

Drinking Water Operator Certification Training



Module 1: General Overview Volume I

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Unit 1 – Overview

Learning Objectives

- Describe the responsibilities of the water supply facility and the treatment plant operator.
- List the 5 drinking water treatment objectives.
- Describe the different classifications of water systems.

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:

- **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.



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

Job of 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.

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.

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.

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.

Purpose of Classification

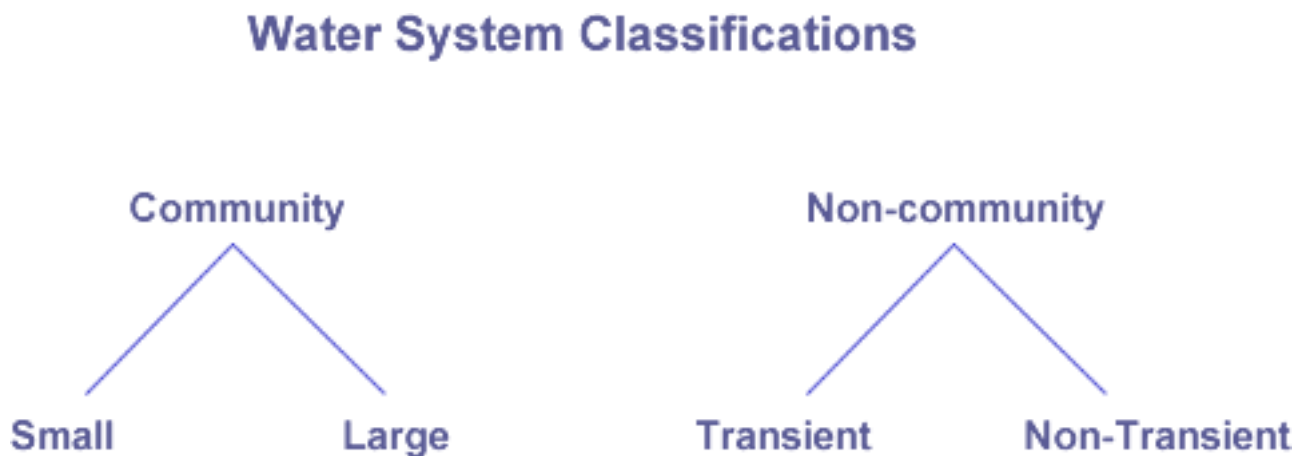
Different types of water systems have different treatment requirements. Water systems are classified on this basis. Regulatory requirements vary from one class to another, and operator certifications are specific to certain classifications of systems.

Definition of Public Water System

- ① The United States Environmental Protection Agency (EPA) defines a **Public Water 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.”¹

Water systems are classified according to the illustration in Figure 2.1

Figure 2.1: Water system classification tree



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.”² 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.

Noncommunity 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.**”³



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



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.”⁴



What are some examples of a transient water system?

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 **Medium or 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.



Unit 1 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.
2. A farmer has a good spring on his property and provides drinking water to 16 of his neighbors, free of charge.
3. A real estate developer drills a well and provides the water to the 17 homes in his development.
4. A restaurant with its own well supply has an apartment above that's connected to the restaurant's plumbing system.

Unit 1 Key Points:



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



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



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 “medium or 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 “nontransient”. 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.

¹ Definition taken from the National Primary Drinking Water Standards, which is available at the EPA Ground Water & Drinking Water website <https://www.epa.gov/ground-water-and-drinking-water>).

² Ibid.

³ Ibid.

⁴ Ibid.

Unit 2 – Federal and State Regulations

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.

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).

Operator Certification Act and Chapter 302 Regulations

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 and in the Chapter 302 regulations. Chapter 302 Operators' Certification Program Regulations requires certified water operators to comply with all state and federal laws, rules and regulations.

ACT 11 and Chapter 302 Regulations

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.

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.

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.

Certification Requirements

Experience Requirements

Classification	High School Diploma	CP	ASP	AS	BS/BA
A	4 years	2 years	1 year	3.5 years	2 years
B	3 years	1 year	6 months	2.5 years	1 year
C	2 years	6 Months	6 Months	1.5 year	6 Months
D	1 year	6 Months	6 Months	6 Months	6 Months
E	1 Year	6 Months	6 Months	6 Months	6 Months
Dn	6 Months	0	0	6 Months	0
Dc	6 months	0	0	6 Months	0

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

AS: Associate Degree in environmental or physical sciences, engineering or engineering technology NOT 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.

