered a component of the treatment technique requirement. This is because *Cryptosporidium* oocysts are very resistant to typical disinfection practices used by public water systems. The LT2 Rule requires systems avoiding filtration to install ozone, ultraviolet light, or chlorine dioxide treatment to inactivate *Cryptosporidium*, and filtered systems may use one of these disinfection methods if additional treatment is required. The LT2 Rule treatment provisions for *Cryptosporidium* are phased-in beginning in 2011 or later, depending on the system size.

Research has determined the amount of removal and inactivation credit that can be assumed to be achieved by different types of filtration systems and different disinfection practices. Typically, the removal credit for a treatment plant is identified first, based on its assumed capabilities and compliance with the turbidity performance standards. The difference between the required level of treatment and the amount credited to filtration determines the amount of inactivation that must be obtained through the disinfection process. Table 1.1 summarizes the log removal credit and the resulting disinfection requirement for each treatment type. Section 5 includes information on additional treatment options and their credits as defined by the LT2 Rule, which may be helpful to systems if treatment enhancements are needed in 2011 or later.

Table 1.1 Log Removal Credits for Each Type of Treatment Process

Treatment Process	Typical Log Removal Credits through Filtration			Resulting Log Inactivation Requirements through Disinfection *(excludes LT2 Requirements)*		
	Crypto-sporidium	***Giardia lamblia***	**Viruses**	***Crypto-sporidium***	***Giardia lamblia***	**Viruses**
Conventional Treatment (including Lime Softening)	2	2.5	2	0	0.5	2
Direct Filtration	2	2	1	0	1	3
Slow Sand Filtration	2	2	2	0	1	2
Diatomaceous Earth Filtration	2	2	1	0	1	3
Alternative (membranes, bag filters, cartridges)	*	*	*	*	*	*
Unfiltered	0	0	0	2	3	4

* Systems must demonstrate to DEQ by pilot study or other means that the alternative filtration technology provides the required log removal and inactivation.

For example, systems that use conventional treatment would be assumed to achieve 2-log removal of *Cryptosporidium*, 2.5-log removal of *Giardia*, and 2-log removal of viruses in the filtration process and then need to achieve 0.5-log inactivation of *Giardia* and 2-log inactivation of viruses with disinfection to

meet the total log reduction. Meeting the turbidity and disinfection requirements of the surface water treatment regulations ensures that systems are able to achieve these log removal/inactivation credits.

The following definitions will be helpful in identifying the type of treatment provided by a particular system:

- *Conventional Filtration Treatment* – a series of processes including coagulation, flocculation, sedimentation, and filtration resulting in substantial particulate removal. Lime softening facilities treating surface water sources and contact adsorption clarifier (CAC) units are considered conventional filtration treatment
    - *Sedimentation* – means a process for removal of solids before filtration by gravity or separation.
- *Direct Filtration* – a series of processes including coagulation and filtration but excluding sedimentation resulting in substantial particulate removal. Depending on the system, the flocculation process may or may not be included.
- *Slow Sand Filtration* – a process involving passage of raw water through a bed of sand at low velocity resulting in substantial particulate removal by physical and biological mechanisms.
- *Diatomaceous Earth (DE) Filtration* – a process resulting in substantial particulate removal in which a precoat cake of diatomaceous earth filter media is deposited on a support membrane while water is filtered by passing through the cake. Additional filter media (body feed) is continuously added to the feed water to maintain the permeability of the filter cake.
- *Alternative filtration* – a filtration technology other than conventional, direct, slow sand, or diatomaceous earth filtration such as membrane filtration or bag and cartridge filters.
- *Unfiltered Systems Meeting Filtration Avoidance Criteria* – systems that do not filter and rely entirely on meeting criteria for watershed control programs, A-closed watershed classification in ARM 17.30.621, water quality, and disinfection practices to protect public health from disease causing organisms.

1.3. HOW TO USE THIS DOCUMENT

> *Systems that are unfiltered but are required to install filtration must meet the requirements specified by DEQ for their system.*

This document summarizes all of the regulations related specifically to the treatment and monitoring of surface water systems. The document has been organized to address requirements that apply to all systems in a single section, with discussion of requirements that are specific to certain types of filtration technologies or to systems avoiding filtration in distinct portions of the document. Systems should identify their type of treatment and refer to the applicable sections of this summary.

The following is a brief description of each of the sections of this document that is intended to help identify the pertinent sections for each type of surface water treatment system.

- **Requirements Applicable to All Systems** (Section 2)

  All systems that use surface water must meet specific disinfection treatment requirements including inactivation requirements, maximum residual disinfectant levels, and maximum disinfection byproduct levels. Systems must also perform disinfection profiling and benchmarking, and meet disinfection reporting requirements. This section addresses the disinfection requirements that all surface systems must meet as well as the requirements for reporting and recordkeeping related to water treatment, performing and reporting to DEQ the calibration of turbidimeters, and the treatment technique requirements for acrylamide and epichlorohydrin if water treatment chemicals are used that may contain either of those two compounds. Each of these items is discussed in this section as they apply to surface water systems.

- **Filtration Treatment Requirements** (Section 3)

  Turbidity performance, monitoring, and reporting requirements; follow-up actions triggered by filter effluent turbidities; recycled treatment waste stream requirements; disinfection byproduct precursor requirements; and related public notification requirements for violations are addressed in this section. The information is presented in three subsections covering conventional and direct filtration, slow sand and diatomaceous earth filtration, and alternative filtration technologies.

- **Systems Meeting Filtration Avoidance Criteria** (Section 4)

  Specific disinfection treatment equipment and watershed control program requirements for systems avoiding filtration are included in this section. Annual onsite inspection requirements, violations, and related public notification requirements applicable to these systems are also summarized. This section *does not* apply to systems that are unfiltered but are required to install filtration – requirements for such systems are specified by DEQ.

- **Long Term 2 Enhanced Surface Water Treatment Rule** (Section 5)

  Existing source water monitoring requirements and other possible treatment implications from the LT2 Rule are summarized in this chapter. All systems should read this chapter since the regulation affects filtered systems and systems avoiding filtration.

- **Operator Certification and Classification** (Section 6)

  All community and non-transient non-community water systems that use surface water or ground water under the direct influence of surface water must comply with operator certification requirements. Although transient non-community water systems are not required to have a certified operator, it is recommended due to the public health risks associated with using surface water as a source of drinking water. All systems should review this section which addresses operator certification requirements for surface water systems.

2. REQUIREMENTS APPLICABLE TO ALL SYSTEMS

Systems that filter surface water or are avoiding filtration must meet specific disinfection treatment requirements including: inactivation (CT) requirements for *Giardia lamblia*, *Cryptosporidium,* and viruses; maximum residual disinfectant levels; maximum disinfection byproduct levels; disinfection profiling and benchmarking; and disinfection reporting requirements.

All surface water systems must meet requirements for reporting and recordkeeping related to water treatment, performing and reporting to DEQ the calibration of turbidimeters, and the treatment technique requirements for acrylamide and epichlorohydrin if water treatment chemicals are used that may contain either of those two compounds.

Each of these items is summarized in this section; key rule provisions are found in ARM 17.38.205, 17.38.217, 17.38.225, and 17.38.234. Systems avoiding filtration may find some of the recordkeeping requirements related to water treatment and the acrylamide and epichlorohydrin requirements may not apply.

2.1. MAXIMUM RESIDUAL DISINFECTANT LEVELS AND DISINFECTION BYPRODUCTS

Requirements for maximum residual disinfectant levels (MRDLs) and disinfection byproducts (DBPs) are discussed in Section 4 of the document, *Drinking Water Regulations Summary: Community and Non-Transient Non-Community Water Systems*. Those requirements are too extensive to also include in this summary of regulations for surface water systems.

2.2. DISINFECTION OF FILTERED SYSTEMS AND FOR FILTRATION AVOIDANCE

All surface water and ground water under the direct influence of surface water (GWUDI) systems are required to achieve 99 percent (2-log) removal of *Cryptosporidium*, 99.9 percent (3-log) inactivation and/or removal of *Giardia lamblia* cysts, and 99.99 percent (4-log) inactivation and/or removal of viruses. Montana systems are also required to monitor disinfectant residual daily in the distribution system.

Although these criteria specify removal for *Cryptosporidium,* the LT2 Rule will require inactivation of *Cryptosporidium* for unfiltered systems avoiding filtration and for some filtered systems with high levels of this organism in their source water. The LT2 Rule is described further in Section 5. Refer to Table 1.1 in Section 1 for a summary of the minimum log inactivation requirements by type of surface water treatment.

Compliance with log inactivation requirements is determined by calculating the CT values for the disinfection system. CT values achieved by the water systems are the concentration of the disinfectant multiplied by the number of minutes of contact time the disinfectant has before the water reaches the first user. CT values that must be met are provided in tables in the regulations, which take the disinfectant used, water temperature, and pH into account when appropriate. The CT tables for the disinfectants and calculations for CT are too complex for this rule summary. This section summarizes the disinfection

requirements and the reporting requirements for surface water systems. Additional disinfection equipment requirements specific to systems avoiding filtration are included in Section 4.

2.2.1 Disinfection Requirements at the Entry Point, and Distribution System

The following explains CT compliance and describes disinfection requirements at the disinfectant point of application, at the entry point to the distribution system, and in the distribution system for all regulations current as of April 2009, except the inactivation requirements of the LT2 Rule which are discussed in Section 5.

