

# Drinking Water Operator Certification Training Instructor Guide



## Module 1 General Overview Volume I



Slide 1

Revised April 2013

This course includes content developed by the Pennsylvania Department of Environmental Protection (Pa. DEP) in cooperation with the following contractors, subcontractors, or grantees:

The Pennsylvania State Association of Township Supervisors (PSATS)  
Gannett Fleming, Inc.  
Dering Consulting Group  
Penn State Harrisburg Environmental Training Center

## General Overview Instructor Guide Notes

**TIME:** 7 contact hours, plus 2 breaks and lunch = 9 hour day

### **METHODS:**

- Lecture
- Full group discussion/Q&A
- Unit exercises

### **MATERIALS:**

- PowerPoint slides, laptop, and projector
- Instructor Guide – 3 volumes
- Student Workbook – 3 volumes
- Flipchart or whiteboard

### **Notes to Instructors:**

Please focus the instruction on the information highlighted in the instructor guide.

The highlighted information and notes tell the instructor the information that should receive the most attention. Some of the content is for reference and will not be covered in detail during the classroom session.

The instructor will need to practice the material using the instructor guide, PowerPoint, and the workbook. There are not slides for all information since the workbook also serves as a visual reference.

You may add your own examples and images. This is preferred, since it adds to the learning experience.

**Unit Exercises:** There are important exercise activities at the end of each unit. The Unit Exercises are the assessment method or “test for understanding” for the course. Please have the students complete the exercises on their own. The instructors should circulate the classroom during this time and make sure that each student is grasping the concepts.

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## Module #1 General Overview Volume I

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### Slide 2 – General Overview



### Slide 3 – Module Included

The general overview modules are designed to prepare water operators for the Part I General Exam. For this reason, there are excerpts from various modules combined within this training workbook.

Let's take a look at our outline for this volume.  
These are the topics we'll be covering.

## Topical Outline

### Unit 1 –Overview

- I. Responsibilities of Water Supplier and Treatment Plant Operator
  - A. Job of Public Water Supplier
  - B. Job of Water Treatment Plant Operator
- II. Water and Public Health
  - A. Water Treatment Objectives
  - B. History of Water Treatment
  - C. Timeline of Water Quality Regulations

### Unit 2 – Public Water Supply System Classifications

- I. Purpose and Definition
  - A. Purpose of Classification
  - B. Definition of Public Water Supply System
- II. Basis Used for Classification
  - A. Noncommunity vs. Community
  - B. Nontransient vs. Transient
  - C. Size Classifications of Community Water Systems

### Unit 3 – Federal and State Regulations

- I. Roles of Various Government Agencies
  - A. United States Environmental Protection Agency
  - B. State of Pennsylvania – Department of Environmental Protection
  - C. Other Regulatory Agencies

- II. Specific Regulations
  - A. Operator Certification Act
  - B. Safe Drinking Water Act
  - C. Other Relevant Regulations
  - D. Pennsylvania Water Supply Regulations
- III. Monitoring and Reporting

### Unit 4 – System Management Responsibilities

- I. Table 1: Total Coliform Sample Siting Plan
- Table 2: Lead and Copper Rule Sample Siting Plan
- Table 3: Stage 2 Disinfection Byproducts Rule Monitoring Plan
- Table 4: Monthly Operational Report
- Table 5: Complaint Record
- Table 6: Operation and Maintenance Plan
- Table 7: Emergency Response Plan
- Table 8: Distribution System Map
- Table 9: Sanitary Survey by water supplier
- Table 10: Cross Connection Control Program
- Table 11: Record Retention
- Table 12: Additional Resources

### Appendices

Turn to page 1-1 and look at our Unit 1 overview objectives.

# Unit 1 – Overview

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## Slide 4 – Unit One Learning Objectives

### Learning Objectives

- Describe the responsibilities of the water supply facility and the treatment plant operator.
- List the 5 drinking water treatment objectives.
- Describe three important historical achievements in water treatment that link contaminated water to disease.

Turn to page 1-2 and let's discuss the types of contaminants that could be found in water.

*Q. Give me an example of a contaminant either natural or man-made.*

*A: (any primary or secondary contaminant)*

## Job of Public Water Supplier

Water is essential to life. A human can only survive 5-7 days without water. However, consuming contaminated water can cause disease and death. Water can be contaminated by:

- Suspended material.
- Chemical contaminants.
- Biological contaminants.

Uncontaminated natural water sources are rare. Most water sources are contaminated by:



### Slide 5 Examples of Contaminants

- **Natural impurities**
  - Dissolved naturally occurring minerals and chemicals, e.g., arsenic, radon.
  - Animal waste.
  - Algae, decaying leaves, and other organic material.
- **Man-made impurities**
  - Industrial waste discharges.
  - Human waste discharges, e.g., malfunctioning septic systems, and sewage treatment plant discharges.
  - Agricultural activities, e.g., soil erosion, chemical fertilizers, and animal wastes/manure.



### Slide 6 – Job of the Public Water Supplier



The job of the public water supplier is to provide a clean, safe, and reliable supply of water at a reasonable cost.

Turn to page 1-3 and look at the job of the water operator.

## Job of Water Treatment Plant Operator



### Slide 7 – Job of the Water Treatment Plant Operator



The water treatment plant operator is ultimately responsible for the quality and safety of the treated water leaving the water treatment plant.



### Slide 8 – Operator Must:

Operator must:

- Be aware of the type and concentration of contaminants in the raw water supply, and be aware of changing raw water conditions.
- Understand the treatment process used and be able to make adjustments to the process to compensate for changing raw water conditions.
- Monitor the quality of the water at various stages of the treatment process.
- Monitor the quality of the treated water leaving the plant to make sure it is potable, aesthetically pleasing, and meets all state and federal regulations.
- Ensure water treatment plant facilities are maintained in a safe and operable condition.
- Ensure reliable production and delivery of water to the distribution system.

Let's discuss the relationship between drinking water and public health.

Turn to page 1-4 and look at the water treatment objectives.



 Slide 9 – Water Treatment Objectives

### Water Treatment Objectives

Availability of clean, safe, potable drinking water is essential to public health. In order to safeguard public health, water treatment must achieve the following objectives:

- Remove turbidity (suspended) material.
- Reduce concentrations of chemical contaminants to levels low enough that they do not pose a health risk and meet or exceed regulatory requirements.
- Remove or inactivate pathogenic protozoans, bacteria, and viruses.
- Produce water that is clear, with no objectionable colors, odors or taste.
- Produce water that is chemically stable, and is not corrosive to metal piping and fixtures.

In looking at the timeline, notice that boiling and filtering water occurred in 4000 B.C.

### History of Water Treatment

People were originally concerned with quantity of water, not quality. Water was used mainly for irrigation. People settled near rivers where there was a large quantity of readily available water. It was believed that taste and color determined purity.

 Slide 10 – Figure 1.1

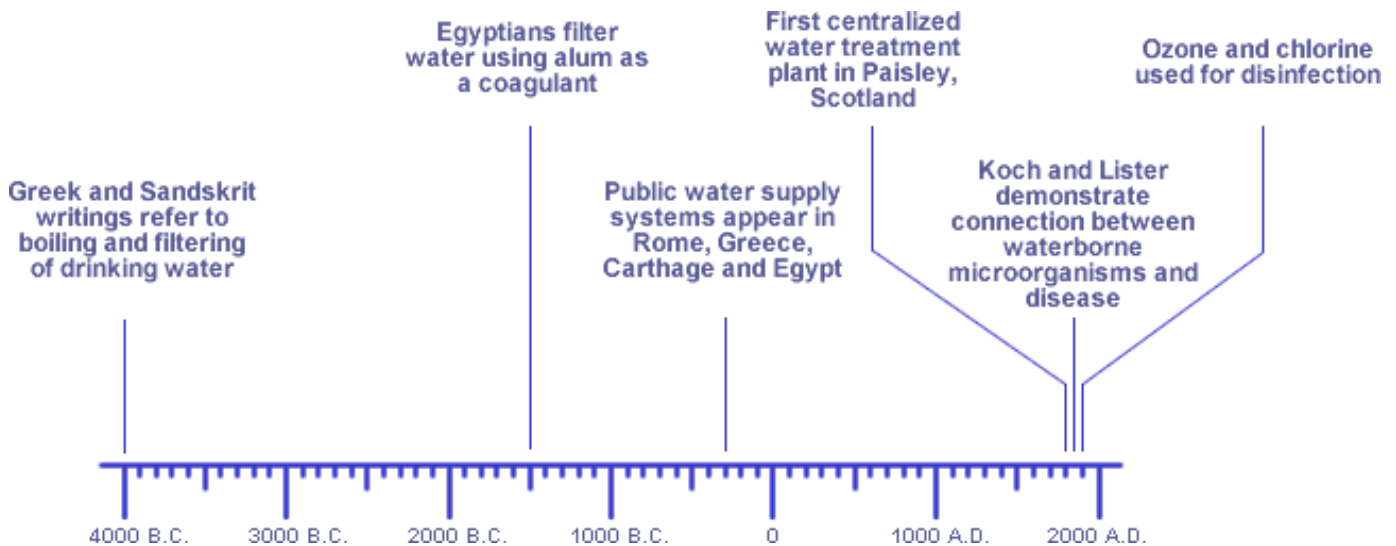


Figure 1.1 Timeline of Significant Developments in Water Treatment

Turn to page 1-5 and read the descriptions.

### Timeline of Early Water Treatment Advances

- 4,000 B.C. – Greek and Sanskrit writings reference boiling water and filtering through sand and coarse gravel.
- 2,000 B.C. – People in India filter water through charcoal.
- 1,500 B.C. – Egyptian tomb paintings show people filtering water using wick siphons. It is believed that they also used alum for treating water.
- 400 B.C. – Hippocrates makes connection between water and health. Recommends boiling and filtering rainwater through a cloth bag.
- 343 B.C. to 225 A.D. – Romans construct aqueducts.
- 300 B.C. – Public water supply systems appear in Rome, Greece, Carthage and Egypt. Cisterns constructed for storage and settling.
- 1680 - Anton Van Leeuwenhoek invents the microscope and 1685 - Lu Antonio Porzio invents a multiple sand filter.
- 1749 – Joseph Amy patents water filter for home use using sponge, charcoal and wool.
- 1804 - First centralized water treatment plant (supplying water to an entire town) constructed in Paisley Scotland. Intended to improve aesthetic quality of water. Was not concerned with health.
- 1854 - Contaminated water supplies linked with disease by Dr. John Snow in cholera outbreak in London.
- 1870's – Dr. Robert Koch and Dr. Joseph Lister demonstrate link between waterborne microorganisms and disease.
- Late 1800's – Improvements made to slow sand filtration. Rapid sand filtration developed.
- 1906 – Ozone used for disinfection in France.
- 1908 – Chlorination used for disinfection in U.S. Incidence of waterborne disease declines as more communities adopt filtration and disinfection.



In your opinion, what are the three key historical achievements in water treatment and why?  
A: Highlighted in yellow above.

Turn to page 1-6 and let's see how water quality regulations developed.

## Timeline of Water Quality Regulations

Timeline of key legislation on regulating water quality is given below.

- 1893 – U.S. Public Health Service (USHPS) enacts Interstate Quarantine Act, a regulation prohibiting use of a common drinking cup by passengers on commercial transportation carriers traveling between states.
- 1914 - Federal standard for bacteriological water quality developed.
- 1925 - USPHS expanded standards to include guidelines for bacteriological sampling and maximum levels for lead, fluoride, arsenic, selenium, and chromium. Generally these were non-enforceable guidelines.
- 1962 – Guidelines are expanded to include additional constituents. Limits on many constituents made mandatory.
- 1974 – Congress passes Safe Drinking Water Act.
- 1986 and 1996 - Safe Drinking Water Act amended.



As a water treatment plant operator, you must have an understanding of all the water supply regulations that apply to your treatment plant. These regulations directly affect your day-to-day responsibilities.

To summarize Unit 1, let's review a few key points.



### Slide 11 – Unit 1 Key Points

## Key Points



The job of the public water supplier is to provide a clean, safe, and reliable supply of water at a reasonable cost.



People have been treating water to some extent since 4000 B.C. The key historical achievements in water treatment are those that link water quality to human health.

-400 B.C. – Hippocrates made a connection between water and health.

-1854 – Dr. John Snow linked contaminated water supplies with disease in 1854 cholera outbreak in London.

-1906 – Ozone used for disinfection in France and 1908 – Chlorination used for disinfection in U.S.  
Widespread disinfection of public water supplies finally brought many diseases under control.



Water treatment plant operators are responsible for understanding the regulations that apply to their treatment plant.

Turn to page 2-1 and we'll begin Unit 2 by classifying types of public water systems.