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.

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

- (i) **General Exam:** Measures the applicant's general knowledge, skills and abilities common to all water or wastewater systems regardless of size.
- (ii) **Subclassification Exams:** 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.

Dc and Dn Classifications:

Separate and single water system examinations are prepared for both Class Dc and Class Dn water treatment plants.

Class E Distribution:

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.

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

Water System Classes	
A	>5 MGD
B	>1 MGD but \leq 5 MGD
C	>0.1 MGD but \leq 1 MGD
D	\leq 0.1 MGD
E	Distribution systems and consecutive water systems without treatment

Water System Subclasses
1. Conventional filtration
2. Direct filtration
3. Diatomaceous earth filtration
4. Slow sand filtration
5. Cartridge or bag filtration
6. Membrane filtration
7. Corrosion control and sequestering
8. Chemical addition
9. Inorganic removal
10. Organic removal
11. Gaseous chlorine disinfection
12. Non-gaseous chemical disinfection
13. Ultraviolet disinfection
14. Ozone disinfection

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

- 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 certified in both the class and subclasses 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.

**Unit 2 Part 1 Exercise**

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) and uses conventional filtration with gaseous chlorination as a disinfectant?

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?

2. What certificates would be needed to run a 10 MGD water system that uses conventional filtration and non-gaseous disinfection?

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

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

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?

Note that the education must be approved by DEP.

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

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**.

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.

Certified Operators must

- Meet all the requirements for recertification.
- Report to the system owner any know violation or system condition that may be or are 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.
- Providing for the suitable O&M of a water system utilizing available resources to comply with all laws.
- Making or implementing process control decisions, or directing actions related to process control decisions for specific water systems.

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**.

**Unit 2 Part 2 Exercise:**

Complete the following sentences by filling in the blanks.

1. Class B operators must obtain ____ hours of continuing education during their first renewal cycle and _____ hours during all subsequent renewal cycles.
2. Owners, _____, non-certified operators and maintenance staff can be prosecuted for failing to comply with the Drinking Water and Wastewater Systems Operator Certification Act.
3. A _____ 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.
4. An _____ 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.
5. If an owner directs a non-certified operator to make a process control decision, who may be in violation of the Operator's Certification Act?
 - a) Owner
 - b) Non-certified operator
 - c) Both a and b
 - d) Neither owner nor non-certified operator

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)**. Some example MCLs and the only MRDL are listed below.



The **maximum residual disinfectant level (MRDL)** is the maximum permissible level of a disinfectant added for water treatment that may not be exceeded at the consumer's tap without an unacceptable possibility of adverse health effects.

<u>Contaminant</u>	<u>MCL or MRDL</u>
Total Trihalomethanes (TTHMs), a DBP	0.080 mg/L
Haloacetic Acids (HAA5), a DBP	0.060 mg/ L
Bromate, a DBP	0.010 mg/ L
Chlorite, a DBP	1.0 mg/L
Benzene	0.005 mg/ L
Diquat	0.02 mg/ L
Chlorine (as Cl ₂)	4.0 mg/ L as maximum residual disinfectant level (MRDL)

- Other contaminants are regulated by requiring specific treatment techniques and performance requirements that will assure their removal.



Treatment technique (TT) is a requirement which specifies a specific treatment method known to cause a reduction in the level of a contaminant which cannot practically be regulated by establishing an MCL.



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. Here are the secondary contaminants and their MCL values.

<u>Contaminant</u>	<u>MCL</u>
Aluminum	0.2 mg/L
Chloride	250 mg/L
Color	15 color units
Corrosivity	Non-corrosive
Foaming Agents	0.5 mg/L
Iron	0.3 mg/L
Manganese	0.05 mg/L
Odor	3 Threshold Odor Number (TON)
pH	6.5 – 8.5
Silver	0.1 mg/L
Sulfate	250 mg/ L
Total Dissolved Solids (TDS)	500 mg/L
Zinc	5 mg/L

Selected Federal and State 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.



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, including ground water under the direct influence of surface water (GUDI) sources.
- 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.
- 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 multiplied by 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).

- 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 MCLs 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 (GUDI). **Any GUDI source is subject to disinfection and filtration requirements.**



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 ensure 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.



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 Enhanced Surface Water Treatment Rule.



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.



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.



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 (MCLs) for total trihalomethanes (TTHMs) 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 TTHMs 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 (MRDLs) of 4.0 mg/L (as Cl₂) for chlorine, 4.0 mg/L (as Cl₂) for chloramines, and 0.8 mg/L for chlorine dioxide (as ClO₂).