CT Compliance

Surface water systems must calculate CT (disinfectant concentration multiplied by time) every day the plant is in operation in order to ensure the system is adequately disinfecting their system.

In order to calculate CT, at least once *daily* a system needs to determine the following:

- Disinfectant residual of the water measured before or at the first customer and measured during peak hourly flow;
- Disinfectant contact time during peak hourly flow;
  - The contact time achieved prior to filtration is *not* included in CT calculations.
- Temperature of the disinfected water measured at the same location and time as the residual disinfectant; and
- If the system uses chlorine, the pH of the disinfected water which must be measured at the same location and time as the residual chlorine.

If the system has more than one entry point before or at the first customer, CT values must be determined for each disinfection sequence immediately prior to the next entry point. The total CT of each of the sequences is used to determine CT compliance.

DEQ has developed specific forms for calculating and recording CT. The forms can be obtained by contacting DEQ. For additional information, refer to the following website: http://www.deq.state.mt.us/wqinfo/pws/pwsMonitoringForms.asp

At the Entry Point

Systems are required to maintain at least 0.2 ppm disinfectant residual at the entry point to the distribution system. The residual disinfectant:

- Cannot drop below 0.2 ppm for more than 4 hours; and
- Must be continuously monitored and the lowest value recorded every day.
- Systems conducting continuous monitoring that experience disinfection equipment failure can substitute grab samples every 4 hours for no more than 5 working days.

In the Distribution System

At least once daily a disinfectant residual test must be performed and recorded in the distribution system.

The concentration cannot be less the detectable level in more than 5% of the samples each month for any two consecutive months that the system serves water to the public.

- A heterotrophic bacteria (HPC) concentration in water in the distribution system less than or equal to 500 per mL is an acceptable substitute for the minimum disinfectant residuals noted above.
- The selected sample locations must be consistent with the sample siting plan used for total coliform monitoring in the distribution system and changed regularly to cover the system completely at least each week.
- Samples for residual disinfectant concentrations must be taken at the same time and location TCR samples are taken unless DEQ determines another location is more representative.

2.2.2 Filtered System and Filtration Avoidance Disinfection-Related Violations

Violations and public notice requirements related to disinfection treatment technique requirements for filtered systems and systems avoiding filtration are shown in Table 2.1 and described below. Systems are in violation if any of the following occur:

- They do not meet disinfection requirements prior to the first customer (CT value).
- They fail to maintain at least 0.2 ppm disinfectant residual at the entry point for more than 4 hours.
- They fail to maintain a distribution system disinfectant residual.

Systems may incur a monitoring violation of they fail to meet any of the monitoring or testing requirements. Testing requirements include the use of approved analytical methods and sampling procedures.

The minimum Tiers for public notification for each of these violations are included in Table 2.1. DEQ may require Tier 1 public notification for disinfection treatment technique violations under certain circumstances, an example of a violation that may trigger a Tier 1 public notification would be the failure of disinfection equipment for an extended period of time.

Table 2.1 Disinfection Treatment Violations and Public Notices **Note that in all cases, DEQ may elevate the public notification Tier to a higher level to ensure the public is notified in a timely manner of conditions or events that may present a public health risk.*		
Violation	Violation Type	*Public Notification Requirement
Failure to meet disinfection requirements at the treatment plant (CT value)	Treatment Technique	Tier 2
Failure to maintain at least 0.2 ppm disinfectant residual at the entry point for more than 4 hours	Treatment Technique	Tier 2
Failure to maintain a distribution system disinfectant residual	Treatment Technique	Tier 2
Failure to meet any monitoring or testing requirements	Monitoring	Tier 3

2.3. DISINFECTION REPORTING REQUIREMENTS

Obtain reporting forms by calling DEQ at 444-4400.

Report to DEQ immediately:

- If at any time the disinfectant residual falls below 0.2 ppm at the entry point to the distribution system.
  - The system must notify DEQ as soon as possible but no later than by the end of the next business day.
  - The system also must notify DEQ by the end of the next business day whether or not the residual was restored to at least 0.2 ppm within 4 hours.

By the 10th of the following month:

- The lowest disinfection residual each day at the entry point to the distribution system.
- Date and duration of each period when the disinfectant residual fell below 0.2 ppm at the entry point and the date DEQ was notified of the occurrence.
- For samples taken in the distribution system
  - Number of instances when the residual disinfectant is measured.
  - Number of instances when the residual disinfectant is measured but is not detected

2.4. DISINFECTION PROFILING AND BENCHMARKING

Disinfection profiling and benchmarking are necessary for *community and non-transient non-community water systems* to determine if they are adding too little or too much disinfectant to their treatment process. They are useful to help implement a balance between making sure enough disinfectant is added to inactivate microorganisms, without adding too much disinfectant that creates issues with disinfection byproducts in the distribution system.

Disinfection Profiling

A disinfection profile is a graph of the log inactivation of *Giardia lamblia* or viruses in the disinfection treatment system. Systems serving fewer than 10,000 people calculate the log inactivation on a weekly basis over a 12-month period so the plot is made of 52 data points. Systems serving 10,000 or more people plot the daily log inactivation for up to a 3-year period.

All community and non-transient non-community water systems must have already completed a profile unless DEQ waived the requirement based on a system's TTHM and HAA5 sample results. For new systems, contact DEQ to obtain guidance on conducting a disinfection profile. If a system was required to perform a profile, they must keep the results of the profile on hand indefinitely.

Under the LT2 Rule, if a system plans to make a significant change to their disinfection practices after they have conducted their source water monitoring, they must develop a profile and calculate a benchmark for *Giardia lamblia* and viruses. More information on the LT2 Rule is found in Section 5.

Disinfection Benchmarking

A disinfection benchmark is the lowest average monthly *Giardia lamblia* inactivation in each year of disinfection profiling data. All systems must calculate a benchmark if:

- The system was required to develop a disinfection profile ***and***
- Plans on making a significant change to its disinfection practice.

Significant changes to disinfection practices include, but are not limited to:

- Changes to the point of disinfection;
- Changes to the disinfectant(s) used in the treatment plant;
- Changes to the disinfection process; or
- Any other modification identified by DEQ.

If a system conducts a benchmark, they must keep the result of the benchmark on hand indefinitely.

DEQ has developed specific forms for calculating CT. The forms can be obtained by contacting DEQ. For additional information, refer to the following website:
http://www.deq.state.mt.us/wqinfo/pws/pwsMonitoringForms.mcpx

2.5. TESTING AND SAMPLING RECORDS AND REPORTING

To ensure the safety of water delivered to consumers it is essential that there be a record of the operations performed in the treatment process. This information is also critical to the ongoing evaluation of the treatment system because it provides records of operations activities and their effect on treatment performance. This section addresses testing and sampling related to treatment other than disinfectant residuals and CT.

2.5.1 Records Related to Water Treatment Other than Disinfection and CT

All surface water systems using coagulation, settling, softening, or filtration must keep a daily record of the operations performed in the treatment process and specific water chemistry tests. Each of these requirements is described as follows:

Water Chemistry and Operations

- Systems using coagulation, settling, softening, or filtration must keep a daily record of operations performed in the treatment process such as: [see 17.38.234(5)]
    - Chemical dosages and adjustments
    - Filter backwash procedures performed
    - Sludge handling or management procedures
    - Hours of plant operation and volume of water produced
    - Observations
    - Costs related to the operation of the plant.
- Surface water systems using coagulation, settling, softening, or filtration must also record the following items that are related to water chemistry and water flow:
    - measured flows
    - phenolphthalein (p) alkalinity
    - total alkalinity
    - hardness (where softening is utilized)
    - chemical doses

2.5.2 Reporting Related to Water Treatment Other than Disinfection and CT

All records related to water treatment must be kept on report forms approved by DEQ and must be prepared in duplicate. Unless indicated otherwise, the originals must be forwarded to DEQ by the 10th day of the month following testing.

Actual laboratory reports may be kept or data may be transferred to tabular summaries, provided the following is included:

- Date, place and time of sampling
- Name of the person who collected the sample
- Identification of the samples regarding whether it was a routine distribution system sample, raw or process water sample, or other special purpose sample
- Date of the analysis
- Laboratory and person performing the analysis
- Analytical technique/analysis method used and the analysis number
- Results of the analysis.

2.6. TURBIDITY METER CALIBRATION

All surface water systems must monitor turbidity using an approved method, whether the system is filtered or avoiding filtration. Because turbidity values are critical to determining compliance, and in some cases treatment requirements, maintaining accurate turbidity meters is very important. Calibration of turbidimeters must be conducted using procedures specified by the meter's manufacturer. Failure to properly maintain and operate a turbidimeter is a monitoring violation.

Montana regulations [see ARM 17.38.225] state that secondary turbidity standards may be used for daily calibration of turbidimeters if those standards are calibrated against an EPA-approved primary at least quarterly. Documentation of the date, analyst performing the procedure, procedures used, and results of the quarterly calibration check must be maintained by the water system and reported to DEQ within 10 days following the end of the month during which this procedure took place.

- Lime softening systems may acidify their representative combined filter effluent turbidity samples prior to analysis using a DEQ approved method.

DEQ may invalidate a turbidity measurement based on documentation that demonstrates the exceedance was caused by turbidimeter performance difficulty or sample site location problems and not indicative of true water quality.