# Unit 2 – Public Water Supply System Classifications

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## Slide 12 – Unit 2 Learning Objectives

### Learning Objectives

- Describe the different classifications of water systems and an example of each.

Turn to page 2-2 and read the definition of a public water system.

### Purpose of Classification

Different types of water systems have different treatment requirements. Water systems are classified on this basis. Regulatory requirements vary from one class to another, and operator certifications are specific to certain classifications of systems.



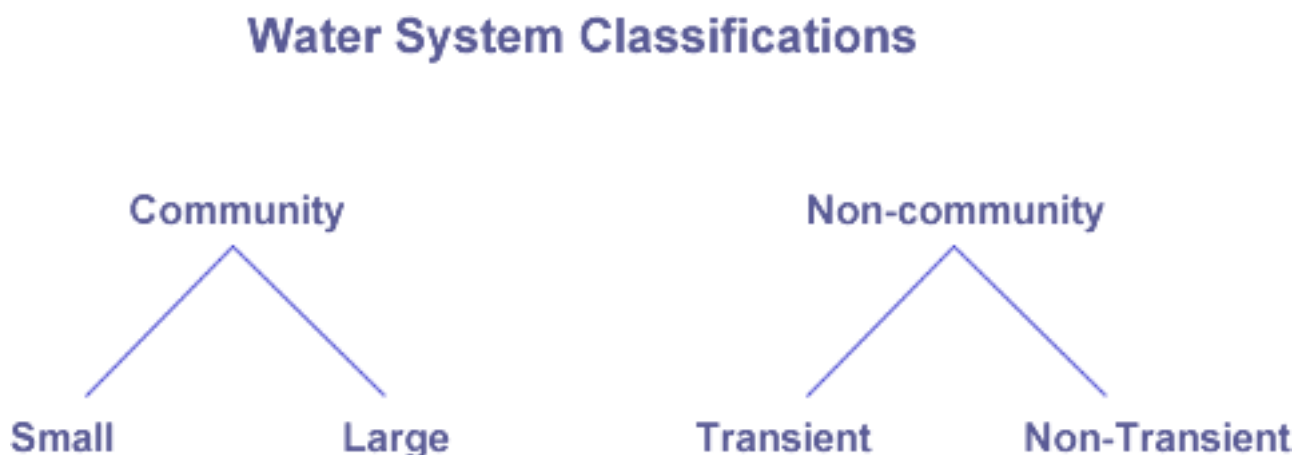
### Slide 13 – EPA Definition of Public Water Supply

### Definition of Public Water Supply System

- ① The United States Environmental Protection Agency (EPA) defines a **Public Water Supply System** as “a system for the provision to the public of water for human consumption through pipes or other constructed conveyances, if such system has at least fifteen service connections or regularly serves an average of at least twenty-five individuals daily at least 60 days out of the year.”<sup>1</sup>

Water systems are classified according to the illustration in Figure 2.1

Figure 2.1: Water system classification tree



Notice that public water systems are further classified as community or noncommunity.

### Community or Noncommunity



A **Community Water System** is defined by EPA as “a public water system which serves at least 15 service connections used by year-round residents or regularly serves at least 25 year round residents.”<sup>2</sup> Examples include:

- Municipally owned and operated water systems
- Systems owned and operated by authorities
- Investor owned water systems, such as Pennsylvania-American Water Company, United Water, and Aqua
- Privately owned systems serving residential developments or manufactured housing units.



A **Noncommunity Water System** is a public water system that serves at least 25 people, but doesn't serve them continuously year round.

There's a final distinction in the noncommunity systems. They are either nontransient or transient.

*Q. Read the definitions and tell me what is the distinguishing difference between nontransient and transient systems?*

**A** Nontransient systems are serving the **SAME** people and transient systems serve different (transient populations)

### Nontransient or Transient

Non-community water systems are further broken down into Transient and Nontransient systems.



A **Nontransient Water System** is defined by EPA as “a public water system that is not a community water system and that regularly serves at least 25 of the **same persons over 6 months per year.**”<sup>3</sup>



**What are some examples of a non-transient water system?**

**A:** Any business (office, school, hotel, factory) with at least 25 employees with its own water supply.



A **Transient Water System** is defined by EPA as “a noncommunity water system that does not regularly serve at least 25 of the same persons over 6 months per year.”<sup>4</sup>



**What are some examples of a transient water system?**

**A:** Restaurant, campground, vacation resort with its own water supply.

Turn to page 2-4 and let's complete the exercise.

## Size Classifications of Community Water Systems



**Small Water Systems** - water systems that serve 3,300 persons or fewer.

- Small water systems are not required to meet all the same requirements as larger systems. Most of the differences relate to frequency of sampling and testing for some contaminants.
- Small systems may also be eligible for special assistance from US-EPA and groups like the American Water Works Association (AWWA) to help them meet their needs with the limited resources generally available to small systems.



Generally, water systems that serve more than 3,300 people are classified as **Large Water Systems**. For certain specific regulations, a system must serve more than 10,000 people or 50,000 to be considered a "Large Water System."

- Large water systems have to meet more stringent monitoring requirements under certain regulations. Some of these are discussed in Unit 3.



**Slide 14 – Exercise with Answers**



### Exercise

Look at the following descriptions of water systems. Identify them as Community or Noncommunity. If Noncommunity, further identify them as Transient or Nontransient.

1. A hospital has its own private well and water treatment system.

**A: NTNCWS because it employs 25 of the same people at least 6 months of the year.**

2. A farmer has a good spring on his property and provides drinking water to 16 of his neighbors, free of charge.

**A: CWS because it has 16 service connections.**



3. A real estate developer drills a well and provides the water to the 17 homes in his development.

**A: CWS because it has 17 service connections.**

4. A restaurant with its own well supply has an apartment above that's connected to the restaurant's plumbing system.

**A: TNCWS because the restaurant serves a transient population.**

5. A campground has sites with camper trailers set up permanently.

**A: TNCWS because the people are probably not staying year round or even 6 months out of the year.**

**Let's review Unit 2 Key points.**



### **Slide 15 – Key Points**

## **Key Points**



A community water system is defined as “a public water system which serves at least 15 service connections used by year-round residents or regularly serves at least 25 year round residents.” All other public water suppliers are considered to be noncommunity.



Community water systems that serve more than 3300 people are classified as “large” while those that serve 3300 or fewer are considered to be small.



Noncommunity water systems that regularly serve at least 25 of the same persons over 6 months per year are classified as “non-transient”. All other noncommunity systems are considered “transient”.



Operators must be familiar with how treatment plants are classified because many individual plant requirements are based, in part, on the classification the water system.

**Turn to page 3-1 and look at Unit 3 objectives.**

<sup>1</sup> Definition taken from the National Primary Drinking Water Standards, which is available at the EPA Ground Water & Drinking Water website ([www.epa.gov/safewater/mcl.html](http://www.epa.gov/safewater/mcl.html)).

<sup>2</sup> Ibid.

<sup>3</sup> Ibid.

<sup>4</sup> Ibid.

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# Unit 3 – Federal and State Regulations

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## Slide 16 – Unit 3 Learning Objectives

### Learning Objectives

- State the roles of federal and state agencies regarding drinking water.
- Explain the requirements to becoming and maintaining operator certification
- Identify key regulations that directly affect the water treatment plant operator.
- Identify the maximum contaminant levels, and monitoring and reporting requirements for regulated contaminants.

Turn to page 3-2 and let's talk about how EPA and DEP relate to each other.



### Slide 17 – Who Makes the Rules and Enforces Them?

EPA is mandated by Congress through the Safe Drinking Water Act to establish drinking water regulations and periodically review these regulations to update them.

## United States Environmental Protection Agency

EPA studies health issues related to water quality and develops regulations, standards, and guidance documents related to drinking water. It legislates specific minimum requirements that the states must meet, though the states are generally permitted to enact more stringent requirements.

## State of Pennsylvania Department of Environmental Protection

The Pennsylvania Department of Environmental Protection (Pa. DEP) has **primacy**, i.e., responsibility for enforcement of EPA drinking water regulations. Pa. DEP obtains primacy by meeting the minimum requirements mandated by EPA.

## Other Agencies

Pennsylvania has two River Basin Commissions:

- Susquehanna River Basin Commission (SRBC)
- Delaware River Basin Commission (DRBC)

River Basin Commissions handle issues related to:

- Water allocations
- Water withdrawal limits
- Minimum stream flows and required reservoir releases
- Interbasin water transfers (i.e. water withdrawn from one river basin and discharged to another river basin either directly or as treated wastewater after consumption).

Turn to page 3-3 and let's talk about the Operator Certification Act.

**Instructor Note:** Read all the text on this page because there are exam questions about this content.



### Slide 18 – Operator Certification Act

#### Operator Certification Act

The purpose of the operator certification (ACT 11) is to protect public health, safety and the environment. The act ensures that certified operators have appropriate skills, knowledge and abilities to make appropriate process control decisions during the operation of water systems and water distribution systems. To achieve this, the State Board of Certification of Water and Wastewater Systems Operators and the Pa. DEP sets the training, experience and examination standards for operator certification. This was done in ACT 11.



### Slide 19 – Appropriately Certified Operator/Process Control Decision

#### ACT 11

Every water system regulated under ACT 11 must have an **appropriately certified operator** and an appropriately certified operator must make all process control decisions of system operation.



What is an appropriately certified operator?

What is a process control decision?



An **appropriately certified operator** is an operator who holds a certificate of the same or high class and with all the subclasses of the system at which they work or want to work.



A **process control decision** is any decision that changes or maintains water quantity or water quality of a water or wastewater system in a manner that may affect public health or the environment.



### Slide 20 – Uncertified/not appropriately certified operators can only make process control decisions when

Act 11 does not require all operators that work at a water system to be certified; however only appropriately certified operators can make process control decisions. Uncertified and not appropriately certified operators can only make process control decisions when:

- Under direction of an appropriately certified operator or,
- Using Standard Operating Procedures (SOP) that were developed by an appropriately certified operator.

Additionally, an appropriately certified operator must be **available at all times** during system operations.



**Available** means that an appropriately certified operator is **on site or available to be contacted as needed** to make process control decisions for the system in a timely manner.

Page 3-4 summarizes the requirements (experience and education) to becoming certified.



**Slide 21 – Requirement to becoming an appropriately certified operator.**

The requirements to becoming an appropriately certified operator include:

- **Education Requirement**
  - The applicant must be at least a high school graduate, possess a GED or have been an operator before February 21, 2002.
- **Examination**
- **Criminal History Check**
  - Completed not more than 90 days before the date the operator signs the application
- **Experience Requirement**
- **Final official approval by the Board** and awarded a certificate of a class and subclass(es) commensurate with you experience. Final approval will be granted after a thorough review of the applicant's information.



**Slide 22 – Table 3.1**

**Certification Requirements**

**Experience Requirements**

Classification	High School Diploma	AS	CP	ASP	BS/BA
A	4 years	3 years	2 years	1 year	2 years
B	3 years	2 years	2 year	6 months	1 year
C	2 years	1 year	6 Months	6 Months	6 Months
D	1 year	1 year	6 Months	6 Months	6 Months
Dn	1 year	1 year	6 Months	6 Months	6 Months
Dc	6 Months	1 year	0	0	0
E	6 Months	1 year	0	0	0

**AS:** Associate Degree in environmental or physical sciences, engineering or engineering technology NOT approved by DEP

**CP:** A certificate program of a DEP-approved Certification Program in Water Treatment

**ASP:** An Associate Degree in a Water Treatment Program approved by DEP

**BS/BA:** A bachelor's or graduate degree in Biology, Chemistry, Environmental Sciences, Physical Sciences, Sanitary or Environmental Engineering or Engineering Technology from a nationally accredited college or university

**Education/Experience Substitution (for High School Diploma ONLY)**

Education/Experience	Total Experience Allowed
Successful completion of every 10 hours of post high school or post GED water or wastewater related training (as applicable) approved by DEP and determined by the State Board for Certification of Water and Wastewater Systems Operators (Board) to be applicable to the certification sought.	1 month experience per 10 hours of training.

Successful completion of a college course approved by DEP as being specifically applicable to the water or wastewater disciplines  (Each semester college credit is equivalent to 15 hours.)	1.5 months experience for each semester college credit.
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Turn to page 3-5 and look at the type of activities that demonstrate experience.



**Slide 23 – Experience can be demonstrated:**

Experience can be demonstrated by participating in any of the following activities under the supervision of a certified operator or a certified operator of a higher classification than requested:

- (1) Operation of mechanical equipment,
- (2) Maintenance of mechanical equipment,
- (3) Collection of samples,
- (4) Analysis of chemical and biological samples,
- (5) Performing calculations related to process control,
- (6) Preparing or standardizing chemical and biological solutions,
- (7) Compiling and completing monitoring data, determining appropriate process control measures

### Examination Requirements

#### Types of Exams

Certification examinations measure the knowledge, skills and abilities necessary to successfully operate specific system sizes and technologies associated with the classification and subclassification of the water or wastewater system.



