PN Website Items and Policy on Loss of Positive Pressure Situations

Objectives:

- Identify selected items that are available on the PN website.
- Discuss why the Loss of Positive Pressure policy was developed.
- Walk through the policy and discuss the associated AWWA Standard C-651-05 – *Disinfecting Water Mains.*
- Use the policy to make decisions about follow-up actions and compliance determinations.
- Answer any additional questions about the PN revisions.

PN Website:

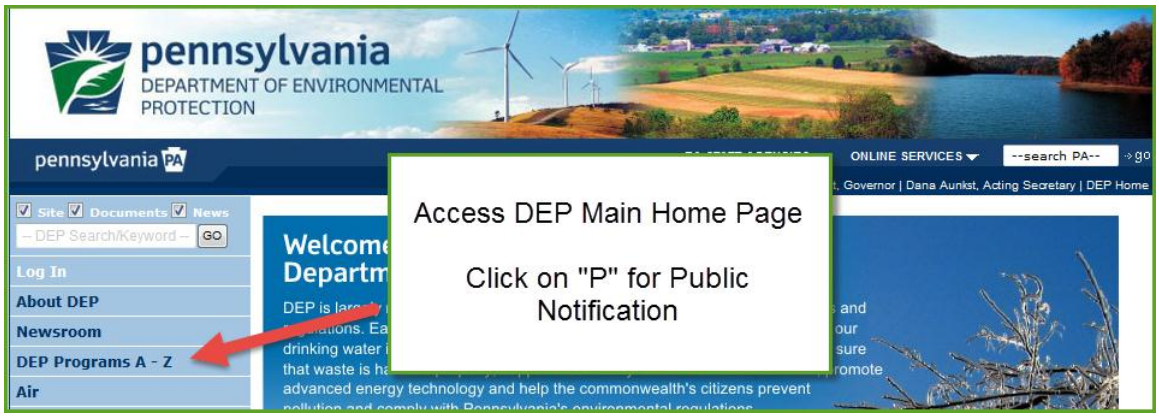
There are 2 ways to find the PN webpages:

1. Access it through the main DEP home page, using DEP Program A-Z link.
2. Access the direct link to PN webpages.

1. Access the main DEP home page:

http://www.depweb.state.pa.us/portal/server.pt/community/dep_home/5968

Click on DEP Program (A-Z) on the left.
Click on “P” and then click on public notification to open the PN web page.



2. **Access the direct link to the PN main webpage:**

http://www.portal.state.pa.us/portal/server.pt/community/public_drinking_water/21162/public_notification/1258843

PN Main Webpage

We'll review a few pages and 5 selected items that you can use.

Item #1: PN Certification Form

All public notices require certification to DEP within 10 days of the required PN delivery time frame.

What information is required in the PN Certification?

The PN Certification form fulfills the certification requirements for PN. It must be submitted to DEP within 10 days of the required PN delivery time frame.

How can PWSs prepare for PN before a violation or situation occurs?

Item #2: Tier 1 PN Templates

There are 19 Tier 1 PN templates.

Tier 1 PN Templates

All Tier 1 PN Notices are located on DEP's eLibrary.

Failure of a key water treatment process involving filtration or disinfection (3800-FM-BSDW0494)
Template and instructions for completing a Tier 1 notice for the failure of a key water treatment process involving filtration or disinfection.

Failure of a key water treatment process involving nitrate removal (3800-FM-BSDW0495)
Template and instructions for completing a Tier 1 notice for the failure of a key water treatment process involving nitrate removal.

GUDI sources (3800-FM-BSDW0496)
Template and instructions for completing a Tier 1 notice for GUDI sources.

Failure to Meet Disinfection Treatment Requirements for GW and SW systems (3800-FM-BSDW0151)
Template and instructions for completing a Tier 1 Notice for the failure to meet disinfection treatment requirements for groundwater and surface water systems.

Presence of E. coli in a Groundwater Source when 4-log Treatment of Viruses is not Provided (3800-FM-WSFR0150)
Template and instructions for completing a Tier 1 Notice for the Presence of E. coli in a Groundwater Source when 4-log Treatment of Viruses is not Provided

Failure to provide the level of Cryptosporidium Treatment that is appropriate for the System's Bin Classification (3800-FM-WSFR0153)
Template and instructions for completing a Tier 1 Notice for the failure to provide the level of Cryptosporidium Treatment that is appropriate for the System's Bin Classification.