2.7. TREATMENT TECHNIQUE FOR ACRYLAMIDE AND EPICHLOROHYDRIN

Acrylamide and epichlorohydrin are used in the manufacturing process of some water treatment chemicals – specifically some of the chemical coagulants used to improve the coagulation, sedimentation, and filtration treatment processes. It is not feasible to monitor for them in water, so they are regulated by a treatment technique that specifies the maximum amount that can be used in water treatment.

Systems must certify annually in writing to DEQ using a third party or manufacturer's certification that when acrylamide and epichlorohydrin are used in the manufacture of water treatment chemicals used in their system, the combination (or product) of dose and monomer level does not exceed the following:

- Acrylamide – 0.05% dosed at 1 ppm (or equivalent)
- Epichlorohydrin – 0.01% dosed at 20 ppm (or equivalent)

Systems are in violation if they do not meet the requirements for acrylamide or epichlorohydrin when used in their drinking water system. Tier 2 public notification is required for this violation.

Table 2.2 Acrylamide and Epichlorohydrin Violation and Public Notice

Violation	Violation Type	Public Notification Requirement
Acrylamide or Epichlorohydrin requirements not met	Treatment Technique	Tier 2

3. FILTRATION TREATMENT REQUIREMENTS

This section presents, by similar filtration treatment type where the requirements are identical for the grouped treatment technologies: the turbidity performance, monitoring, and reporting requirements; follow-up actions triggered by filter effluent turbidities; disinfection byproduct precursor removal requirements through enhanced coagulation or enhanced softening; recycled treatment waste stream requirements; and related public notification requirements for violations. The requirements are grouped by type of filtration and include: conventional and direct filtration, slow sand and diatomaceous earth filtration, and alternative filtration technologies.

The following definitions will help identify the type of treatment system used by a surface water system.

- ***Conventional Filtration*** – a series of processes including coagulation, flocculation, sedimentation, and filtration resulting in substantial particulate removal.
    - *Contact Adsorption Clarifier (CAC)* – a unit process prior to filtration that combines flocculation and sedimentation into one step. CAC units are conventional filtration systems.
    - *Lime softening* – incorporates the same processes as conventional filtration as well as additional processes to soften the water. Lime softening units are considered conventional filtration systems.
    - *Sedimentation* – means a process for removal of solids before filtration by gravity or separation.
- ***Direct Filtration*** – a series of processes including coagulation and filtration but excluding sedimentation resulting in substantial particulate removal. Depending on the system, the flocculation process may or may not be included.
- ***Slow Sand Filtration*** – a process involving passage of raw water through a bed of sand at low velocity resulting in substantial particulate removal by physical and biological mechanisms.
- ***Diatomaceous Earth (DE) Filtration*** – process resulting in substantial particulate removal in which a pre-coat cake of diatomaceous earth filter media is deposited on a support membrane while water is filtered by passing through the cake. Additional filter media (body feed) is continuously added to the feed water to maintain the permeability of the filter cake.
- ***Alternative Filtration*** – is a filtration technology other than conventional, direct, lime softening, slow sand, or diatomaceous earth filtration that, in combination with the disinfection treatment requirements, consistently achieves 99 percent (2-log) removal of Cryptosporidium, 99.9 percent (3-log) inactivation and/or removal of Giardia lamblia cysts, and 99.99 percent (4-log) inactivation and/or removal of viruses as demonstrated to DEQ through pilot studies or other means. Alternative filtration technologies may include membrane processes, bags and cartridges, or other similar technologies.

3.1. CONVENTIONAL AND DIRECT FILTRATION

Surface water systems using conventional or direct filtration treatment have very similar monitoring, reporting, and turbidity requirements. The requirements for conventional treatment apply to CAC units and lime softening plants using surface water because they meet the definition of a conventional treatment facility. The requirements for direct filtration, including in-line filtration systems, differ slightly from conventional plants in the amount of *Giardia* and virus removal credit allowed for the filtration component of the treatment system (refer to Table 1.1), and whether the system must comply with disinfection byproduct precursor requirements.

3.1.1 Types of Turbidity Requirements

Systems using conventional or direct filtration treatment must meet combined filter effluent (CFE) and individual filter effluent (IFE) turbidity requirements.

> ***Combined filter effluent*** – means a sample that combines the effluent water from all filters in operation at the time the sample is collected. Typical sampling locations include the combined filter effluent piping prior to water reaching the clearwell, or water sampled from the water treatment plant clearwell.
>
> ***Individual filter effluent*** – means the effluent water from individual filters, measured at a point prior to mixing with effluent from other filters or other sources.

Failure to meet CFE requirements is a treatment technique violation. Failure to meet the IFE requirements is also a treatment technique violation, and triggers additional actions to investigate why the treatment plant was not performing adequately.

3.1.2 Combined Filter Effluent Turbidity Requirements

The treatment technique, monitoring, and reporting requirements for conventional and direct filtration treatment system combined filter effluent turbidity are presented in Table 3.1 and described below.

Table 3.1 Combined Filter Effluent (CFE) Treatment Technique Requirements for Conventional or Direct Filtration			
CFE Treatment Technique Requirement	CFE Turbidity Level	CFE Monitoring Frequency	CFE Reporting
Combined Filter Effluent Turbidity Limit based on 95% of monthly measurements.	Less than or equal to 0.3 NTU 95 % of the time.	Record and report one turbidity reading every four hours that the system serves water to the public.	By the 10th of the following month.
Combined Filter Effluent Maximum Turbidity.	1.0 NTU	Record and report one turbidity reading every four hours that the system serves water to the public.	Report to MDEQ within 24 hours if the CFE exceeds 1.0 NTU. Report the maximum CFE by the 10th of the following month if no measurements exceed 1.0 NTU.

CFE Turbidity Level Treatment Technique Requirements

- Turbidity must be less than or equal to 0.3 NTU in at least 95% of the measurements taken each month. That is, 95 percent of the measurements recorded every 4 hours must be less than or equal to 0.3 NTU over each calendar month period.
- Turbidity must not exceed 1.0 NTU at any time during a month.

CFE Monitoring Requirements

- Sample for turbidity and measure and record the results every four hours during plant operation.
    - Sampling may be by grab sample or by continuous monitoring.
    - If the combined filter effluent continuous monitoring equipment fails, the system must conduct 4-hour grab samples until the equipment is replaced or repaired.

CFE Reporting Requirements

Obtain reporting forms by calling DEQ at 444-4400.

- **Report to DEQ immediately:**
  - If turbidity exceeds 1.0 NTU the system must contact DEQ as soon as practical but within 24 hours of learning of the violation.
- Report to DEQ By the 10th of the following month:
  - Total number of measurements taken every 4 hours during the month.
  - Number and percentage of measurements taken that were less than or equal to 0.3 NTU.
  - Date and value of any measurements that exceeded 1.0 NTU.
  - Information pertaining to quarterly turbidimeter calibration against a primary standard.

CFE Recordkeeping Requirements

- CFE records must be retained by the system for at least 3 years.

3.1.3 Individual Filter Effluent (IFE) Turbidity Requirements

In Montana, individual filter effluent turbidity must be less than or equal to 0.5 NTU in 95% of the measurements taken each month and must at no time exceed 5.0 NTU or the system will incur a treatment technique violation.

In addition, under specific circumstances, individual filter effluent turbidity measurements above 1.0 NTU or 2.0 NTU trigger follow-up investigations of the performance of the filter. As for combined filter effluent turbidity, individual filter effluent turbidity over 1.0 NTU must be reported to MDEQ within 24 hours of the exceedance. Tables 3.2, 3.3, and 3.4 and the discussion below further describe these requirements.

Table 3.2 Individual Filter Effluent (IFE) Treatment Technique Requirements for Conventional or Direct Filtration			
IFE Treatment Technique Requirement	IFE Turbidity Level	IFE Monitoring Frequency	IFE Reporting
Individual Filter Effluent Turbidity Limit based on 95% of monthly measurements.	Less than or equal to 0.5 NTU 95 % of the time.	Continuous monitoring recorded no less than every 15 minutes when the system serves water to the public.	By the 10th of the following month.
Individual Filter Effluent Maximum Turbidity.	5.0 NTU	Based on continuous monitoring when the system serves water to the public.	Report to MDEQ within 24 hours if the IFE exceeds 1.0 NTU.

IFE Turbidity Level Treatment Technique Requirements

- Turbidity must be less than or equal to 0.5 NTU in at least 95% of the measurements taken each month. That is, 95 percent of the measurements recorded every 15 minutes must be less than or equal to 0.5 NTU over each calendar month.
    - One exception applies – if the turbidity reading for the effluent from each individual filter is the first reading of the month that exceeds 0.5 NTU and the individual filter is taken off-line within 24 hours after the sample analysis that shows the exceedance.
- Turbidity must not exceed 5.0 NTU at any time during a month.
- If the treatment plant has two or fewer filters, continuous monitoring of the combined filter effluent may be performed instead of individual filer monitoring. In this case, the CFE treatment technique requirements of less than or equal to 0.3 NTU 95% of the time would apply, since it is more stringent than the individual filter effluent limits, and the IFE filter performance investigation triggers would apply. In addition, if combined filter effluent or individual filter effluent requirements are not met, both filters must be examined in the follow-up actions described below.