**Slide 24 – Examination for certification consist of a two part examination:**

Examination for certification consists of a two (2)-part examination.

- (i) Part I of the examination measures the applicant's general knowledge, skills and abilities common to all water or wastewater systems regardless of size.
- (ii) Part II of the examination measures the applicant's specific knowledge, skills and abilities necessary to operate treatment technologies or system components and will parallel the water and wastewater sub-classifications.

The master examination for water systems measures the applicant's general knowledge, skills and abilities and their competency to operate all available treatment technologies and system components.

Separate and single water system examinations are prepared for both Class Dc and Class Dn water treatment plants. Also a separate and single examination for Class E water distribution systems and consecutive systems without treatment will be prepared for operator certification as well as a separate and single examination for wastewater collection systems.

Examination and experience requirements must be met before the Board can issue a certificate. On the next page are three tables that illustrate the Water system classes, subclasses and requirements for the Dc and Dn certificates.

Look at page 3-6 and the 3 tables that describe water system classes and subclasses.

These three illustrations below identify the Water system classes and subclasses.

<b>Water System Classes</b>	<b>Water System Subclasses</b>
<b>A</b> >5 MGD <b>B</b> >1 MGD but $\leq$ 5 MGD <b>C</b> >0.1 MGD but $\leq$ 1 MGD <b>D</b> $\leq$ 0.1 MGD <b>E</b> Distribution systems and consecutive water systems without treatment	<ol style="list-style-type: none"><li>1. Conventional filtration</li><li>2. Direct filtration</li><li>3. Diatomaceous earth filtration</li><li>4. Slow sand filtration</li><li>5. Cartridge or bag filtration</li><li>6. Membrane filtration</li><li>7. Corrosion control and sequestering</li><li>8. Chemical addition</li><li>9. Inorganic removal</li><li>10. Organic removal</li><li>11. Gaseous chlorine disinfection</li><li>12. Non-gaseous chemical disinfection</li><li>13. Ultraviolet disinfection</li><li>14. Ozone disinfection</li></ol>

<b>Small Water Systems</b>
<i>Dc systems</i> <ol style="list-style-type: none"><li>1. system serves less than 500 individuals or has no more than 150 connections, whichever is less;</li><li>2. the source of water for the system is exclusively groundwater,</li><li>3. requires only disinfection, and</li><li>4. meets other applicable requirements provided by the Act and is not in violation of the Act or other PADEP rules and regulations.</li></ol> <i>Dn system</i> <p>Same criteria as Dc system except for condition #3. A Dn system is one where the water requires no treatment.</p>

**Instructor Note:** Read the following:



**Slide 25 – Water System Subclasses**



- If you have treatment you cannot be classified as an E or Dn.
- If you have treatment other than disinfection you cannot be classified as a Dc.
- In order to have an appropriate license an operator must be certified in both the class and sub-classes of the treatment plant they are operating.
- The advantage of being classified as either Dn or Dc is that the testing process is simplified. Both the Dn and Dc classes have stand-alone tests, and no sub-classification tests are required.

Turn to page 3-7 and we'll answer these questions as a full group.

### Exercise I

Answer the next three questions.

1. What certificates would be needed to run a 1 MGD water system that requires treatment for copper (due to low pH), manganese and uses gaseous chlorination as a disinfectant?

**Class B, Subclasses 1, 7, 11**

How much experience would be needed for a person with only a high school diploma before the board would grant a certificate to make process control decisions at this plant? **3 years**

2. What certificates would be needed to run a 10 MGD water system that uses conventional filtration and non-gaseous disinfection? **Class A, Subclasses 1 and 12**

How much experience would be needed for a person with an associates degree in environmental science before the board would grant a certificate to make process control decisions at this plant? **3 years**

3. What certificates would be needed to run a groundwater system with 100 connections and 450 customers and treats with non-gaseous chemical disinfection? **Class Dc**

How much experience would be needed for a person with only a high school diploma before the board would grant a certificate to make process control decisions at this plant? **6 months**

Turn to page 3-8 and look at the continuing education requirements.

Note that the education must be approved by DEP.

 **Slide 26 – Continuing Education Requirements**  
**Continuing Education Requirement**

Certified operators are required to obtain continuing education depending on the operator class. The continuing education requirements are different for each operator class. Continuing education must be earned in their 3-year renewal cycle and the education must be approved by DEP.

Operator Class	Contact Hours First 3-Yr Cycle	Contact Hours Subsequent 3-Yr Cycles
A	15	30
B	15	30
C	15	30
D	8	15
E (Distribution)	8	15
Dc	4	9
Dn	3	6
Grandparented	8	15

 **Slide 27 – Certified Operator and Owner Responsibility**  
**Certified Operator and Owner Responsibility**

Certificate holders are required to make sound judgment and must consider the health and welfare of their customers, community and the environment. If it is found that an operator has been negligent, committed fraud, falsified an application, falsified operating records, or failed to use reasonable care or judgment in performance of duties the board may revoke suspend or modify a certificate. [Instructor Note: *Emphasize this point*]

Another important part of this responsibility is liability, with the new certification requirements liability of owners and operators comes to the forefront. Always use your best judgment or your system might find itself hit with a lawsuit.

 **Slide 28 – Certified Operator Must**  
**Certified Operators must**

- Meet all the requirements for recertification.
- Report to the system owner any known violation(s) or system condition(s) that may be causing violations of any department regulation or permit condition
- Report to the system owner any action to permit or eliminate a violation of applicable water system laws.
- Provide for the suitable O&M of a water system utilizing available resources to comply with all laws.
- Make or implement process control decisions, or direct actions related to process control decisions for specific water systems.

Turn to page 3-9 and look at Owner responsibilities.



### Slide 29 – Owners Must

*Owners must:*

- Employ, identify and report to the department the names of available operators required by DEP
- Require, supervise and direct certified operators to take such action so that the water system is in compliance with all laws.
- Providing a copy of permit conditions to the certified operator in responsible charge.

Owners, Operators, non-certified operators and maintenance staff can be prosecuted for failing to comply with the **Drinking Water and Wastewater Systems Operators Certification Act**.

### *Exercise II*

Complete the following sentences by filling in the blanks.

1. Every water system regulated under ACT 11 must have an **appropriately certified operator**.
2. Class B operators must obtain **15** hours of continuing education during their first renewal cycle and **30** hours during all subsequent renewal cycles.
3. Owners, **operators**, non-certified operators and maintenance staff can be prosecuted for failing to comply with the **Drinking Water and Wastewater Systems Operators Certification Act**.
4. A **process control decision** is a decision, which maintains or changes the quality or quantity of water or wastewater in a water system that may affect the public health or environment.
5. An **appropriately certified operator** is defined as an operator having a certificate containing the class and subclass(es) matching the class and subclass(es) of the system that they operate.

Turn to page 3-10 and we'll begin our discussion of regulations with the Safe Drinking Water Act.

**Instructor Note:** Review all text on this page.



## Slide 30 - Vocabulary

### Safe Drinking Water Act



The **Safe Drinking Water Act** authorizes EPA to set national health-based standards for drinking water to protect against both naturally-occurring and man-made contaminants that may be found in drinking water. These standards are divided into:



**Primary Standards** – National Primary Drinking Water Regulations (NPDWRs or primary standards) are legally enforceable standards that apply to public water systems. Primary standards protect public health by limiting the levels of specific contaminants in drinking water.

- Some contaminants are regulated by establishing a specific maximum concentration. These maximum concentrations are called maximum contaminant levels (MCLs) or maximum residual disinfectant levels (MRDLs).
- Other contaminants are regulated by requiring specific treatment techniques and performance requirements that will assure their removal.
- A listing of contaminants regulated by the primary standards, their MCL's and/or treatment techniques, potential health effects, and potential sources of contamination can be found in Appendix 1.



**Secondary Standards** – National Secondary Drinking Water Regulations (NSDWRs or secondary standards) are guidelines regulating contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor, or color) in drinking water.

- Pa. DEP **does** require monitoring for secondary contaminants and is obligated to require public notification and treatment if the secondary MCLs are violated.
- A listing of contaminants regulated by the secondary standards and their MCL's can be found in Appendix 2.

Turn to page 3-11 and we'll briefly discuss certain provisions of additional regulations.

EPA develops regulations from authority they receive under the Safe Drinking Water Act.

Under the Surface Water Treatment Rule, system using surface water and GUDI sources must provide both disinfection and filtration. [NOTE: Exam topic]

Q. What does the acronym GUDI represent?

A. Groundwater under the direct influence



Slide 31 – Other Relevant Regulations

### Other Relevant Federal Regulations

The Safe Drinking Water Act serves as the “springboard” for all Federal drinking water regulations. This section discusses some, but not all, of the more important rules and describes the major provisions of each.

*Instructor Note: Read highlighted text below.*



**Surface Water Treatment Rule** - The Surface Water Treatment Rule was implemented to overcome the shortfalls of the National Interim Primary Drinking Water Regulations (NIPDWR). This rule became effective in June, 1989. Pa. DEP has primacy for enforcement. Major components include:

- Requires disinfection of all surface supplies.
- Establishes treatment techniques to achieve at least 99.9% removal or inactivation (referred to as “3-log removal”) of *Giardia lamblia* cysts and 99.99% (referred to as “4-log” removal) of viruses. [Module 5 – Disinfection addresses the concept of log removal]
- Systems must be operated by “qualified personnel.”
- Establishes criteria for operating without filtration.
  - To avoid filtration, a system must meet specific source water quality criteria and must still meet the disinfection requirements.
  - All systems that do not meet the avoidance criteria must provide filtration.
  - All surface water and GUDI sources must provide filtration
- Establishes “CT” as the basis for disinfection. “CT” is an abbreviation for “Disinfectant Residual Concentration x Contact Time in minutes.” It provides a means of determining the level of disinfection being achieved under specific operating conditions.
  - In consideration of short circuiting which may occur in some basins, this rule establishes a methodology for determining effective detention time for different basin and clearwell configurations .

- Provides a means to determine that required disinfection has been achieved, based on disinfectant used, disinfectant concentration, contact time, water temperature, pH, and required “log removal” of targeted microbes (*Giardia*, viruses). [Module 5 addresses CT and these issues]
- Establishes suitable filtration technologies and performance criteria for removal of turbidity and *Giardia*. Filtration is covered in detail in Modules 14 through 19.
- Establishes sampling requirements and MCL’s for combined filter effluent turbidity to monitor performance of the filtration system.
- The Surface Water Treatment Rule includes groundwater that is “under the influence” of surface water.

Look at page 3-12. The first revision to the SWTR is named the Interim Enhanced Surface Water Treatment Rule and it affected surface water systems serving 10,000 people or more.

**Instructor Note:** Read highlighted text below.



**Interim Enhanced Surface Water Treatment Rule:** This rule builds upon the Surface Water Treatment Rule to improve control of microbial pathogens and address risk trade-offs with disinfection byproducts. This rule became effective February 16, 1999. PADEP has primacy for enforcement. This rule generally only affects systems that use surface water and serve 10,000 people or more. Some of the major provisions include:

- Systems that are required to filter under the Surface Water Treatment Rule must achieve at least 99% (2-log) removal of the protozoan *Cryptosporidium*. Systems are considered to be in compliance with this requirement if filter effluent turbidity requirements are met.
- Strengthened filter effluent turbidity requirements.
  - Combined filter effluent turbidity must be below 0.3 NTU in at least 95% of the turbidity measurements taken, and measurements must be taken at least every four hours.
  - Combined filter effluent turbidity must be below 1 NTU at all times.
  - Effluent turbidity of all individual filters must be monitored continuously.
- Includes disinfection CT benchmarking/profiling requirements to insure changes in disinfection practices to reduce disinfection byproducts don’t result in any reduction of disinfection of pathogens.
  - The operator must record disinfectant residual, water temperature, pH, and contact time daily during peak hourly flow for one year. This is also a beneficial monitoring practice for purposes other than simply meeting regulations.
  - Using the recorded information, the operator must calculate *Giardia lamblia* inactivation for each day. Using the daily data, the operator must determine the average *Giardia lamblia* inactivation for each month and plot on a graph. This is the disinfection profile.

- If any changes are made to disinfection practices, the water system operator must demonstrate that the level of *Giardia lamblia* inactivation will not be less than the lowest level shown on the system's current disinfection profile. (The lowest level on the current profile is the "benchmark").
- States are required to conduct sanitary surveys for all systems using surface water (or groundwater under direct influence of surface water).
- All new treated water storage tanks and reservoirs must be covered.

Turn to page 3-13 and look at the Long Term 1 Enhanced Surface Water Treatment Rule. This rule carried the same requirements as IESWTR and it applied to the smaller surface water systems (under 10,000 people).



