State of Ohio Class A Drinking Water Operator Certification Program

Session One:
Introduction; Public Water Systems; Hydrologic Cycle; Source Water Assessment; Wellhead Protection & Operations

This course includes content developed by the Ohio Environmental Protection Agency, the Pennsylvania Department of Environmental Protection, the Indiana Department of Environmental Management, California State University at Sacramento, and 360water, Inc.

Project funded by the USEPA.

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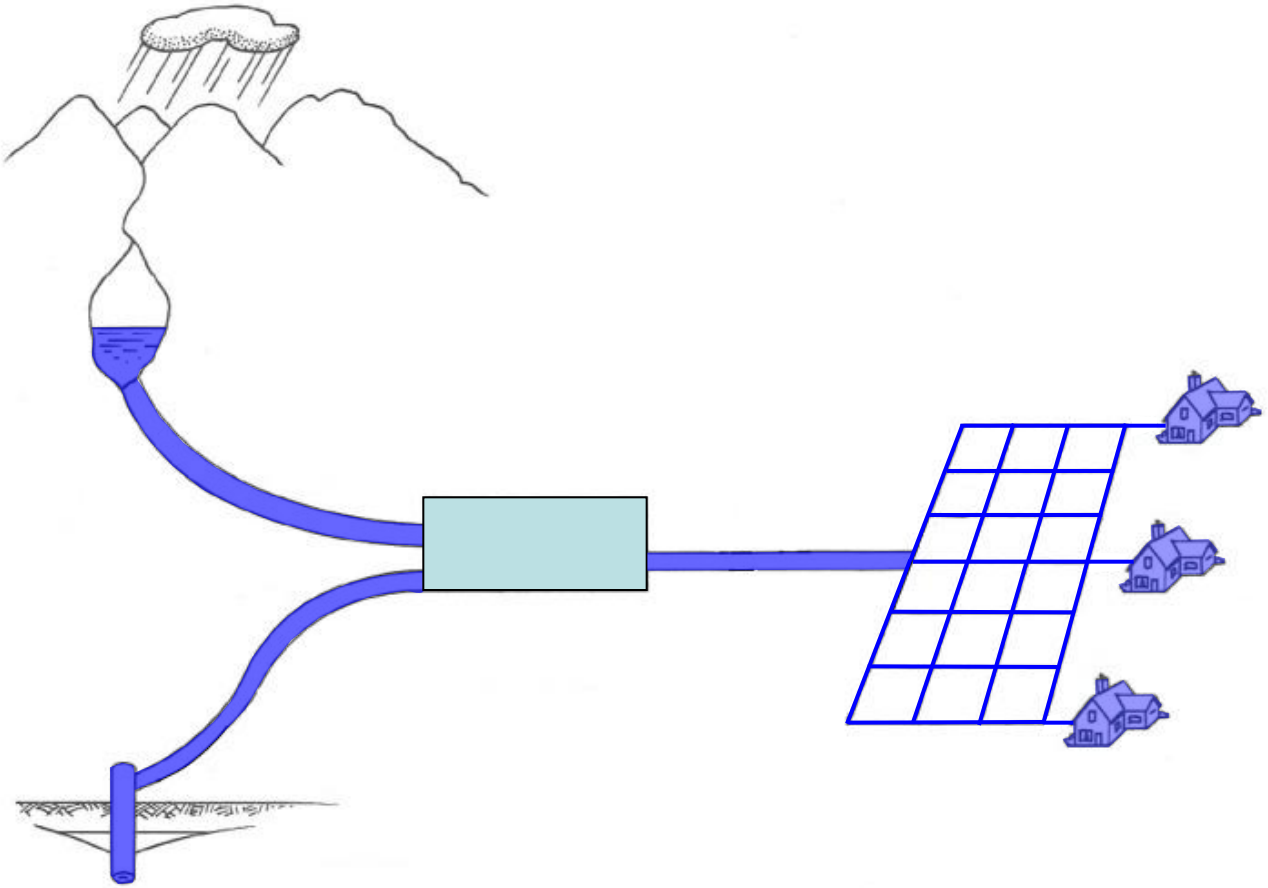
The Water Supply System



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Public Water System

According to the Safe Drinking Water Act (SDWA), a public water system is one that serves piped water to at least 25 persons or 15 service connections for at least 60 days per year.

Three Types of Public Systems

- Community Public Water System
- Non-Transient Non-Community (NTNC) Public Water System
- Transient Non-Community (TNC) Public Water System

Community Public Water System

Must have at least 15 service connections used by year round residents

- *or* –

Regularly serve 25 year-round residents

Examples: Municipalities, Mobile Home Parks, Home Owners Associations, Nursing Homes

Ohio has about 1,450 of these systems serving over 10 million people.

Non-Transient Non-Community (NTNC) Public Water System

Must serve at least 25 of the same persons per day for more than 6 months of the year

***Examples**:* Schools, Offices, Factories

Ohio has about 930 of these systems serving over 200,000 people.

Transient Non-Community (TNC) Public Water System

Serve at least 25 persons per day for at least 60 days each year

Examples: Campgrounds, Restaurants, Hotels, Rest Areas, Golf Courses, Churches

Ohio has about 3,200 of these systems serving almost 500,000 people

Class A Public Water System is classified as:

- A community or non-transient, non-community public water system which serves a population of no more than 250 or a transient non-community public water system which serves a population of greater than 250
- Uses only purchased water or ground water sources
- Does not provide precipitative softening
- Has no serious public health or environmental hazard associated with the operation of the public water system

Class A Public Water System, *continued…*

Examples: Manufactured Housing Parks and Homeowners Associations, Schools, Places of Employment, and Rest Areas.

Ohio has about 1,495 Class A Public Water Systems

Class A Certified Operator Limited Class A Certification

- In 2004, the EPA issued approximately 1,050 operators a limited Class A certification
- The limited certification is ***site specific*** and is ***not transferable***
- Limited certification is no longer valid if the classification of the public water system changes
- For ***new operators***, limited Class A certification is ***no longer available***

Class A Certified Operator Limited Class A Certification, *continued…*

- If already holding a limited Class A certification, it is valid for a two year period. To renew, the operator must show proof of obtaining not less than 8 hours of Director-approved training

- Receiving a Class A Certificate will allow you to work at any ***Class A Public Water System***

- A Class A Certificate is valid for two (2) years. You will need to take Ohio EPA approved Contact Hours (CH) in order to renew your license. There is currently a $25.00 fee for renewal and the operator must show proof of obtaining not less than 8 hours of Director-approved training

Operator Certification Fees

Exam Fees By Class	
Class A	$35
Class I	$60
Class II	$75
Class III	$85
Class IV	$100

There is no exam fee required for today's certification program.

Certification Renewal Fees By Class	
Class A	$25
Class I	$35
Class II	$45
Class III	$55
Class IV	$65

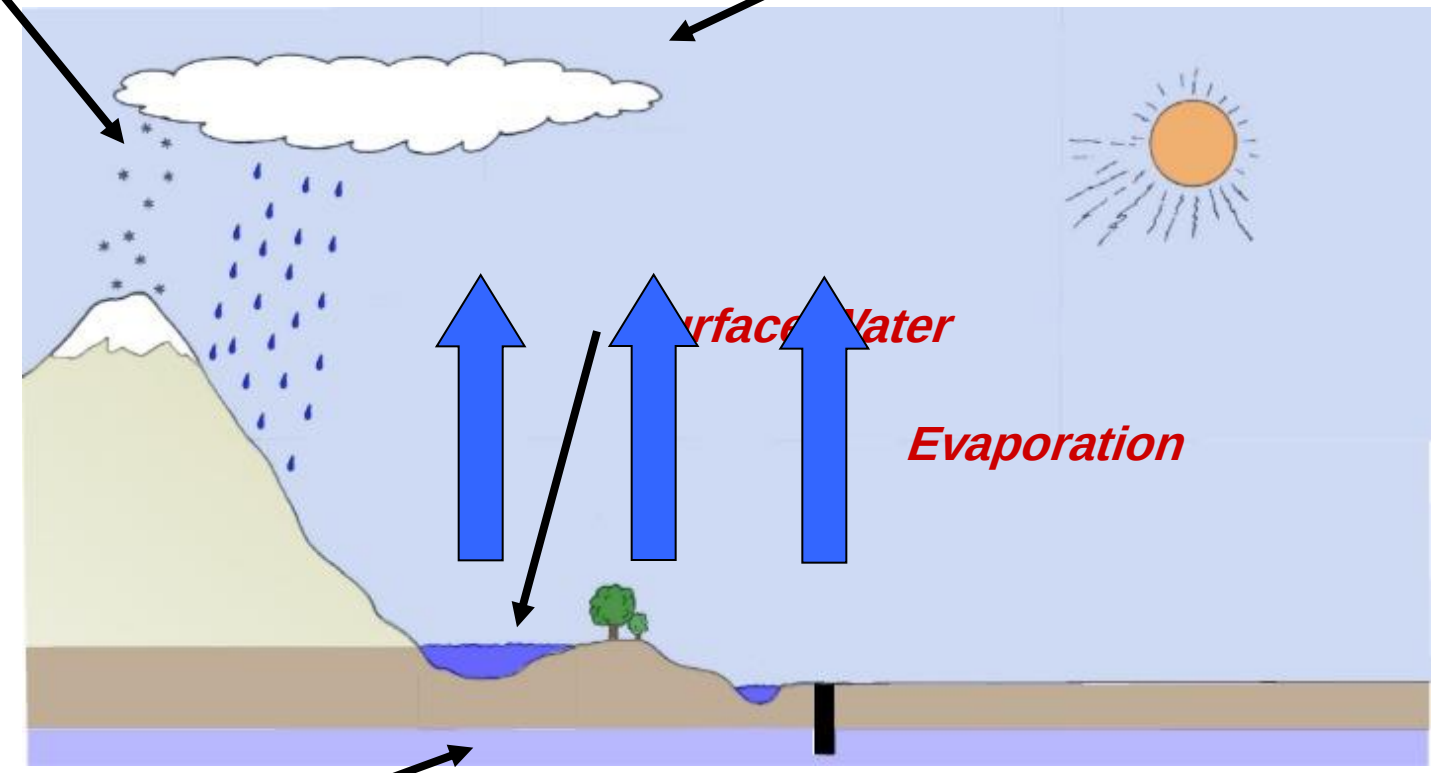
Renewal fees are paid every two years.