IFE Monitoring Requirements

- Using a continuously monitoring device, sample for turbidity and measure and record results at least every 15 minutes during plant operation.
- Systems serving 10,000 or more can substitute grab samples every 4 hours for no more than 5 working days if continuously monitoring turbidimeters fail.
- Systems serving less than 10,000 can substitute grab samples every 4 hours for no more than 14 working days if continuously monitoring turbidimeters fail.

IFE Reporting Requirements

- IFE performance is recorded on the forms used for CFE reporting.
- **Report to DEQ immediately:**
    - If turbidity exceeds 1.0 NTU the system must contact DEQ as soon as practical but within 24 hours of learning of the violation.
- Report to DEQ by the 10th of the following month
    - That 15-minute IFE recordings were conducted during the month
    - Follow up reporting when a system exceeds a turbidity trigger (see Table 3.3 for systems serving fewer than 10,000 people or Table 3.4 for systems serving 10,000 or more people)
    - Number and percentage of measurements less than or equal to 0.5 NTU.
    - Date and value of any measurements that exceeded 5.0 NTU.
    - Information on quarterly turbidimeter calibration against a primary standard.

IFE Recordkeeping Requirements

- Systems must maintain continuous individual filter effluent results for at least 3 years.

3.1.4 IFE Follow-Up Actions Triggered by Specific Turbidity Levels

In addition to IFE turbidity treatment technique requirements, specific follow-up actions are triggered by IFE turbidity values that indicate a performance problem with an individual filter. The follow-up actions include filter assessments and Comprehensive Performance Evaluations (CPEs). The triggers and follow-up actions differ slightly by the population served by the system. Tables 3.3 and 3.4 summarize the triggers and actions, and a description of each is provided after the tables are presented.

Table 3.3 IFE Follow-up and Reporting for Systems Serving Fewer than 10,000 People			
Turbidity Trigger	**Follow-up Assessment or CPE Action**	**Report to DEQ**	**Reporting Timeframe**
> 1.0 NTU **In 2 consecutive recordings that are 15 minutes apart** from individual filter or 2 filters if CFE is used instead of IFE	None – other than Reporting	Filter Number(s) Turbidity value(s) Date of trigger Cause (if known) for the exceedance	10th of the following month
> 1.0 NTU **In 2 consecutive recordings that are 15 minutes apart** **for 3 months in a row** from the same individual filter or 2 filters if CFE is used instead of IFE	Conduct a filter self-assessment within 14 days of the exceedance that occurred in the third consecutive month. (Systems with 2 filters that monitor CFE must assess both filters.) *unless a CPE was already required.*	Filter Number(s) Turbidity value(s) Date of trigger Cause (if known) for the exceedance Date filter self-assessment triggered & completed	10th of the following month or within 14 days of filter self-assessment being triggered
> 1.0 NTU **In 2 consecutive recordings that are 15 minutes apart** **for 2 months in a row** **and** **>2.0 NTU in 2 consecutive 15 minute readings** from the same individual filter or 2 filters if CFE is used instead of IFE	Arrange for a CPE to be conducted within 60 days of the 2.0 NTU exceedances *a new CPE is not required if already triggered or system is participating in ongoing tech assistance project*	Filter Number(s) Turbidity value(s) Date of trigger Cause (if known) for the exceedance	10th of the following month
		Submit CPE report	120 days after exceedance

Table 3.4 IFE Follow-up and Reporting for Systems Serving 10,000 or More People			
Turbidity Trigger	**Follow-up Assessment or CPE Action**	**Report to DEQ**	**Reporting Timeframe**
>0.5 NTU **In 2 consecutive recordings** **from the same filter** **that are 15 minutes apart** **at the end of the first 4 hours of continuous filter operation after the filter was backwashed or otherwise taken off-line**	Produce filter profile within 7 days (if cause not known)	Filter Number(s) Turbidity Value Date of trigger Cause (if known) or report profile was produced	Within 7 days of the exceedance
> 1.0 NTU **In 2 consecutive recordings** **from the same filter** **that are 15 minutes apart**	Produce filter profile within 7 days (if cause not known)	Filter Number(s) Turbidity value(s) Date of trigger Cause (if known) for the exceedance	10th of the following month
> 1.0 NTU **In 2 consecutive recordings** **from the same filter** **that are 15 minutes apart** **for 3 months in a row**	Conduct a filter self-assessment within 14 days of the exceedance that occurred in the third consecutive month.	Filter Number(s) Turbidity value(s) Dates of trigger Cause (if known) for the exceedance Date filter self-assessment triggered & completed	10th of the following month or within 14 days of filter self-assessment being triggered
> 2.0 NTU **In 2 consecutive recordings** **from the same filter** **that are 15 minutes apart** **for 2 months in a row**	Arrange for a CPE to be conducted within 30 days of the 2.0 NTU exceedances	Filter Number(s) Turbidity value(s) Dates of trigger Cause (if known) for the exceedance	10th of the following month
		Submit CPE report	90 days after exceedance

Filter Self-Assessment

- A filter self-assessment is an evaluation of a system's filter performance. A self-assessment is performed by the water system and must consist of at least the following:
  - Assessment of filter performance – an assessment of the performance of the filter, such as a need for backwashing of the filter media during the periods in which the turbidity triggers were exceeded;
  - Development of a filter profile – a graphic representation of the turbidity measurements (or total particle counts if particle counting is allowed by DEQ) over the entire filter run from start-up after backwash to initiation of the next backwash event. It should be representative of a typical filter run.
  - Identification and prioritization of factors limiting filter performance – as determined through an evaluation of hydraulic loading issues, filter media condition and placement, valve operations, backwash triggers and practices, etc.;
  - Assessment of the applicability of corrections; and
  - Preparation of a filter assessment report.
- For more information on how to conduct a filter self-assessment, there is a variety of guidance developed by EPA and DEQ. Contact DEQ at 444-4400 to obtain guidance documents or information on locating suggested documents.

Comprehensive Performance Evaluation (CPE)

- The purpose of the CPE is to identify and prioritize factors that are limiting the performance of the treatment plant.
- A CPE is an evaluation of the entire treatment plant including the design, operations, maintenance, and administration of the facility. It must be performed by a party approved by DEQ.
- The public water system is responsible for arranging for a qualified individual or team to conduct the CPE. Contact DEQ at 444-4400 for information on making these arrangements.

3.1.5 Disinfection Byproduct Precursor Requirements for Conventional Filtration Systems

The Disinfection Byproduct Precursors requirements apply to community water systems and non-transient non-community water systems that use conventional filtration treatment (including lime softening treatment and CAC units). If directed by DEQ, it may apply to systems that use direct filtration, It does not apply *to transient water systems.*

Natural organic material (referred to as total organic carbon (TOC)) is found in water. TOC is a disinfection byproduct precursor which means that it will react with disinfectants to form potentially harmful disinfection byproducts (DBPs).

Conventional water treatment plants are capable of removing these precursors under many circumstances. In general, to meet the DBP Precursor requirements conventional water treatment plants must:

- Monitor for source water TOC and alkalinity, and treated water TOC as described in Table 3.5 for routine monitoring and Table 3.6 for reduced monitoring.
- Determine whether precursor removal is necessary and feasible based on the TOC and alkalinity requirements of Table 3.7, and Alternative Compliance Requirements in Table 3.8.
- Practice enhanced coagulation or enhanced softening to remove precursors if required.

Conventional treatment plants must operate with enhanced coagulation or enhanced softening unless alternative criteria are met. The alternative criteria and enhanced treatment methods are complicated and too detailed for this summary guide. This section provides an overview of this regulation, but DEQ will need to be consulted regarding system-specific requirements.

DBP Precursor Routine Monitoring Requirements

Table 3.5 Routine Monitoring Requirements for TOC and Alkalinity

Constituent to be Monitored	Frequency	Where Monitoring Must be Conducted
TOC	One paired TOC sample per plant per **month.** *(A paired sample includes one sample of source water and one of treated water.)*	• One sample of source water prior to any treatment • One sample no later than the point of CFE turbidity monitoring and representative of filtered water
Alkalinity	One alkalinity sample per plant per **month** at same time as source water TOC sample is taken	• Same location as source water TOC sample is taken

DBP Precursor Reduced Monitoring Requirements

In order to meet the requirements for reduced monitoring, systems must have:

- An average treated water TOC less than 2.0 mg/L for 2 consecutive years if raw water is less than 2 mg/L; OR
- An average treated water TOC less than 1.0 mg/L for 1 year if raw water is less than 2 mg/L; OR
- Demonstrated through testing that they cannot meet the TOC removal requirements.

Table 3.6 Reduced Monitoring Requirements for TOCs and Alkalinity

Constituent to be Monitored	Frequency	Where Monitoring Must be Conducted
TOC	One paired TOC sample per plant per **quarter** *(A paired sample includes one sample of source water and one of treated water.)*	• One sample of source water prior to any treatment • One sample no later than the point of CFE turbidity monitoring and representative of filtered water
Alkalinity	One alkalinity sample per plant per **quarter** at same time as source water TOC sample is taken	• Same location as source water TOC sample is taken

Percent TOC Removal Requirements

Conventional filtration systems are required to remove a percentage of TOC from the source water. These removal percentages were developed based on historical performance of conventional filtration and softening systems. The percent removal is based on the source water TOC and alkalinity levels. As source water alkalinity increases, the required removal percentage decreases.

