

## 5 MICROBIAL -- DISINFECTION BY- PRODUCT RULES

### 5.1 SURFACE WATER TREATMENT RULES

#### 5.1.1 AUTHORITY

This section outlines the monitoring, treatment technique and reporting responsibilities for water systems utilizing either a surface water source or a ground water source under the direct influence of surface water (GWUDI). These monitoring requirements are authorized by both the Federal Safe Drinking Water Act, and recent additions thereto, and the Arkansas Department of Health's Rules and Regulations Pertaining to Public Water Systems (RRPPWS). The Federal requirements can be found in Code of Federal Regulations (CFR), 40 CFR Parts 9, 141, and 142. The state requirements can be found in Sections V, VI, VII, IX, X, XVIII, XXI and XXII of the RRPPWS and Rules and Regulations Pertaining to Water Operator Licensing, Sections III and V.

#### 5.1.2 INTRODUCTION

The **Surface Water Treatment Rule (SWTR)** was promulgated by the Environmental Protection Agency on June 29, 1989. The Rule sets forth drinking water regulations requiring treatment of surface water and GWUDI sources. Regulations regarding filtration were specifically mandated in the amendments to the Safe Drinking Water Act in 1986.

The **Interim Enhanced Surface Water Treatment Rule (IESWTR)** was promulgated by the Environmental Protection Agency on December 16, 1998. The Rule sets forth drinking water regulations requiring enhanced treatment and monitoring of large systems using surface water and GWUDI sources. This Rule builds upon the Surface Water Treatment Rule previously promulgated on June 29, 1989.

The **Long Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR)** was promulgated by the Environmental Protection Agency on January 14, 2002. The Rule sets forth drinking water regulations requiring enhanced treatment and monitoring of small systems using surface water and GWUDI sources. This Rule builds upon the Surface Water Treatment Rule previously promulgated on June 29, 1989.

The **Filter Backwash Recycle Rule (FBRR)** was promulgated by the Environmental Protection Agency on June 8, 2002. The Rule sets forth drinking water regulations for systems using surface water and GWUDI sources using conventional or direct filtration that recycles certain waste streams.

#### 5.1.3 SCOPE

Surface water systems must be in compliance with the **SWTR** by June 29, 1993. Groundwater systems which are found to be directly influenced by surface water must be in compliance with SWTR within 18 months after the determination has been made.

Surface water systems and groundwater systems under the direct influence of surface water (i.e. Subpart H systems) serving a retail population of at least 10,000 people must meet the requirements of the **IESWTR** by January 1, 2002.

Surface water systems and groundwater systems under the direct influence of surface water serving a retail population of less than 10,000 people must meet the requirements of the **LT1ESWTR** by **January 14, 2005**.

The purpose of the IESWTR and the LT1ESWTR is to strengthen the existing SWTR by:

- A. Requiring a 99.0% (2-log) removal of Cryptosporidium,
- B. Strengthening turbidity performance standards to 0.3 NTU in 95% of the readings for the combined filter effluent and lowering the maximum allowed combined filter effluent turbidity to 1.0 NTU for most systems.
- C. Adding individual filter turbidity monitoring and reporting provisions. Filter(s) are required to be continuously monitored (by use of turbidimeter(s)), and
- D. To establish provisions for disinfection profile(s) and benchmarking to assure continued levels of microbial protection where facilities take steps to comply with the new Disinfection By-Product standards (DBP).

All surface water systems and groundwater systems under the direct influence of surface water using conventional or direct filtration and that recycles filter backwash water, thickener supernatant and/or liquids from a solids dewatering process must meet the requirements of the **FBRR**.

#### 5.1.4 ACRONYMS

ADH – Arkansas Department of Health  
CCP – Composite Correction Program  
CPE – Comprehensive Performance Evaluation  
CTA – Comprehensive Technical Assistance  
CT – Residual Disinfectant Concentration x Disinfectant Contact Time  
D/DBP – Disinfectants/Disinfection By-Products  
DOE -- Arkansas Department of Health, Division of Engineering  
EPA – Environmental Protection Agency  
FBRR – Filter Backwash Recycle Rule  
GAC – Granular Activated Carbon  
GWUDI – Ground Water Under the Direct Influence of surface water  
HAA5 – Haloacetic Acids (five)  
ICR – Information Collection Rule  
IESWTR – Interim Enhanced Surface Water Treatment Rule  
LT1ESWTR – Long Term 1 Enhanced Surface Water Treatment Rule  
MCL – Maximum Contaminant Level  
NTU – Nephelometric Turbidity Unit  
SWTR – Surface Water Treatment Rule  
TOC – Total Organic Carbon  
TT – Treatment Technique  
TTHM – Total Trihalomethanes

#### 5.1.5 DEFINITIONS

“Coagulation” – a process using coagulant chemicals and mixing by which colloidal and suspended materials are destabilized and agglomerated into flocs.

“Conventional filtration treatment” – a series of processes including coagulation, flocculation, sedimentation, and filtration resulting in substantial particulate removal.

“Comprehensive Performance Evaluation” (CPE) – a thorough review and analysis of a treatment plant’s performance-based capabilities and associated administrative, operation and maintenance practices. It is conducted to identify factors that may be adversely impacting a plant’s capability to achieve compliance and emphasizes approaches that can be implemented without significant capital improvements. A CPE consists of the following components; assessment of plant performance, evaluation of major unit processes, identification and prioritization of performance

limiting factors, assessment of the applicability of comprehensive technical assistance, and preparation of a CPE report.

“CT” – the product of the residual disinfectant concentration (C) in mg/l and the disinfectant contact time (T) in minutes. The residual disinfectant is measured at the effluent from the basin or pipeline; the contact time is the time at which no more than 10% of the water would have exited a basin or pipeline.

“Direct Filtration” – a series of processes including coagulation and filtration, but excluding sedimentation, resulting in substantial particulate removal.

“Disinfection” – a process which inactivates pathogenic organisms in water by chemical oxidants or equivalent agents.

“Disinfection Profile” – a summary of daily *Giardia lamblia* inactivation through the treatment plant.

“Filter Profile” – a graphical representation of individual filter performance, based on continuous turbidity measurements or total particle counts versus time for an entire filter run, from start-up to backwash inclusively, that includes an assessment of filter performance while another filter is being backwashed.

“Filter Backwash Water” – a stream containing particles that are dislodged from filter media when water is forced back through a filter (backwashed) to clean the filter.

“Filtration” – the process for removing particulate matter from water through the use of porous media including, where appropriate, coagulation, flocculation, and sedimentation. Filtration processes recognized by the SWTR include conventional filtration, direct filtration, diatomaceous earth filtration, and slow sand filtration.

“Giardia lamblia” – a disease causing microorganism found in the feces of humans and a number of warm blooded animals, both domestic and wild. The cyst form of the organism can survive in the environment for several months. Drinking water supplies receiving sewage discharges and runoff from watersheds containing infected animals is the basis for the Surface Water Treatment Rule.

“Groundwater Under the Direct Influence of Surface Water” (GWUDI) – any water beneath the surface of the ground with significant occurrence of: insects or other macroorganisms, algae, large diameter pathogens such as *Giardia lamblia* and *Cryptosporidium*, or the significant and relatively rapid shift in water characteristics such as turbidity, temperature, conductivity, or pH which correlates to climatological or surface water conditions.

“Liquids from Dewatering Processes” – a stream containing liquids generated from a unit used to concentrate solids for disposal.

“Thickener supernatant” – a stream containing the decant from a sedimentation basin, clarifier or other unit that is used to treat water, solids, or semi-solids from the primary treatment processes.

“Sedimentation” – a process for removal of solids by gravity or separation before filtration.

“State” – the delegated state primacy agency responsible for implementation of the National Primary Drinking Water Regulations. In Arkansas this is the Department of Health, Division of Engineering.

“Uncovered finished water storage” – a tank, reservoir, or other facility used to store water that will undergo no further treatment except residual disinfection and is open to the atmosphere. (Note: The phrase “open to the atmosphere” means facilities subject to potential contamination

from rainfall, run off, animals, birds, insects or other sources. Covered tanks with properly constructed and maintained hatches, vents, and overflows are not considered "open to the atmosphere".)

"Virus" – means a virus of fecal origin, which is infectious to humans by waterborne transmission.

## **5.1.6 GENERAL REQUIREMENTS**

### **5.1.6.1 SWTR**

- A. Surface water and groundwater systems under the direct influence of surface water must achieve at least 99.9% (3-log) removal and/or inactivation of *Giardia lamblia* cysts, and a 99.99% (4-log) removal and/or inactivation of enteric viruses prior to the first customer. Removal rates higher than this can be established by the State.
- B. Surface water and ground water systems under the direct influence of surface water must establish, monitor, and report minimum disinfectant levels both at the treatment plant and in the distribution system; and must establish, monitor, and report turbidity levels of finished water.
- C. Each public water system using a surface water source or a ground water source under the direct influence of surface water must be operated by qualified personnel who meet the Water Operator Licensing requirements specified by the State. See "Licensed Water Operator Requirements" chapter of this summary.

### **5.1.6.2 IESWTR**

- D. Additional requirements for surface water systems and groundwater systems under the direct influence of surface water serving a retail population of at least 10,000 people:
  - 1. Systems must achieve at least 99.0% (2-log) removal of *Cryptosporidium*. Removal rates higher than this can be established by the State.
  - 2. Systems must monitor turbidity on each individual filter continuously.
  - 3. Systems (in operation prior to March 19, 1999) must complete monitoring so a disinfection profile and benchmark applicability determination can be made prior to March 16, 2000. Applicability monitoring consists of four consecutive quarters of TTHM and HAA5 monitoring. Systems with annual average levels  $\geq 0.064$  mg/l for TTHM or  $\geq 0.048$  mg/l for HAA5 must complete disinfection profiling and benchmarking. (This process has been completed by all applicable systems.)
    - a) Systems with a start-up date after March 19, 1999, should refer to Section 5.1.12 – Discretionary Items for disinfection profile and benchmark requirements.
  - 4. Systems required to develop a disinfection profile must calculate their disinfection benchmark and consult with the ADH prior to making a significant change in their disinfection process.

### 5.1.6.3 LT1ESWTR

- E. **Beginning January 14, 2005**, except as noted below, additional requirements for surface water systems and groundwater systems under the direct influence of surface water serving a retail population of less than 10,000 people will become effective.
1. Systems must achieve at least 99.0% (2-log) removal of *Cryptosporidium*. Removal rates higher than this can be established by the State.
  2. Systems must monitor turbidity on each individual filter continuously. (Note: Systems with two or fewer filters may conduct continuous monitoring of the combined filter effluent in place of individual filter turbidity monitoring.)
  3. Community and non-transient non-community systems must develop a disinfection profile. The ADH may deem a profile unnecessary based on TTHM and HAA5 sample data collected after January 1, 1998.
    - a) Systems serving a population between 500 and 9,999 people must complete disinfection profiling no later than June 30, 2004.
    - b) Systems serving a population of less than 500 people must complete disinfection profiling no later than December 31, 2004.
  4. Systems required to develop a disinfection profile must calculate their disinfection benchmark and consult with the ADH prior to making a significant change in their disinfection process.