Item #3: O&M Plan and ERP Templates

There are links to both the ERP and O & M Plan templates.

O&M Plan and ERP Templates

- Emergency Response Plan for Public Water System
- Operation and Maintenance Plan for Public Water System

Item #4: PN Guidances, Handbook and Regulations

There are links to both guidance documents (Loss of Positive Pressure and Water Supply Warning).

PN Guidances, Handbook and Regulations

Policy for Determining When Loss of Positive Pressure Situations in the Distribution System Require One-Hour Reporting to the Department and Issuing Tier 1 Public Notification (PDF) (383-2129-004) -- DEP's technical guidance for evaluating and responding to possible contamination of water distribution systems during loss of positive pressure situations. This guidance includes the criteria for one hour reporting and Tier 1 Public Notification.

Policy for Issuing and Removing Water Supply Warnings (PDF) (383-2129-005) -- DEP's technical guidance for issuing and removing water supply warnings. This guidance includes EPA's health advisory levels and acute health effects language. Water suppliers are required to insert acute health effects language into a Tier 1 PN when EPA health advisory levels are exceeded.

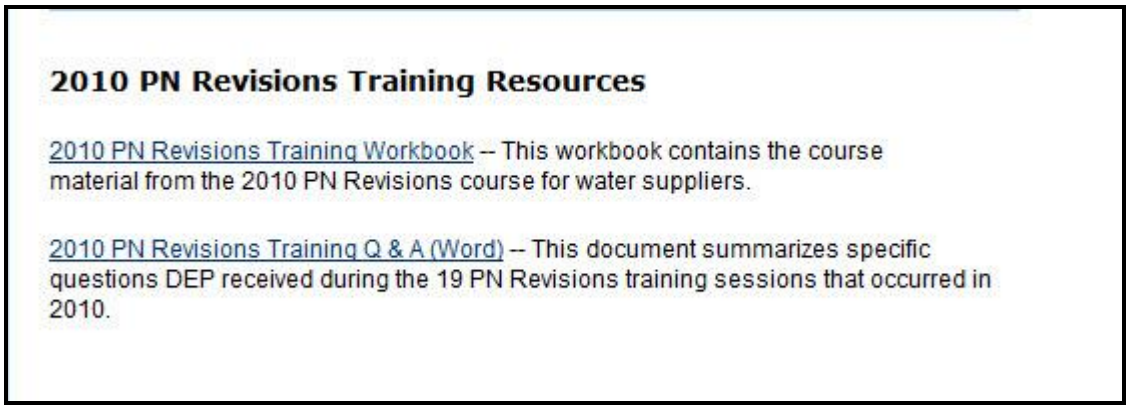
PN Handbook for Community Water Systems (PDF) -- DEP's comprehensive handbook that describes all public notice requirements including the PN revisions that were published in the PA Bulletin on 05/09/09.

2012 Edition of the Drinking Water Standards and Health Advisories -- U.S. Environmental Protection Agency

PA DEP Public Notification Revisions Regulations Final Rulemaking (5/9/09) -- PN Revisions Final Rulemaking was published in the PA Bulletin on 05/09/09. The Chapter 109 rule revisions are effective May 9, 2009 except those published under 109.408(d) (New direct delivery requirements for Tier 1 public notices) which will become effective May 10, 2010.

Item #5: 2010 PN Revisions Training Resources

Finally, we've added links to the original 2010 training resources.



2010 PN Revisions Training Resources

2010 PN Revisions Training Workbook -- This workbook contains the course material from the 2010 PN Revisions course for water suppliers.

2010 PN Revisions Training Q & A (Word) -- This document summarizes specific questions DEP received during the 19 PN Revisions training sessions that occurred in 2010.

Policy on Loss of Positive Pressure Situations:

In 2006, DEP was directed by Governor Rendell and Secretary McGinty to improve the effectiveness of PN for Tier 1 violations and situations. The directive lead to several improvements in the way water suppliers plan for and issue PN.