- Systems must achieve the percent reduction of TOC between the source water and the combined filter effluent specified in Table 3.7. These are referred to as "Step 1" requirements
- Systems using softening must meet the TOC requirements in the "greater than 120" column regardless of their water alkalinity. This is due to the fact that these systems typically have very high levels of alkalinity.

Systems unable to meet the removal requirements listed in Table 3.7 must apply to DEQ for approval of an alternate minimum TOC removal requirement – this involves additional investigation of treatment capabilities and is referred to as "Step 2" requirements. Contact DEQ for more information on this requirement.

- If a system can meet at least one of the six alternative compliance criteria, they are in compliance with the enhanced coagulation and enhanced softening requirements.
- Alternative compliance criteria considers the source water TOC levels, treated water TOC levels, source water alkalinity, and distribution system total trihalomethane (TTHM) and regulated haloacetic acid (HAA5) levels.

Table 3.7 Percent Removal Requirements of TOC

Step 1 TOC Percent Removal Requirements

Source Water TOC (mg/L)	**Source Water Alkalinity (mg/L as $CaCO_3$)**		
	0-60 mg/L	**> 60-120 mg/L**	**> 120mg/L**
Greater than (>) 2.0 to 4.0	35.0%	25.0%	15.0%
Greater than (>) 4.0 to 8.0	45.0%	35.0%	25.0%
Greater than (>) 8.0	50.0%	40.0%	30.0%

Systems practicing precipitative (not ion exchange) softening must meet TOC removal requirements in the third column

DBP Precursor Reporting Requirements

Obtain reporting forms by calling DEQ at 444-4400.

- Report to DEQ by the 10th of the following month:
  - Number of paired TOC samples taken during last quarter
  - Location, date, result of each paired sample and associated alkalinity taken during last quarter.

- For systems using Step 1 or Step 2 enhanced coagulation or enhanced softening:
  - For each month in the reporting period, the arithmetic average of the percent reduction of TOC for each paired sample and the required TOC percent removal.
  - Calculations for determining compliance with the TOC percent removal requirements
  - Whether system is in compliance with the enhanced coagulation or enhanced softening percent removal requirements for the last 4 quarters.
- For systems using an alternative compliance criterion:
  - Meet the requirements specified for the criterion applied to the system.

3.1.6 Treatment Waste-Stream Recycle Requirements

Recycle requirements only apply to conventional and direction filtration systems. If a system recycles spent filter backwash, thickener supernatant, or dewatering liquids, as of June 8, 2006, the flows must be returned through all the unit process or a location specified by DEQ.

3.1.7 Conventional and Direct Filtration Treatment-Related Violations

The following table is a summary of the violations that are applicable to conventional and direct filtration treatment systems as described in this section. For details on public notification requirements identified in this section, refer to Section 7 of the *Drinking Water Regulations Summary: Community and Non-Transient Non-Community Water Systems* document.

Table 3.8 Conventional and Direct Filtration Violations and Public Notices

**Note that in all cases, DEQ may elevate the public notification Tier to a higher level to ensure the public is notified in a timely manner of conditions or events that may present a public health risk.*

Violation	Violation Type	*Public Notification Requirement
CFE turbidity of 0.3 NTU in 95% of the time or IFE of 0.5 NTU 95% of the time was not met	Treatment Technique	Tier 2
Single IFE maximum turbidity of over 5.0 NTU or CFE maximum turbidity of over 1.0 NTU	Treatment Technique	Tier 1 or Tier 2**
Failure to return recycle flows to appropriate location	Treatment Technique	Tier 2
Failure to meet DBP precursor control requirements	Treatment Technique	Tier 2
Failure to meet any monitoring or testing requirements	Monitoring	Tier 3

** For a single exceedance of the IFE or CFE maximum allowable turbidity, DEQ will decide whether Tier 1 or Tier 2 public notification is required. However, if the system does not contact the primacy agency within 24 hours of learning of the violation, Tier 1 public notification is automatically required.

Turbidity Treatment Technique (TT) Violations

- If a system does not meet 0.3 NTU in 95% of their CFE samples or 0.5 NTU in 95% of their IFE samples, they have exceeded the monthly turbidity requirement and are in violation and must provide Tier 2 public notification.
- If a system has a single IFE or CFE maximum turbidity of more than 1.0 NTU, they are in violation and must contact the state within 24 hours. DEQ will decide whether Tier 1 or Tier 2 public notification is appropriate. However, if the system fails to call DEQ within 24 hours, the system must automatically provide Tier 1 public notification.
- If a system has a single IFE maximum turbidity of more than 5.0 NTU, they are in violation and must provide Tier 1 public notification.

Other TT Violations

- Under FBRR, systems are in violation if they fail to return recycle flows through the processes of the existing filtration system or to an alternate location approved by DEQ. Tier 2 public notification is required for this violation.
- Failure to meet DBP precursor (TOC) control requirements or otherwise comply with the enhanced coagulation or enhanced softening requirements is a treatment technique violation.

Monitoring Violations

- Systems that fail to meet any monitoring or testing requirements for any of the surface water treatment regulations are in violation and must provide Tier 3 public notification. The Tier of public notification required by DEQ may be elevated under certain circumstances. An example of this type of violation would be failure to monitor over a period of several months.

3.2. SLOW SAND AND DIATOMACEOUS EARTH FILTRATION

Slow sand and diatomaceous earth (DE) treatment plants have essentially the same surface water treatment technique requirements, although the log removal credits typically awarded for removal of viruses is less for DE systems than slow sand, and small systems using slow sand may reduce turbidity monitoring if approved by DEQ.

3.2.1 Types of Turbidity Requirements

Turbidity is used as a surrogate to ensure a system's treatment process is adequately removing microorganisms. Turbidity is measured for the combined filter effluent and individual filter effluent for slow sand and diatomaceous earth filtration systems in Montana [see ARM 78.38.225].

Combined filter effluent – means a sample that combines the effluent water from all filters in operation at the time the sample is collected. Typical sampling locations include the combined filter effluent piping prior to water reaching the clearwell, or water sampled from the water treatment plant clearwell.

Individual filter effluent – means the effluent water from individual filters, measured at a point prior to mixing with effluent from other filters or other sources.

Turbidity requirements for systems that use slow sand or diatomaceous earth filtration are summarized in Table 3.9 and described below.

Table 3.9 Slow Sand and DE Filtered Water Turbidity Requirements			
CFE and IFE Treatment Technique Requirement	Turbidity Level	Monitoring Frequency	Reporting
Combined Filter Effluent and Individual Filter Effluent limit based on 95% of monthly samples	Less than or equal to 1.0 NTU 95% of the time *unless a higher limit is established for slow sand systems by DEQ*	Record and report one turbidity reading at least every four hours that the system serves water to the public. *Systems using slow sand filtration may reduce to once per day if approved by DEQ*	By the 10th of the following month
Combined Filter Effluent Maximum Turbidity	5.0 NTU		By the 10th of the following month unless filter effluent exceeds 5 NTU then within 24 hours

Filtered Effluent Turbidity Level Requirements

- Turbidity must be less than or equal to 1.0 NTU in at least 95% of the measurements taken each month. That is, 95 percent of the measurements recorded every 4 hours must be less than or equal to 1.0 NTU over a one month period.
    - If approved by DEQ, systems using slow sand filtration may substitute a higher turbidity limit than 1.0 NTU if it is determined the higher turbidity will not interfere with disinfection.
- Turbidity must not exceed 5.0 NTU in the combined filter effluent at any time during the month.

Filtered Effluent Monitoring Requirements

- Sample for turbidity, measure, and record results every four hours during plant operation.
    - If approved by DEQ, systems using slow sand filtration may monitor turbidity once per day if DEQ determines once per day is enough to indicate effective filter performance.

- If the filter effluent monitoring equipment fails, the system must conduct 4-hour grab samples until the equipment is replaced or repaired.
    - This is not applicable for systems using slow sand filtration if once-per-day turbidity monitoring is approved by DEQ

Filter Effluent Reporting Requirements

Obtain reporting forms by calling DEQ at 444-4400.

- **Report to DEQ Immediately:**
    - If turbidity exceeds 5.0 NTU the system must contact DEQ as soon as practical but within 24 hours of learning of the violation.
- Report to DEQ by the 10th of the following month…
    - Total number of measurements taken during the month.
    - Number and percentage of measurements taken that were less than or equal to 1.0 NTU (or the DEQ-approved system-specific higher limit, if applicable).
    - Date and value of any measurements that exceeded 5.0 NTU.
    - Information pertaining to quarterly turbidimeter calibration against a primary standard.

3.2.2 Slow Sand and Diatomaceous Earth Filtration Treatment Violations

The following table summarizes the violations that are applicable to slow sand and diatomaceous earth filtration systems. For details on public notification requirements identified in this section, refer to Section 7 of the *Drinking Water Regulations Summary: Community and Non-Transient Non-Community Water Systems* document.

Table 3.10 Slow Sand and DE Filtered Water Treatment and Monitoring Violations and Public Notification Requirements

**Note that in all cases, DEQ may elevate the public notification Tier to a higher level to ensure the public is notified in a timely manner of conditions or events that may present a public health risk.*

Violation	Violation Type	*Public Notification Requirement
IFE or CFE turbidity of 1.0 NTU in 95% of the monthly samples was not met (or a higher limit for slow sand filters if approved by DEQ)	Treatment Technique	Tier 2
Single measurement of IFE or CFE is over the maximum turbidity of 5.0 NTU	Treatment Technique	Tier 1 or Tier 2**
Failure to meet any monitoring or testing requirements	Monitoring	Tier 3

** For a single exceedance of the IFE or CFE maximum allowable turbidity, DEQ will decide whether Tier 1 or Tier 2 public notification is required. However, if the system does not contact the primacy agency within 24 hours of learning of the violation, Tier 1 public notification is automatically required.