### 5.1.6.4 FBRR

- A. Systems that recycle must submit a recycle notification to the ADH by **December 8, 2003**.
- B. Systems that recycle must collect and retain recycle flow information on file for review and evaluation by the ADH beginning **June 8, 2004**.
- C. Systems that recycle must return recycle flows to the head of the plant by **June 8, 2004**, or
- D. For systems that require capital improvements to return recycle flows to the head of the plant, all capital improvements must be completed by **June 8, 2006**.

### 5.1.6.5 Surface Water Influence Determination

- A. The State must evaluate each well source serving a public water system to determine whether or not the well is directly influenced by surface water. The Department's determination may be based on area geology, well construction, field evaluation, historical water quality data, and/or analysis of current water quality parameters.
- B. Wells serving community water systems were required to have been evaluated by June 29, 1994. Wells serving non-community water systems were required to have been evaluated by June 29, 1999.
- C. If determined to be under the direct influence of surface water, a system must comply with the interim monitoring and disinfection requirements the State deems necessary until

filtration is installed. (Note: Systems declared GWUDI has 18 months to achieve full compliance with the SWTR, IESWTR or LT1ESWTR, as appropriate.)

## 5.1.7 TREATMENT TECHNIQUE REQUIREMENTS

### 5.1.7.1 Turbidity

Failure to meet any requirement of this section is a treatment technique violation.

#### A. Conventional and direct filtration –

1. **SWTR** -- Filtered water turbidity must be less than or equal to 0.5 NTU in at least 95% of the measurements taken each month. The turbidity of any sample must never exceed 5 NTU. These criteria will remain in effect for surface water systems and groundwater systems under the direct influence of surface water serving a retail population of less than 10,000 people until **January 14, 2005**.
2. **IESWTR** – For surface water systems and groundwater systems under the direct influence of surface water serving a retail population of at least 10,000 people, the turbidity level of representative samples of a system's combined filter effluent must be less than or equal to 0.3 NTU in at least 95% of the measurements taken each month. The turbidity level of representative samples of a system's combined filter effluent must at no time exceed 1 NTU.

(Note: A system that uses lime softening may acidify representative samples prior to analysis using a protocol approved by the State.)

3. **LT1ESWTR** -- Beginning **January 14, 2005**, surface water systems and groundwater systems under the direct influence of surface water serving a retail population of less than 10,000 people, must meet the same combined filter effluent turbidity standards required by the IESWTR for large systems as outlined above in Section 5.1.7.1(A2).

- B. Other treatment technologies – contact the Department of Health, Division of Engineering. For additional information see the “Small System Compliance Technology List for the Surface Water Treatment Rule” -- Guidance, EPA 815-R-97-002 @ <http://www.epa.gov/ogwdw/regs/swtrlist.html> .

### 5.1.7.2 Disinfection.

Failure to meet any requirement of this section is a treatment technique violation.

#### **SWTR**

- A. The water system must comply with the log removal/inactivation rate for *Giardia lamblia* cysts and enteric viruses established by the State, as determined by the required CT value.
- B. The residual disinfectant concentration in the water entering the distribution system can not be less than 0.2 mg/l for more than 4 hours.
- C. The residual disinfectant concentration measured in the distribution system cannot be undetectable in more than 5% of the samples each month. Heterotrophic plate counts by a certified laboratory of less than or equal to 500/ml is deemed equal to a detectable residual concentration.

## **IESWTR and LT1ESWTR**

- D. Additional requirements for surface water systems and groundwater systems under the direct influence of surface water.
1. Systems must comply with the requirements for disinfection profiling and benchmarking discussed in Section 5.1.8.

### **5.1.7.3 Recycle Flows – FBRR**

All surface water and/or GWUDI systems using conventional or direct filtration treatment that recycles filter backwash water, thickener supernatant, or liquids from a dewatering process must return these flows to the head of the plant by June 8, 2004. If capital improvements are required to modify the recycle location to meet this requirement, all capital improvements must be completed by June 8, 2006. Failure to return recycle flows by the dates indicated is a treatment technique violation.

### **5.1.8 DISINFECTION PROFILING AND BENCHMARKING**

The **IESWTR** currently requires all public water systems serving a retail population of at least 10,000 people that use surface water sources and/or groundwater sources under the direct influence of surface water to comply with disinfection profiling and benchmarking requirements.

The **LT1ESWTR** will require community and non-transient non-community systems serving a retail population of less than 10,000 people and using surface water sources and/or groundwater sources under the direct influence of surface water to comply with similar disinfection profiling and benchmarking requirements.

Below is a summary of the requirements and critical compliance dates for each rule.

- A. Determination of systems that are required to profile.

### **IESWTR**

1. Applicability Monitoring for Large Systems -- System must determine their TTHM and HAA5 annual average as follows:
  - a) Conduct monitoring for TTHM and HAA5 for four consecutive quarters before March 16, 2000. TTHM and HAA5 shall be monitored during the same period.
  - b) At least 25% of the samples for TTHM and HAA5 shall be taken at locations within the distribution system reflecting maximum residence time of the water in the system.
  - c) The remaining 75% of the samples for TTHM and HAA5 shall be taken at representative locations in the distribution system, taking into account the number of people served, the different sources of water, and the different treatment methods employed.
  - d) Systems that have either a TTHM annual average  $\geq 0.064$  mg/l or an HAA5 annual average  $\geq 0.048$  mg/l must conduct Disinfection Profiling.

### LT1ESWTR

2. Applicability Monitoring for Small Systems – System may determine their TTHM and HAA5 levels in the distribution as follows:
  - a) Conduct optional monitoring for TTHM and HAA5 after January 1, 1998 during the month of warmest water temperature and at the maximum residence time in the distribution system.
  - b) Systems that have TTHM levels  $\geq 0.064$  mg/l or HAA5 levels  $\geq 0.048$  mg/l or do not conduct optional monitoring must conduct a Disinfection Profile.

### B. Developing the Disinfection Profile

#### IESWTR

1. A disinfection profile is developed by compiling daily *Giardia lamblia* log inactivation computed over a 12-month period. In addition, a disinfection profile for daily virus log inactivation must be developed for PWSs that use either chloramines or ozone for primary disinfection. The log inactivation values are calculated using daily measurements of operational data collected during peak-hourly flows. This disinfection profiling must be completed no later than March 2001.
2. A PWS that has 3 years of existing operational data may use these data to develop a disinfection profile as long as the State has determined that these data are substantially equivalent to data that would be collected under the IESWTR.

#### LT1SWTR

3. The disinfection profile is developed by compiling weekly *Giardia lamblia* log inactivation computed over a 12-month period. In addition, a disinfection profile for weekly virus log inactivation must be developed for PWSs that use either chloramines or ozone for primary disinfection. The log inactivation values are calculated using weekly measurements of operational data collected during peak-hourly flows. Systems serving between 500 – 9,999 people must begin disinfection profiling no later than **July 1, 2003** and be completed by **June 30, 2004**. Systems serving less than 500 people must begin disinfection profiling no later than **January 1, 2004** and be completed by **December 31, 2004**.

Note: Systems must keep the disinfection profile on file to be reviewed during its Sanitary Survey.

### C. Disinfection Benchmarking

1. Any system that is required to develop a disinfection profile and decides to make a significant change to its disinfection practice must consult with the State prior to making such change. Significant changes to disinfection practice include but are not limited to:
  - a) Changes to the point of disinfection;

- b) Changes to the disinfectant(s) used in the treatment plant;
  - c) Changes to the disinfection process
2. Any system that is modifying its disinfection practice must calculate its disinfection benchmark (i.e. the lowest monthly average inactivation value based on the Disinfection Profile) and must submit the following information to the State as a part of its consultation process:
- a) A description of the proposed change;
  - b) The disinfection profile for *Giardia lamblia* (and, if necessary, viruses) and the disinfection benchmark;
  - c) An analysis of how the proposed change will affect the current levels of disinfection.
3. The disinfection benchmark is determined as follows:
- a) Using the data collected to develop the disinfection profile, determine the average *Giardia lamblia* inactivation (and if required the average virus inactivation) for each calendar month by dividing the sum of all the inactivations for that month by the number of values calculated for that month.
  - b) The disinfection benchmark is the lowest monthly average value out of the twelve values.

The State will provide technical assistance on a case by case basis for systems required to develop a disinfection profile and benchmark.

## 5.1.9 MONITORING REQUIREMENTS

### 5.1.9.1 Turbidity

#### SWTR

- A. Measurements for turbidity must be performed on a system's filtered water every four hours, or less, that the system serves water to the public.
- B. Samples for turbidity can be taken from the combined filter effluent line, the effluent line from the clearwell, or the treatment plant effluent line to the distribution system. Once chosen, the sample location can not be changed without prior approval from the State. is not to change unless concurred with by the State.
- C. Continuous turbidity monitors can be substituted for grab samples provided the results of the continuous monitor is manually or automatically recorded at least every four hours, and provided the continuous monitor is calibrated on a regular basis.
- D. The State may reduce the turbidity sampling frequency for systems serving 500 or fewer persons to once per day if the State determines that less frequent monitoring is sufficient to indicate effective filtration.

**IESWTR**

Additional monitoring requirements for surface water and GWUDI systems serving a retail population of at least 10,000 people using conventional or direct filtration treatment include:

- E. Continuous monitoring of turbidity on each individual filter effluent line must be performed. The system must record the results of individual filter monitoring every 15 minutes. Turbidimeters must be calibrated using the procedure specified by the manufacturer. (Note: It is recommended that turbidimeters be calibrated using primary standards on a frequency of at least once every 3 months.)
- F. If there is a failure in the continuous turbidity monitoring equipment, the system must conduct grab sampling every 4 hours in lieu of continuous monitoring, but for no more than five working days following the failure of the equipment.

**LT1ESWTR**

Beginning **January 14, 2005**, additional monitoring requirements for surface water and GWUDI systems serving a retail population of less than 10,000 people using conventional or direct filtration treatment will include:

- G. Continuous monitoring of turbidity on each individual filter effluent line must be performed. Systems with two or fewer filters may conduct continuous monitoring of the combined filter effluent turbidity in place of individual filter effluent turbidity monitoring. The system must record the results of individual filter monitoring every 15 minutes. Turbidimeters must be calibrated using the procedure specified by the manufacturer. (Note: It is recommended that turbidimeters be calibrated using primary standards on a frequency of at least once every 3 months.)
- H. If there is a failure in the continuous turbidity monitoring equipment, the system must conduct grab sampling at least every 4 hours in lieu of continuous monitoring, but for no more than 14 days following the failure of the equipment (i.e. the monitoring equipment must be repaired or replaced by the 14<sup>th</sup> day).