The Hydrologic (Water) Cycle

- Rain falls to the ground from clouds
- The rain makes its way to oceans, lakes, rivers, and groundwater
- The water evaporates and forms clouds in the sky
- The clouds produce rain and the cycle continues…

Hydrologic Cycle Video, courtesy NASA

The Hydrologic Cycle



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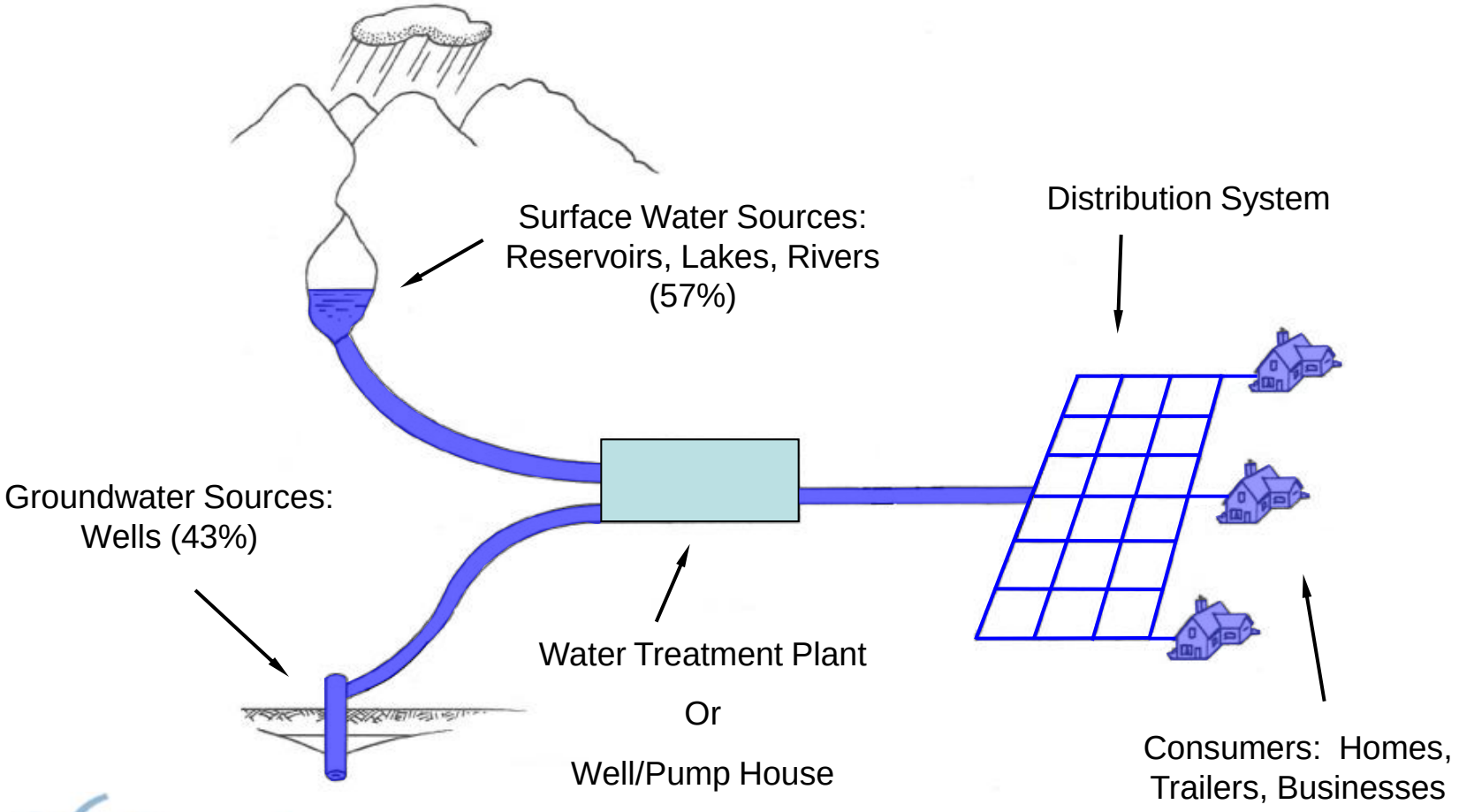
The Water Supply System



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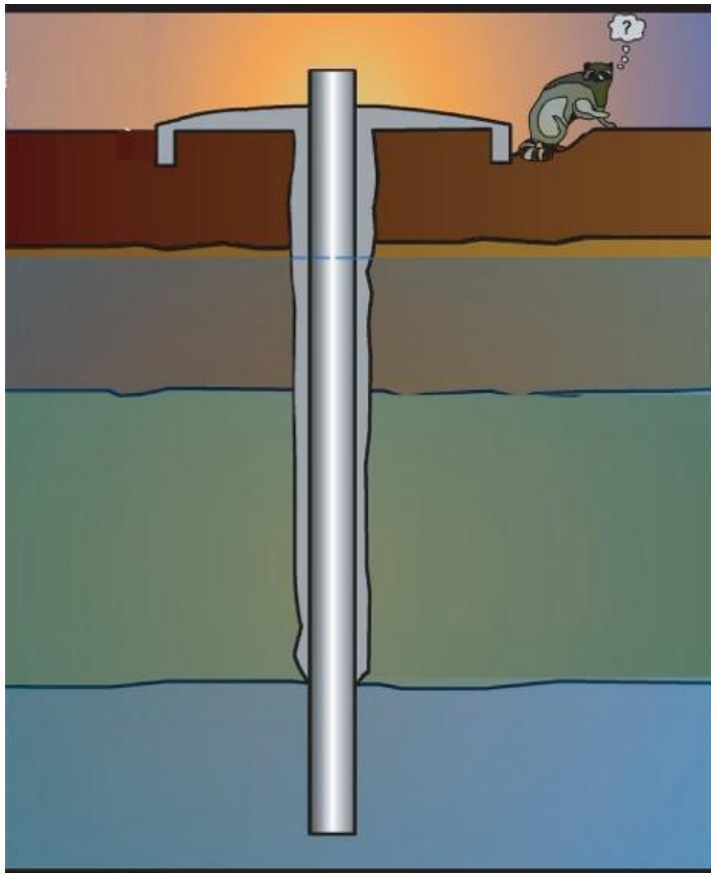
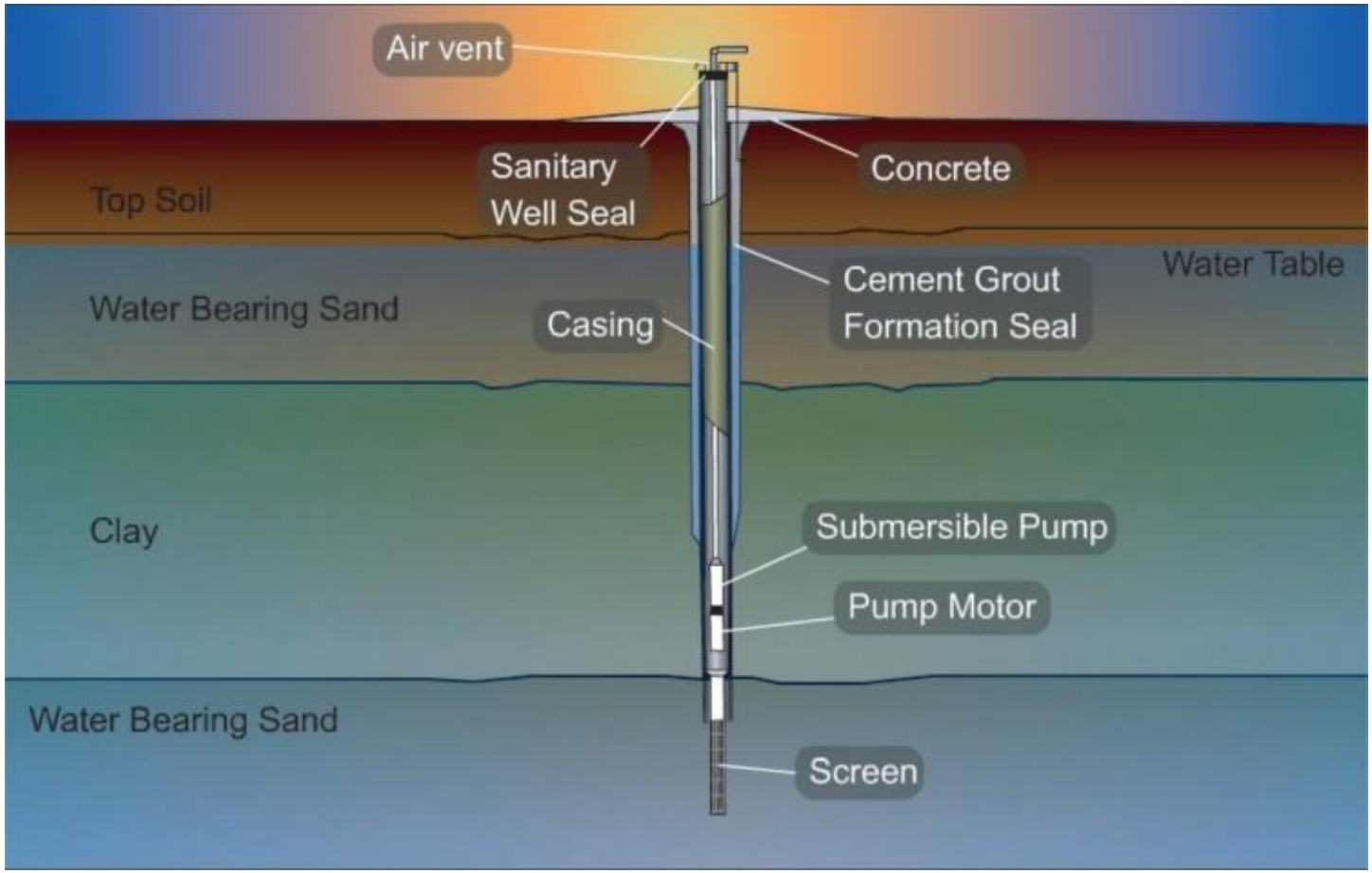
Well Head Protection