Turbidity Treatment Technique (TT) Violations

- If a system does not meet 1.0 NTU in 95 percent of their monthly samples, or a system –specific higher limit for slow sand filtration if approved by DEQ, they have exceeded the monthly turbidity requirement and are in violation.
- If a system has a single IFE or CFE maximum turbidity of over 5.0 NTU, they are in violation and must contact the state within 24 hours. DEQ will decide whether Tier 1 or Tier 2 public notification is appropriate. However, if the system fails to call DEQ within 24 hours, the system must automatically provide Tier 1 public notification.

Monitoring Violations

- Systems that fail to meet any monitoring or testing requirements for any of the surface water treatment regulations are in violation and must provide Tier 3 public notification.

3.3. ALTERNATIVE FILTRATION TECHNOLOGIES

This section summarizes the requirements for alternative filtration technologies. Examples of alternative filtration technologies include membranes, bag filers, and cartridge filters. It is important to note that alternative filtration systems must demonstrate their ability to control pathogens. This demonstration may be obtained through data provided by the manufacturer and/or through on-site pilot studies, depending on the requirements specified by DEQ.

3.3.1 Types of Turbidity Requirements

Turbidity is used as a surrogate to ensure a system's treatment process is adequately removing microorganisms. Turbidity is measured for the combined filter effluent and individual filter effluent.

Combined filter effluent – means a sample that combines the effluent water from all filters in operation at the time the sample is collected. Typical sampling locations include the combined filter effluent piping prior to water reaching the clearwell, or water sampled from the water treatment plant clearwell.

Individual filter effluent – means the effluent water from individual filters, measured at a point prior to mixing with effluent from other filters or other sources.

Turbidity requirements for systems that use alternative filtration are assigned on a system-specific basis by DEQ and cannot exceed the maximum limits summarized in Table 3.11 and described below.

Table 3.11 Alternative Filtration Technology Maximum Filtered Water Turbidity Limits			
CFE and IFE Treatment Technique Requirement	Maximum Turbidity Level	Monitoring Frequency	Reporting
Combined Filter Effluent and Individual Filter Effluent limit based on 95% of monthly samples	Set by DEQ but must be less than or equal to 1.0 NTU 95% of the time	Record and report one measurement at least every four hours that the system serves water to the public. *Systems using alternative filtration treatment may reduce to once per day if approved by DEQ*	By the 10th of the following month
Combined Filter Effluent Maximum Turbidity	5.0 NTU		By the 10th of the following month unless filter effluent exceeds 5.0 NTU then within 24 hours

Filtered Effluent Turbidity Level Requirements

- A system-specific turbidity limit will be set by DEQ. The limit cannot be higher than 1.0 NTU in at least 95% of the measurements taken each month, and may be much lower if the treatment technology warrants a lower limit.
    - To be in compliance, the system must be less than or equal to the DEQ-specified limit in 95 percent of the measurements recorded every 4 hours over a one month period.
- Turbidity must not exceed 5.0 NTU in the combined filter effluent at any time during the month.

Filtered Effluent Monitoring Requirements

- Sample for turbidity and measure and record results every four hours during plant operation.
    - If approved by DEQ, systems using alternative filtration technologies may monitor turbidity once per day if DEQ determines once per day is enough to indicate effective filter performance.
- If the filter effluent monitoring equipment fails, the system must conduct 4-hour grab samples until the equipment is replaced or repaired.
    - This is not applicable for systems using alternative filtration if once-per-day turbidity monitoring is approved by DEQ

Filter Effluent Reporting Requirements

Obtain reporting forms by calling DEQ at 444-4400.

- Report to DEQ Immediately:
  - If turbidity exceeds 5.0 NTU, the system must contact DEQ as soon as practical but within 24 hours of learning of the violation.
- Report to DEQ by the 10th of the following month:
  - Total number of measurements taken during the month.
  - Number and percentage of measurements taken that were less than or equal to the DEQ-established turbidity limit.
  - Date and value of any measurements that exceeded 5.0 NTU.
  - Information pertaining to quarterly turbidimeter calibration against a primary standard.

3.3.2 Alternative Filtration Treatment Violations

The following table is a summary of the violations that are applicable to alternative filtration systems. For details on public notification requirements identified in this section, refer to Section 7 of the *Drinking Water Regulations Summary: Community and Non-Transient Non-Community Water Systems* document.

Table 3.12 Violations of Alternative Filtration Technology Water Treatment and Monitoring Requirements

**Note that in all cases, DEQ may elevate the public notification Tier to a higher level to ensure the public is notified in a timely manner of conditions or events that may present a public health risk.*

Alternative Filtration Technology Violation	Violation Type	*Public Notification Requirement
Filter effluent turbidity does not meet the DEQ-specified limit in 95% of the monthly samples	Treatment Technique	Tier 2
Single IFE or CFE maximum turbidity exceedance of 5.0 NTU	Treatment Technique	Tier 1 or Tier 2**
Failure to meet any monitoring or testing requirements	Monitoring	Tier 3

** For a single exceedence of the IFE or CFE maximum allowable turbidity, DEQ will decide whether Tier 1 or Tier 2 public notification is required. However, if the system does not contact the primacy agency within 24 hours of learning of the violation, Tier 1 public notification is automatically required.

Turbidity Treatment Technique (TT) Violations

- If a system does not meet the DEQ-specified turbidity limit in 95% of their monthly samples, they have exceeded the monthly turbidity requirement and are in violation.
- If a system has a single IFE or CFE turbidity reading that exceeds the maximum allowable limit of 5.0 NTU, they are in violation and must contact the state within 24 hours. DEQ will decide whether Tier 1 or Tier 2 public notification is appropriate. However, if the system fails to call DEQ within 24 hours, the system must automatically provide Tier 1 public notification.

Monitoring Violations

- Systems that fail to meet any monitoring or testing requirements for any of the surface water treatment regulations are in violation and must provide Tier 3 public notification.

4. SYSTEMS MEETING FILTRATION AVOIDANCE CRITERIA

Unfiltered surface water systems that meet filtration avoidance criteria are not required to install filtration as long as they continue to meet the criteria. These systems rely entirely on meeting criteria for watershed control programs, A-closed watershed classification in ARM 17.30.621, source water quality requirements, and disinfection practices to protect public health from disease causing organisms. Unfiltered surface water systems meeting filtration avoidance criteria must have a waiver from DEQ to avoid filtration requirements. This section summarizes watershed control requirements, source water quality requirements, disinfection treatment equipment requirements specific to systems avoiding filtration, and other applicable requirements such as other reporting requirements. Other disinfection treatment requirements are included in Section 2 of this document.

4.1. WATERSHED CONTROL REQUIREMENTS

Watershed control must be maintained to minimize contamination by *Giardia lamblia*, viruses, and *Cryptosporidium*. In Montana, only surface water sources in watersheds classified as **A-Closed** in ARM 17.30.621 may be considered for use as an unfiltered system. If source water is obtained from an A-Closed watershed, a DEQ-approved watershed control program must also be developed and implemented.

Watershed Control Program

At a minimum, the watershed control program must:

- Characterize the watershed hydrology and land ownership by:
  - Documenting land ownership areas and specific landowners,
  - Identifying point and non-point sources of pollution discharge, including roads and drainage ditches
  - Point sources are defined discharge points such as discharges from pipes, conduits, or ditches.
  - Non-point sources have no distinctive point of discharge, such as run-off from agricultural fields or animal containment areas.
  - Identifying the location of septic tanks and other waste disposal facilities and their proximity to surface water
  - Producing a documented watershed map depicting all of the items noted above and assigning a reference number or other code by which to identify specific areas and impacts
- Identify watershed characteristics and activities that may have an adverse effect on source water quality by:
  - Documenting activities and specific land uses in all public areas on the watershed map, including pollution control measures practiced by the owner-agency and the population of users involved

- Identifying activities and improvements on all private lands such as
  - buildings,
  - grazing or other agricultural uses and number of livestock involved,
  - animal waste management practices,
  - disposal of human wastes,
  - population involved on a maximum and average-day basis, and
  - use of fertilizers, pesticides, and herbicides,
- Identifying seasonal, short-term, and year-round impacts

o Monitor and control the occurrence of activities that may have an adverse effect on source water quality by:

- Denoting minimum surveillance, monitoring methods, and frequency.
- Denoting the agency contract personnel or other party responsible for assessing impacts and the responsible party's qualifications.
  - Systems must demonstrate through ownership and/or written agreements that activities can be controlled.

o Demonstrate through land ownership or written agreements with land owners that the water systems can control all human activities that may have an adverse impact on the microbiological quality of the water or interfere with disinfection treatment.

- The criteria specifically prohibit fishing, swimming, boating, and camping on the terminal water supply reservoir. The terminal water supply reservoir is the area providing the storage of water immediately prior to treatment and delivery to the distribution system.

Annual Watershed Inspection and Report

Each year, a watershed inspection must be performed by a DEQ-approved party. The inspection includes:

- An assessment of the effectiveness of the watershed control program and
- An inspection and assessment of the disinfection treatment process.