**5.1.9.2 Disinfection**

- A. For systems serving greater than 3300 population, the residual disinfection concentration of the water entering the distribution system must be monitored continuously, and the lowest value recorded each day. If there is a failure in the continuous monitoring equipment, grab sampling may be conducted every 4 hours, but for no more than 5 working days following the failure of the equipment (i.e. the monitoring equipment must be repaired or replaced by the 5<sup>th</sup> day).
- B. Systems serving 3300 population or less may take grab samples in lieu of continuous monitoring in accordance with the table below. Samples must be spaced evenly throughout the period(s) of the day when water enters the distribution system. If at any time the residual concentration falls below 0.2mg/l, grab samples must be taken at least every 4 hours until a residual greater than 0.2mg/l is established.

<u>Population</u>	<u>Samples/day</u>
≤ 500	1
501 – 1000	2
1001 – 2500	3
2501 – 3300	4

- C. The residual disinfectant concentration must be measured at least at the same points and at the same time as total coliform bacteriological samples are collected. Heterotrophic plate count analysis by a certified laboratory may be utilized in lieu of residual disinfectant concentration.

### 5.1.9.3 CT

Monitoring for disinfectant residuals, pH, and temperature for each basin where a disinfection credit is desired must be conducted at a frequency and with a protocol established by the State in order to determine compliance for CT.

## 5.1.10 REPORTING AND RECORDKEEPING REQUIREMENTS

### 5.1.10.1 Turbidity

#### SWTR

- A. Results of turbidity measurements must be reported to the State within 10 days after the end of the month on the report form supplied by the State.
- B. If at any time the turbidity exceeds 5 NTU, the system must inform the State as soon as possible, but no later than the end of the next business day.

#### IESWTR & LT1ESWTR

The following Reporting and Recordkeeping requirements for surface water and GWUDI systems serving a retail population of at least 10,000 people (i.e. IESWTR) using filtration treatment are currently in effect. The following Reporting and Recordkeeping requirements for surface water and GWUDI systems serving a retail population of less than 10,000 people (i.e. LT1ESWTR) using filtration treatment become effective on **January 14, 2005**.

- C. Monitoring results must be reported to the State within 10 days after the end of each month the systems serves water to the public on the forms provided by or in a format approved by the State. These reports must include the following:
  - 1. The total number of combined filter effluent turbidity measurements taken during the month
  - 2. The number and percentage of combined filter effluent turbidity measurements taken during the month which are greater than:
    - a) 0.3 NTU for systems using conventional or direct filtration, or
    - b) the turbidity performance standards set by the State for systems utilizing another State approved technology.
  - 3. The date and value of any combined filter effluent turbidity measurements taken during the month which exceeds
    - a) 1 NTU for systems utilizing conventional filtration or direct filtration, or
    - b) the maximum level set by the State for systems utilizing another State approved technology.

4. Verification that individual filter turbidity monitoring was conducted during the month.
- D. Systems must maintain results of individual filter monitoring for at least three years. These records must be readily available for State representatives to review during sanitary surveys or other visits.
- E. Systems must report individual filter turbidity measurements within 10 days after the end of the month the system serves water to the public **only if** measurements demonstrate one of the following:

### **IESWTR**

1. For any individual filter that has a measured turbidity level of greater than 1.0 NTU in two consecutive measurements taken 15 minutes apart, the system must report the filter number, turbidity measurements, and the date(s) on which the exceedance occurred. In addition, the system must either conduct a filter profile for the filter within 7 days of the exceedance (if the system is not able to identify an obvious reason for abnormal filter performance) and either report that the profile has been produced or report the obvious reason for exceedance.
2. For any individual filter that has a measured turbidity level of greater than 0.5 NTU in two consecutive measurements taken 15 minutes apart, **at the end of the first four hours of continuous filter operation after the filter has been backwashed or otherwise taken off line**, the system must report the filter number, turbidity measurements, and the date(s) on which the exceedance occurred. In addition, the system must conduct a filter profile for the filter within 7 days of the exceedance (if the system is not able to identify an obvious reason for abnormal filter performance) and report that the profile has been produced or report the obvious reason for exceedance. (Note: "At the end of the first four hours" means turbidity readings taken at 4 hours and 4 hours and 15 minutes after the filter is placed back into service.)
3. For any individual filter that has a measured turbidity level of greater than 1.0 NTU in two consecutive measurements taken 15 minutes apart at any time in each of **three consecutive months**, the system must report the filter number, turbidity measurements, and the date(s) on which the exceedance occurred. In addition, the system must conduct a self-assessment of the filter within 14 days of the exceedance and report that the self-assessment was conducted, the date that it was triggered and the date that it was completed. The following components must be contained in the self-assessment:
  - a) Assessment of filter performance,
  - b) Development of a filter profile,
  - c) Identification and prioritization of factors limiting filter performance,
  - d) Assessment of the applicability of corrections, and
  - e) Preparation of a filter self-assessment report.
4. For any individual filter that has a measured turbidity level of greater than 2.0 NTU in two consecutive measurements taken 15 minutes apart at any time in

each of **two consecutive months**, the system must report the filter number, turbidity measurement, and the date(s) on which the exceedance occurred. In addition the system must arrange for a CPE evaluation by the State or a third party approved by the State no later than **30** days following the exceedance. The evaluation must be completed and submitted to the State no later than **90** days following the exceedance.

### **LT1ESWTR**

5. For any individual filter (or the combined filter effluent for systems with 2 filters that monitor the combined filter effluent in lieu of individual filters) that has a measured turbidity level of greater than 1.0 NTU in two consecutive measurements taken 15 minutes apart, the system must report the filter number, turbidity measurements, the date(s) on which the exceedance occurred and, if known, the cause for the exceedance.
  
6. For any individual filter (or the combined filter effluent for systems with 2 filters that monitor the combined filter effluent in lieu of individual filters) that has a measured turbidity level of greater than 1.0 NTU in two consecutive measurements taken 15 minutes apart at any time in each of **three consecutive months**, the system must report the filter number, turbidity measurements, and the date(s) on which the exceedance occurred. In addition, the system must conduct a self-assessment of the filter (or both filters, if the system monitors the combined filter effluent in lieu of individual filters) within 14 days of the exceedance and report that the self-assessment was conducted, the date that it was triggered and the date that it was completed. The following components must be contained in the self-assessment:
  - a) Assessment of filter performance,
  - b) Development of a filter profile,
  - c) Identification and prioritization of factors limiting filter performance,
  - d) Assessment of the applicability of corrections, and
  - e) Preparation of a filter self-assessment report.
  
7. For any individual filter (or the combined filter effluent for systems with 2 filters that monitor the combined filter effluent in lieu of individual filters) that has a measured turbidity level of greater than 2.0 NTU in two consecutive measurements taken 15 minutes apart at any time in each of **two consecutive months**, the system must report the filter number, turbidity measurement, and the date(s) on which the exceedance occurred. In addition the system must arrange for a CPE evaluation by the State or a third party approved by the State no later than **60** days following the exceedance. The evaluation must be completed and submitted to the State no later than **120** days following the exceedance. (Note: If a CPE has been conducted by the State or a third party approved by the State within 12 months prior to the exceedance or the system and State are jointly participating in a Comprehensive Technical Assistance Project, a new CPE will not be required.)

### 5.1.10.2 Disinfection

- A. Results of residual disinfection measurements on water entering the distribution system from the treatment plant, and at the total coliform sampling points in the distribution system must be reported to the State within 10 days after the end of the month on the report forms supplied by the State.
- B. If at any time the residual disinfectant concentration in water entering the distribution system from the treatment plant falls below 0.2 mg/L, the system must notify the State as soon as possible, but no later than the end of the next business day. The system must also notify the State within the same time frame whether or not the residual was restored to 0.2 mg/L or higher within 4 hours.

### 5.1.10.3 Disinfection Profiling and Benchmarking

Systems required to develop a disinfection profile must retain disinfection profile data indefinitely on the forms provided by or in a format approved by the State for review as a part of sanitary surveys conducted by the State. Disinfection profile data includes monitoring data necessary to determine the total log inactivation throughout the plant collected on a daily basis for large systems and weekly basis for small systems during peak hourly flow.

### 5.1.10.4 Recycle Flows – FBRR

- A. Recycle Notification: A system must notify the ADH in writing by December 8, 2003, if the system recycles filter backwash water, thickener supernatant, or liquids from the dewatering processes. This notification must include, at a minimum, the following information.
  - 1. A plant schematic showing the origin of all flows that are recycled, the hydraulic conveyance used to transport them, and the location where they are reintroduced back into the treatment plant.
  - 2. Typical recycle flow in gallons per minute, the highest observed plant flow experienced in the previous year (gpm), design flow for the treatment plant (gpm), and the ADH approved operating capacity for the plant.
- B. Recycle Flow Information: Beginning June 8, 2004, the system must collect and retain indefinitely recycle flow information, as indicated below, on file for review and evaluation by the ADH.
  - 1. A copy of the recycle notification and information submitted to the ADH detailed above.
  - 2. A list of all recycle flows and the frequency with which they are returned.
  - 3. The average and maximum backwash flow rate through the filter and the average and maximum duration of the filter backwash process in minutes.
  - 4. The typical filter run length and a written summary of how filter run length is determined.
  - 5. The type of treatment provided for the recycle flow.

6. Data on the physical dimensions of the equalization and /or treatment units, typical and maximum hydraulic loading rates, type of treatment chemicals used and average dose and frequency of use, and frequency at which solids are removed, if applicable.

#### **5.1.10.5 CT**

Results of monitoring for disinfectant residuals, pH, and temperature for the purposes of CT determination must be reported on the form provided by the State within 10 days after the end of the month.

#### **5.1.10.6 Disease Outbreak**

The water system must report to the State as soon as possible, but no later than the end of the next business day, any disease outbreak potentially attributed to the water system.

### **5.1.11 ANALYTICAL TECHNIQUES**

#### **5.1.11.1 Turbidity**

Turbidity must be measured in accordance with EPA Method 180.1, or Method 214A in the 16<sup>th</sup>, or later, edition of Standard Methods for the Examination of Water and Wastewater, 1985, American Public Health Association.

A system that uses lime softening may acidify representative samples prior to analysis. Contact the Arkansas Department of Health, Division of Engineering for detailed instructions regarding the acidification of samples.

#### **5.1.11.2 Disinfectants**

- A. Chlorine. Residual concentration for free and combined chlorine must be measured by one of the following methods listed in the 16<sup>th</sup>, or later, edition of Standard Methods for the Examination of Water and Wastewater, 1985, American Public Health Association. Residuals may also be measured using colorimetric field test kits, provided the kits utilize DPD.