Components of a Well



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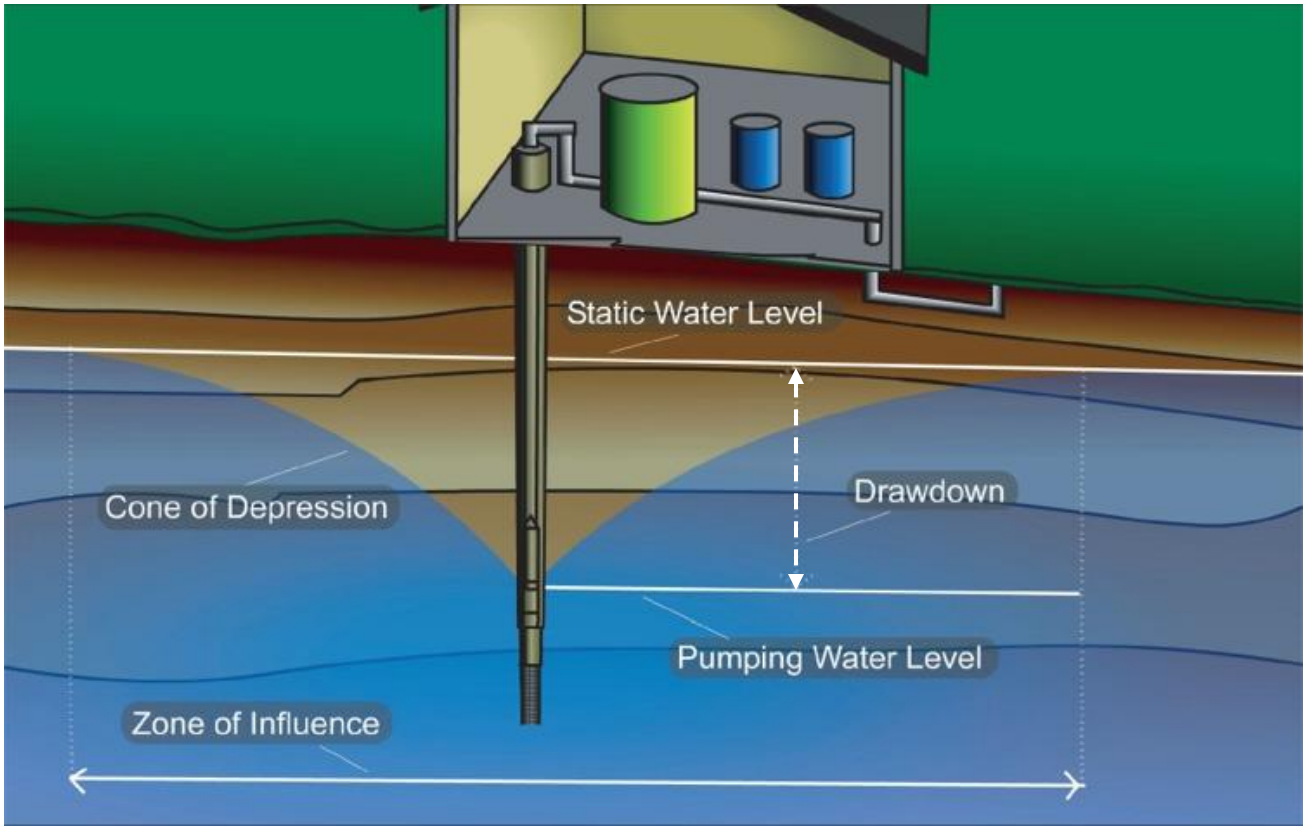
Examples of Well Pumps

Submersible Pump

Jet Pump

Turbine Pump

Well Levels



Key Points:

- Static Water Level
- Pumping Water Level
- Drawdown is the difference between the Static Water Level and the Pumping Water Level

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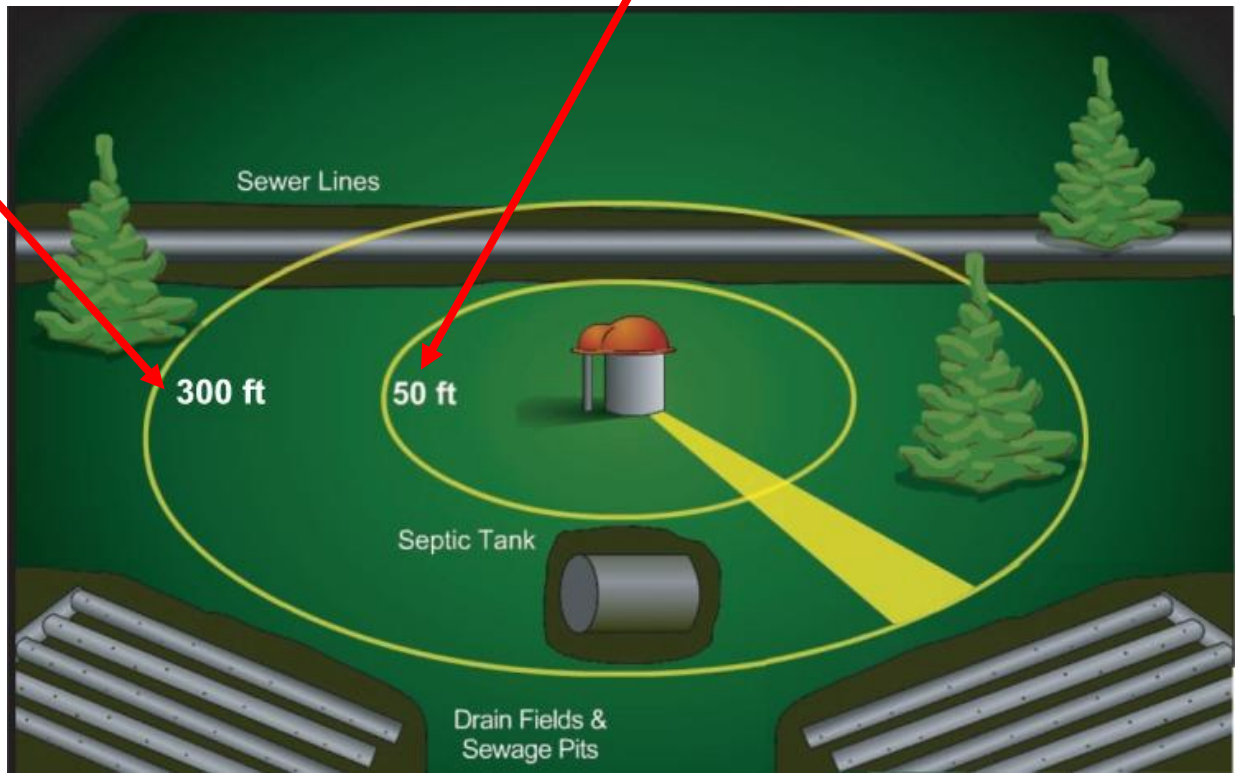
Source Water Protection

The Isolation Distance increases as the amount of water pumped increases to a maximum of 300 ft.