The annual on-site inspection details, including review of the disinfection processes, are described in Section 4.4.

4.2. SOURCE WATER QUALITY REQUIREMENTS

Source water quality requirements for systems meeting criteria to avoid filtration include source water turbidity, and source water fecal coliform or total coliform maximum limits.

4.2.1 Turbidity Requirements

Turbidity Level Requirements

- Turbidity at the source cannot exceed 5.0 NTU unless:
- DEQ determines the event was caused by unusual and unpredictable circumstances; and
- As a result of any such event, the turbidity has not exceeded 5.0 NTU in more than:
  - Two events in the past 12 months the system served water to the public or
  - More than five events in the past 120 months the system served water to the public.

Turbidity Monitoring Requirements

- Systems must monitor source turbidity every 4 hours immediately prior to the first or only point of disinfection.
  - Systems may take grab samples or use continuous turbidity monitoring
- Turbidity Reporting Requirements

  Obtain reporting forms by calling DEQ at 444-4400.
  - **Report to DEQ immediately if:**
    - Turbidity exceeds 5.0 NTU, the system must contact DEQ as soon as practical but within 24 hours of learning of the violation.
  - Report to DEQ by the 10th of the following month…
    - The maximum turbidity level measured during the month.
    - The date(s) turbidity exceeded 5.0 NTU and the date(s) the occurrence(s) was reported to DEQ.
    - The date(s) and number of events that the turbidity exceeded 5.0 NTU in the previous 12 months the system served water to the public (an event is a series of consecutive days that at least one turbidity reading is over 5.0 NTU).
    - The date(s) and number of events that the turbidity exceeded 5.0 NTU in the previous 120 months the system served water to the public (an event is a series of consecutive days that at least one turbidity reading is over 5.0 NTU).
    - Information pertaining to quarterly turbidimeter calibration against a primary standard.

4.2.2 Source Water Coliform Requirements

Total and Fecal Coliform Source Water Limits

- Fecal coliform concentrations must be less than or equal to 20/100 mL *or* total coliform must be less than or equal to 100/100 mL in source samples…
  - Collected immediately prior to the first or only point of disinfection
  - In at least 90 percent of the measurements made for the 6 previous months that the system served water to the public on an ongoing basis.
- If the system measures both fecal and total coliforms, only the fecal coliform criteria must be met.

Total and Fecal Coliform Monitoring Requirements

- Source water fecal coliform or total coliform density measurements must be performed weekly.
  - If more than one sample is required the samples must be taken on separate days.
- The number of source water samples collected per week depends on the number of people a system serves as shown in Table 4.1.

Table 4.1 Source Water Coliform Monitoring Requirements for Systems Avoiding Filtration

Population Served by the System	Number of Samples per Week[1]
500 or less	1
501 to 3,300	2
3,301 to 10,000	3
10,001 to 25,000	4
More than 25,000	5

[1] If more than one sample is required, samples must be taken on separate days

- If the source water turbidity exceeds 1.0 NTU, systems must also collect one total coliform sample at or near the first customer and use the results of that sample in determining compliance with the Total Coliform Rule requirements.
    - The sample must be collected within 24 hours of the first turbidity exceedance, unless DEQ approves an alternative schedule based on an inability to have the sample analyzed within 30 hours of collection.
    - Total Coliform Rule requirements are described in the *Drinking Water Regulations Summary: Community and Non-Transient Non-Community Water Systems* or the *Drinking Water Regulations Summary: Transient Non-Community Public Water Systems* documents

Source Water Total and Fecal Coliform Reporting Requirements

Obtain reporting forms by calling DEQ at 444-4400**.**

- Report to DEQ by the 10th of the following month:
    - Cumulative number of months for which results are reported
    - For systems analyzing total coliforms in the source:
        - Number total coliform samples analyzed during the month, the dates of sample collection, and the dates when turbidity level exceeded 1.0 NTU
        - Number of samples during the month that were equal to or less than 100 total coliforms per 100 mL
        - The cumulative number of total coliform samples during the previous six months the system served water to the public
        - The cumulative number of samples that were equal to or less than 100 total coliforms per 100 mL during the previous six months the system served water to the public
        - The percentage of samples that were equal to or less than 100 total coliforms per 100 mL during the previous six months the system served water to the public
    - For systems analyzing fecal coliforms in the source:
        - Number fecal coliform samples analyzed during the month, the dates of sample collection, and the dates when turbidity level exceeded 1.0 NTU
        - Number of samples during the month that were equal to or less than 20 fecal coliforms per 100 mL.

- The cumulative number of fecal coliform samples during the previous six months the system served water to the public
- The cumulative number of samples that were equal to or less than 20 fecal coliforms per 100 mL during the previous six months the system served water to the public
- The percentage of samples that were equal to or less than 20 fecal coliforms per 100 mL during the previous six months the system served water to the public

- For systems monitoring for both total coliforms and fecal coliforms, only fecal coliform results must be reported

- A report that summarizes a system's compliance with watershed control program requirements.
- A report on the on-site inspection conducted during that year unless DEQ conducted the inspection in which case DEQ must provide a copy of the report to the system.

4.3. DISINFECTION TREATMENT REQUIREMENTS FOR SYSTEMS MEETING FILTRATION AVOIDANCE CRITERIA

Disinfection requirements will change for unfiltered systems meeting the criteria to avoid filtration when the LT2 rule compliance dates must be met. This section summarizes the disinfection requirements other than those in LT2 and other than those that apply to all surface water systems and are summarized in Section 2 of this document. The disinfection requirements of LT2 will not lessen the requirements systems must meet, but will require a second method of disinfection be added to inactivate *Cryptosporidium*. See Section 5 for more information on LT2.

Compliance with the log inactivation requirements are the sole treatment system for unfiltered surface water avoiding filtration. CT values achieved by the water system are the concentration of the disinfectant multiplied by the number of minutes of contact time the disinfectant has before the water reaches the first user. CT values that must be met are provided in tables in the regulations, which take water temperature and pH into account when appropriate. The CT tables for the disinfectants and calculations for CT are too complex for this rule summary. This section summarizes the log inactivation requirements and the disinfection equipment requirements for unfiltered surface water systems avoiding filtration.

Log-Inactivation Requirements

Disinfection must provide 99.9 percent (3-log) inactivation of *Giardia lamblia,* and 99.99 percent (4-log) inactivation of viruses every day the system serves water to the public:

- The treatment must be achieved every day of the month, except one day per month is allowed to not achieve the requirement.
  - CT values must be calculated daily

- The treatment must be met in at least 11 of the past 12 months unless caused by "unusual and unpredictable circumstances" as agreed-to by DEQ.
    - That is, if more than one day occurs where the CT requirements are not met, it cannot occur in more than one month in each rolling 12-month period.

If the system has more than one point of disinfectant application before or at the first customer, CT values must be determined for each disinfection sequence immediately prior to the next point of application. The total CT of each of the sequences is used to determine CT compliance.

DEQ has developed specific forms for calculating CT. The forms can be obtained by contacting DEQ. For additional information, refer to the following website: http://www.deq.state.mt.us/wqinfo/pws/pwsMonitoringForms.asp.

Equipment Requirements for Unfiltered Systems

The disinfection system must have:

- Redundant disinfection components including auxiliary power supply with automatic start-up and alarms to ensure disinfection is maintained continuously; OR
- Automatic shut-off of water to the distribution system when residual disinfectant is below 0.2 ppm.

Disinfectant At the Entry Point

These requirements for unfiltered surface water systems avoiding filtration are the same as for filtered systems. The requirements are summarized in Section 2 of this document.

4.4. OTHER REQUIREMENTS FOR UNFILTERED SYSTEMS

Annual Onsite Inspection

Systems that do not filter are subject to an annual on-site inspection to assess their watershed control program and disinfection treatment process. DEQ or a third party approved by DEQ must conduct the on-site inspection. The inspection must show that the watershed control program and disinfection treatment process are adequately designed and maintained.

A report of the on-site inspection summarizing all findings must be prepared every year and include:

- A review of the effectiveness of the watershed control program
- A review of the physical condition of the source intake and how well it is protected
- A review of the system's equipment maintenance program
- An inspection of the disinfection equipment for physical deterioration
- A review of operating procedures
- A review of data records to ensure that all required tests are being conducted and recorded and disinfection is effectively practiced

- Identification of any improvements which are needed in the equipment, system maintenance and operation, or data collection

Other Reporting Requirements

In addition to the reporting requirements discussed in this section, **systems must report to DEQ immediately**:

- If a waterborne disease outbreak potentially attributable to the system has occurred.

4.5 FILTRATION AVOIDANCE VIOLATIONS OTHER THAN DISINFECTION TREATMENT REQUIREMENTS

Table 4.2 is a summary of the violations that are applicable to unfiltered systems avoiding filtration. Failure to meet the treatment technique requirements may cause the system to be required to install filtration or cease using the unfiltered surface water as a source of supply.

For details on the violations, see the discussion in the previous sections on each of the requirements.

For details on public notification requirements identified in this section, refer to Section 7 of the *Drinking Water Regulations Summary: Community and Non-Transient Non-Community Water Systems* document.