**Long Term 1 Enhanced Surface Water Treatment Rule (LT1):** EPA promulgated this rule on February 13, 2002. In Pennsylvania, the final version of the rule was published in the PA Bulletin on June 19, 2004 and water systems must begin compliance starting in January 2005. PADEP has primacy for enforcement. Like the Interim Enhanced Surface Water Treatment Rule, this rule was put in place to improve control of microbial pathogens, specifically the protozoan *Cryptosporidium*, and to address risk trade-offs with disinfection by-products. However, this rule applies to public water systems that serve fewer than 10,000 people. Some of the major provisions include:

- All systems covered by this rule must achieve at least 99% (2-log) removal or inactivation of *Cryptosporidium*. Systems are considered to be in compliance with this requirement if filter effluent turbidity requirements are met.
- Strengthened filter effluent turbidity monitoring requirements, as described in the Interim Enhanced Surface Water Treatment Rule.
- Disinfection benchmarking and profiling, as described in the Interim Enhanced Surface Water Treatment Rule.

The most recent surface water treatment rule became effective in PA in 2009 and it is the Long Term 2 Enhances Surface Water Treatment Rule.

*Instructor Note: Read highlighted text below.*



**Long Term 2 Enhanced Surface Water Treatment Rule (LT2):** This rule became effective in PA in December 2009. It builds upon the earlier surface water treatment rules to address higher risk public water systems for protection measures beyond those required for existing regulations. Higher risk systems include filtered water systems with high levels of *Cryptosporidium* in their sources and all unfiltered water systems. Some of the major provisions include:

- All systems covered by this rule will monitor their sources with two years of monthly sampling for *Cryptosporidium* (or *E. coli* for small systems).
- Systems are classified into treatment bins based on their monitoring results. Many systems will be classified in the lowest treatment bin which carries no additional treatment requirements. Systems classified in higher treatment bins must provide 90 to 99.7 percent (1.0 to 2.5-log) additional treatment for *Cryptosporidium*.
- Systems will select from a wide range of treatment and management strategies in the “microbial toolbox” to meet their additional treatment requirements.

*Instructor Note: Skip the Filter Backwash rule and go to DBP rules beginning on page 3-14.*



**Filter Backwash Recycling Rule:** This rule became effective August 7, 2001. This rule was passed to regulate filter backwash recycling methods and prohibit practices that may compromise treatment. Some of the major provisions include:

- Applies to **all** systems that use surface water (or ground water under the direct influence of surface water), use conventional or direct filtration, and recycle spent filter backwash water and/or liquids from sludge thickening and dewatering processes.
- Recycled water must be reintroduced into the process upstream of any chemical treatment.
- Water system operators must submit information to their state related to their treatment process, including:
  - A treatment process schematic
  - Recycle flow streams
  - Backwash flow rates
  - Treatment provided to the waste streams before they are recycled.
- Based on this information, the state may require modifications to the water treatment plant's recycle practices.

Let's turn to page 3-14 and look at the Disinfectants and Disinfection Byproduct Rules beginning with Stage 1 that applies to all public water systems that add a disinfectant during any part of the water treatment process.

*Instructor Note: Read highlighted text below.*



**Stage 1 Disinfectants and Disinfection Byproduct Rule:** This rule became effective February 16, 1999. Pa. DEP has primacy for enforcement. This rule sets maximum contaminant levels (MCL's) for total trihalomethanes (TTHM's) and the total of five haloacetic acids (HAA5). It also



sets maximum disinfectant residual concentrations for chlorine, chloramines, and chlorine dioxide. Some of the major provisions include:

- Applies to all public water systems that add a disinfectant during **any** part of the water treatment process.
- Sets MCL for TTHM's at 0.08 mg/L (80 parts per billion or ppb) and MCL for HAA5 at 0.06 mg/L (60 ppb).
- Sets MCL for chlorite (a by-product of chlorine dioxide) at 1.0 mg/L and MCL for bromate (a by-product of ozone) at 0.01 mg/L (10 ppb).
- Sets maximum residual disinfectant levels (MRDL's) of 4.0 mg/L (as Cl<sub>2</sub>) for chlorine, 4.0 mg/L (as Cl<sub>2</sub>) for chloramines, and 0.8 mg/L for chlorine dioxide (as ClO<sub>2</sub>).
- Requires removal of total organic carbon (TOC) present in the raw water by enhanced coagulation (for systems using conventional treatment). Chemical disinfectants react with organic carbon in the raw water to form by-products. Removal requirements are outlined in the table below:

Table 3.1: Required Removal of Total Organic Carbon (Percent) by Enhanced Coagulation

Source Water TOC (mg/L)	Source Water Alkalinity (mg/l as CaCO <sub>3</sub> )		
	0 - 60	>60 - 120	>120
	Required % Removal of TOC		
>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

TOC removal requirements apply to any system using surface water or groundwater under direct influence of surface water and that use conventional treatment (chemical coagulation, flocculation, sedimentation, and filtration) regardless of the size of the system.

Stage 2 is being phased in for all systems based on their population served and their source type (G or S)

*Instructor Note: Read highlighted text below.*



**Stage 2 Disinfectants and Disinfection Byproduct Rule:** This rule became effective in PA in December 2009. Some of the major provisions include:

- Creating a new TTHM/HAA5 site selection procedure known as the initial distribution system evaluation (IDSE) for systems serving 10,000 or more people. The IDSE is intended to identify areas of the distribution system that are or likely to cause high levels of disinfection byproducts (DBPs). These locations will be used as monitoring locations under Stage 2.

- The monitoring schedule is based on source water type, population served and population of the largest system in a combined distribution system (CDS).
- The monitoring (frequency and number of required samples) is based on source water type and population served (excluding CDS).
- Compliance is now determined as a **locational running annual average (LRAA)** at each TTHM and HAA5 monitoring site to better protect customers.
- Systems collecting compliance samples on a **quarterly basis** are subject to an operational evaluation level (OEL).
  - The purpose of conducting an OEL is to do a comprehensive review of system operations.
  - The OEL calculation is completed at each location to determine if DBP levels are increasing and further action is needed to prevent a violation.
- Requires systems to submit a **monitoring plan** to identify locations and the sample collection schedule for TTHM/HAA5 samples.

*Instructor Note: Read highlighted text below.*



### Slide 32 – More Regulations



**Ground Water Rule:** This rule became effective in PA in December 2009. Some of the major provisions include:

- Community groundwater systems are required to provide continuous disinfection and at least 4-log treatment of viruses (99.99% removal and/or inactivation).
- Community groundwater systems are required to maintain at each groundwater entry point a minimum residual disinfection concentration approved by DEP to provide 4-log treatment of viruses.
- DEP must conduct sanitary surveys that address the 8 components (source, treatment, distribution system, finished water storage, pumps/facilities/controls, monitoring, reporting and data verification, system management and operation, and operator compliance with state requirements) every 3 years. Community water systems must address any significant deficiencies DEP has described in a written notice no later than 30 days after DEP identifies the significant deficiency.

*Instructor Note: Read highlighted text below.*



**Total Coliform Rule:** This rule became effective December 31, 1990. Pa. DEP has primacy for enforcement. This rule sets monitoring and compliance requirements for coliform bacteria. Some of the major provisions include:

- All systems must have a written sample siting plan.
- For Community Water Systems, the number of samples is based on minimum population served.
- **If any samples are positive for total coliforms, repeat samples (i.e., check samples) must be taken as follows:**
  - Systems that collect more than one sample per month must collect at least three repeat samples within 24 hours for each sample that tested positive for total coliforms.
  - Systems that collect only one sample per month must collect at least four repeat samples within 24 hours for each sample that tested positive for total coliforms.
  - **Systems must continue to collect repeat samples until all samples are negative or it is determined that the system has violated the MCL.**
  - Systems that collect less than five samples per month must collect at least five routine samples during the month immediately following the positive sample.
  - **Any sample that tests positive for total coliforms must be analyzed for *E. coli* or fecal coliforms.**
- Water systems that collect fewer than five routine samples per month must undergo a sanitary survey every five years.

*Instructor Note: Read highlighted text below.*



**Arsenic Rule:** This rule became effective March 23, 2001. Pa. DEP has primacy for enforcement. **This rule reduces the MCL for arsenic in drinking water from its previous concentration of 0.05 mg/L (50 ppb) to 0.01 mg/L (10 ppb).** This rule also examines the “best available technologies” (BAT’s) for arsenic removal. Some of the BAT’s discussed in this rule are summarized in the table below:

Table 3.2: Best Available Technologies For Arsenic Removal

Treatment Technology	Maximum Percent Removal
Ion Exchange	95
Activated Alumina	95
Reverse Osmosis	>95
Modified Coagulation and Filtration	95
Modified Lime Softening	90

*Instructor Note: Read highlighted text below.*



**Slide 33 – Last Regulation**



**Lead and Copper Rule:** This rule became effective in 1991 with revisions that became effective April 11, 2000. Pa. DEP has primacy for enforcement. **This rule deals mainly with lead and copper levels in water at the customers’ tap.** Major provisions of this rule include:

- Requires monitoring of lead and copper levels at customer taps. Monitoring requirements vary, depending upon the size of the system.
  - Monitoring requirements are broken down by systems serving more than 50,000 persons, systems serving 3,301 to 50,000 persons, and systems serving 3,300 or fewer persons.
  - Transient non-community water systems are excluded from this rule.
- Systems where lead and copper levels at the customer tap exceed action levels in the 90<sup>th</sup> percentile sample result (0.015 mg/L for lead and 1.3 mg/L for copper) must institute corrosion control practices. This usually involves additional chemical treatment at the water treatment plant to raise pH and make the water more stable and less corrosive.
- Follow-up monitoring is required to verify corrosion control practices are working.
- Water systems must provide educational information to their customers outlining the causes of elevated lead and copper levels, the health effects of lead and copper, and actions the customers can take on their own to reduce their risk of exposure.

**Instructor Note:** Skip this section and turn to page 3-18.



#### Slide 34 – PA Water Supply Regulations

### Pennsylvania Water Supply Regulations

Pa. DEP publishes a Pennsylvania Water Supply Manual that describes design and operation requirements under Pennsylvania regulations. The Manual is divided into parts:

- Community System Design Standards – covers design requirements for water treatment processes, facilities, and distribution for community systems.
- Non-Community System Design Standards - covers design requirements for water treatment processes and facilities for non-community systems.
- Bottled Water, Bulk Water Hauling, Water Vending Machines, and Retail Water Facilities – covers requirements for processing and handling bottled water and bulk water hauling equipment.
- Operations and Maintenance – provides guidance on system start-up, operation, maintenance, and monitoring and reporting requirements.
- Emergency Response – describes various types of hazards, accidents, and failures that can affect water treatment plant operations and provides guidance for developing appropriate response plans.
- Cross-Connection Control/Backflow Prevention - covers acceptable means and methods for preventing cross connections and backflow between non-potable and potable water systems.

Turn to page 3-19 and we'll look at some key monitoring and reporting requirements.

**Instructor Note:** Read highlighted text below.



Slide 35 - Microbiological

Key Monitoring and Reporting Requirements

Microbiological (Coliform)

- Must be monitored monthly. The required number of samples is based on the population served.
- Samples are taken from the distribution system.
- A system is in violation if:
  - **Tier 1 Acute violation:** Any sample (routine or check) is fecal or *E. coli* coliform positive AND at least one check sample is total coliform positive.
  - **Tier 1 Acute violation:** If the fecal or *E. coli* test is not done as a follow-up analysis to the original total coliform positive sample, the check sample shall be considered fecal positive.

Here's a table that summarizes the acute TCR violations:

Table 3.3: Acute MCL violation if the following conditions exist:

	Total Coliform	Fecal or <i>E. coli</i>
Routine Sample	+	+
Associated Check Sample	+	

OR

	Total Coliform	Fecal or <i>E. coli</i>
Routine Sample	+	
Associated Check Sample	+	+

- **Tier 2 Monthly violation:** If two or more monthly samples (for systems collecting 1 to 39 samples per month) or more than 5% of all samples collected (for systems collecting 40 or more samples per month) are coliform positive.

*Q. Has anyone had to collect a source water *E. coli* sample?*

Here's the information about when that is required.

Microbiological (source water *E. Coli*)

For groundwater systems that have not yet installed 4-log treatment of viruses, within 24 hours of notification of a total coliform positive routine sample, collect at least one raw sample from each groundwater source that is connected to the distribution system from which the total coliform positive sample was collected. Analyze raw sample for *E. coli*.

Turn to page 3-19 and look at the nitrate/nitrite.