DEP was also directed to clarify and expand the list of situations requiring one-hour reporting to DEP. The Secretary wanted to make sure water suppliers knew when to bring DEP into the decision-making process. Several situations were added to the list, including:

- An overfeed of a drinking water treatment chemical.
- A lack of resources that adversely affect operations.
- 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.

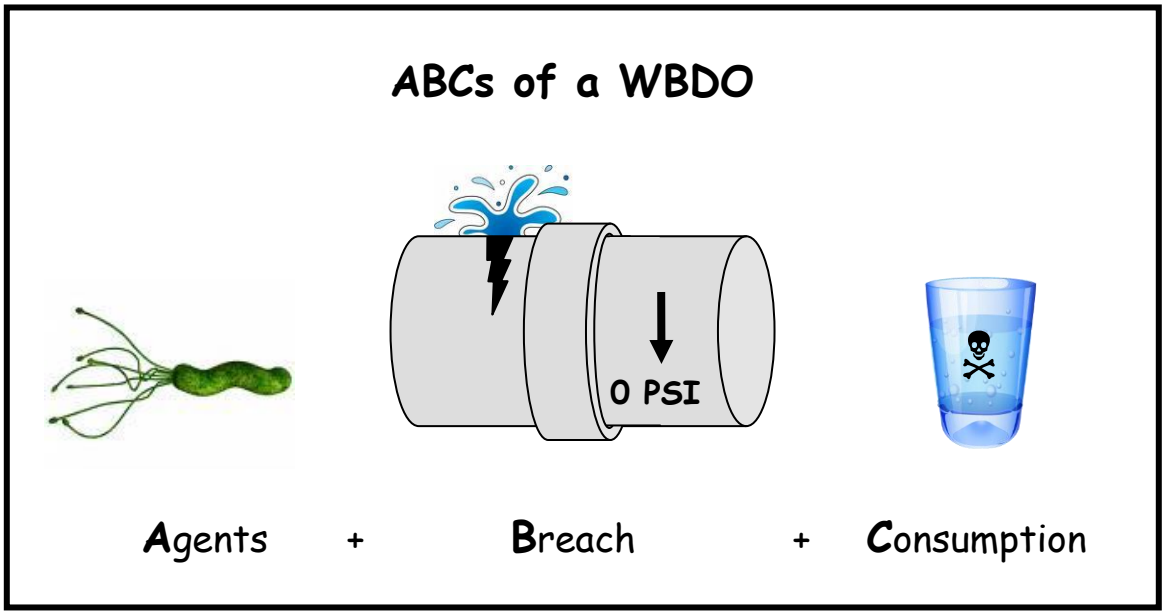
The integrity of the distribution system is considered the final barrier in the multiple barrier approach to providing safe drinking water. A breach in the distribution system represents a serious risk because it provides a direct conduit for pathogens and other contaminants to enter the water supply.

Even though water suppliers maintain a minimum detectable disinfectant residual in the distribution system, it isn't enough to inactivate newly introduced pathogenic organisms into the water supply.

ABCs of a WBDO:

The ABCs of a waterborne disease outbreak (WBDO) include:

- **A = agents** of pathogenic disease
- **B = breach** in the distribution system with a loss of positive pressure
- **C = consumption** of contaminated water



Agents of Pathogenic Disease:

The *Public Water Supply Manual* requires a separation of 10 feet horizontally between water mains and sewer lines or on-lot septic tanks/drain fields. Crossings must be separated by 18 inches.

- However, deviations are allowed under certain circumstances and many older pipe installations do not meet the separation criteria.
- Sewer lines are notorius for leaking.
- Certain areas of the state are impacted by overloaded on-lot septic systems.
- As a result, it would not be unexpected to find human enteric pathogens in the environment external to drinking water pipelines.

Various studies by EPA, National Research Council, American Water Works Association Research Foundation (AWWARF) and others provide evidence that soil and groundwater surrounding distribution pipes contains a variety of microbial pathogens.

In 2001, AWWARF published the results of a study that looked at the quality of soil and water surrounding water main repair sites in an effort to determine the potential for pathogen intrusion (*Pathogen Intrusion Into the Distribution System*, Kirmeyer et al., 2001).