Table 4.2 Violations of Unfiltered Surface Water Systems Avoiding Filtration Water Treatment and Monitoring Requirements

**Note that in all cases, DEQ may elevate the public notification Tier to a higher level to ensure the public is notified in a timely manner of conditions or events that may present a public health risk.*

Violation	Violation Type	*Public Notification Requirement
Failure to meet the total or fecal coliform source water limits.	Treatment Technique	Tier 2
Failure to meet the source water turbidity limits of 5.0 NTU.	Treatment Technique	Tier 1 or Tier 2**
Failure to install filtration if required to do so by DEQ	Treatment Technique	Tier 2
Failure to meet watershed control program requirements	Treatment Technique	Tier 2
Failure to meet the requirements of the coliform rule (unless DEQ has determined the violation is not related to source water treatment) or the disinfection byproducts rules	Treatment Technique	Tier 2
Failure to meet any monitoring or testing requirements	Monitoring	Tier 3

** DEQ will decide whether Tier 1 or Tier 2 public notification is required. However, if the system does not contact the primacy agency within 24 hours of learning of the violation, Tier 1 public notification is automatically required.

5. LONG TERM 2 ENHANCED SURFACE WATER TREATMENT RULE

The LT2 Rule is intended to target systems at risk for waterborne disease outbreaks because their source water quality would not be sufficiently treated through compliance with other surface water treatment regulations. The LT2 Rule requires source water quality monitoring to determine if additional treatment or other tools are necessary. It also requires unfiltered systems to install a second inactivation method to control *Cryptosporidium*. The regulation also mandates that uncovered finished water storage facilities be covered or their discharge be treated. A Fact Sheet for the LT2 Rule has been prepared by EPA to describe these regulatory requirements.

5.1. INITIAL EVALUATION OF SOURCE WATER QUALITY

- Large systems (serving 10,000 or more people) that provide filtration conduct a 2-year sampling program for *Cryptosporidium, E. coli,* and turbidity.
- Large unfiltered systems also conduct a 2-year program, and in addition to the fecal coliform and turbidity source sampling that they already conduct, they sample for *Cryptosporidium*.
- Smaller systems have the option of sampling for *E. coli* for one year. Depending on the results of this monitoring, they may or may not need to conduct a 1 or 2 year *Cryptosporidium* sampling program.

By the date of this publication (April 2009), all systems should have either begun or have completed their initial source water quality sampling program. The results of this sampling will determine if additional treatment or other water protection tools are necessary to provide public health protection from *Cryptosporidium*. A second round of source water monitoring will be performed beginning in 2015, depending on the system size.

If a system determines they will not perform source water sampling, they must commit to installation of treatment to obtain 5.5-log removal/inactivation of Cryptosporidium beginning in 2012, depending on system size.

5.2. UNFILTERED SYSTEMS

Based on the source water sampling conducted, unfiltered systems will calculate a "mean *Cryptosporidium* level" based on the average level of *Cryptosporidium* found during sampling. Systems that found no more than an average of 0.01 *Cryptosporidium* oocysts per liter will be required to provide 2-log inactivation of *Cryptosporidium*. Systems that find higher *Cryptosporidium* levels will be required to provide 3-log inactivation of *Cryptosporidium.*

Systems that do not perform source water monitoring to determine their bin concentration must notify DEQ of their intent to provide 5.5-log *Cryptosporidium* treatment no later than the date they were required to submit their plan for monitoring, and they must meet the treatment compliance dates that begin in 2012, depending on system size.

Table 6.1 *Cryptosporidium* Treatment Requirements for Unfiltered Systems Avoiding Filtration Under LT2	
Mean Cryptosporidium Level	***Cryptosporidium Inactivation Requirements***
<=0.01 oocysts/L	2-log inactivation
>0.01 oocysts/L	3-log inactivation

The following are additional requirements for unfiltered systems:

- The disinfection processes must collectively meet all 3 inactivation requirements (4.0-log inactivation of viruses, 3.0-log inactivation of *Giardia lamblia,* and 2.0 or 3.0-log inactivation of *Cryptosporidium* depending on findings of sampling.)
- The system must utilize at least two different disinfectants to meet their overall inactivation requirements.
- The system must utilize at least one of the following disinfectants
    - chlorine dioxide, ozone, or UV
- Each of the disinfectants must achieve the total inactivation required for at least one of the three pathogen types.

5.3. FILTERED SYSTEMS

Based on the sampling conducted, filtered systems will calculate a “bin concentration” or average level of *Cryptosporidium* found during sampling. Systems that fall into Bin 1, meaning they found less than an average of 0.075 *Cryptosporidium* oocysts, will not be required to provide any additional treatment. Systems that have higher *Cryptosporidium* levels are assigned to Bins 2-4, and the required additional treatment is shown in Table 6.2.

Systems that do not perform source water monitoring to determine their bin concentration must notify DEQ of their intent to provide 5.5-log *Cryptosporidium* treatment no later than the date they were required to submit their plan for monitoring, and they must meet the treatment compliance dates that begin in 2012, depending on system size.

If a system determines that their system falls into Bins 2-4, the “tools” available to achieve additional Cryptosporidium log credit are provided in Table 6.3.

Table 6.2 LT2 Rule *Cryptosporidium* Treatment Requirements for Filtered Systems					
Bin	***Cryptosporidium Bin Concentration***	***Additional Cryptosporidium Treatment Required***			***Total Treatment Requirements for Alternative Filtration***
		Conventional	***Direct***	***Slow Sand & DE***	
1	<0.075 oocysts/L	No additional treatment required			No additional treatment
2	0.075 to <1.0 oocysts/L	1-log additional	1.5-log additional	1-log additional	4.0-log **total**
3	1.0 to <3.0 oocysts/L	2-log additional	2.5-log additional	2-log additional	5.0-log **total**
4	>=3.0 oocysts/L	2.5-log additional	3-log additional	2.5-log additional	5.5-log **total**

Table 6.3 LT2 Microbial Toolbox: Options, Log Credits, and Summary of Design/Implementation Criteria	
Toolbox Option	***Cryptosporidium* log credit with design and implementation criteria**
Source Toolbox Components	
Watershed Control Program	0.5-log credit for state-approved program
Alternative source/ Intake management	No prescribed credit.
Pre-filtration Toolbox Components	
Pre-sedimentation basin with coagulation	0.5-log credit with continuous operation and coagulant addition.
Two-stage Lime softening	0.5-log additional credit.
Treatment Performance Toolbox Components	
Combined filter performance	0.5-log credit for CFE turbidity #0.15 NTU in 95 percent of samples each month.
Individual filter performance	0.5-log credit (in addition to 0.5-log combined filter performance credit) if IFE turbidity is #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.
Demonstration of Performance	State-approved credit.
Additional Filtration Toolbox Components	
Bag filters	Up to 2.0-log credit for individual bag filters. Up to a 2.5-log credit for bag filters in series.
Cartridge filters	Up to 2.0-log credit for individual cartridges. Up to a 2.5-log credit for cartridges in series.
Membranes (microfiltration, ultrafiltration, nanofiltration, reverse osmosis)	Log credit equivalent to removal efficiency demonstrated in challenge test.
Second stage filtration	0.5-log credit.
Slow sand filters	2.5-log credit as a secondary filtration step.
Inactivation Toolbox Components	
Chlorine dioxide	Log credit based on measured CT.
Ozone	Log credit based on measured CT.
UV	Log credit based on validated UV dose.

6. OPERATOR CERTIFICATION AND CLASSIFICATION

Administrative Rules of Montana (ARM) 17.38.249, requires that the owner of a community or non-transient non-community public water supply system shall retain a certified operator, as defined in Title 37, chapter 42, MCA. A public water system must report any change in certified operator or designated contact person to the department within 30 days after the change.

6.1. CERTIFIED OPERATOR AND DESIGNATED CONTACT PERSON RESPONSIBILITIES

The certified operator must be in responsible charge of the public water supply and must conduct the required monitoring and reporting for pH, temperature, turbidity, and residual disinfectant concentrations or must properly train the person that will conduct the measurements. The certified operator or a person approved by DEQ must also collect the system's bacteriological samples.

The public water system must also identify a designated contact person who shall be responsible for contact and communications with DEQ in matters relating to system alteration, extension and construction, monitoring and sampling, maintenance, operation, and record keeping, notification, and reporting. The designated contact person may or may not also be the certified operator.

6.2. CERTIFICATION CLASSIFICATIONS FOR SURFACE WATER SYSTEMS

Operators of public water systems that use surface water or ground water under the direct influence of surface water must be Class 1B or Class 2B certified to operate a surface water treatment plant. A treatment plant may be either a filtration and disinfection system, or just disinfection. The certification class depends on the type of treatment used by the system.

Class 1B Water Treatment certification is required for systems that use any of the following:

- Conventional filtration
- Direct filtration
- Lime softening.

Class 2B Water Treatment certification is required for systems that use any of the following:

- Slow sand filtration
- Diatomaceous earth filtration
- Alternative filtration
- Filtration avoidance (unfiltered systems not required to filter).

6.3. CONTINUING EDUCATION REQUIREMENTS

Class 1 and 2 certified operators must also meet continuing education requirements.

- Class 1 certified operators need 2 continuing education credits (CECs), equivalent to 20 hours of training, every 2 year CEC period. CEC periods begin and end on the even year.

- Class 2 certified operators need 1 CEC every 2 year CEC period, which is equivalent to 10 hours of continuing education.

More information on the certified operator program, examinations, study materials, requirements, and licensing is available by contacting the Water and Wastewater Operator Certification Office at 406-444-4584.