*Instructor Note: Read highlighted text below.*



### **Slide 36 – Inorganic Chemicals**

#### **Inorganic Chemicals**

- One annual sample (surface water sources) or one sample every three years (groundwater sources) is required, or quarterly samples for at least 4 consecutive quarters if initial sample is over the MCL.
- Samples are taken from each point water enters the distribution system.
- A system is in violation if average of routine and check samples exceeds the MCL for any regulated inorganic chemical contaminant.



### **Slide 37 – VOC's**

#### **Volatile Organic Chemicals and Synthetic Organic Chemicals**

- One annual sample is required, or quarterly samples for at least 4 consecutive quarters if initial sample is over the MCL.
- Samples are taken from each point water enters the distribution system.
- A system has exceeded the MCL if average of routine and check samples exceeds the MCL.



### **Slide 38 – Nitrate/Nitrite**

For nitrate and nitrite samples, note that quarterly monitoring is triggered when a sample is over 50% of the MCL.

#### **Nitrate/Nitrite**

- One annual sample is required, or quarterly samples for at least 4 consecutive quarters if initial sample is over 50% of the MCL.
- Samples are taken from each point water enters the distribution system.
- A system has exceeded the MCL if average of routine and check samples exceeds the MCL.



### **Slide 39 – Disinfection Byproducts**

#### **Disinfection Byproducts**

- Sampling requirements (frequency, number of samples, type of sample) for TTHM's and HAA5 vary according to source type and population served.
- Samples are taken from the locations within the distribution system that are or likely to cause high levels of TTHMs and HAA5s. (Stage 2)

- For surface water or GUDI systems serving less than 3,300 people and groundwater systems serving less than 500 people: TTHM and HAA5 samples are individual samples (not paired) and are collected at the highest TTHM site and the highest HAA5 even if those sites are at different locations. (Stage 2)

- A system has exceeded the MCL if the locational running annual average of any site exceeds the MCL. (Stage 2)

Look at the turbidity below requirements that apply to surface water systems using conventional or direct filtration.

**Instructor Note:** Read highlighted text below.



### Slide 40 - Radionuclides

#### Radionuclides

- Level is based on an annual composite of four consecutive quarterly samples (for surface water systems) or one sample every four years (for groundwater systems).
- Samples are taken from the distribution system.



### Slide 41 - Turbidity

#### Turbidity (Conventional or Direct Filtration)\*

- Effluent turbidity of individual filters must be monitored continuously. The turbidity of the combined effluent flow from all filters must be sampled at least every 4 hours.
- The operator must also report the number of hours the filter plant was in operation each month and the number of combined effluent turbidity measurements taken.
- Combined filter effluent samples are taken immediately downstream of the confluence of all filter effluents.
- A system has exceeded the performance level requirements if more than 5% of monthly combined filter effluent samples are over 0.3 NTU or any single sample is over 1 NTU.
- A system has exceeded the performance level requirement if two consecutive individual filter effluent measurements taken 15 minutes apart exceed 1.0 NTU, or if two measurements taken 15 minutes apart at the end of the first four hours of operation (after a filter has been backwashed or taken off-line for any reason) exceed 0.5 NTU.

\*Turbidity performance level requirements and monitoring frequencies are different for slow sand and diatomaceous earth filtration types.

Notice that all systems except groundwater systems serving 3,300 people or fewer are now required to continuously monitor their disinfectant residual.

**Slide 42 – Disinfection Residual****Disinfectant Residual**

- Disinfectant residual must be monitored continuously **except** for groundwater systems serving 3, 300 or fewer people. The lowest value recorded each day is reported.
  - Groundwater systems serving 3, 300 or fewer people shall take a **daily grab sample** at the entry point or other location approved by DEP **during the hour of peak flow**.
- Samples are taken at the point where water enters the distribution system and in the distribution system at the locations where coliform samples are taken.
- A **surface water** system has not met minimum disinfectant residual requirements if residual concentration falls below 0.2 mg/l for four hours at the **entry point** or if residual concentration in the **distribution** system falls below 0.02 mg/l, or if heterotrophic plate count exceeds 500.
  - For **groundwater systems**: A **disinfectant residual acceptable** to DEP shall be maintained throughout the distribution system of the community water system sufficient to assure compliance with the microbiological MCLs and the treatment technique requirements specified in §109.202. DEP will determine the acceptable residual of the disinfectant considering factor such as type and form of disinfectant, temperature and pH of the water, and other characteristics of the water system.
- A breakdown in disinfection treatment occurs when the **groundwater** system demonstrating at least 4-log treatment of viruses fails to meet, for greater than 4 continuous hours, the minimum DEP-approved residual disinfection residual requirements at the **entry point**.

**Instructor Note:** Read highlighted text below.

**Slide 43 – Lead and Copper****Lead and Copper**

- Samples for lead and copper must be taken every six months, unless the system is below the action levels for lead and copper for two consecutive six month periods or has optimized corrosion control. In that case samples must be taken annually.
- Small or medium sized systems (less than 10,000 persons served) that are below the action levels for lead and copper for three consecutive years may reduce sampling to once every three years. Large systems that are below the action levels for lead and copper for three consecutive years may reduce the numbers of samples taken.
- Samples are taken at the point where water enters the distribution system and at a number of locations throughout the distribution system. The number of distribution samples that must be taken depends upon the number of persons served.



- A system must implement appropriate treatment techniques if the 90<sup>th</sup> percentile value of the samples collected in any monitoring period exceeds the action levels for lead or copper.
- The action levels for lead and copper are 0.015 mg/L and 1.3 mg/L.



### Slide 44 – Secondary Contaminants

#### Secondary Contaminants

- The secondary contaminants most commonly monitored by the water treatment plant operator include color, corrosivity, aluminum, chlorides, iron, manganese, odor, pH, and total dissolved solids.

Let's look at one hour reporting and PN requirements on page 3-23.

*Instructor Note: Read highlighted text below.*

The water treatment plant operator is responsible for recording, compiling, and reporting the results of water quality analysis to Pa. DEP.



### Slide 45 – Public Notification

Additionally, the water supplier has one hour reporting requirements for:

- All Tier 1 violations or situations
- Most Tier 2 violations or situations and
- Any sample that requires a check sample.

#### Tier 1 and Tier 2 Definitions:

- Tier 1 violations or situations are those that cause short-term, acute health effects. In the public notice, you are telling your customers to take specific actions like “boil your water” or “Don’t drink the water.” Drinking the water with an acute contaminant would make you sick **very quickly**.
- A Tier 2 violation is a violation that has long-term chronic health effects. This means that it would take 70 years of drinking 2 liters of water each day to see the health effect. Drinking water with a chronic contaminant would take a long time (70 years) to see a health effect. For this reason, water suppliers have 30 days to issue a Tier 2 PN. Also the message within the PN does not require your customers to take any additional action.



The following violations or situations must be reported to the local Pa. DEP Regional Office within **one hour** of their occurrence:

Let's look at the very first Tier 1 violation.

**Q. Has anyone ever had fecal or *E. coli* in any of your water samples?** Notice that the violation occurs because you get fecal or *E. coli* in addition to a total coliform positive result. This is the same information we reviewed on page 3.18. The PN would require your customers to boil their water.



### Slide 46 – Public Notification

#### Tier 1 Acute Violations or Situations under 25 Pa. Code § 109.408(a):

1. Violation of the maximum contaminant level (MCL) for total coliforms, when fecal coliforms or *E. coli* are present in the water distribution system, or when water supplier fails to test for fecal coliforms or *E. coli* when any check sample tests positive for total coliforms.
2. Violation of the MCL for nitrate, nitrite or total nitrate and nitrite or failure to take a confirmation sample within 24 hours of notification of an initial exceedance.
3. Exceedance of the nitrate MCL by noncommunity water systems, when permitted by the Department of Environmental Protection (DEP) in writing to exceed the MCL (also known as the alternate nitrate level).
4. Violation of the maximum residual disinfectant level (MRDL) for chlorine dioxide when the water supplier does not take the required samples in the distribution system on the day following an entry point MRDL exceedance or when one or more samples taken in the distribution system exceeds the MRDL.
5. For unfiltered surface water systems, violation of the turbidity MCL of five nephelometric turbidity units (NTUs) based on an average for two consecutive days.
6. For filtered surface water systems, violation of the single exceedance of the maximum allowable turbidity limit of 1 NTU (conventional, direct or other filtration technologies) or 2.0 NTUs (slow sand or diatomaceous earth filtration technologies) at the combined filter effluent tap.
7. For filtered surface water systems, failure to provide the level of treatment appropriate for the system's *Cryptosporidium* bin classification.
8. For groundwater systems, detection of *E. coli* in source water samples.
9. For groundwater systems, a breakdown in treatment that includes failing to maintain the minimum entry point disinfectant residual for more than four hours or failing to maintain adequate CTs (i.e. the calculated value of chlorine residual multiplied by the contact time) for more than four hours.
10. Occurrence of a waterborne disease outbreak or other emergency situation under 25 Pa. Code § 109.701(a)(3)(iii) that adversely affects the quality or quantity of the finished water and has a significant potential to have serious adverse effects on human health as a result of short-term exposure. Examples of emergency situations include:
  - Failure or significant interruption in key water treatment processes involving disinfection, filtration or nitrate removal.
  - Natural disaster that disrupts the water supply or distribution system.
  - Chemical spill.
  - An unexpected loading of possible pathogens into the source water that significantly increases the potential for drinking water contamination.

- An overfeed of a drinking water treatment chemical that exceeds a published maximum use value, such as National Sanitation Foundation's "Maximum Use Value," as applicable.
- A situation that causes a loss of positive water pressure in any portion of the distribution system where there is evidence of contamination or a water supplier suspects a high risk of contamination.
- A lack of resources that adversely affect operations, such as staff shortages, notification by the power utility of planned lengthy power outages or imminent depletion of treatment chemical inventories.

11. Other violations or situations with significant potential for serious adverse human health effects from short-term exposure.

Turn to page 3-24 and let's look at the Tier 2 non-acute violations.

Look at the first Tier 2 PN about a chemical MCL violation. All chemical MCL violations are Tier 2 except for 2 chemicals which are listed under the Tier 1 category.

*Q. Can anyone tell me which chemicals are Tier 1 chemicals and why? (HINT: Find it on the Tier 1 list on the previous page)*

A. Nitrate and nitrite are acute chemicals because they cause acute health effects in babies under the age of 6 months (blue baby syndrome). The PN says don't give this water to babies under the age of 6 months or use it in making baby formula.

*Q. What's another example of a chemical? (IOCs or metals, VOCs, SOCs)*

*Q. Would iron and manganese be chemicals?*

A. Yes



### Slide 47 – Public Notification

**Tier 2 Non-Acute Violations under 25 Pa. Code § 109.409(a):**

1. Violation of the MCL for a chemical (including secondaries) or radiological contaminant.
2. For filtered surface water systems, exceedance of the monthly turbidity limit which occurs when six percent or more of the combined filter effluent samples exceed the allowable monthly turbidity limit of 0.3 NTU (conventional, direct or other filtration technologies) or 1.0 NTU (slow sand or diatomaceous earth filtration technologies).

Look at total coliform violation under #3.

*Q. Do you see the words *E. coli* or fecal coliform?*

A. No, that is because any total coliform violation that does not also include *E. coli* or fecal coliform is a Tier 2 violation that is not acute, just chronic. This PN would not require customers to boil their water

because total coliform organisms are indicator organisms. We'll discuss indicator organisms when we review Module 4 excerpts.

3. Violation of the MCL for total coliforms occurs when total coliforms are present in the water distribution system in either routine or check samples. For systems taking less than 40 samples per month, more than one positive sample per month constitutes a violation. For systems taking 40 or more samples per month, a violation occurs when more than five percent of the monthly samples taken test positive for total coliforms.
4. Violation of the MCL for fluoride.
5. Violation of the lead and copper rule treatment technique occurs when a system fails to install corrosion control treatment, maintain the range of values for the water quality parameter performance level requirements, or comply with the lead service line replacement requirements.
6. For filtered surface water systems, failure to conduct source water *Cryptosporidium* monitoring for any three months.
7. For filtered surface water systems and groundwater under the direct influence systems, failure to determine and report *Cryptosporidium* bin classification.
8. Failure to take corrective actions for a significant deficiency within required time frame or comply with a DEP-approved corrective action plan or schedule.

### Check Samples Required under 25 Pa. Code § 109.301:

1. A sample result that requires the collection of check samples.

Turn to page 3-26 and let's look at the public notification requirements.



### Slide 48 – Public Notification

### Public Notification Requirements

Tier 1 violations and situations require a Tier 1 PN

Tier 2 violations and situations require a Tier 2 PN

Tier 3 violations and situations require a Tier 3 PN

As we just reviewed, both Tier 1 and Tier 2 situations require the 1 hour reporting to DEP.

- All violations are organized into the three tiers listed in Table 3.4 based on the seriousness of any potential adverse health effects.
  - The Tier 1 violations or situations pose immediate health effects and therefore require a public notice issued within 24 hours.