Minimum Isolation Distance for all wells



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Preventing Contamination

- Maintain an isolation distance of at least 50 feet between the well and potential sources of contamination at all times
- Provide a secure and intact well cap with a screened vent (a locking well cap is recommended)
- Extend the well casing at least 12 inches above grade
- Slope soil surface away from the well to drain surface runoff away from the well

Preventing Contamination, *continued…*

- Well should have at least 25 feet of casing
- Inspect well routinely for problems such as:
  - Cracked, corroded, or damaged well casing
  - Broken or missing well cap
  - Settling and cracking of surface seals
- Protect well from potential vehicle damage

Preventing Contamination, *continued…*

- Disinfect drinking water wells after repairs or modifications
- Have the well tested as directed for Total Coliform bacteria, nitrate, and other constituents of concern
- Keep accurate records of any well maintenance, such as disinfection or sediment removal, that may require the use of chemicals in the well
- Hire a professional well driller for any new well construction, modification, or abandonment/closure

Contaminant Testing

Tests that must be done before new wells are used and the contaminants that must be tested for include:

- Microbiological contaminants
- Inorganic contaminants (IOCs)
- Synthetic organic chemicals (SOCs)
- Volatile organic chemicals (VOCs)
- Radioactive contaminants (Rads)
- Disinfection byproducts (DBPs)

Vulnerability Assessments

Security is important!

A drinking water system should undergo a Vulnerability Assessment. Some of the potential dangers to the system include:

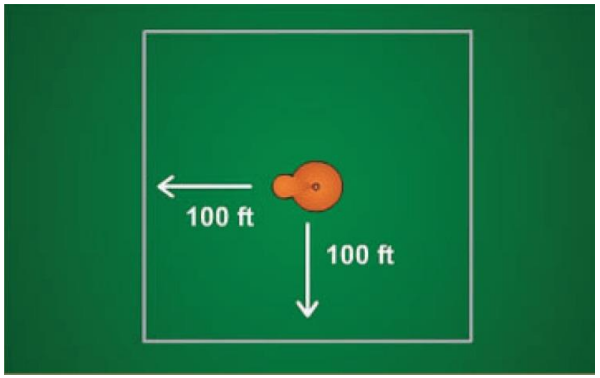
- *Vandals (kids playing around the pump house and wells)*
- *Sabotage (angry neighbor)*
- *Natural Disasters (ice storms, tornadoes, flooding)*

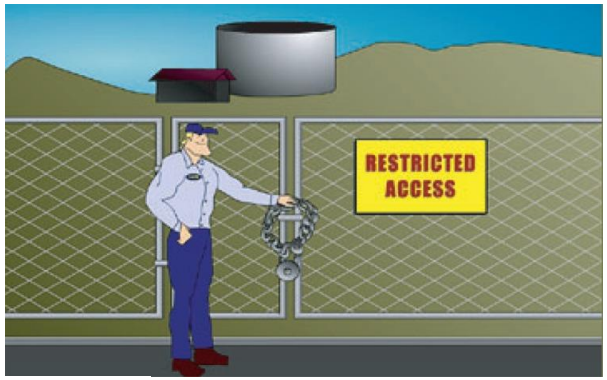
This ensures that the system continues to run and produce safe drinking water.

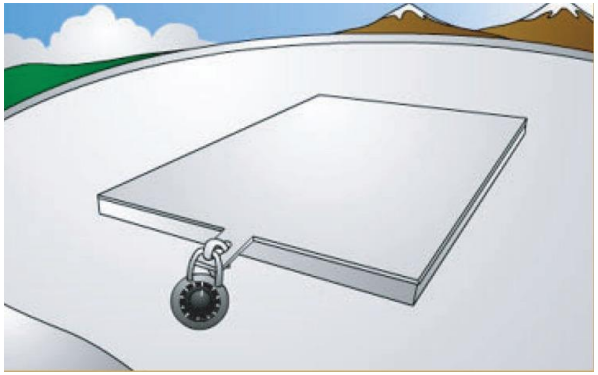
Vulnerability Assessments

Some of the items that you should look at include:

- Water Lines
- Fences
- Pump House
- Chemicals
- Locks







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Disinfection of Public Water System Wells

Requirements:

Ohio Administrative Code 3745-9-08 requires all wells to be properly disinfected by chlorination before a new well is placed into service or an existing well is returned to service after repair.

Examples of when the system should be chlorinated, bacterial samples taken, and a water use advisory issued before consumers use the water:

- A new well pump is installed in the well
- A new pit-less adapter is installed in the well
- Repairs made to a line break
- Installation of a new water line
- A new pressure tank is installed
- A new type of treatment is installed
- Directed by the Ohio EPA to do so

Disinfection of Public Water System Wells, *continued…*

Procedure:

1. All loose debris, sediment, mineral encrustation and bacterial slime must be removed from the well prior to disinfection

2. Disinfectant must be poured slowly into the well by wetting the inside casing walls, drop pipe, and electrical cable

Procedure, continued…

3. Disinfectant concentration in the water column must initially be at least 100 milligrams per liter chlorine. AWWA specification C654-97 can be consulted to determine the necessary amount of sodium or calcium hypochlorite needed. The following formula can be used:

$R^2 \times D \times 0.000272 =$ _____ gallons of unscented bleach containing 6% sodium hypochlorite

where: R = radius of well in inches
D = depth of water in well in feet

Example:

- 6 inch well
- 40 feet of water in the well
- 3^2 x 40 x 0.000272 = 0.097 gallons (approximately 0.1 gallons)
- Therefore, 0.1 gallons **(1½ cups)** of unscented chlorine solution containing 6% sodium hypochlorite will establish a chlorine residual of 100 mg/L in a 6-inch well that has 40 feet of water.

Procedure, continued…

4. Water in the well must be agitated or surged to ensure even dispersal of the disinfectant throughout the entire water column. Re-circulating water back into the well casing from an outside spigot may distribute chlorine throughout the water column if the well pump is located at the bottom of the well.

5. Cap the well and allow it to stand without pumping for at least 8 hours or overnight

Procedure, continued…

6. After disinfection, a well must not supply water for human consumption until it has been found to be Total Coliform negative. Total Coliform samples must be collected at least 48 hours after disinfection and after all residual chlorine is completely flushed from the well. Total chlorine must be undetectable before Total Coliform sampling.

   Two consecutive total Coliform samples, at least 24hours apart, must be Total Coliform negative before the well can supply water for human consumption.

An Ohio EPA certified laboratory must be used for bacterial analysis.

Procedure, continued…

7. If any of the bacterial samples taken from the well in step 6 are reported as Total Coliform positive, then repeat steps 1-6

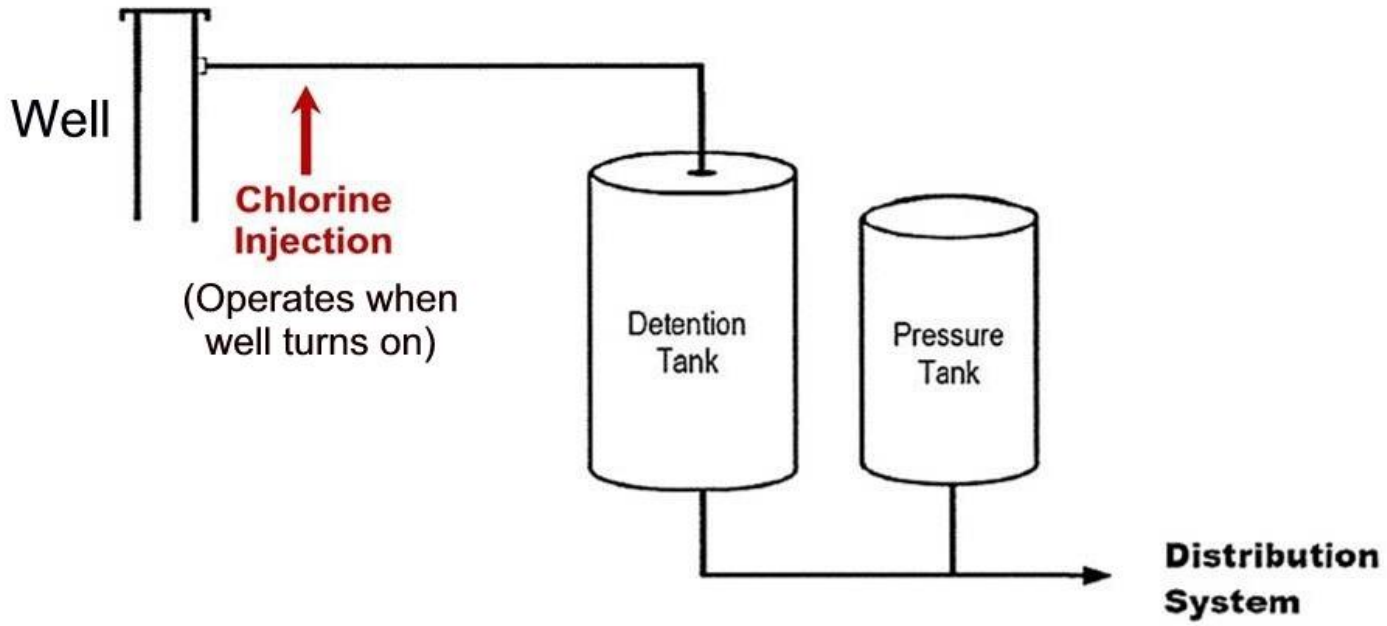
8. If the water is reported as Total Coliform positive after repeating the procedure two times, contact your Ohio EPA district office

Note: When calcium hypochlorite is used for disinfection, tablets or granules must be completely dissolved in water prior to placement in the well. Sodium hypochlorite solution with fragrance additives must not be used for disinfection.