Standard Method 408C (APHA, 1985) – Amperometric Titration Method.

Standard Method 408D (APHA, 1985) – DPD Ferrous Titrimetric Method.

Standard Method 408E (APHA, 1985) – DPD Colorimetric Method.

Note: The numbering nomenclature in later editions of Standard Methods has been changed. Below, for your reference, is a list of the acceptable methods taken from the 19<sup>th</sup> edition of Standard Methods.

Standard Method 4500-Cl D (APHA, 1995) -- Amperometric Titration Method.

Standard Method 4500-Cl E (APHA, 1995) -- Low Level Amperometric Titration Method.

Standard Method 4500-Cl F (APHA, 1995) -- DPD Ferrous Titrimetric Method.

Standard Method 4500-Cl G (APHA, 1995) -- DPD Colorimetric Method.

Standard Method 4500-Cl H (APHA, 1995) -- Syringaldazine (FACTS).

Standard Method 4500-Cl I (APHA, 1995) -- Iodometric Electrode.

- B. Ozone. Residual concentration for ozone must be measured by Method 4500-O3 of the 17<sup>th</sup> edition of Standard Methods for the Examination of Water and Wastewater, 1989, American Public Health Association.
- C. Chlorine Dioxide. Residual concentration of chlorine dioxide must be measured by one of the following methods listed in the 16<sup>th</sup>, or later, edition of Standard Methods for the Examination of Water and Wastewater.

Method 410B (APHA, 1985) -- Amperometric Method.  
Method 410C (APHA, 1985) -- DPD Method.

Note: The numbering nomenclature in later editions of Standard Methods has been changed. Below, for your reference, is a list of the acceptable methods taken from the 19<sup>th</sup> edition of Standard Methods.

Standard Method 4500-CIO2 D (APHA, 1995) – DPD Method.  
Standard Method 4500-CIO2 E (APHA, 1995) – Amperometric Titration Method.

#### **5.1.11.3 pH**

Measurements for pH must be in accordance with Method 423 in the 16<sup>th</sup>, or later, edition of Standard Methods for the Examination of Water and Wastewater. (Note: This method requires the use of a specific ion electrode for pH measurements, colorimetric methods are not acceptable.)

#### **5.1.11.4 Temperature**

Measurements for temperature must be in accordance with Method 212 in the 16<sup>th</sup>, or later, edition of Standard Methods for the Examination of Water and Wastewater.

#### **5.1.11.5 Applicability Monitoring**

- A. Total Trihalomethanes (TTHM) must be handled and analyzed by one of the following analytical methods: EPA 502.2, EPA 524.2, or EPA 551.1.
- B. Haloacetic acids (five) (HAA5) must be handled and analyzed by one of the following analytical methods: EPA 552.1, EPA 552.2, or Standard Method 6251B as stated in the Standard Methods for Examination of Water and Wastewater, 19<sup>th</sup> Edition, 1998.

### **5.1.12 DISCRETIONARY ITEMS**

The Surface Water Treatment Rule requires State discretion in a number of areas in how the regulation is implemented. Following is a list of the major areas of discretion and describes in general how the State will address that discretion. The final determination on all discretionary items is made by the State.

#### **5.1.12.1 Level of Treatment**

All systems have been assigned a minimum treatment level of 99.9% (3 log) removal/inactivation of *Giardia lamblia* cysts and a 99.99% (4 log) removal/inactivation for viruses. Systems serving a retail population of at least 10,000 people have been assigned a minimum treatment level of 99.0% (2-log) removal of *Cryptosporidium* oocysts. Systems serving a retail population of less than 10,000 people will be assigned a minimum treatment level of 99.0% removal of *Cryptosporidium* oocysts after **January 14, 2005**.

#### **5.1.12.2 Treatment Plant Efficiency**

Assigning log removal credit.

- A. Plant efficiency will be assigned based on a comprehensive evaluation conducted by the State of plant design, operation, and possibly the turbidity removal efficiency of the plant. Removal credit for *Giardia lamblia* based on the evaluation will range from 1.5 to 3.0 log cyst. Removal credit for *Cryptosporidium* based on the evaluation will range from 1.5 to 2.0 log oocyst. However, regardless of the evaluation rating, a system meeting the turbidity standards of the IESWTR and LT1ESWTR will receive a 2.0 log oocyst removal credit. A copy of the evaluation criteria can be furnished upon request.

- B. Systems that dispute the level assigned by the State may undertake a program to demonstrate the plant's performance independent of the State's evaluation. The program design would be subject to State approval and could include particle counting, particulate analysis, and/or other challenge studies. The final decision on the plant's efficiency will be determined by the State.
- C. Not less than a 0.5 log inactivation of cysts and 2-log inactivation of viruses must be achieved with a disinfectant regardless of the treatment plant credit determination. Water systems that have demonstrated potential disinfection by-products violation (due to this requirement) may request a temporary reduction of this minimum treatment level provided the following criteria are met:
  - 1. The source water has a total coliform geometric mean of 50 colonies per 100ml or less from a representative series of samples.
  - 2. The treatment plant has been assigned or can demonstrate a 3.0 log *Giardia lamblia* cyst credit removal.

**5.1.12.3 Alternate Turbidity Level for Lime Softening Plants**

Systems that utilize lime softening may apply to the State for alternate exceedance levels if they can demonstrate that higher turbidity levels in individual filters are due to lime carryover only and not due to degraded filter performance.

**5.1.12.4 Alternate Technologies.**

Water systems desiring an alternative treatment technology to those listed herein must demonstrate that the technology is capable of meeting the appropriate log removal / inactivation requirements and turbidity removal. This capability will be based on the technology demonstrating the removal rates through turbidity data, particle counts, challenge studies, particulate analysis, or other appropriate means.

**5.1.12.5 CT Determination.**

Contact time for a basin or clearwell will be established by tracer test or by calculated methods conducted by the water system or its consultant and approved by the State. Flow in pipelines will be assumed to be plug flow. A procedures manual for detention time determination and a paper detailing a series of case studies for tracer tests are available from the State. Tracer tests have proven extremely useful in not only determining T<sub>10</sub> values but also in evaluating treatment plant hydraulics, distribution of flow, and short circuiting problems. For those reasons, tracer tests are the preferred alternate.

The State will, however, consider calculated T<sub>10</sub> values for sedimentation basins and filters, and possibly clearwells, provided it can be shown that the units are properly designed, functioning correctly, and operated within design parameters.

Calculated sedimentation values will be dependent on the type of basin (conventional vs. up-flow), must exclude entry and exit chambers or zones, and would be approved for no more than 50% of the hydraulic detention time. Calculated filter T<sub>10</sub> values must exclude the volume of the media and must be based on volume above the media or contact time in piping and flumes. Clearwell values generally must be determined by tracer tests. Exceptions may be allowed if:

- A. The basin was constructed utilizing extensive baffling, or
- B. Where the system wishes to claim credit for no more than 5% to 10% of the hydraulic detention time, the influent and effluent lines are properly situated (opposite sides of the basin), and the length to width ratio suitable.

In any case, where calculated values are proposed, verification and approval for the particular basin(s) must be obtained in writing from the State.

If the water system fails to establish a contact time through tracer tests or calculated methods, the State, depending on resources, will either conduct its own tracer test or assign a detention time value based on basin configuration and theoretical hydraulic detention time.

#### **5.1.12.6 Disinfection Profiling and Benchmarking**

- A. Systems that meet the following criteria must comply with the requirements of Section 5.1.8 -- Disinfection Profiling and Benchmarking.
  - 1. Surface water systems serving a retail population of at least 10,000 people.
  - 2. Surface water systems that have no retail, but wholesale water to a population base of at least 10,000 people.
  - 3. Surface water systems serving a retail or wholesale population of less than 10,000 people.
- B. Large surface water systems that begin operation after March 16, 1999, and serve a retail or wholesale population, as addressed in Section 5.1.12.6(A1&2) above must, at State discretion, conduct TTHM and HAA5 applicability monitoring. Monitoring for TTHM and HAA5 should begin in the first full quarter after plant startup and continue for four (4) consecutive quarters. If the annual average for TTHM  $\geq 0.064$  mg/l and / or the annual average for HAA5  $\geq 0.048$  mg/l, the system must, at State discretion, complete a disinfection profile. The disinfection profile should be completed within 15 months of the completion of the applicability monitoring.
- C. Surface water systems that serve a retail or wholesale population, as addressed in Section 5.1.12.6(A) above, must monitor for TTHM and HAA5 on a quarterly basis or as otherwise required by the Disinfectant / Disinfection By-Product Rule. If the system's running annual average for TTHM  $\geq 0.064$  mg/l and / or the running annual average for HAA5  $\geq 0.048$  mg/l after March 16, 2000, the system may be required to complete a disinfection profile.

#### **5.1.12.7 Surface Water Influence Determination.**

The determination of whether groundwater is directly influenced by surface water will be based on one or more of the following: well construction, subsurface geology and hydrogeology, proximity to surface waters, well yield, historical water quality data, site inspections, and water quality evaluations for inorganic parameters and microscopic particulate analysis.

Water systems that dispute a determination that their well is directly influenced by surface water must undertake a study of the area hydrogeology and a sampling program whose parameters, frequency, and duration are concurred with by the State. Final determination of whether a source is directly influenced by surface water will be by the State.

#### **5.1.13 COMPLETION AND SUBMITTAL OF REPORT FORMS**

The operator of a water system utilizing a surface water source or a ground water source influenced by surface water (GWUDI) must complete and submit monthly Operation and Chemical Report Forms in order to document compliance with the Surface Water Treatment Rules (SWTRs). The Arkansas Department of Health supplies water systems with the forms to

report the required information. All applicable fields should be completed, however, this section will discuss those sections which must be completed in order to document compliance with the requirements of the SWTR and IESWTR. (Note: This section does not address the future requirements of the LT1ESWTR.) For each month completed operation report forms must be submitted to and received by the State by the 10<sup>th</sup> of the following month.

**5.1.13.1 Combined Filter Effluent Turbidity**

The finished water turbidity must be recorded at least once every four hours that the plant is in operation. For systems serving 500 people or less, one reading per day must be recorded if the Arkansas Department of Health approves reduced turbidity monitoring. A section on the front page is provided which provides a blank for each four-hour period during each day of the month. A finished water turbidity reading must be provided. The headings for this section, which is found on the front page of the report, appear below.

Turbidity (NTU)							
Raw	Set	Finished AM			Finished PM		
		12 -- 4	4 -- 8	8 -- 12	12 --4	4 -- 8	8 -- 12

**5.1.13.2 Combined Filter Effluent Turbidity Summary**

On the front page of the Operations and Chemical Report Form is found a small section where turbidity records are summarized. The operator must calculate the percentage of recordings that were above 0.5 NTU (for systems serving a retail population less than 10,000 - SWTR) or 0.3 NTU (for systems serving a retail population of 10,000 or more - IESWTR) and indicate them here. The headings for this section appear below.