- Tier 2 violations pose **chronic** health effects and therefore require a public notice issued within 30 days.
- Tier 3 violations do not pose health effects

<b>Table 3.4: Public Notification Delivery Deadlines</b>		
<b>Tier</b>	<b>Deadlines for Notice</b>	<b>Deadlines to Contact DEP*</b>
1	24 hours	1 Hour**
2	30 days	1 Hour for MCL, MRDL,TT Violations
3	1 year***	Not required

**Notes:**

- \* For all Tiers, a copy of each notice issued must be sent to DEP within 10 days of the issuance, along with a certification that all PN requirements have been met.
- \*\* For Tier 1, systems must also initiate consultation with DEP within 24 hours and issue a "Problem Corrected" notice within 24 hours of correcting the problem.
- \*\*\* DEP recommends consolidating all Tier 3 violations/situations occurring within a given year into an annual notice.

Turn to page 3-27 and we'll do the first exercise question.



Slide 49 – Exercise

**Instructor Note:** Complete question 1 and skip the other questions.



**Exercise**

1. The barium level in your treated water is 3 mg/L.
  - a. Are you in violation? Hint: MCL's are found in Appendices 1 and 2 (YES)
  - b. Are you required to notify DEP within 1 hour? (YES)
  - c. Name the tier type of the public notice you must issue? (Tier 2)
  - d. In what timeframe is this public notice required? (30 days)
  
2. Look at the turbidity data in the table below. Is this system in violation of the performance level requirement for turbidity? If so, identify which measurements constitute a violation and identify the type of each violation.

(Answer: Individual filter violation due to exceeding 1.0 NTU in 2 consecutive 15 minute readings on Filter 2 requires DEP notification within 24 hours and reporting the obvious reason for the exceedance. Also, system had a combined filter effluent violation of the maximum allowable turbidity limit of 1 NTU at 11:45 AM that requires one hour reporting and Tier 1 PN.)

Clear Water Conventional Treatment Plant Turbidity Data			
Time	Filter 1	Filter 2	Combined Filter Effluent
0800	0.23	0.19	0.20
0815	0.25	0.19	0.22
0830	0.25	0.20	0.22
0845	0.24	0.19	0.21
0900	0.25	0.19	0.22
0915	0.26	0.18	0.23
0930	0.25	0.19	0.23
0945	0.25	0.29	0.27
1000	0.26	0.74	0.52
1015	0.25	0.76	0.53
1030	0.25	0.78	0.54
1045	0.23	0.80	0.54
1100	0.24	0.89	0.63
1115	0.23	0.97	0.72
1130	0.24	1.21	0.89
1145	0.24	2.81	1.89
1200	0.24	-Taken offline-	0.24
1215	0.23		0.23
1230	0.24		0.24
1245	0.24		0.24

3. Your system is required to take 20 samples for lead and copper. The results of those 20 samples are given in the table below. Are you in compliance?

Sample No.	Lead Concentration (mg/L)	Copper Concentration (mg/L)
1	0.013	1.1
2	0.009	0.7
3	0.007	0.9
4	0.002	0.6
5	0.017	0.7
6	0.016	1.2
7	0.020	1.4
8	0.004	1.2
9	0.011	1.0
10	0.009	0.7
11	0.009	0.7
12	0.005	0.5
13	0.014	0.3
14	0.013	0.9
15	0.008	1.0
16	0.012	1.2
17	0.012	1.1
18	0.003	0.6
19	0.006	0.5
20	0.011	0.8

Let's review our key points for Unit 3 on page 3-29.

**Slide 49 – Unit 3 Key Points****Unit 3 Key Points**

The United States Environmental Protection Agency (EPA) studies health issues related to water quality and develops regulations, standards, and guidance documents related to drinking water.



The Pennsylvania Department of Environmental Protection (Pa. DEP) has **primacy**, i.e. responsibility for enforcement of EPA drinking water regulations.

- DEP does require monitoring for secondary contaminants and is obligated to require public notification and treatment if the secondary MCLS are violated.



The Operator Certification Act ensures that certified operators have appropriate skills, knowledge and abilities to make appropriate process control decisions during the operation of water systems and water distribution systems.

- An **appropriately certified operator** is an operator who holds a certificate of the same or high class and with all the subclasses of the system at which they work or want to work.
- A **process control decision** is any decision that changes or maintains water quantity of water quality of a water or wastewater system in a manner that may affect public health or the environment.
- The Certification Board may revoke, suspend or modify a certified operator's certificate if that operator has been negligent, committed fraud, falsified an application, falsified operating records, or failed to use reasonable care or judgment in performing job duties.



There are many regulations that dictate the various duties of a water treatment operator. It is the operator's responsibility to maintain full knowledge of not only existing water treatment requirements, but also new requirements as they are developed.

- Water suppliers are required to notify DEP within one hour for the following types of violations or situations:
  1. Tier 1 violations or situations
  2. Tier 2 violations or situations
  3. A sample result that requires a check sample
- Water suppliers are required to issue a Tier 1 public notice within 24 hours experiencing a Tier 1 acute violation or situation.
- Water suppliers are required to issue a Tier 2 public notice within 30 days of experiencing a Tier 2 non-acute violation or situation.



- Water suppliers should post a copy of the Tier 1 violations or situations in an area of their plant so they can respond quickly and appropriately to these acute situations.

Our final unit involves system management responsibilities. Turn to page 4-1 to review the objectives.

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## Unit 4 – System Management Responsibilities

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### Slide 50 – Unit 4 Learning Objectives

#### Learning Objectives

- Identify the major system management responsibility topics and provide links to templates.
- Identify additional drinking water resources.

Turn to page 4-2 and look at the selected system management responsibilities we'll be reviewing on the following pages.



**Slide 51** - This unit includes tables that summarize selected system management responsibilities. Chapter 109 contains system management responsibilities for community water suppliers. This unit includes tables that summarize the following selected system management responsibilities:

- Total coliform sample siting plan
- Lead and Copper Rule sample siting plan
- Stage 2 Disinfectant Byproduct Rule monitoring plan
- Monthly operational reports
- Complaint record
- Operation and Maintenance plan
- Emergency Response plan
- Distribution system map
- Cross connection control program
- Sanitary Survey
- Record retention

Refer to Chapter 109.701 for additional system management responsibilities.

Turn to page 4-3 and we'll look at Table 1 which describes the Total Coliform Sample Siting Plan.

If you have not yet completed this plan, use the link to the template.

**TABLE 1: Total Coliform Sample Siting Plan under 109.701(a)(5)**

At a minimum, a total coliform sample siting plan shall include:

- A list of available sample site location in the distribution system to be used for routine monitoring purposes, including the first service connection and dead ends.
- The name of the company or individual collecting the samples.
- A time period by which available sites representative of the distribution system are to be sampled during each monitoring period.

When a water supplier revises this plan, within 30 days, the supplier shall submit written revisions to DEP.

A **Total Coliform Sample Siting Plan template** is located at this link:

[http://www.depweb.state.pa.us/portal/server.pt/community/drinking\\_water\\_regulations%2C\\_standards\\_resources/10544](http://www.depweb.state.pa.us/portal/server.pt/community/drinking_water_regulations%2C_standards_resources/10544)

Turn to page 4-4.

You are also required to have a lead and copper rule sample site location plan.

**TABLE 2: Lead and Copper Rule Sample Site Location Plan under 109.1107(a)(1)**

A lead and copper sample site location plan shall include:

- A materials evaluation of the distribution system
- Lead and copper tap sample site locations
- Water quality parameter sample site locations
- Certification that proper sampling procedures were used.

If a water supplier selects different lead and copper or water quality parameter distribution or entry point sample sites, the supplier shall update the sample site location plan and submit it to DEP within ten days following the end of each applicable monitoring period.

A **Lead and Copper Rule Sample Site Location Plan template** is located at this link:

[http://www.depweb.state.pa.us/portal/server.pt/community/regulations/10547/lead\\_and\\_copper\\_rule/975048](http://www.depweb.state.pa.us/portal/server.pt/community/regulations/10547/lead_and_copper_rule/975048)

Turn to page 4-5.

The 3<sup>rd</sup> plan you need to prepare is a Stage 2 DBP Monitoring plan.

**TABLE 3: Stage 2 Disinfection Byproducts Rule (DBP) Monitoring Plan under 109.701(g)(2)**

A Stage 2 Disinfection Byproducts Rule monitoring plan shall include:

- Monitoring locations
- Monitoring dates
- Compliance calculation procedures

All community water systems shall submit a Stage 2 DBP monitoring plan to DEP unless the system submitted an Initial Distribution System Evaluation (IDSE) report that was evaluated by DEP.

<b>System Size</b>	<b>Monitoring plan and compliance monitoring begin due date</b>
Greater than or equal to 100,000 people	April 1, 2012
50,000 to 99,999 people	October 1, 2012
10,000 to 49,999 people	October 1, 2013
Less than 10,000 people	October 1, 2013 if <i>Cryptosporidium</i> monitoring is not required.  <b>OR</b> October 1, 2014 if <i>Cryptosporidium</i> monitoring is required.

**Stage 2 DBP monitoring plan template:**

<http://www.elibrary.dep.state.pa.us/dsweb/View/Collection-10727>

Be sure to print the instructions document which is a separate file.

**TABLE 4: Monthly Operational Report under 109.701(b)(1)**

A community water supplier shall prepare a monthly operational report that is maintained on file by the operator for at least two years and submitted upon request by DEP. The report must include at least the following:

- The water produced daily.
- The chemicals added daily.
- The physical and chemical determinations taken daily. (e.g. pumping rates, daily water quality measurements, etc...)
- Water-level monitoring data for supply and any associated monitoring wells.
- The maintenance performed.
- Operational problems.

Monthly operating report forms are found in **Section 5 Records and Reporting of the Operation and Maintenance Plan template** at this link:

<http://www.elibrary.dep.state.pa.us/dsweb/View/Collection-8798>

Page 4-6 has tables that identify the monthly operational report and complaint record requirements.

**TABLE 5: Complaint Record under 109.701(b)(3)**

A community water supplier shall keep a record of complaints received from consumers related to the act or Chapter 109. Water suppliers complying with the Pennsylvania Public Utility Commission (PUC) complaint recordkeeping requirements shall be in compliance with this subsection. The records shall be maintained on file by the operator for at least three years and submitted upon request to DEP.

A record of customer complaints is found in **Section 5 Records and Reporting of the Operation and Maintenance Plan template** at this link:

<http://www.elibrary.dep.state.pa.us/dsweb/View/Collection-8798>

Turn to page 4-7 and look at the O & M Plan requirements.

**TABLE 6: Operation and Maintenance Plan under 109.702**

A community water supplier shall develop an operation and maintenance plan that contains at least the following:

- A description of the facilities.
- An explanation of startup and normal operation procedures.
- Procedures for repairing and replacing water mains that conform to DEP and AWWA standards.
- A routine maintenance program.
- Records and reporting system.
- Sampling and analyses program.
- Public notification elements:
  - PN template
  - EPA contaminant fact sheets, when available
  - An explanation of appropriate methods of delivery of PNs
- Staffing and training.
- Sanitary survey program including the wellhead protection program.
- Safety program.
- Emergency plan and operating procedures.
- Manufacturer’s manuals.
- An interconnect, valve and blowoff exercise and testing program.
- Date of last update.

The supplier shall review and update the O & M plan as necessary to reflect changes in the operation or maintenance of the water system.

**Operation and Maintenance Plan template link:**

<http://www.elibrary.dep.state.pa.us/dsweb/View/Collection-8798>



Turn to page 4-8 and look at the Emergency Response Plan requirements.

**TABLE 7: Emergency Response Plan under 109.707**

A community water supplier shall develop an emergency response plan that contains at least the following:

- Organizational table.
- Communication procedures and contact information.
- Means of communication.
- Summary description of the system.
- Assessment of available resources.
- Corrective actions for probable emergency situations.
- Record the date of last update on the plan.

The supplier shall review and update the ERP at least annually and as necessary to reflect changes to communication procedures and contact information.

**Emergency Response Plan template link:**

<http://www.elibrary.dep.state.pa.us/dsweb/View/Collection-8776>

**Note:** Systems serving more than 3,300 people must also conduct vulnerability assessments to address threats of terrorism.

Notice the vulnerability requirements for systems serving more than 3,300 people.

**TABLE 8: Distribution System Map under 109.706**

A community water supplier shall prepare and maintain on file a detailed map of the water system's transmission and distribution facilities. The map shall include information sufficient to allow DEP to analyze the distribution system and determine:

- Quantity
- Pressure and direction of flow from the sources to the customers
- Type and size of pipes within distribution system.

The map shall be updated at least annually.

Turn to page 4-9 and look at the sanitary survey requirements.