- 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 2.1: Required Removal of Total Organic Carbon (Percent) by Enhanced Coagulation

Source Water TOC (mg/L)	Source Water Alkalinity (mg/l as CaCO ₃)		
	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 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.



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.



Revised Total Coliform Rule: This rule became effective April 1, 2016. This rule sets monitoring and compliance requirements for coliform bacteria and establishes an MCL for *E. coli*. Some of the major provisions include:

- All systems must have a written sample siting plan with locations that are representative of water throughout the distribution system. All systems must collect samples monthly; the number of samples is based on population served.
- Seasonal systems must develop, submit for approval, and conduct a seasonal start-up procedure, and forward an annual certification form to the department.
- If any samples are total coliform positive, the system must collect three check samples within 24 hours for each total coliform positive result.
- Any sample that tests positive for total coliform must be analyzed for *E. coli*.
- A public water system is in violation of the MCL for *E. coli* when any of the following conditions occur:
 1. The system has a total coliform-positive check sample following an *E. coli*-positive routine sample.
 2. The system fails to take all required check samples following an *E. coli*-positive routine sample.
 3. The system has an *E. coli*-positive check sample following a total coliform-positive routine sample.
 4. The system fails to test for *E. coli* when any check sample tests positive for total coliform.

- A Level 1 Assessment is an evaluation of a public water system to identify sanitary defects or problems with monitoring practices. A Level 1 Assessment is required when:
 - Two or more samples are total coliform positive (for systems collecting less than 40 samples per month).
 - More than 5% of samples are total coliform positive (for systems collecting 40 or more samples per month).
 - A system fails to collect the required number of check samples within 24 hours.

- A Level 2 Assessment is a more detailed evaluation of a public water system to identify sanitary defects or problems with monitoring practices. A Level 2 Assessment is required when:
 - A public water system triggers a second Level 1 Assessment within a 12-month rolling period.
 - A public water system has an *E. coli* MCL violation.

- If any sanitary defects are identified during a Level 1 or Level 2 Assessment, the public water system is required to take corrective actions to correct the defects.

- Systems must continue to collect check samples until all samples are negative, it is determined that the system has violated the MCL, or the system triggers an assessment.



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 2.2: 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



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 creating a sample site location plan to locate the highest risk sample sites for lead prior to sampling. **NOTE:** Refer to Unit 3, Table 2 for more information about the LCR Sample Site Location Plan elements and link to the DEP LCR Sample Site Location Plan template.
- 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 (i.e. **LARGE**), systems serving 3,301 to 50,000 persons (i.e., **MEDIUM**) and systems serving 3,300 or fewer persons (i.e., **SMALL**)
 - 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 90th percentile sample result (0.015 mg/L for lead and 1.3 mg/L for copper) must institute corrosion control treatment. 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 treatment is working.
- Systems that exceed the lead action level after installing corrosion control treatment must begin lead service line replacement (if applicable). Water suppliers must replace lead service lines at a rate of at least 7 percent per year.
- 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 to lead.

Pennsylvania Water Supply Manual

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.

Key Monitoring and Reporting Requirements

Microbiological (Coliform/*E. coli*)

- Must be monitored monthly. The required number of samples is based on the population served.
- Samples are taken from the distribution system.
- Any sample that tests positive for total coliform must be analyzed for *E. coli*.
- A system has a Tier 1 acute MCL violation if any of the following conditions occur:
 - The system has a total coliform-positive check sample following an *E. coli*-positive routine sample.
 - The system fails to take all required check samples following an *E. coli*-positive routine sample.
 - The system has an *E. coli*-positive check sample following a total coliform-positive routine sample.
 - The system fails to test for *E. coli* when any check sample tests positive for total coliform.

Table 2.3 below summarizes the conditions that constitute a Tier 1 acute MCL violation.

Table 2.3: Tier 1 Acute MCL violation if any of the following conditions exist:	
Routine Sample	Check Sample
<i>E. coli</i> +	Total Coliform +
<i>E. coli</i> +	Failure to take all required check samples
Total Coliform +	<i>E. coli</i> +
Total Coliform +	Total Coliform + and failure to analyze for <i>E. coli</i>

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***.

ONE HOUR REPORTING AND PUBLIC NOTICE REQUIREMENTS

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. (e.g., entry point)
- A system is in violation if average of routine and check samples exceeds the MCL for any regulated inorganic chemical contaminant.