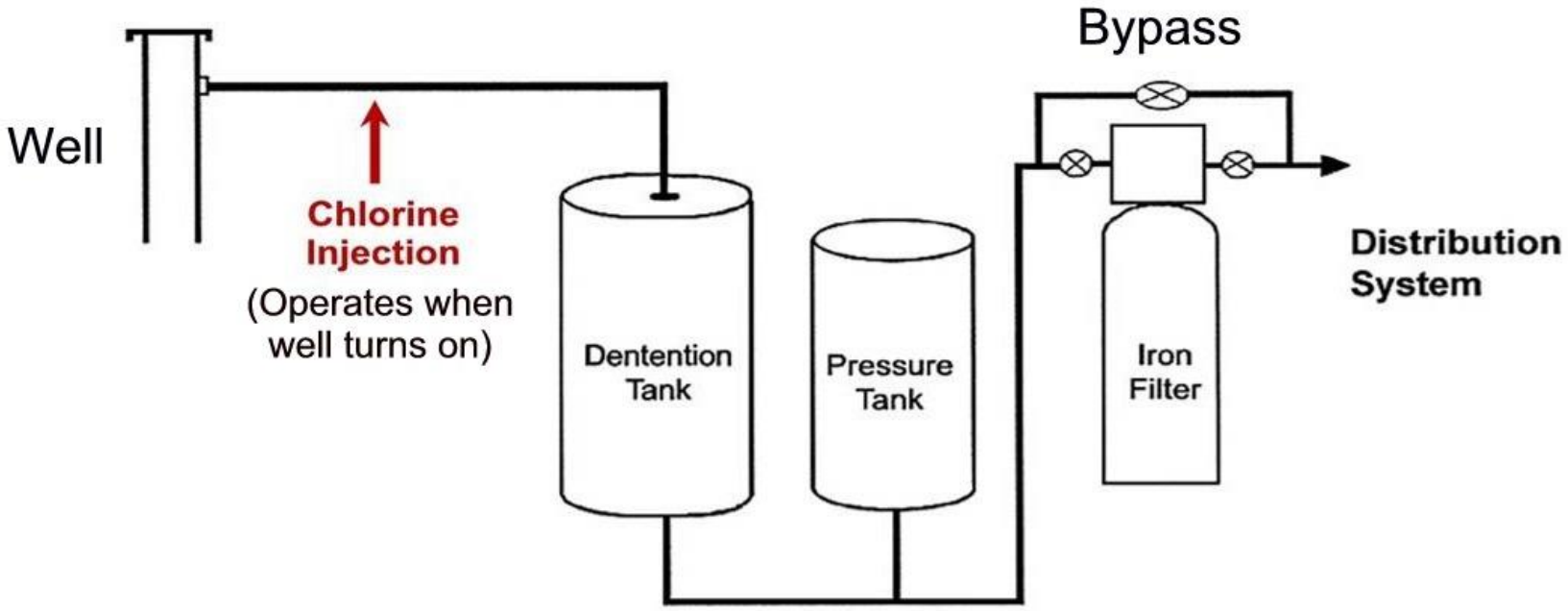
Chlorine Injection in Different System Layouts