**TABLE 9: Sanitary Survey by Water Supplier under 109.705**

A community water supplier shall conduct a sanitary survey of the water system at least annually. The survey shall include the following activities:

- Watershed surveillance consisting of an inspection of portions of the drainage area or wellhead protection area necessary to identify and evaluate actual and probable sources of contamination.
- Evaluation of source protection, intake structures and transmission facilities.
- Treatment facilities inspection consisting of an evaluation of the effectiveness of the operation and maintenance procedures and the condition and operability of permitted facilities.
- Pressure surveys consisting of a measurement of pressures at representative points in the distribution system. Surveys shall be made during periods of maximum and minimum usage. Records of these surveys shall show the date and time of the beginning and end of the test and the location at which the test was made.

**Section 9 *Sanitary Survey* template is located in the Operation and Maintenance Plan template** at this link:

<http://www.elibrary.dep.state.pa.us/dsweb/View/Collection-8798>

Turn to page 4-10 and look at the cross connection control program requirements.

**TABLE 10: Cross Connection Control Program under 109.709**

At the direction of DEP, the public water supplier shall develop and implement a comprehensive control program for the elimination of existing cross-connection or the effective containment of sources of contaminations, and prevention of future cross-connections. A description of the program including the following information, shall be submitted to DEP for approval:

- A description of methods and procedures to be used.
- An implementation schedule for the program.
- Legal authority for implementation of the program, such as, by ordinance or rules.
- A time schedule for inspection of nonresidential customer’s premises for cross-connection with appropriate recordkeeping.
- A public education program for residential customers.
- A description of the methods and devices which will be used to protect the water system.
- A program for the review of plans for new users to assure that no new cross-connections are developed.
- Provisions for discontinuance of water service, after reasonable notice, to premises where cross-connection exist.

Section 9 Sanitary Survey template includes two questions about whether a water supplier has a DEP-approved cross connection control program and if devices are inspected. **Section 9 is located in the Operation and Maintenance Plan template** at this link:

<http://www.elibrary.dep.state.pa.us/dsweb/View/Collection-8798>

Turn to page 4-11 and table 11 lists the minimum record retention time for records.

**TABLE 11: Record Retention under 109.701(d)**

<b>Record</b>	<b>Minimum Retention Time</b>
Monthly operational report	2 years
Long Term 2 source water monitoring for bin Class	3 years
Long Term 2 treatment monitoring (toolbox options)	3 years
Residual disinfectant performance monitoring at entry point and same distribution sites as TCR sites	3 years
Records of actions to correct violations of MCLs, MRDLs, and treatment techniques (except Groundwater Rule)	3 years
Public notices and PN certifications	3 years
Customer complaints	3 years
Bacteriological analyses	5 years
Turbidity analyses	5 years
Groundwater Rule daily minimum disinfectant residuals	5 years
For consecutive systems that have a total coliform positive result within their distribution system, notification to the supplier of total-coliform positive samples	5 years
Groundwater Rule 4 log demonstration	10 years
Groundwater Rule records of actions to correct violations	10 years
Chemical analyses	12 years
Sanitary survey reports	12 years
Plans, specifications, permits	Life of facility

Turn to page 4-12 and look at the additional resources table.

**Table 12: Additional Resources**

Chapter 109	<p>The current version of Chapter 109 is located at this link:</p> <p><a href="http://www.pacode.com/secure/data/025/chapter109/025_0109.pdf">http://www.pacode.com/secure/data/025/chapter109/025_0109.pdf</a></p>
Drinking Water home page	<p>Drinking water web pages contain many links and resources to specific Chapter 109 topics:</p> <p><a href="http://www.depweb.state.pa.us/portal/server.pt/community/drinking_water_management/10543">http://www.depweb.state.pa.us/portal/server.pt/community/drinking_water_management/10543</a></p>
Surface water filtration web page	<p>The surface water filtration web pages contain many links and resources to surface water topics:</p> <p><a href="http://www.portal.state.pa.us/portal/server.pt/community/public_drinking_water/10549/surface_water_filtration/553912">http://www.portal.state.pa.us/portal/server.pt/community/public_drinking_water/10549/surface_water_filtration/553912</a></p>
Public Water Supply Design Manual Part II Community Water System Design Standards	<p><a href="http://www.elibrary.dep.state.pa.us/dsweb/View/Collection-8280">http://www.elibrary.dep.state.pa.us/dsweb/View/Collection-8280</a></p>
DEP Public Notification web page	<p>This page includes many links to various PN templates and resources:</p> <p><a href="http://www.portal.state.pa.us/portal/server.pt/community/public_drinking_water/10549/public_notification/553901">http://www.portal.state.pa.us/portal/server.pt/community/public_drinking_water/10549/public_notification/553901</a></p>

Turn to page 4-13 and we'll do an activity with all of these tables.

**Unit 4 Activity:**

Using the tables in this unit, answer the following questions:

1. Does the Total Coliform Rule Sample Siting Plan require first service connection sample locations?  
(Circle correct answer)      **Yes**      No
2. Does the Lead and Copper Rule Sample Siting Plan require a certification that proper sampling procedures were used?      **Yes**      No
3. When is a Stage 2 Disinfection Byproducts Rule Monitoring Plan due for a system that serves 12,000 people? **October 1, 2013**
4. Are water suppliers required to keep a record of consumer complaints?      **Yes**      No
5. Does an Operation and Maintenance Plan include an explanation of start-up and normal operation procedures?      **Yes**      No
6. Does an Emergency Response Plan include corrective actions for probable emergency situations?  
**Yes**      No
7. Are water suppliers required to conduct a sanitary survey?      **Yes**      No
8. How long do you keep records of your public notices and PN certification forms? **3 years**

**Turn to page 4-14 to summarize Unit 4 key points.**



**Slide 52 – Unit 4 Key Points**

## Unit 4 Key Points



Use the numerous tables in this unit to review your system management responsibilities under Chapter 109.



Use the templates for the various plans if you have not yet created these plans.



Table 12: Additional Resources provides you with links to many important DEP web pages.



Systems that serve more than 3,300 people must conduct a vulnerability assessment to address terrorist threats.

## APPENDICES

Appendix	Page
Appendix 1 - National Primary Drinking Water Regulations	A—2
Appendix 2 - National Secondary Drinking Water Regulations	A—14



Appendix 1  
National Primary Drinking Water Regulations

Microorganisms	MCLG <sup>1</sup> (mg/L) <sup>2</sup>	MCL or TT <sup>1</sup> (mg/L) <sup>2</sup>	Potential Health Effects from Ingestion of Water	Sources of Contaminant in Drinking Water
<i>Cryptosporidium</i>	zero	TT <sup>3</sup>	Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and fecal animal waste
<i>Giardia lamblia</i>	zero	TT <sup>3</sup>	Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and animal fecal waste
Heterotrophic plate count	n/a	TT <sup>3</sup>	HPC has no health effects; it is an analytic method used to measure the variety of bacteria that are common in water. The lower the concentration of bacteria in drinking water, the better maintained the water system is.	HPC measures a range of bacteria that are naturally present in the environment
<i>Legionella</i>	zero	TT <sup>3</sup>	Legionnaire's Disease, a type of pneumonia	Found naturally in water; multiplies in heating systems
Total Coliforms (including fecal coliform and <i>E. Coli</i> )	zero	5.0% <sup>4</sup>	Not a health threat in itself; it is used to indicate whether other potentially harmful bacteria may be present <sup>5</sup>	Coliforms are naturally present in the environment; as well as feces; fecal coliforms and <i>E. coli</i> only come from human and animal fecal waste.
Turbidity	n/a	TT <sup>3</sup>	Turbidity is a measure of the cloudiness of water. It is used to indicate water quality and filtration effectiveness (e.g., whether disease-causing organisms are present). Higher turbidity levels are often associated with higher levels of disease-causing microorganisms such as viruses, parasites and some bacteria. These organisms can cause symptoms such as nausea, cramps, diarrhea, and associated headaches.	Soil runoff
Viruses (enteric)	zero	TT <sup>3</sup>	Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and animal fecal waste

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Disinfection Byproducts	MCLG <sup>1</sup> (mg/L) <sup>2</sup>	MCL or TT <sup>1</sup> (mg/L) <sup>2</sup>	Potential Health Effects from Ingestion of Water	Sources of Contaminant in Drinking Water
Bromate	zero	0.010	Increased risk of cancer	Byproduct of drinking water disinfection
Chlorite	0.8	1.0	Anemia; infants & young children: nervous system effects	Byproduct of drinking water disinfection
Haloacetic acids (HAA5)	n/a <sup>6</sup>	0.060	Increased risk of cancer	Byproduct of drinking water disinfection
Total Trihalomethanes (TTHMs)	none <sup>7</sup> ----- n/a <sup>6</sup>	0.10 ----- 0.080	Liver, kidney or central nervous system problems; increased risk of cancer	Byproduct of drinking water disinfection

Disinfectants	MRDL <sup>1</sup> (mg/L) <sup>2</sup>	MRDL <sup>1</sup> (mg/L) <sup>2</sup>	Potential Health Effects from Ingestion of Water	Sources of Contaminant in Drinking Water
Chloramines (as Cl <sub>2</sub> )	MRDLG=4 <sup>1</sup>	MRDL=4.0 <sup>1</sup>	Eye/nose irritation; stomach discomfort, anemia	Water additive used to control microbes
Chlorine (as Cl <sub>2</sub> )	MRDLG=4 <sup>1</sup>	MRDL=4.0 <sup>1</sup>	Eye/nose irritation; stomach discomfort	Water additive used to control microbes
Chlorine dioxide (as ClO <sub>2</sub> )	MRDLG=0.8 <sup>1</sup>	MRDL=0.8 <sup>1</sup>	Anemia; infants & young children: nervous system effects	Water additive used to control microbes

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Inorganic Chemicals	MCLG <u>1</u> (mg/L) <u>2</u>	MCL or TT <u>1</u> (mg/L) <u>2</u>	Potential Health Effects from Ingestion of Water	Sources of Contaminant in Drinking Water
Antimony	0.006	0.006	Increase in blood cholesterol; decrease in blood sugar	Discharge from petroleum refineries; fire retardants; ceramics; electronics; solder
Arsenic	<u>07</u>	0.010 as of 01/23/06	Skin damage or problems with circulatory systems, and may have increased risk of getting cancer	Erosion of natural deposits; runoff from orchards, runoff from glass & electronics production wastes
Asbestos (fiber >10 micrometers)	7 million fibers per liter	7 MFL	Increased risk of developing benign intestinal polyps	Decay of asbestos cement in water mains; erosion of natural deposits
Barium	2	2	Increase in blood pressure	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits
Beryllium	0.004	0.004	Intestinal lesions	Discharge from metal refineries and coal-burning factories; discharge from electrical, aerospace, and defense industries
Cadmium	0.005	0.005	Kidney damage	Corrosion of galvanized pipes; erosion of natural deposits; discharge from metal refineries; runoff from waste batteries and paints
Chromium (total)	0.1	0.1	Allergic dermatitis	Discharge from steel and pulp mills; erosion of natural deposits

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Copper	1.3	TT8; Action Level=1.3	Short term exposure: Gastrointestinal distress  Long term exposure: Liver or kidney damage  People with Wilson's Disease should consult their personal doctor if the amount of copper in their water exceeds the action level	Corrosion of household plumbing systems; erosion of natural deposits
Cyanide (as free cyanide)	0.2	0.2	Nerve damage or thyroid problems	Discharge from steel/metal factories; discharge from plastic and fertilizer factories
Fluoride	4.0	4.0	Bone disease (pain and tenderness of the bones); Children may get mottled teeth	Water additive which promotes strong teeth; erosion of natural deposits; discharge from fertilizer and aluminum factories
Lead	zero	TT8; Action Level=0.015	Infants and children: Delays in physical or mental development; children could show slight deficits in attention span and learning abilities  Adults: Kidney problems; high blood pressure	Corrosion of household plumbing systems; erosion of natural deposits
Mercury (inorganic)	0.002	0.002	Kidney damage	Erosion of natural deposits; discharge from refineries and factories; runoff from landfills and croplands
Nitrate (measured as Nitrogen)	10	10	Infants below the age of six months who drink water containing nitrate in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue-baby syndrome.	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits

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Nitrite (measured as Nitrogen)	1	1	Infants below the age of six months who drink water containing nitrite in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue-baby syndrome.	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits
Selenium	0.05	0.05	Hair or fingernail loss; numbness in fingers or toes; circulatory problems	Discharge from petroleum refineries; erosion of natural deposits; discharge from mines
Thallium	0.0005	0.002	Hair loss; changes in blood; kidney, intestine, or liver problems	Leaching from ore-processing sites; discharge from electronics, glass, and drug factories