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. (e.g., entry point)
- A system has exceeded the MCL if average of routine and check samples exceeds 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. (e.g., entry point)
- A system has exceeded the MCL if average of routine and check samples exceeds the MCL.

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)

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.

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.

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 0.20 mg/l for four hours at the entry point or if residual concentration in the distribution system falls below 0.2 mg/l.**

ONE HOUR REPORTING AND PUBLIC NOTICE REQUIREMENTS

- 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.**

Lead and Copper

- Samples for lead and copper must be taken at the customer's tap. Systems must sample the highest risk sites known as Tier 1 sites which contain lead service lines, interior lead pipe or copper pipe with leaded solder installed between 1983 and 1991.
- 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.
- Water quality parameter samples are taken at the point where water enters the distribution system (e.g., entry point) 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 corrosion control treatment if the 90th 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.

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.

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

ONE HOUR REPORTING AND PUBLIC NOTICE REQUIREMENTS

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 manifest the health effect. Drinking water with a chronic contaminant would take a long time (70 years) before the health effect occurs. 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:

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

1. Violation of the maximum contaminant level (MCL) for *E. coli*, or when water supplier fails to test for *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.

ONE HOUR REPORTING AND PUBLIC NOTICE REQUIREMENTS

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.

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).
3. Violation of the MCL for fluoride.
4. 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.
5. For filtered surface water systems, failure to conduct source water *Cryptosporidium* monitoring for any three months.
6. For filtered surface water systems and groundwater under the direct influence systems, failure to determine and report *Cryptosporidium* bin classification.

ONE HOUR REPORTING AND PUBLIC NOTICE REQUIREMENTS

7. Failure to take corrective actions for a significant deficiency within required time frame or comply with a DEP-approved corrective action plan or schedule.
8. Failure to perform a Level 1 or Level 2 assessment when required or failure to complete a corrective action for a sanitary defect identified during a Level 1 or Level 2 assessment.
9. For seasonal noncommunity water systems (NCWS), failure to follow state-approved start-up procedures prior to serving water to the public.

Check Samples Required under 25 Pa. Code § 109.301:

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

ONE HOUR REPORTING AND PUBLIC NOTICE REQUIREMENTS

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

- 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 does not pose health effects

Table 2.4: Public Notification Delivery Deadlines		
Tier	Deadlines for Notice	Deadlines to Contact DEP*
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.

**Unit 2 Part 3 Exercise:**

1. The barium level in your treated water has exceeded the MCL of 2 mg/L.
 - a. Are you in violation? _____
 - b. Are you required to notify DEP within 1 hour? _____
 - c. Name the tier type of the public notice you must issue? _____ (Options: Tier 1, Tier 2, or Tier 3 PN)
 - d. In what timeframe is this public notice required? _____

2. A groundwater under the direct influence of surface water (GUDI) source is subject to:
 - a) Disinfection requirements
 - b) Filtration requirements
 - c) Both (a) and (b)
 - d) Neither (a) and (b)

3. A water supplier has one hour reporting to DEP for the following violations or situations:
 - a) All Tier 1 violations or situations
 - b) Most Tier 2 violations or situations
 - c) Any sample that requires a check sample.
 - d) All of the above

4. In a Tier 1 PN, how long should customers boil their water?
 - a) 30 seconds
 - b) 1 minute
 - c) 2 minutes
 - d) 5 minutes

Unit 2 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 or 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.

Unit 3 – System Management Responsibilities

Learning Objectives

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

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.

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

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

- Population served by the water system.
- A list of sample site locations in the distribution system to be used for **routine monitoring** purposes, including **check sample sites** for all routine locations.
- The name of the company or individual collecting the samples.
- A description of the accessibility of sample sites.
- A sample collection schedule.
- A description of how routine distribution sample locations are representative of water throughout the distribution system.
- For seasonal systems, the beginning and ending dates of each operating season.
- For noncommunity groundwater systems, triggered source water monitoring locations.

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

Total Coliform Sample Siting Plan templates are located at this link:

<http://www.elibrary.dep.state.pa.us/dsweb/View/Collection-12438>

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 on this webpage:

www.dep.pa.gov/lead_copper_rule

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.

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-12477>

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-12477>

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-12477>

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.

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.