Systems serving < 10,000 population		Systems serving ≥ 10,000 population	
Total # of Finished Turbidity Values		Total # of Finished Turbidity Values	
Number > 0.5 NTU		Number > 0.3 NTU	
Percent > 0.5 NTU		Percent > 0.3 NTU	

**5.1.13.3 Effluent Chlorine**

The water system is required to maintain a minimum chlorine residual of 0.2 ppm in the finished treated water leaving the plant and entering the distribution system. The system must report the lowest measured chlorine residual for each day. For systems serving above 3300 population, the effluent chlorine residual must be continuously monitored. The headings for this section, which is found on the front page of the report, appear below.

Effluent Cl <sub>2</sub> (ppm)	Chlorite Monitoring (For Systems Using Chlorine Dioxide)		D A T E
	Entry Point Chlorite (ppm)	Dist. Samples Collected (Y / N)	
Lowest Measured Value*			
			1
			2

**5.1.13.4 Effluent Chlorine If Below 0.2 ppm**

When the effluent chlorine residual falls below 0.2 ppm, the system is required to report effluent chlorine residual measurements at four-hour intervals until a 0.2 ppm residual is restored. The section for reporting these readings is found on the front page of the Operation and Chemical Report Forms. The headings for this section appear below.

\*4 Hr Effluent Residual Monitoring Required if < 0.2 PPM

Date	AM			PM		
	12 -- 4	4 -- 8	8 -- 12	12 -- 4	4 -- 8	8 --12

**5.1.13.5 CT Compliance**

Water quality data must be supplied which documents the systems compliance with the CT (contact time) requirements of the SWTR. Each water systems has a letter from the Arkansas Department of Health which indicates the worst case requirements for the particular treatment facility and the specific basins which are being credited towards this requirement. The water operator must familiarize himself/herself with this correspondence before taking recordings and completing this section. The disinfectant residuals leaving the basins and clearwell used for compliance must be recorded. Also, pH, flow rate, and water temperature recordings are required. It may be in the interest of the water operator to consult with the personnel of the Arkansas Department of Health’s Division of Engineering when completing this section for the first time. However, the operator needs to clearly understand that this section must be completed for every day that the plant is operating. The headings for this section appear below.

					(RECORD DISINFECTANT INJECTION POINTS BELOW)							
D A T E	Peak Raw / Plant Flow Rate (GPM)	Peak Service Flow Rate (GPM)	Minimum Clearwell Level* (FEET)	Water Temp. Degrees (C / F)	#1:			#2:		#3:	Was compliance met this date? (Yes / No)	If no, within 12 hours? (Yes / No)
					(RECORD MONITORING LOCATIONS BELOW)							
					pH	Residual (mg/l)	pH	Residual (mg/l)	pH	Residual (mg/l)		
1												
2												

**5.1.13.6 Operator Certification**

The SWTR requires that the treatment facility be operated by qualified personnel. The Arkansas department of health requires that the operators be licensed through the ADH operator certification program. On the front page of the operation and chemical report form, a block is provided for the operator to list their name, license number, position, and to sign the form. By signing the form, the operator is certifying that the information presented on the form is correct. This block appears below.

Comments: _____	
I certify that the information in this report is true and accurate to the best of my knowledge. I acknowledge that any knowingly false or misleading information may be punishable under 18 USC 1001 and other applicable laws.	
Signature _____	Date _____
Printed Name _____	Position _____ License # _____

**5.1.13.7 Chlorine/Bacteriological Monitoring Record**

The SWTR requires the water system to record and report the chlorine residuals in the distribution system at the same place and time that bacteriological samples are collected. These chlorine residuals must be recorded on the Bacteriological Monitoring Report (BMR) and this report must be submitted to the Arkansas Department of Health each month. The headings for that form appear below. See Section 4 on the proper manner to complete this form.

<b>PUBLIC WATER SYSTEM - BACTERIOLOGICAL MONITORING RECORD</b>						
Arkansas Department of Health / Division of Engineering						
PUBLIC WATER SYSTEM NAME _____				PWS ID # _____		
MONTH _____		YEAR _____		COUNTY _____		
DATE	SAMPLE SITE #	TYPE - REGULAR OR RESAMPLE	CHLORINE RESIDUAL MG/L	LAB RESULTS	DAY/DATE RESULTS RECEIVED	RESAMPLE CONTAINERS  (Day/Date Received)

**5.1.13.8 Individual Filter Turbidity Monitoring**

The IESWTR requires systems serving a retail population of at least 10,000 people to continuously monitor each individual filter for turbidity. The water system must report that each filter was monitored continuously, any trigger level exceedance and follow-up actions. This must be recorded on the Individual Filter Turbidity Monitoring Report (IFMR) and this report must be submitted to the Arkansas Department of Health each month. The form has four sections to track different trigger levels and examples are provided below.

**INDIVIDUAL FILTER TURBIDITY MONITORING REPORT**

REPORT FOR PWS \_\_\_\_\_  
 PWS ID # \_\_\_\_\_

MONTH \_\_\_\_\_ YR \_\_\_\_\_  
 WTP NAME \_\_\_\_\_

Filter #	Value in NTU of Turbidity Measurements > 1.0 in 2 Consecutive Measurements Taken 15 Minutes Apart -- During Normal Operation			Conduct a Filter Profile Within 7 Days of the Exceedance(s) or Determine Obvious Reason for Abnormal Filter Performance  <b>(Attach Filter Profile Report or Attach Report Outlining Obvious Reason for Exceedance)</b>	
	Date	Initial Reading Exceeding 1.0	2nd Reading Exceeding 1.0	Date Profile Conducted	Date Obvious Reason for Exceedance Determined

Filter #	Value in NTU of Turbidity Measurements > 1.0 in 2 Consecutive Measurements Taken 15 Minutes Apart -- At Any Time In Each of Three Consecutive Months					Conduct a Self-Assessment of the Filter Within 14 Days of the Exceedance	
	Turbidity Exceeding 1.0 NTU					<b>(Attach Report of Filter Assessment)</b>	
	1st Month		2nd Month		3rd Month		
	Date	Value	Date	Value	Date	Value	Date Completed

Filter #	Value in NTU of Turbidity Measurements > 0.5 in 2 Consecutive Measurements Taken 15 Minutes Apart -- At the End of the First 4 Hours of Continuous Filter Operation After the Filter Has Been Backwashed or Otherwise Taken Off Line			Conduct a Filter Profile Within 7 Days of the Exceedance(s) or Determine Obvious Reason for Abnormal Filter Performance  <b>(Attach Filter Profile Report or Attach Report Outlining Obvious Reason for Exceedance)</b>	
	Date	Initial Reading Exceeding 0.5	2nd Reading Exceeding 0.5	Date Profile Conducted	Date Obvious Reason for Exceedance Determined

Filter #	Value in NTU of Turbidity Measurements > 2.0 in 2 Consecutive Measurements Taken 15 Minutes Apart -- At Any Time In Each of Two Consecutive Months				Within 30 Days of the Exceedance the System Must Arrange Through the ADH to Have a CPE Conducted  <b>(Within 90 Days of the Exceedance a CPE Must Be Completed and the CPE Report Submitted to the ADH)</b>	
	Turbidity Exceeding 2.0 NTU				Date CPE Arrangements Completed	Date CPE Completed and Report Submitted to ADH
	1st Month		2nd Month			
	Date	Value	Date	Value		

The above figures are true and accurate to the best of my knowledge.

SIGNATURE \_\_\_\_\_ POSITION \_\_\_\_\_

## 5.2 STAGE I DISINFECTION BY-PRODUCT RULE

### 5.2.1 AUTHORITY

This section outlines the maximum contaminant levels and treatment technique requirements established by the Stage I Disinfectant By-Product Rule as well as the monitoring, reporting and record keeping responsibilities for water systems that apply a chemical disinfectant in any part of the water treatment system. These monitoring requirements are authorized by both the Federal Safe Drinking Water Act, and recent additions thereto, and the Arkansas Department of Health's Rules and Regulations Pertaining to Public Water Systems (RRPPWS). The Federal requirements can be found in Code of Federal Regulations (CFR), 40 CFR Parts 9, 141, and 142. The state requirements can be found in Sections V, VII, X, XVII, XVIII, and XXI of the RRPPWS and Rules and Regulations Pertaining to Water Operator Licensing, Sections III and V.

### 5.2.2 INTRODUCTION

The **Stage I Disinfectant By-Product Rule (Stage I DBP)** was promulgated by the Environmental Protection Agency on December 16, 1998. The Rule sets forth drinking water regulations designed to reduce exposure to disinfection byproducts (DBPs). It establishes maximum residual disinfectant levels (MRDLs), maximum contaminant levels (MCLs) and, for some systems, treatment techniques (TTs) for the control of disinfection by-product precursors. This Rule builds upon the Trihalomethane Regulations and is designed to work in concert with the Surface Water Treatment Rules to control DBPs while maintaining microbial protection for surface and GWUDI systems.

### 5.2.3 SCOPE

All community water systems (CWS) and non-transient non-community water systems (NTNCWS) that add a chemical disinfectant and all transient non-community water systems (TNCWS) using chlorine dioxide are affected by the Rule. The effective date of the rule is staged depending upon the type and size of system.

- A. Surface water systems and groundwater systems under the direct influence of surface water (i.e. Subpart H systems) serving a retail population of at least 10,000 people must meet the requirements of the Stage 1 DBPR by January 1, 2002.
- B. Groundwater systems serving a retail population of at least 10,000 people must continue to meet the requirements of the Trihalomethane Rule until January 1, 2004. These systems must meet the requirements of the Stage 1 DBPR beginning **January 1, 2004**.
- C. All other systems (i.e. surface and groundwater system serving a retail population of less than 10,000 people) that add a disinfectant must meet the requirements of the Stage I DBPR beginning **January 1, 2004**.

In order to reduce exposure to disinfection byproducts (DBPs) the Rule:

- A. Lowers the MCL for total trihalomethanes (TTHM) for large surface and groundwater systems.
- B. Establishes a MCL for TTHM for small surface and groundwater systems.
- C. Establishes MCLs for five haloacetic acids (HAA5), Bromate (for systems using ozonation) and Chlorite (for systems using chlorine dioxide).

- D. Establishes a Treatment Technique (TT) for the removal of natural organic material from the source water. This TT applies only to surface systems and groundwater systems under direct influence of surface water that use conventional filtration treatment.