1. Disinfection
2. Iron Removal
3. Disinfection with Ion Exchange Softening
4. Iron Removal with Ion Exchange Softening

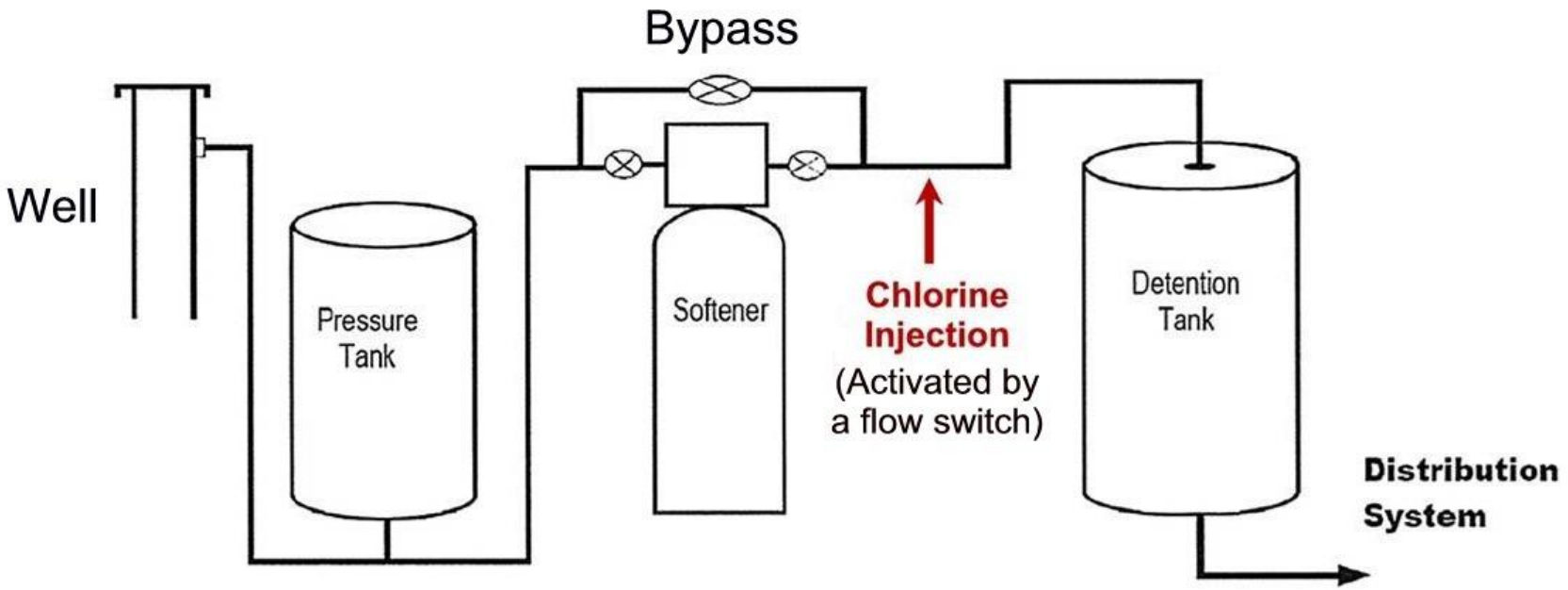
Example 1: Disinfection



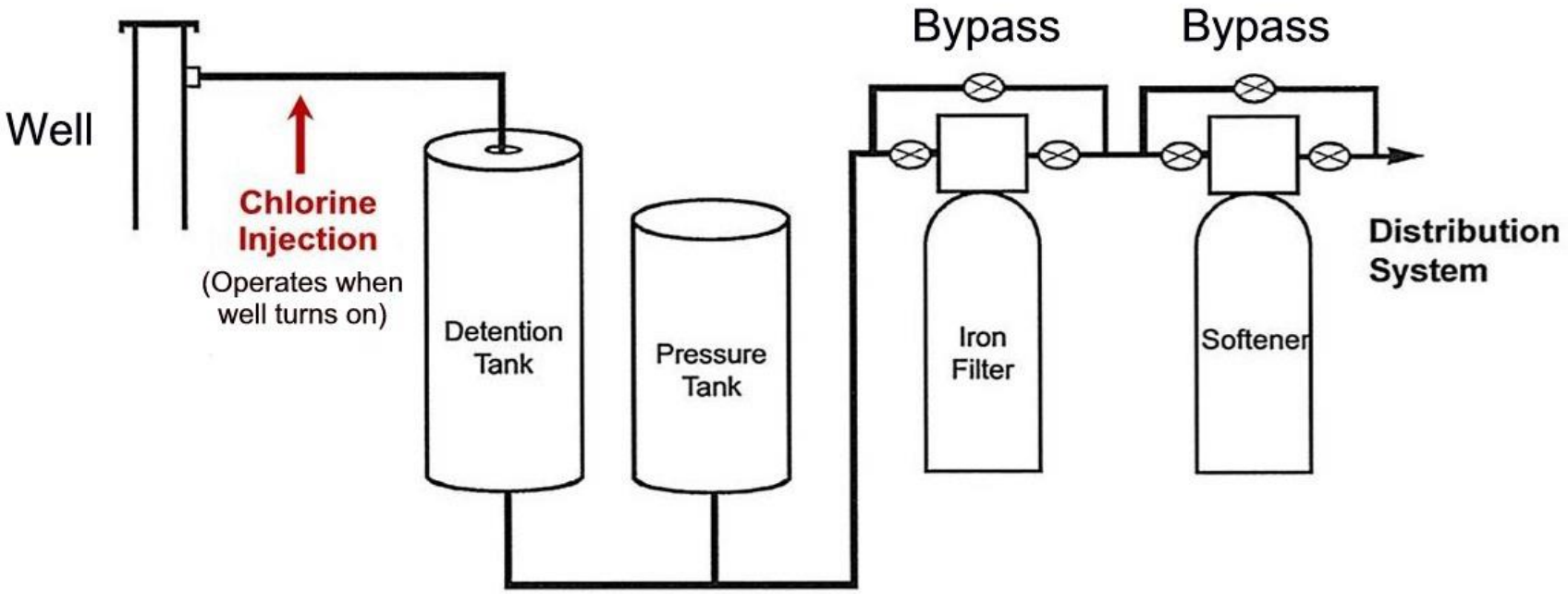
Example 2: Iron Removal



Example 3: Disinfection with Ion Exchange Softening

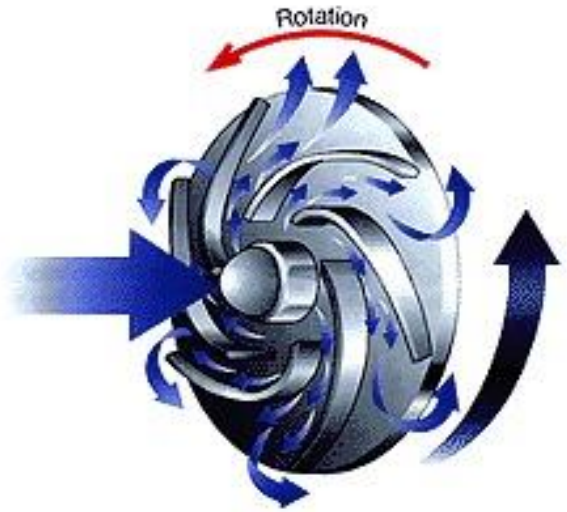


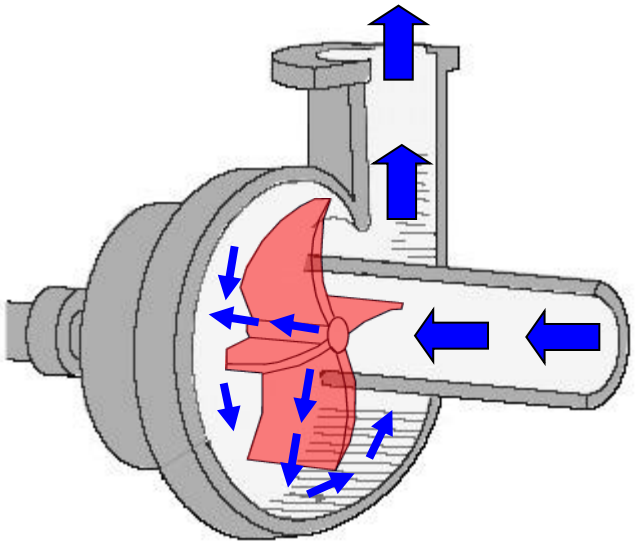
Example 4: Iron Removal with Ion Exchange Softening



Centrifugal Pumps

- These pumps use an ***Impeller*** to direct water from the center of the impeller to its outer edge. By the time the water reaches the edge, its speed and pressure have increased.
- The Impeller is rotated by a motor

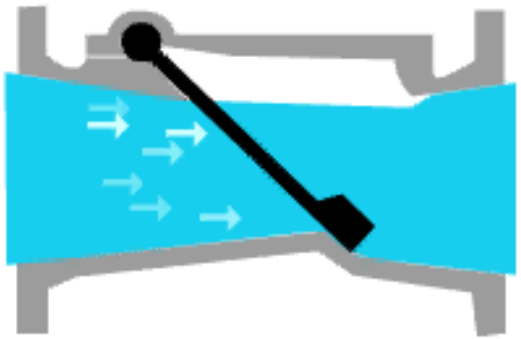




Check and Foot Valves

Check Valves

The purpose of a Check Valve is to act as an automatic shut-off valve when the pump stops.



- When the pump is on, the valve allows the water to flow
- When the pump is off, the valve prevents the water from flowing back

Foot Valves

A Foot Valve is often placed at the inlet to the suction line of a pump. It is essentially a check valve that is placed at the bottom of a pump and performs several important functions:

- It maintains the prime on the line
- It prevents the water from flowing back

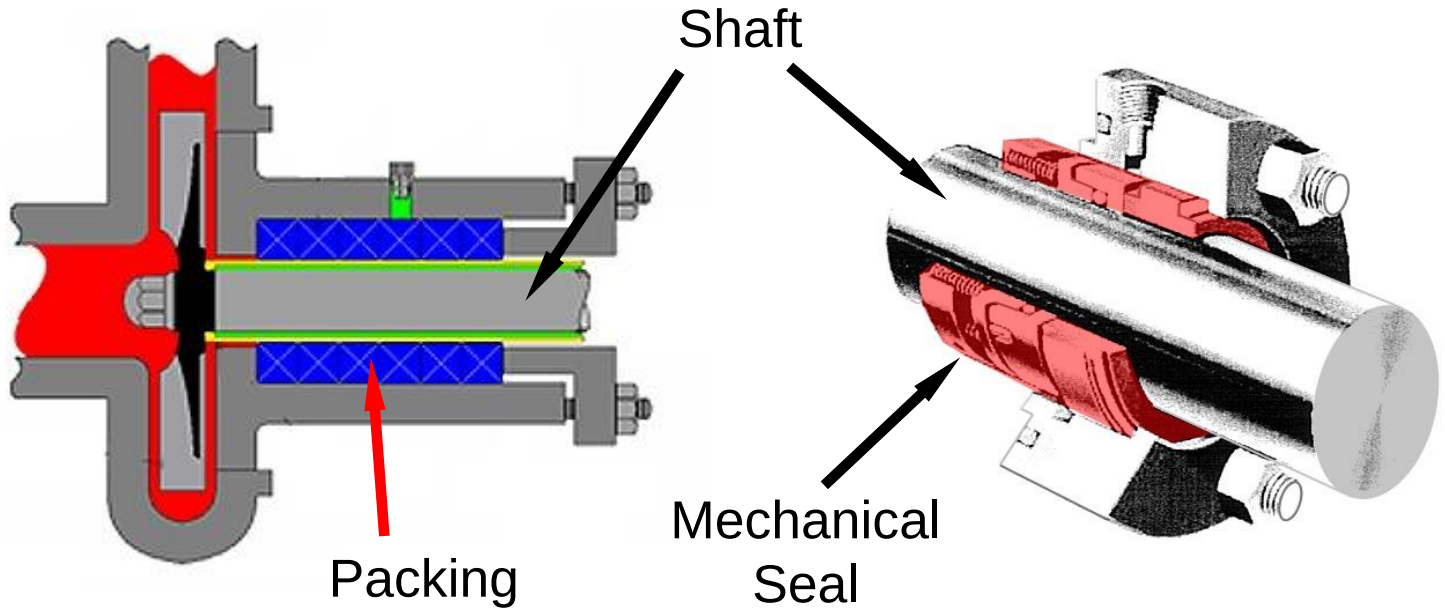
Pump Maintenance

Most pumps require some maintenance periodically. For specific information regarding a pump, the owner's manual (Operation and Maintenance manual/manufacturer's recommendations) should be consulted. The following are some of the maintenance requirements of a typical pump:

- Lubrication of the pump bearings and motor bearings (usually with a grease gun)
- Checking for water leakage
- Checking for unusual vibrations and noise (check the motor alignment if present)

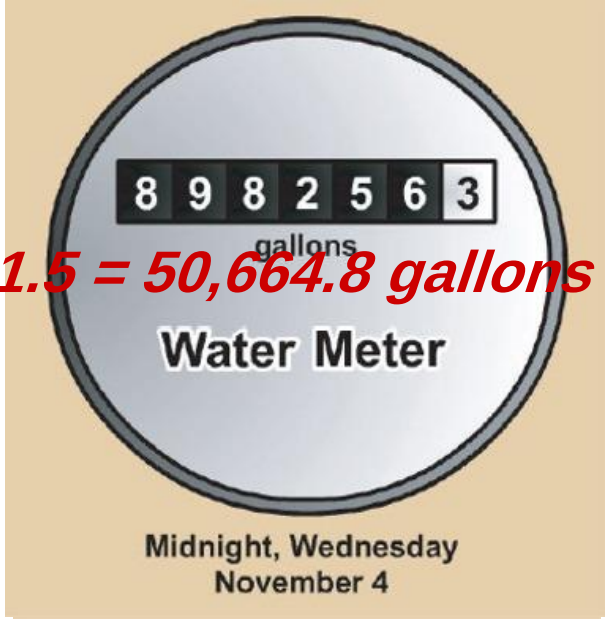
Mechanical Seals and Packing

- All pumps need a seal to prevent water from contacting the shaft
- Most pumps use ***Packing*** or a ***Mechanical Seal*** that is placed on the shaft



Totalizer Meter

- To calculate daily usage, a totalizer meter should be placed on the line to our [illegible] to determine the amount of water pumped from the well each day.
- The Totalizer Meter at midnight on November 3rd reads ***847,591.5 Gallons***. We will write this number down.
- The Totalizer Meter at midnight on November 4th reads ***898,256.3 Gallons***. We will write this number down.
- Now, let's do an example of how to calculate the ***Daily Usage***.



898,256.3 – 847,591.5 = 50,664.8 gallons of water used in 1 day.