Organic Chemicals	MCLG <sup>1</sup> (mg/L) <sup>2</sup>	MCL or TT <sup>1</sup> (mg/L) <sup>2</sup>	Potential Health Effects from Ingestion of Water	Sources of Contaminant in Drinking Water
Acrylamide	zero	TT <sup>9</sup>	Nervous system or blood problems; increased risk of cancer	Added to water during sewage/wastewater treatment
Alachlor	zero	0.002	Eye, liver, kidney or spleen problems; anemia; increased risk of cancer	Runoff from herbicide used on row crops
Atrazine	0.003	0.003	Cardiovascular system or reproductive problems	Runoff from herbicide used on row crops
Benzene	zero	0.005	Anemia; decrease in blood platelets; increased risk of cancer	Discharge from factories; leaching from gas storage tanks and landfills

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Benzo(a)pyrene (PAHs)	zero	0.0002	Reproductive difficulties; increased risk of cancer	Leaching from linings of water storage tanks and distribution lines
Carbofuran	0.04	0.04	Problems with blood, nervous system, or reproductive system	Leaching of soil fumigant used on rice and alfalfa
Carbon tetrachloride	zero	0.005	Liver problems; increased risk of cancer	Discharge from chemical plants and other industrial activities
Chlordane	zero	0.002	Liver or nervous system problems; increased risk of cancer	Residue of banned termiticide
Chlorobenzene	0.1	0.1	Liver or kidney problems	Discharge from chemical and agricultural chemical factories
2,4-D	0.07	0.07	Kidney, liver, or adrenal gland problems	Runoff from herbicide used on row crops
Dalapon	0.2	0.2	Minor kidney changes	Runoff from herbicide used on rights of way
1,2-Dibromo-3-chloropropane (DBCP)	zero	0.0002	Reproductive difficulties; increased risk of cancer	Runoff/leaching from soil fumigant used on soybeans, cotton, pineapples, and orchards
o-Dichlorobenzene	0.6	0.6	Liver, kidney, or circulatory system problems	Discharge from industrial chemical factories
p-Dichlorobenzene	0.075	0.075	Anemia; liver, kidney or spleen damage; changes in blood	Discharge from industrial chemical factories

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1,2-Dichloroethane	zero	0.005	Increased risk of cancer	Discharge from industrial chemical factories
1,1-Dichloroethylene	0.007	0.007	Liver problems	Discharge from industrial chemical factories
cis-1,2-Dichloroethylene	0.07	0.07	Liver problems	Discharge from industrial chemical factories
trans-1,2-Dichloroethylene	0.1	0.1	Liver problems	Discharge from industrial chemical factories
Dichloromethane	zero	0.005	Liver problems; increased risk of cancer	Discharge from drug and chemical factories
1,2-Dichloropropane	zero	0.005	Increased risk of cancer	Discharge from industrial chemical factories
Di(2-ethylhexyl) adipate	0.4	0.4	Weight loss, liver problems, or possible reproductive difficulties.	Discharge from chemical factories
Di(2-ethylhexyl) phthalate	zero	0.006	Reproductive difficulties; liver problems; increased risk of cancer	Discharge from rubber and chemical factories
Dinoseb	0.007	0.007	Reproductive difficulties	Runoff from herbicide used on soybeans and vegetables
Dioxin (2,3,7,8-TCDD)	zero	0.00000003	Reproductive difficulties; increased risk of cancer	Emissions from waste incineration and other combustion; discharge from chemical factories
Diquat	0.02	0.02	Cataracts	Runoff from herbicide use

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Endothall	0.1	0.1	Stomach and intestinal problems	Runoff from herbicide use
Endrin	0.002	0.002	Liver problems	Residue of banned insecticide
Epichlorohydrin	zero	TT <sup>9</sup>	Increased cancer risk, and over a long period of time, stomach problems	Discharge from industrial chemical factories; an impurity of some water treatment chemicals
Ethylbenzene	0.7	0.7	Liver or kidneys problems	Discharge from petroleum refineries
Ethylene dibromide	zero	0.00005	Problems with liver, stomach, reproductive system, or kidneys; increased risk of cancer	Discharge from petroleum refineries
Glyphosate	0.7	0.7	Kidney problems; reproductive difficulties	Runoff from herbicide use
Heptachlor	zero	0.0004	Liver damage; increased risk of cancer	Residue of banned termiticide
Heptachlor epoxide	zero	0.0002	Liver damage; increased risk of cancer	Breakdown of heptachlor
Hexachlorobenzene	zero	0.001	Liver or kidney problems; reproductive difficulties; increased risk of cancer	Discharge from metal refineries and agricultural chemical factories
Hexachlorocyclopentadiene	0.05	0.05	Kidney or stomach problems	Discharge from chemical factories
Lindane	0.0002	0.0002	Liver or kidney problems	Runoff/leaching from insecticide used on cattle, lumber, gardens



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Methoxychlor	0.04	0.04	Reproductive difficulties	Runoff/leaching from insecticide used on fruits, vegetables, alfalfa, livestock
Oxamyl (Vydate)	0.2	0.2	Slight nervous system effects	Runoff/leaching from insecticide used on apples, potatoes, and tomatoes
Polychlorinated biphenyls (PCBs)	zero	0.0005	Skin changes; thymus gland problems; immune deficiencies; reproductive or nervous system difficulties; increased risk of cancer	Runoff from landfills; discharge of waste chemicals
Pentachlorophenol	zero	0.001	Liver or kidney problems; increased cancer risk	Discharge from wood preserving factories
Picloram	0.5	0.5	Liver problems	Herbicide runoff
Simazine	0.004	0.004	Problems with blood	Herbicide runoff
Styrene	0.1	0.1	Liver, kidney, or circulatory system problems	Discharge from rubber and plastic factories; leaching from landfills
Tetrachloroethylene	zero	0.005	Liver problems; increased risk of cancer	Discharge from factories and dry cleaners
Toluene	1	1	Nervous system, kidney, or liver problems	Discharge from petroleum factories
Toxaphene	zero	0.003	Kidney, liver, or thyroid problems; increased risk of cancer	Runoff/leaching from insecticide used on cotton and cattle
2,4,5-TP (Silvex)	0.05	0.05	Liver problems	Residue of banned herbicide

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1,2,4-Trichlorobenzene	0.07	0.07	Changes in adrenal glands	Discharge from textile finishing factories
1,1,1-Trichloroethane	0.20	0.2	Liver, nervous system, or circulatory problems	Discharge from metal degreasing sites and other factories
1,1,2-Trichloroethane	0.003	0.005	Liver, kidney, or immune system problems	Discharge from industrial chemical factories
Trichloroethylene	zero	0.005	Liver problems; increased risk of cancer	Discharge from metal degreasing sites and other factories
Vinyl chloride	zero	0.002	Increased risk of cancer	Leaching from PVC pipes; discharge from plastic factories
Xylenes (total)	10	10	Nervous system damage	Discharge from petroleum factories; discharge from chemical factories

Radionuclides	MCLG <sup>1</sup> (mg/L) <sup>2</sup>	MCL or TT <sup>1</sup> (mg/L) <sup>2</sup>	Potential Health Effects from Ingestion of Water	Sources of Contaminant in Drinking Water
Alpha particles	none <sup>7</sup> ----- zero	15 picocuries per Liter (pCi/L)	Increased risk of cancer	Erosion of natural deposits of certain minerals that are radioactive and may emit a form of radiation known as alpha radiation
Beta particles and photon emitters	none <sup>7</sup> ----- zero	4 millirems per year	Increased risk of cancer	Decay of natural and man-made deposits of certain minerals that are radioactive and may emit forms of radiation known as photons and beta radiation

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Radium 226 and Radium 228 (combined)	none ----- zero	5 pCi/L	Increased risk of cancer	Erosion of natural deposits
Uranium	zero	30 ug/L as of 12/08/03	Increased risk of cancer, kidney toxicity	Erosion of natural deposits

### Notes

<sup>1</sup> Definitions:

**Maximum Contaminant Level (MCL)** - The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to MCLGs as feasible using the best available treatment technology and taking cost into consideration. MCLs are enforceable standards.

**Maximum Contaminant Level Goal (MCLG)** - The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety and are non-enforceable public health goals.

**Maximum Residual Disinfectant Level (MRDL)** - The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.

**Maximum Residual Disinfectant Level Goal (MRDLG)** - The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contaminants.

**Treatment Technique** - A required process intended to reduce the level of a contaminant in drinking water.

<sup>2</sup> Units are in milligrams per liter (mg/L) unless otherwise noted. Milligrams per liter are equivalent to parts per million.

<sup>3</sup> EPA's surface water treatment rules require systems using surface water or ground water under the direct influence of surface water to (1) disinfect their water, and (2) filter their water or meet criteria for avoiding filtration so that the following contaminants are controlled at the following levels:

- Cryptosporidium (as of 1/1/02 for systems serving >10,000 and 1/14/05 for systems serving <10,000) 99% removal.
- Giardia lamblia: 99.9% removal/inactivation
- Viruses: 99.99% removal/inactivation
- *Legionella*: No limit, but EPA believes that if *Giardia* and viruses are removed/inactivated, *Legionella* will also be controlled.
- Turbidity: At no time can turbidity (cloudiness of water) go above 5 nephelometric turbidity units (NTU); systems that filter must ensure that the turbidity go no higher than 1 NTU (0.5 NTU for conventional or direct filtration) in at least 95% of the daily samples in any month. As of January 1, 2002, turbidity may never exceed 1 NTU, and must not exceed 0.3 NTU in 95% of daily samples in any month.

- HPC: No more than 500 bacterial colonies per milliliter.
- Long Term 1 Enhanced Surface Water Treatment (Effective Date: January 14, 2005); Surface water systems or (GWUDI) systems serving fewer than 10,000 people must comply with the applicable Long Term 1 Enhanced Surface Water Treatment Rule provisions (e.g. turbidity standards, individual filter monitoring, Cryptosporidium removal requirements, updated watershed control requirements for unfiltered systems).
- Filter Backwash Recycling; The Filter Backwash Recycling Rule requires systems that recycle to return specific recycle flows through all processes of the system's existing conventional or direct filtration system or at an alternate location approved by the state.

<sup>4</sup> more than 5.0% samples total coliform-positive in a month. (For water systems that collect fewer than 40 routine samples per month, no more than one sample can be total coliform-positive per month.) Every sample that has total coliform must be analyzed for either fecal coliforms or *E. coli* if two consecutive TC-positive samples, and one is also positive for *E. coli* fecal coliforms, system has an acute MCL violation.

<sup>5</sup> Fecal coliform and *E. coli* are bacteria whose presence indicates that the water may be contaminated with human or animal wastes. Disease-causing microbes (pathogens) in these wastes can cause diarrhea, cramps, nausea, headaches, or other symptoms. These pathogens may pose a special health risk for infants, young children, and people with severely compromised immune systems.

<sup>6</sup> Although there is no collective MCLG for this contaminant group, there are individual MCLGs for some of the individual contaminants:

- Trihalomethanes: bromodichloromethane (zero); bromoform (zero); dibromochloromethane (0.06 mg/L). Chloroform is regulated with this group but has no MCLG.
- Haloacetic acids: dichloroacetic acid (zero); trichloroacetic acid (0.3 mg/L). Monochloroacetic acid, bromoacetic acid, and dibromoacetic acid are regulated with this group but have no MCLGs.

<sup>7</sup> MCLGs were not established before the 1986 Amendments to the Safe Drinking Water Act. Therefore, there is no MCLG for this contaminant.

<sup>8</sup> Lead and copper are regulated by a Treatment Technique that requires systems to control the corrosiveness of their water. If more than 10% of tap water samples exceed the action level, water systems must take additional steps. For copper, the action level is 1.3 mg/L, and for lead is 0.015 mg/L.

<sup>9</sup> Each water system must certify, in writing, to the state (using third-party or manufacturer's certification) that when acrylamide and epichlorohydrin are used in drinking water systems, the combination (or product) of dose and monomer level does not exceed the levels specified, as follows:

- Acrylamide = 0.05% dosed at 1 mg/L (or equivalent)
- Epichlorohydrin = 0.01% dosed at 20 mg/L (or equivalent)

## Appendix 2 National Secondary Drinking Water Regulations

National Secondary Drinking Water Regulations (NSDWRs or secondary standards) are guidelines regulating contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor, or color) in drinking water.

Contaminant	Secondary Standard
Aluminum	0.05 to 0.2 mg/L
Chloride	250 mg/L
Color	15 (color units)
Copper	1.0 mg/L
Corrosivity	noncorrosive
Fluoride	2.0 mg/L
Foaming Agents	0.5 mg/L
Iron	0.3 mg/L
Manganese	0.05 mg/L
Odor	3 threshold odor number
pH	6.5-8.5
Silver	0.10 mg/L
Sulfate	250 mg/L
Total Dissolved Solids	500 mg/L
Zinc	5 mg/L