#### 5.2.4 ACRONYMS

ADH – Arkansas Department of Health  
CWS – Community Water System  
DOC – Dissolved Organic Carbon  
DBP – Disinfection By-product  
DBPR – Disinfection By-product Rule  
EPA – Environmental Protection Agency  
GWUDI – Groundwater Under the Direct Influence of surface water  
HAA5 – Haloacetic Acids (five)  
MCL – Maximum Contaminant Level  
MRDL – Maximum Residual Disinfectant Level  
NTNCWS – Non-transient, Non-Community Water System  
PODR – Point of Diminishing Return  
RAA – Running Annual Average  
SUVA – Specific Ultraviolet Absorption  
SWTR – Surface Water Treatment Rule  
TNCWS – Transient Non-community Water System  
TOC – Total Organic Carbon  
TT – Treatment Technique  
TTHM – Total Trihalomethanes

#### 5.2.5 DEFINITIONS

“Coagulation” – a process using coagulant chemicals and mixing by which colloidal and suspended materials are destabilized and agglomerated into floc.

“Conventional filtration treatment” – a series of processes including coagulation, flocculation, sedimentation, and filtration resulting in substantial particulate removal.

“Disinfection” – a process which inactivates pathogenic organisms in water by chemical oxidants or equivalent agents.

“Enhanced Coagulation” – the addition of sufficient coagulant for improved removal of disinfection by-product precursors by conventional filtration treatment.

“Enhanced Softening” – the addition of sufficient softening agent for improved removal of disinfection by-product precursors by conventional filtration treatment.

“Filtration” – the process for removing particulate matter from water through the use of porous media including, where appropriate, coagulation, flocculation, and sedimentation.

“Groundwater Under the Direct Influence of Surface Water” (GWUDI) – any water beneath the surface of the ground with significant occurrence of: insects or other macroorganisms, algae, large diameter pathogens such as *Giardia lamblia* or *Cryptosporidium*, or the significant and relatively rapid shift in water characteristics such as turbidity, temperature, conductivity, or pH which correlates to climatological or surface water conditions.

“Haloacetic Acids (HAA5)” – the sum of the concentrations in milligrams per liter of the haloacetic acid compounds (monochloroacetic acid, dichloroacetic acid, trichloroacetic acid, monobromoacetic acid, and dibromoacetic acid).

“Maximum Contaminant Level (MCL)” – the maximum permissible level of a contaminant in water which is delivered to any user of a public water system.

“Maximum Residual Disinfectant Level (MRDL)” – the maximum level of a disinfectant added for water treatment that may not be exceeded at the consumer’s tap without an unacceptable possibility of adverse health effects. MRDLs are enforceable in the same manner as maximum contaminant levels under the Safe Drinking Water Act. There is convincing evidence that addition of a disinfectant is necessary for control of waterborne microbial contaminants. Notwithstanding the MRDLs, operators may increase residual disinfectant levels of chlorine or chloramines (but not chlorine dioxide) in the distribution system to a level and for a time necessary to protect public health to address specific microbiological contamination problems caused by circumstances such as distribution line breaks, storm runoff events, source water contamination, or cross-connections.

“Point of Diminishing Return (PODR)” – the point at which further coagulant addition yields an insignificant additional TOC removal. More specifically, the PODR is the point at which TOC removal is less than 0.3 mg/l for an increase in coagulant dosage of 10 mg/l and remains less than 0.3 mg/l TOC removal for subsequent increases in coagulant dosage of 10 mg/l.

“Sedimentation” – a process for removal of solids by gravity or separation before filtration.

“Specific Ultraviolet Absorption (SUVA)” – is an indicator of the humic content of water. It is calculated by dividing a sample’s ultraviolet absorption at a wavelength of 254 nanometers ( $UV_{254}$ ) by its concentration of dissolved organic carbon (DOC) in mg/l.

“State” – the delegated state primacy agency responsible for implementation of the National Primary Drinking Water Regulations. In Arkansas that is the Department of Health, Division of Engineering.

“Subpart H System” – A public water system that utilizes surface water or ground water under the direct influence of surface water as its primary source.

“Total Trihalomethanes (TTHM)” – the sum of the concentration in milligrams per liter of the trihalomethane compounds: chloroform (trichloromethane), dibromochloromethane, bromodichloromethane and bromoform (tribromomethane).

## **5.2.6 GENERAL REQUIREMENTS**

Systems that add a chemical disinfectant as part of their treatment process must modify their practices, if necessary, to comply with the maximum contaminant levels for disinfection by-products and the maximum residual disinfectant levels established by the Stage I DBPR. Surface systems and groundwater systems under the direct influence of surface water using conventional filtration treatment must meet the treatment techniques for disinfection by-product precursors. Systems must develop monitoring plans and monitor for disinfection by-product and residual disinfectant levels as summarized below.

- A. All CWS and NTNCWS must monitor for and comply with the MCLs for TTHMs, HAA5 and the MRDLs for disinfectant residuals in the distribution system.
- B. All CWS and NTNCWS using chlorine dioxide as a disinfectant or oxidant must monitor for and comply with the MCL for chlorite and the MRDL for chlorine dioxide at the entry point to the distribution system and in the distribution system.
- C. All TNCWS using chlorine dioxide as a disinfectant or oxidant must monitor for and comply with the MRDL for chlorine dioxide at the entry point to the distribution system and in the distribution system.
- D. CWS and NTNCWS using ozone must monitor for and comply with the MCL for bromate at the entry point to the distribution system.

- E. CWS and NTNCWS using surface and/or GWUDI sources using conventional filtration treatment must monitor TOC and alkalinity in the raw water and TOC in the finished water and comply with the treatment technique for the removal of TOC.
- F. Each CWS and NTNCWS that adds a chemical disinfectant to the water in any part of the drinking water treatment process must be operated by a qualified operator who meets the licensing requirements of the Arkansas Rules and Regulation Pertaining to Water Operation Licensing.
- G. Systems may increase residual disinfectant levels for chlorine or chloramines, but not chlorine dioxide, in the distribution system to a level and for a time necessary to protect public health. Such increase in residual disinfectant levels will not trigger a MRDL violation provided the increase was to address specific microbiological contamination problems caused by circumstances such as, but not limited to, distribution line breaks, storm run-off events, source water contamination events, or cross-connections.

**5.2.7 MAXIMUM CONTAMINANT LEVELS**

The Stage I DBPR lowered the MCL for TTHM previously required for large systems. The rule also requires small systems to comply with the new lower MCL for TTHM and set new MCLs for HAA5, Chlorite and Bromate.

<u>Disinfection By-Product</u>	<u>MCL</u>
Total Trihalomethanes (TTHM)	0.080 mg/l
Haloacetic Acids (HAA5)	0.060 mg/l
Chlorite	1.0 mg/l
Bromate	0.010 mg/l

**5.2.8 MAXIMUM RESIDUAL DISINFECTANT LEVELS**

The Stage I DBPR set MRDL for the three chemical disinfectants as listed below:

<u>Disinfectant</u>	<u>MRDL</u>
Chlorine (as Cl <sub>2</sub> )	4.0 mg/l
Chloramines (as Cl <sub>2</sub> )	4.0 mg/l
Chlorine Dioxide (as ClO <sub>2</sub> )	0.8 mg/l

**5.2.9 TREATMENT TECHNIQUE FOR THE REMOVAL OF DISINFECTION BY-PRODUCT PRECURSORS**

The Stage I DBPR established a treatment technique for the removal of disinfection by-product precursors. Surface or GWUDI systems using conventional filtration treatment must practice enhanced coagulation or enhanced softening to achieve increased removal of Total Organic Carbon (TOC) through the treatment process.

**5.2.9.1 Enhanced Coagulation / Enhanced Softening**

- A. Surface and GWUDI systems using conventional filtration treatment must operate with enhanced coagulation or enhanced softening to achieve TOC percent removal levels unless the system meets at least one of the alternative compliance criteria outlined in the DBPR. The alternative compliance criteria are discussed in Section 5.2.9.1(D).
- B. Enhanced Coagulation and Enhanced Softening – **Step 1** Requirements
  - 1. Surface and GWUDI systems using conventional filtration treatment must achieve the percent reduction of TOC between its raw water source and combined filter effluent as indicated the following table, unless the ADH approves

the system's request for alternative minimum TOC removal (Step 2) requirements.

**Step1 -- Required Removal of TOC by  
Enhanced Coagulation & Enhanced Softening**

Source Water TOC (mg/l)	Source Water Alkalinity (mg/l as CaCO <sub>3</sub> )		
	0 to 60	>60 to 120	>120 <sup>(1)</sup>
	% TOC Removal Required		
>2.0 – 4.0	35.0 %	25.0%	15.0%
>4.0 – 8.0	45.0%	35.0%	25.0%
>8.0	50.0%	40.0%	30.0%

<sup>(1)</sup> Plants practicing enhanced softening must meet the TOC requirements in this column.

2. Systems that cannot achieve the Step 1 TOC removal requirements as indicated above due to water quality parameters or operational constraints, must apply to the ADH within three months of the failure to achieve the removal requirements for approval of alternative minimum TOC requirements (i.e. Step 2 removal requirements – see section 5.2.9.1.C).
  - a) If approved the Step 2 removal requirements may be made retroactive (for one quarter) for the purposes of determining compliance.
  - b) Until the ADH approves alternative Step 2 removal requirements, the system must continue to meet the Step 1 removal requirements.

C. Enhanced Coagulation and Enhanced Softening – **Step 2** Requirements

Because of unique water conditions, some plants may not be able to achieve the Step 1 TOC removal rates. Such system will be required to conduct bench- or pilot-scale testing in order to establish alternate TOC removal requirements.

1. Alternate enhanced coagulation level is defined as coagulation at a coagulant dose and pH such that an incremental addition of 10 mg/l of alum (as aluminum), or an equivalent amount of ferric salt, results in a TOC removal of  $\leq 0.3$  mg/l. The percent removal of TOC at this point on a “TOC removal versus coagulant dose” curve defines, if approved by the State, the minimum TOC removal required by the system and is referred to as the Point of Diminishing Returns (PODR).
  - a) Once approved by the State the Step 2 TOC removal requirements will supercede the Step 1 TOC removal requirements.
  - b) Step 2 TOC removal requirements will be effective until such time as the ADH approves a new value based on the results of a new bench- or pilot-scale test.
  - c) Failure to achieved ADH set alternative minimum removal requirements will be a violation.
2. Bench- or Pilot-scale Testing for Establishing Step 2 Removal Requirements:

- a) Jar test must be conducted on representative samples of the source water by adding 10 mg/l increments of alum (as aluminum), or equivalent amounts of ferric salt, until the pH is reduced to a level less than or equal to the enhanced coagulation Step 2 target pH shown in the following table.