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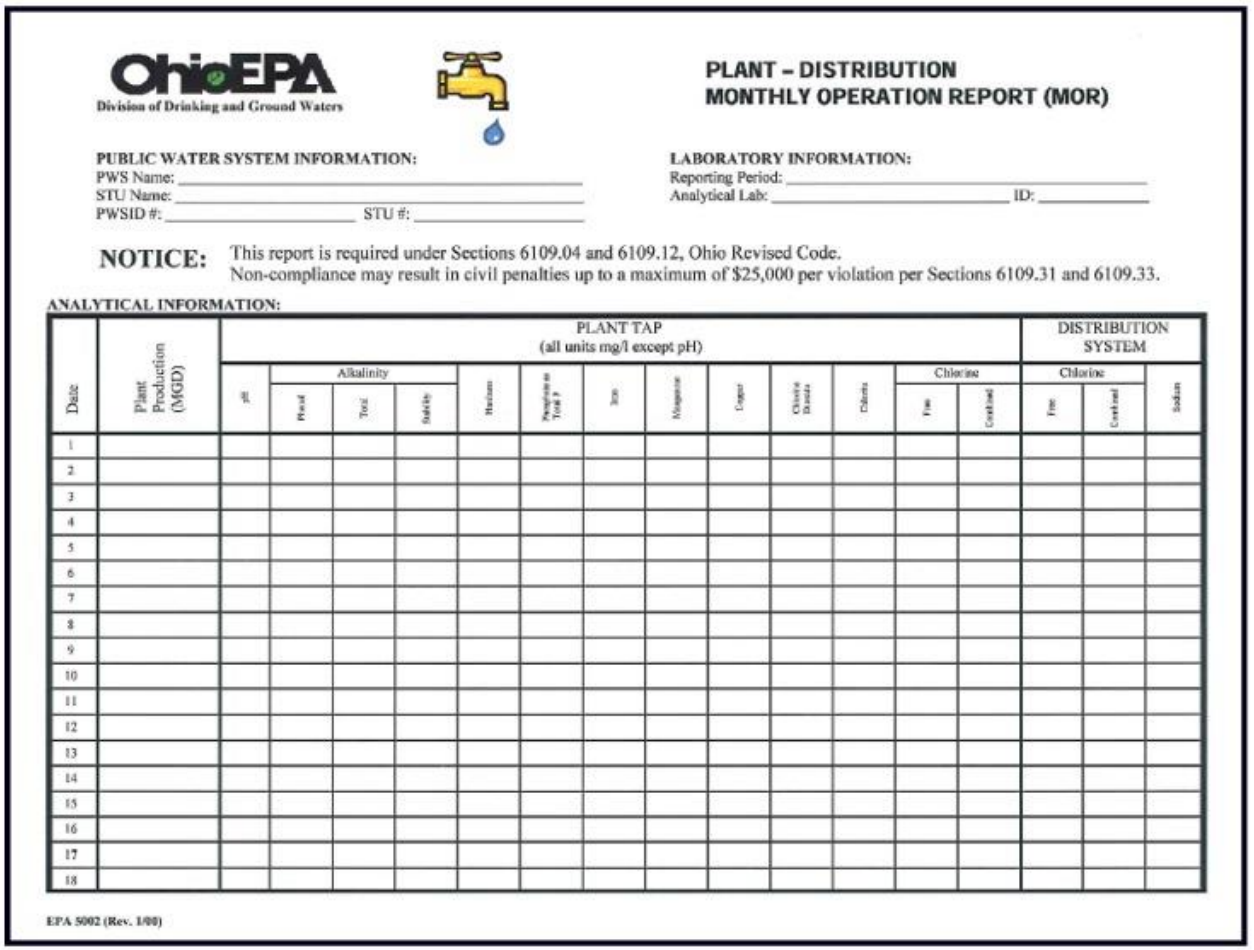
Converting to MGD

Instead of calculating the Daily Usage in Gallons per Day, we can use ***Million Gallons per Day***, abbreviated as ***MGD***. For instance, if we produce 1,000,000 gallons of water per day, we can also say we produced 1 MGD—they are the same thing.

Now, let's take our number we just calculated for the Daily Usage and convert it to MGD. To do this, we divide the Daily Usage by 1,000,000.

$$\frac{50{,}664.8\ Gallons\ Produced\ per\ Day}{1{,}000{,}000} = 0.051\ MGD$$

Plant Distribution Reports



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Division of Drinking and Ground Waters

PLANT – DISTRIBUTION
MONTHLY OPERATION REPORT (MOR)

PUBLIC WATER SYSTEM INFORMATION:
PWS Name: _____
STU Name: _____
PWSID #: _____ STU #: _____

LABORATORY INFORMATION:
Reporting Period: _____
Analytical Lab: _____ ID: _____

NOTICE: This report is required under Sections 6109.04 and 6109.12, Ohio Revised Code.
Non-compliance may result in civil penalties up to a maximum of $25,000 per violation per Sections 6109.31 and 6109.33.

ANALYTICAL INFORMATION:

Date	Plant Production (MGD)	PLANT TAP (all units mg/l except pH)													DISTRIBUTION SYSTEM		
		pH	Alkalinity			Hardness	Phosphorus Total P	Iron	Magnesium	Copper	Chloride Dioxide	Chlorite	Chlorine		Chlorine		
			Phenol	Total	Bakelite								Free	Combined	Free	Combined	Sodium
1																	
2																	
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EPA 5002 (Rev. 1/00)

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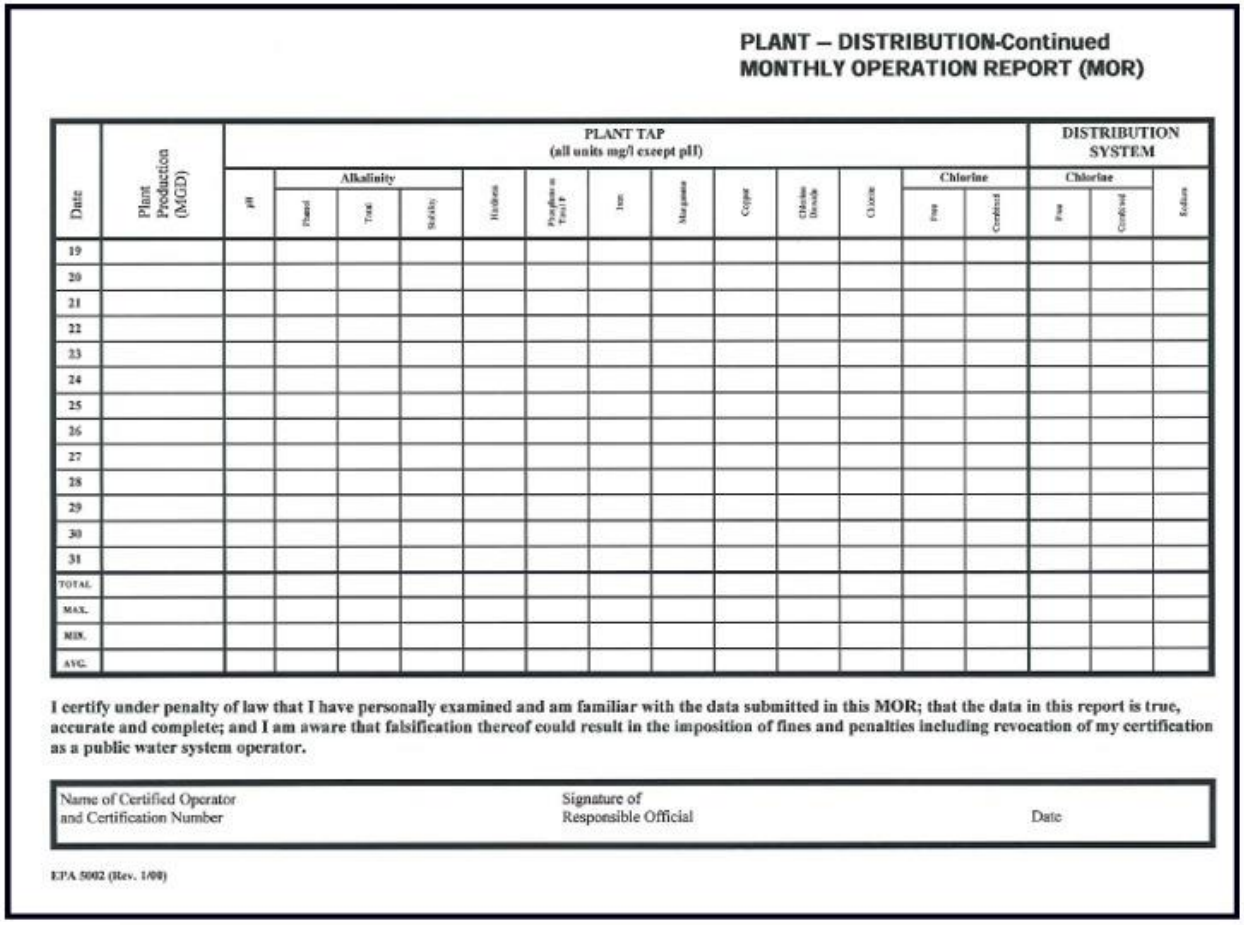
Plant Distribution Reports



PLANT – DISTRIBUTION-Continued
MONTHLY OPERATION REPORT (MOR)

Date	Plant Production (MGD)	PLANT TAP (all units mg/l except pH)													DISTRIBUTION SYSTEM		
		pH	Alkalinity			Hardness	Phosphate or Total P	Iron	Manganese	Copper	Chloride Dioxide	Chlorite	Chlorine		Chlorine		Fluoride
			Phenol	Total	Bicarb.								Free	Combined	Free	Combined	
19																	
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TOTAL																	
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MIN.																	
AVG.																	