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-12477>

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-12477>

SYSTEM MANAGEMENT RESPONSIBILITIES

TABLE 11: Record Retention under 109.701(d)

Record	Minimum Retention Time
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
Revised Total Coliform Rule assessment forms and documentation of corrective actions completed	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

SYSTEM MANAGEMENT RESPONSIBILITIES

Table 12: Additional Resources

Chapter 109	<p>The current version of Chapter 109 is located at this link:</p> <p>http://www.pacode.com/secure/data/025/chapter109/chap109toc.html</p>
Drinking Water home page	<p>Drinking water web pages contain many links and resources to specific Chapter 109 topics:</p> <p>http://www.dep.pa.gov/Business/Water/BureauSafeDrinkingWater/Pages/default.aspx</p>
Long Term 1 Enhanced Surface Water Treatment Rule web page	<p>http://www.dep.pa.gov/Business/Water/BureauSafeDrinkingWater/DrinkingWaterMgmt/Regulations/Pages/LT1ESWTR.aspx</p>
Long Term 2 Enhanced Surface Water Treatment Rule web page	<p>http://www.dep.pa.gov/Business/Water/BureauSafeDrinkingWater/DrinkingWaterMgmt/Regulations/Pages/LT2ESWTR.aspx</p>
Public Water Supply Design Manual Part II Community Water System Design Standards	<p>http://www.elibrary.dep.state.pa.us/dsweb/View/Collection-8280</p>
DEP Public Notification web page	<p>This page includes many links to various PN templates and resources:</p> <p>http://www.dep.pa.gov/Citizens/My-Water/PublicDrinkingWater/Pages/Public-Notification.aspx</p>



Unit 3 Exercise:

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

- 1. Does the Revised Total Coliform Rule Sample Siting Plan require routine and check 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. Are water suppliers required to keep a record of consumer complaints? Yes No

- 4. Does an Operation and Maintenance Plan include an explanation of start-up and normal operation procedures? Yes No

- 5. Does an Emergency Response Plan include corrective actions for probable emergency situations?
 Yes No

- 6. Are water suppliers required to conduct a sanitary survey? Yes No

- 7. How long do you keep records of your public notices and PN certification forms?_____



Unit 3 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

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**Appendix 1
National Primary Drinking Water Regulations**

Microorganisms	MCLG ¹ (mg/L) ²	MCL or TT ¹ (mg/L) ²	Potential Health Effects from Ingestion of Water	Sources of Contaminant in Drinking Water
<i>Cryptosporidium</i>	zero	TT ³	Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and fecal animal waste
<i>Giardia lamblia</i>	zero	TT ³	Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and animal fecal waste
Heterotrophic plate count	n/a	TT ³	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 ³	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% ⁴	Not a health threat in itself; it is used to indicate whether other potentially harmful bacteria may be present ⁵	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 ³	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 ³	Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and animal fecal waste.

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Disinfection Byproducts	MCLG ¹ (mg/L) ²	MCL or TT ¹ (mg/L) ²	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 ⁶	0.060	Increased risk of cancer	Byproduct of drinking water disinfection
Total Trihalomethanes (TTHMs)	none ⁷ ----- n/a ⁶	0.10 ----- 0.080	Liver, kidney or central nervous system problems; increased risk of cancer	Byproduct of drinking water disinfection

Disinfectants	MRDL ¹ (mg/L) ²	MRDL ¹ (mg/L) ²	Potential Health Effects from Ingestion of Water	Sources of Contaminant in Drinking Water
Chloramines (as Cl ₂)	MRDLG=4 ¹	MRDL=4.0 ¹	Eye/nose irritation; stomach discomfort, anemia	Water additive used to control microbes
Chlorine (as Cl ₂)	MRDLG=4 ¹	MRDL=4.0 ¹	Eye/nose irritation; stomach discomfort	Water additive used to control microbes
Chlorine dioxide (as ClO ₂)	MRDLG=0.8 ¹	MRDL=0.8 ¹	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 ¹ (mg/L) ²	MCL or TT ¹ (mg/L) ²	Potential Health Effects from Ingestion of Water	Sources of Contaminant in Drinking Water
Acrylamide	zero	TT ⁹	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 ⁹	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 ¹ (mg/L) ²	MCL or TT ¹ (mg/L) ²	Potential Health Effects from Ingestion of Water	Sources of Contaminant in Drinking Water
Alpha particles	none ⁷ ----- 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 ⁷ ----- 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

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

¹ 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.

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

³ 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.

⁴ 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.

⁵ 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.

⁶ 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.

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

⁸ 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.

⁹ 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