**Enhanced Coagulation Step 2 Target pH**

ALKALINITY (mg/L as CaCO <sub>3</sub> )	TARGET pH
0 – 60	5.5
>60 – 120	6.3
>120 – 240	7.0
>240	7.5

- b) For waters with alkalinities of less than 60 mg/l where addition of small amounts of coagulant drives the pH below 5.5 before significant TOC removal occurs, chemicals must be added to maintain the pH between 5.3 and 5.7 in samples until the PODR is reached.
- c) A system may operate at any coagulant dose or pH necessary to achieve the alternate Step 2 TOC percent removal approved by the ADH.
- d) If the TOC removal is consistently less than 0.3 mg/l of TOC per 10 mg/l of incremental alum dose at all dosages of alum, or equivalent addition of iron coagulation, the water is deemed to contain TOC not amenable to enhanced coagulation. For such waters the system may apply to the ADH for a waiver of the enhanced coagulation requirements.

**D. Alternative Compliance Criteria for Enhanced Coagulation and Enhanced Softening**

1. Source water TOC < 2.0 mg/l: -- If the source water contains less than 2.0 mg/l of TOC, calculated quarterly as a running annual average, the system is in compliance with the treatment technique requirements. Additionally, for individual months in which raw water TOC is less than 2.0 mg/l, compliance with the treatment technique has been achieved for that month.
2. Treated water TOC < 2.0 mg/l: -- If treated water contains less than 2.0 mg/L TOC, calculated quarterly as a running annual average, the system is in compliance with the treatment technique requirements. Additionally, for individual months in which treated water TOC is less than 2.0 mg/l, compliance with the treatment technique has been achieved for that month.
3. Raw water SUVA ≤ 2.0 L/mg-m: -- If the raw water specific ultraviolet absorption (SUVA) is less than or equal to 2.0 L/mg-m prior to any treatment, calculated quarterly as a running annual average, the system is in compliance with the treatment technique requirements. Additionally, for individual months in which raw water SUVA is less than or equal to 2.0 L/mg-m, compliance with the treatment technique has been achieved for that month.
4. Treated water SUVA ≤ 2.0 L/mg-m: -- If the treated water SUVA is less than or equal to 2.0 L/mg-m prior to any treatment, calculated quarterly as a running annual average, the system is in compliance with the treatment technique requirements. Additionally, for individual months in which treated water SUVA is less than or equal to 2.0 L/mg-m, compliance with the treatment technique has been achieved for that month.

5. Raw water TOC < 4.0 mg/L; Raw water alkalinity > 60mg/L (as CaCO3); TTHM ≤ 40 µg/L; HAA5 ≤ 30 µg/L: -- Because it is more difficult to remove appreciable amounts of TOC from waters with higher alkalinity and lower TOC levels, systems that meet the above criteria are in compliance with the treatment technique requirements. All of the parameters are based on running annual averages computed quarterly.

Systems that have made a clear and irrevocable financial commitment (prior to the system's effective compliance date for the DBPR) to use technologies that will limit TTHM and HAA5 to 40 µg/L and 30 µg/L, respectively, do not have to practice enhanced coagulation, provided that the TOC and alkalinity levels of this criterion are met.

6. TTHM ≤ 40 µg/L and HAA5 ≤ 30 µg/L with only chlorine for disinfection: -- Systems that use only free chlorine as their primary disinfectant and for maintenance of a residual in the distribution system and achieve the stated TTHM and HAA5 levels are in compliance with the treatment technique. The TTHM and HAA5 levels are based on running annual averages, computed quarterly. TTHM and HAA5 compliance samples are used to qualify for this alternative performance criterion.

#### E. Additional Alternative Compliance Criteria for Softening Systems

1. Compliance is achieved if, softening results in lowering the treated water alkalinity to less than 60 mg/l (as CaCO<sub>3</sub>) measured monthly and calculated quarterly as a running annual average.
2. Compliance is achieved if, softening results in removing at least 10 mg/l of magnesium hardness measured monthly and calculated quarterly as a running annual average.

NOTE: Systems practicing enhanced softening that cannot achieve the Step 1 TOC removals required by Section 5.2.9.1(B1) may use the alternative compliance criteria above to achieve compliance.

#### 5.2.9.2 TOC Removal Compliance

A. Surface and GWUDI systems using conventional filtration must begin compliance determinations with the enhanced coagulation requirements of the DBPR beginning twelve months after the effective date of the Rule. The ADH will make compliance determinations and advise the system on a quarterly basis.

1. Compliance calculations will be made on quarterly basis and consist of the following steps.
  - a) Determine the actual monthly TOC percent removal by the following formula:
$$[1 - (\text{Treated water TOC} / \text{Source water TOC})] \times 100$$
  - b) Determine the required monthly TOC percent removal based on Step 1 criteria or on Step 2 criteria if approved.
  - c) Determine the TOC removal ratio by dividing the actual TOC percent removal by the required TOC percent removal.

Note: In any month that this result is less than 1.00, a system may apply a value of 1.00 for that month if any one of the following criteria is met.

- The treated or finished water TOC level is less than 2.0 mg/l.
  - The treated or finished water SUVA level is less than or equal to 2.0 L/mg-m.
  - A system practicing softening that removes at least 10 mg/l magnesium hardness (as CaCO<sub>3</sub>).
  - A system practicing enhanced softening lowers alkalinity below 60 mg/l.
- d) Average the results in Step (c) above for the previous 12 months to obtain the TOC Removal Ratio - Running Annual Average (RAA). If the average is greater than or equal to 1.00 the system is in compliance.
2. Systems with a TOC Removal Ratio - RAA of less than 1.00, based solely on Step 1 TOC removal requirements, must apply to the ADH for alternative Step 2 removal requirements for use in compliance determinations.

B. The effective date and various compliance actions are phased based on system size as indicated in the table below.

COMPLIANCE ACTION	POPULATION SERVED	
	≥ 10,000	< 10,000
Begin TOC compliance monitoring no later than: <sup>1</sup>	January 2002	January 2004
Calculate first TOC Removal Ratio - RAA.	January 2003	January 2005
Systems with a RAA Removal Ratio < 1.0 must conduct Step 2 testing and submit to ADH.	February through April 2003	February through April 2005

<sup>1</sup>Note: EPA recommends that systems conduct at least one year TOC monitoring prior to the date indicated to determine whether compliance can be achieved.

### 5.2.10 MONITORING REQUIREMENTS

All systems that add a chemical disinfectant as a part of their treatment process must develop a monitoring plan and maintain it on file for review by the ADH during sanitary surveys and by the general public as requested. All monitoring must be in accordance with approved monitoring plans. ( Note: The ADH will assist systems with the development of a monitoring plan to assure compliance with the Stage 1 DPBR.)

The ADH will provide sample collection and analysis for TTHM, HAA5, TOC, bromate, and distribution system chlorite samples. The water system must conduct sample collection and analysis for disinfectant residuals and, where applicable, entry point chlorite and source water alkalinity samples.

The Stage 1 Disinfectant Byproduct Rule monitoring requirements for various system types and size are listed below.

**Surface and GWUDI Systems Serving Populations of 10,000 or Greater**

Analyte	Routine Monitoring	Reduced Monitoring
TTHM & HAA5	Four (4) TTHM and HAA5 sample sets per plant per quarter. One sample taken at maximum residence time and 3 samples taken at representative locations in the distribution system. <b>ADH collects and analyzes.</b>	<ol style="list-style-type: none"> <li>1) Monitoring can not be reduced if a system's source water TOC &gt; 4.0 mg/L based on a running annual average.</li> <li>2) Monitoring can be reduced to one (1) sample set per plant per quarter if:               <ol style="list-style-type: none"> <li>a) System has completed one year of routine monitoring, and</li> <li>b) Both TTHM and HAA5 running annual averages are no more than 40 µg/L and 30 µg/L, respectively.</li> </ol> </li> </ol>
TOC & Alkalinity	<b>Plants using conventional filtration:</b> One (1) source water and one (1) finished water TOC sample (i.e. paired samples) per plant per month & one (1) source water alkalinity sample collected at the same time that the source water TOC sample is collected. <b>ADH collects and analyzes TOC samples; and system monitors alkalinity.</b>	Monitoring may be reduced to one (1) paired TOC sample set and one (1) source water alkalinity sample per plant per quarter if: <ol style="list-style-type: none"> <li>1) Average treated water TOC &lt; 2.0 mg/L for 2 years, or</li> <li>2) Average treated water TOC &lt; 1.0 mg/L for one year.</li> </ol>
Bromate	<b>Plants using ozone for disinfection or oxidation:</b> One (1) sample per plant per month taken at the entry point to the distribution system while the ozonation system is operating under normal conditions. <b>ADH collects and analyzes.</b>	If the system can demonstrate that the average raw water bromide is < 0.05 mg/L (based on an annual average of monthly samples), then sampling may be reduced to one (1) sample per plant per quarter. (Note: The ADH will <u>not</u> collect or analyze bromide samples.)
Chlorite	<b>CWS &amp; NTNCWS using ClO2 for disinfection or oxidation:</b> <i>Daily Monitoring</i> -- One (1) sample per day collected at the entry point to the distribution system. <b>System collects and analyzes.</b>  <i>Triggered Monitoring</i> -- If daily entry point chlorite > 1.0 ppm, the system should notify ADH and must collect one 3-sample set in the distribution system on the following day. <b>System collects and ADH analyzes.</b>  <i>Monthly Monitoring</i> -- One 3-sample set per month in the distribution system. <b>ADH collects and analyzes.</b>	<i>Daily monitoring</i> -- Daily monitoring may not be reduced.  <i>Triggered Distribution System Monitoring</i> -- Triggered distribution system monitoring may not be reduced.  <i>Monthly monitoring</i> -- Monitoring may be reduced to quarterly, if the chlorite concentration in all samples taken in the distribution system is below 1.0 mg/l for a period of one year.
Chlorine & Chloramines	Samples taken at the same time and location as total coliform samples. <b>System collects and analyzes.</b>	Monitoring may not be reduced.
Chlorine dioxide	<b>All public water systems using ClO2 for disinfection or oxidation:</b> <i>Daily Monitoring</i> -- One (1) sample per day collected at the entry point to the distribution system. <b>System collects and analyzes.</b>  <i>Triggered Monitoring</i> -- If daily entry point ClO2 > 0.8 mg/l, the system must collect 3 distribution system samples on the following day. <b>System collects and analyzes.</b>	Monitoring may not be reduced.