I certify under penalty of law that I have personally examined and am familiar with the data submitted in this MOR; that the data in this report is true, accurate and complete; and I am aware that falsification thereof could result in the imposition of fines and penalties including revocation of my certification as a public water system operator.

Name of Certified Operator and Certification Number	Signature of Responsible Official	Date

EPA 5002 (Rev. 1/00)

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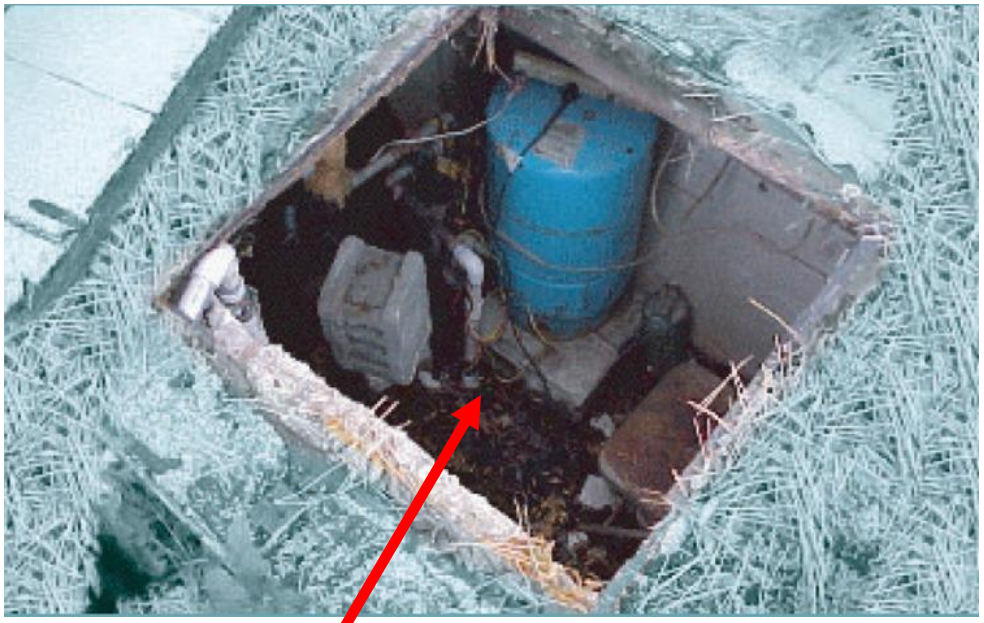
Typical Safety Concerns

- *Confined Space Entry*
- *Lock-Out/Tag-Out*
- *Fire Safety*

Confined Spaces

- Have the potential for a toxic, explosive, or oxygen-deficient atmosphere
- Have the potential for engulfment by a liquid such as water
- Require an ***additional person*** outside the space
- ***These are very dangerous places to work in!***
- ***In an ideal situation, you should sample for the presence of a hazardous atmosphere***



Well Pit

Lock-Out/Tag-Out Procedure

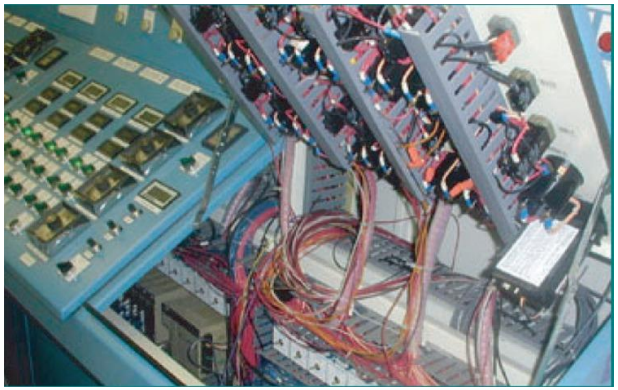
Any equipment that can unexpectedly start-up when it is being worked on ***MUST*** be locked and tagged out. The basic procedure is:

- The operator performing the work puts a lock on the switch or valve he is working on
- A tag is installed on the lock indicating why the equipment is locked out and who is working on it
- Only the person working on the equipment is allowed to remove the tag or lock out device

Fire Extinguishers

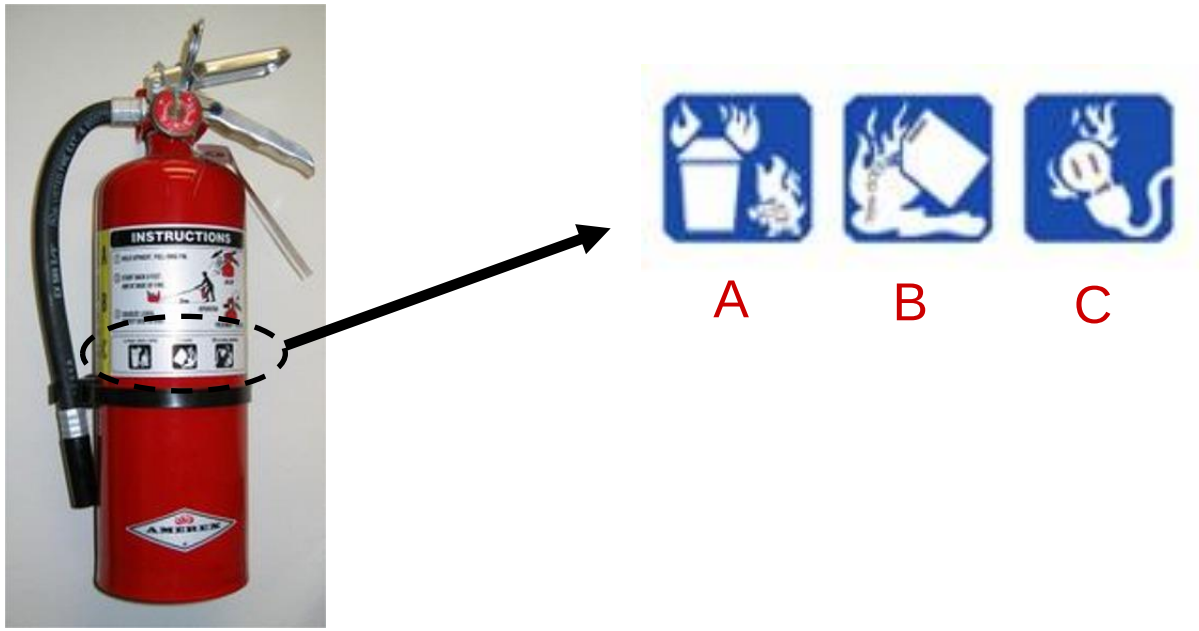
Fire Extinguishers should always be present where a fire can potentially occur. There are usually three types of fires that occur in a drinking water system:

- Class A Fires: Fueled by such materials as wood, paper, and textiles
- Class B Fires: Fueled by such materials as grease, oil, and paint
- Class C Fires: Electrical Fires (Most common fire in water systems)



Fire Extinguishers

- Instead of using three separate extinguishers, a Class ABC extinguisher can be used for all three fire types
- All fire extinguishers should be placed in a visible and accessible location



Recommended Daily Operational Duties

- Inspect well, pump house, or booster pump station
- Check water meter readings and record water production
- Check chemical solution tanks and record amounts used
- Check and record water levels in storage tanks
- Inspect chemical feed pumps
- Check and record chlorine residual at the point of application
- Check and record chlorine residual in the distribution system

SESSION ONE SAMPLE QUESTIONS BEGIN

SESSION ONE SAMPLE QUESTION

1. According to the SDWA, the basic definition of a public water supply system is any water system that supplies water for human consumption that serves . . .

   a. 25 homes or more for over 120 days a year
   b. The public in any capacity, no matter how small
   c. 25 or more persons for at least 30 days a year
   d. 15 service connections or over 25 persons for over 60 days a year.

d. 15 service connections or over 25 persons for over 60 days a year

SESSION ONE QUIZ QUESTION

2. What causes water to move through pores in soil and rocks?

a. Temperature
b. Viscosity
c. Barometric pressure
d. Gravity

d. Gravity

SESSION ONE QUIZ QUESTION

3. Under the requirement of the SDWA, it is the duty of the water purveyor to deliver potable water of proper quantity only as far as the . . .

   a. Entry point of the distribution system
   b. Customer's curb box and service connection
   c. Consumer's tap inside home
   d. Furthest water main blow-off or sampling point

c. Consumer's tap inside home

SESSION ONE QUIZ QUESTION

4. Which source of water has the greatest natural protection from bacterial contamination?

   a. Shallow well
   b. Deep well in gravel
   c. Surface water
   d. Spring

b. Deep well in gravel

SESSION ONE QUIZ QUESTION

5. Most pumps must be primed before start-up in order to . . .

a. Calculate the flow rate
b. Prevent reverse flow
c. Start the flow of water
d. Prevent water hammer

c. Start the flow of water

SESSION ONE QUIZ QUESTION

6. What is the purpose of a pump guard?

a. Allows operators to turn off pump in emergency situations
b. Notifies operators of excessive temperatures
c. Allows operators to pump against a closed discharge valve
d. Protects operators from rotating parts

d. Protects operators from rotating parts

Questions?

END OF SESSION ONE