### Surface and GWUDI Systems Serving Populations Less than 10,000

Analyte	Routine Monitoring	Reduced Monitoring
TTHM & HAA5	<p>One (1) sample each per plant per quarter at maximum residence time in the distribution system.</p> <p>If system serves &lt; 500 people, then one (1) sample per plant a year collected during the month of warmest water temperature.</p> <p><b>ADH collects and analyzes.</b></p>	<ol style="list-style-type: none"> <li>1) Monitoring may not be reduced if the system's source water TOC &gt; 4.0 mg/L based on a running annual average.</li> <li>2) Monitoring may be reduced to one (1) sample per plant a year collected during the month of warmest water temperature, if               <ol style="list-style-type: none"> <li>a) System has completed 1 year of routine monitoring, and</li> <li>b) Both TTHM and HAA5 running annual averages are no more than 40 µg/L and 30 µg/L respectively.</li> </ol> </li> </ol>
TOC & Alkalinity	<b>Plants using conventional filtration:</b> Same as for large surface and GWUDI systems.	Same as for large surface and GWUDI systems.
Bromate	<b>Plants using ozone for disinfection or oxidation:</b> Same as for large surface and GWUDI systems.	Same as for large surface and GWUDI systems.
Chlorite	<b>CWS &amp; NTNCWS using ClO2 for disinfection or oxidation:</b> Same as for large surface and GWUDI systems.	Same as for large surface and GWUDI systems.
Chlorine & Chloramines	Same as for large surface and GWUDI systems.	Same as for large surface and GWUDI systems.
Chlorine dioxide	<b>All systems using ClO2 for disinfection or oxidation:</b> Same as for large surface and GWUDI systems.	Same as for large surface and GWUDI systems.

### Groundwater Water Systems Serving Populations of 10,000 or Greater

Analyte	Routine Monitoring	Reduced Monitoring
TTHM & HAA5	One (1) sample per plant per quarter at maximum residence time in the distribution system during the month of maximum water temperature.	<p>Monitoring may be reduced to one (1) sample per plant per year at maximum residence time during the month of warmest water temperature if:</p> <ol style="list-style-type: none"> <li>1) System has completed 1 year of routine monitoring and</li> <li>2) Both TTHM and HAA5 running annual averages are no more than 40 µg/L and 30 µg/L, respectively.</li> </ol>
Bromate	<b>Plants using ozone for disinfection or oxidation:</b> Same as for large surface and GWUDI systems.	Same as for large surface and GWUDI systems.
Chlorite	<b>CWS &amp; NTNCWS using ClO2 for disinfection or oxidation:</b> Same as for large surface and GWUDI systems.	Same as for large surface and GWUDI systems.
Chlorine & Chloramines	Same as for large surface and GWUDI systems.	Same as for large surface and GWUDI systems.
Chlorine dioxide	<b>All systems using ClO2 for disinfection or oxidation:</b> Same as for large surface and GWUDI systems.	Same as for large surface and GWUDI systems.

## Groundwater Water Systems Serving Populations Less Than 10,000

Analyte	Routine Monitoring	Reduced Monitoring
TTHM & HAA5	One (1) sample per plant per year at the maximum residence time in the distribution system during the month of warmest water temperature.	Sampling may be reduced to one (1) sample per plant every 3 years, taken at maximum residence time during the month of warmest water temperature if: 1) System has completed 2 years of routine monitoring and both TTHM and HAA5 running annual averages are no more than 40 µg/L and 30 µg/L respectively, or 2) System has completed 1 year of routine monitoring and both TTHM and HAA5 running annual averages are no more than 20 µg/L and 15 µg/L respectively.
Bromate	<b><u>Plants using ozone for disinfection or oxidation:</u></b> Same as for large surface and GWUDI systems.	Same as for large surface and GWUDI systems.
Chlorite	<b><u>CWS &amp; NTCWS using ClO<sub>2</sub> for disinfection or oxidation:</u></b> Same as for large surface and GWUDI systems.	Same as for large surface and GWUDI systems.
Chlorine & Chloramines	Same as for large surface and GWUDI systems.	Same as for large surface and GWUDI systems.
Chlorine dioxide	<b><u>All systems using ClO<sub>2</sub> for disinfection or oxidation:</u></b> Same as for large surface and GWUDI systems.	Same as for large surface and GWUDI systems.

### 5.2.11 ANALYTICAL TECHNIQUES

#### 5.2.11.1 Chlorine and Chloramine must be handled and analyzed by one of the following analytical methods:

Standard Method 4500-Cl D (APHA, 1995) -- Amperometric Titration Method.  
 Standard Method 4500-Cl E (APHA, 1995) -- Low Level Amperometric Titration Method.  
 Standard Method 4500-Cl F (APHA, 1995) -- DPD Ferrous Titrimetric Method.  
 Standard Method 4500-Cl G (APHA, 1995) -- DPD Colorimetric Method.  
 Standard Method 4500-Cl H (APHA, 1995) -- Syringaldazine (FACTS).  
 Standard Method 4500-Cl I (APHA, 1995) -- Iodometric Electrode.

#### 5.2.11.2 Chlorine dioxide must be handled and analyzed by one of the following analytical methods:

Standard Method 4500-ClO<sub>2</sub> D (APHA, 1995) – DPD Method.  
 Standard Method 4500-ClO<sub>2</sub> E (APHA, 1995) – Amperometric Titration Method.

#### 5.2.11.3 Total Trihalomethanes (TTHM) must be handled and analyzed by one of the following analytical methods:

EPA Method 502.2 (EPA, 1995).  
 EPA Method 524.2 (EPA, 1995).  
 EPA Method 551.1 (EPA, 1995).

**5.2.11.4 Haloacetic Acids (HAA5) must be handled and analyzed by one of the following analytical methods:**

EPA Method 552.1 (EPA, 1992).  
EPA Method 552.2 (EPA, 1995).  
Standard Method 6251 B (APHA, 1995).

**5.2.11.5 Bromate must be handled and analyzed by the following analytical method:**

EPA Method 300.1 (EPA, 1997e).

**5.2.11.6 Chlorite must be handled and analyzed by one of the following analytical methods:**

Monthly and triggered monitoring -- EPA Method 300.0 (EPA, 1993b).  
Monthly and triggered monitoring -- EPA Method 300.1 (EPA, 1997e).  
Daily monitoring – Standard Method 4500-CIO<sub>2</sub> E.

**5.2.11.7 Total Organic Carbon (TOC) must be handled and analyzed by one of the following analytical methods:**

Standard Method 5310 B -- Standard Methods 19<sup>th</sup> Edition Supplement (APHA, 1996).  
Standard Method 5310 C -- Standard Methods 19<sup>th</sup> Edition Supplement (APHA, 1996).  
Standard Method 5310 D -- Standard Methods 19<sup>th</sup> Edition Supplement (APHA, 1996).

**5.2.11.8 Specific Ultraviolet Absorbance (SUVA): Two separate analytical methods are required to measure SUVA; Dissolved Organic Carbon (DOC) and UV254.**

A. DOC must be handled and analyzed by one of the following analytical methods:

Standard Method 5310 B -- Standard Methods 19<sup>th</sup> Edition Supplement (APHA, 1996).  
Standard Method 5310 C -- Standard Methods 19<sup>th</sup> Edition Supplement (APHA, 1996).  
Standard Method 5310 D -- Standard Methods 19<sup>th</sup> Edition Supplement (APHA, 1996).

B. UV254 must be handled and analyzed by the following analytical method:

Standard Method 5910 B (APHA, 1995).

**5.2.11.9 Bromide must be handled and analyzed by one of the following methods:**

EPA Method 300.0 (EPA, 1993b).  
EPA Method 300.1 (EPA, 1997e).

**5.2.11.10 Alkalinity must be handled and analyzed by one of the following methods:**

Standard Method 2320 B (APHA, 1995).  
Method I-1030-85 (USGS, 1989).

**5.2.11.11 pH must be handled and analyzed by one of the following methods:**

EPA Method 150.1.  
EPA Method 150.2.  
Standard Method 4500 H+ B

**5.2.12 COMPLETION AND SUBMITTAL OF REPORT FORMS**

The operator of a water system which adds a chemical disinfectant as a part of the treatment process must complete and submit monthly Operation and Chemical Report Forms in order to document compliance with the Stage I Disinfection By-Product Rule. The Arkansas Department of Health supplies water systems with the forms to report the required information. This section will discuss those sections which must be completed in order to document compliance with the requirements of the Stage 1 DBPR. (Note: Systems must report all required information to the State within 10 days after the end of each month that system serves water to the public.)

**5.2.12.1 Distribution System Disinfectant Residual Monitoring**

**A. Chlorine and Chloramine Residual Monitoring**

The Stage 1 DBPR requires the water system to record and report the chlorine and/or chloramines residuals in the distribution system at the same time and location that bacteriological samples are collected. These residuals must be recorded on the Bacteriological Monitoring Report (BMR) and this report must be submitted to the Arkansas Department of Health each month. The headings for that form appear below. See Section 4 on the proper manner to complete this form.

<b>PUBLIC WATER SYSTEM - BACTERIOLOGICAL MONITORING RECORD</b>						
Arkansas Department of Health / Division of Engineering						
PUBLIC WATER SYSTEM NAME _____				PWS ID # _____		
MONTH _____		YEAR _____		COUNTY _____		
DATE	SAMPLE SITE #	TYPE - REGULAR OR RESAMPLE	CHLORINE RESIDUAL MG/L	LAB RESULTS	DAY/DATE RESULTS RECEIVED	RESAMPLE CONTAINERS  (Day/Date Received)

**B. Chlorine Dioxide Residual Monitoring**

All water systems using chlorine dioxide for disinfection or oxidation must record and report the chlorine dioxide residuals at the entry point to the distribution system daily and, if triggered, in the distribution system. These residuals must be recorded on the backside of the Operations and Chemical Report Form and this report must be submitted to the Arkansas Department of Health each month. The headings for that form appear below.

ClO <sub>2</sub> Residual Monitoring (ppm)				
Date	Entry Point	Distribution System		
		Pt. 1	Pt. 2	Pt. 3
1				
2				

**5.2.12.2 Chlorite Monitoring**

All CWS and NTNCWS using chlorine dioxide for disinfection or oxidation must record and report the chlorite levels at the entry point to the distribution system daily. If the daily entry point chlorite level is greater than 1.0 mg/l, the system must notify the ADH immediately and collect distribution system chlorite samples on the following day. The chlorite levels and whether or not distribution systems samples were collected must be recorded on the front side of the Operations and Chemical Report Form and this report must be submitted to the Arkansas Department of Health each month. The headings for that section appear below.

Chlorite Monitoring (For Systems Using Chlorine Dioxide)		D
Entry Point Chlorite (ppm)	Dist. Samples Collected (Y / N)	A
		T
		E
		1
		2

### 5.2.12.3 Alkalinity Monitoring

CWS and NTNCWS using surface source(s) and/or groundwater source(s) under the direct influence of surface that use conventional filtration treatment must monitor the raw water alkalinity on the same day that TOC samples are collected. Since the ADH collects TOC samples on a random basis, it is requested that the system measure the raw water alkalinity the first thing in the morning on a daily basis. The raw water alkalinity level must be recorded on the front side of the Operations and Chemical Report Form and this report must be submitted to the Arkansas Department of Health each month. The headings for that section appear below.

Alkalinity (ppm)		
Raw	Set	Fin