Research Study:

Eight utilities in 6 states collected 65 soil and water samples from water lines that were exposed for repairs:

- Soil samples were collected from undisturbed portions of the pit immediately adjacent to the pipe.
- Water samples were collected from water within the excavation pit.
- The samples were assayed for total and fecal coliform bacteria, *Bacillus subtilis, Clostridium perfringens*, coliphages and enteric viruses.
    - Total coliforms: Indicator organisms.
    - Fecal coliforms: Subgroup of total coliforms, more definitive indicator of fecal contamination, some species are opportunistic pathogens and some are known human pathogens.
    - *Bacillus subtilis*: Nonpathogenic, used as a microbial surrogate.
    - *Clostridium perfringens*: Indicator organism, normal flora of intestine, opportunistic pathogen.
    - Bacteriophage: Bacterial virus, fecal indicator, nonpathogenic.
    - Enteric viruses: Pathogenic, excreted only by infected individuals, over 140 types including poliovirus, rotavirus, Norwalk agent.
- Total coliforms were detected in 58% of the water samples and 70% of the soil samples.
- Fecal coliforms were detected in 43% of the water samples and 50% of the soil samples, with levels as high as 10,000/100 grams of soil.
- *Bacillus subtilis* was detected in 80% of the water samples and 97% of the soil samples.
- Viruses were detected in 56% of the samples.
- The results confirm that waterborne pathogens are very common in the environment external to water distribution mains.

Microbial pathogens are not the only risk facing distribution systems. Other studies have found an abundance of chemicals including pesticides, petroleum products and pharmaceuticals in the water and soil surrounding water pipes.

Breach in the Distribution System:

The significance of the distribution system as a potential source of contamination can be illustrated by the magnitude and condition of the piping currently in place in the U.S.

According to the EPA, National Academy of Sciences (NAS) and National Research Council:

- An estimated 1 million miles of distribution pipe convey 34 billion gallons of water daily to nearly 225 million people.
- An estimated 237,000 water main breaks occur each year.
- There are 100's of water advisories issued annually due to main breaks.
- Most distribution pipes will reach the end of their expected lifespan in 30 years.
- An estimated $300 billion - $1 trillion is needed over the next 20 years to replace the aging infrastructure.
- The U.S. will experience an increased risk for contamination of drinking water in distribution systems if the infrastructure is not replaced.
- The distribution system is the remaining component of public water supplies yet to be adequately addressed in national efforts to eradicate waterborne disease.

Statistics on Distribution System Deficiences and WBDOs:

Since 1971, the Centers for Disease Control and Prevention (CDC) has maintained the Waterborne Disease and Outbreak Surveillance System for collecting and reporting data related to waterborne disease outbreaks associated with drinking water.

- A waterborne disease outbreak is defined as two or more persons with the same illness that are linked by location and time of exposure to water.
- State health departments are responsible for the **voluntary** reporting of water-related illness to the CDC.

According to the CDC:

- From 1971 – 2006, there were 119 waterborne-disease outbreaks associated with distribution system deficiencies.
- These outbreaks were associated with more than 18,000 illnesses.
- The percent of outbreaks associated with distribution system deficiencies is on the rise.
- Currently, distribution system deficiencies account for 32% of all outbreaks, second only to treatment inadequacies at 48%.

The CDC uses several factors to classify distribution system deficiencies, including:

- Cross connections
- Backflow situations
- Contamination of storage facilities
- Contamination of water mains during construction or repair

Case Study #1:

1975, Indiana
Etiologic Agent: Acute gastroenteritis
Number of persons affected: 1,400

The illness was associated with contaminated water pipes during storage and construction due to heavy rains.

Case Study #2:

December 1989 – January 1990, Missouri
Etiologic Agent: *E. coli* serotype 0157:H7
Number of persons affected: 240 illnesses and 4 deaths

At least 240 people became ill when contaminants entered the distribution system through two major pipe breaks and 43 service meter failures. The contaminant was most likely introduced when sewer overflows occurred at the same time as the two major breaks. The water utility did not practice disinfection following main repairs, relying instead on flushing the repaired main with finished water.

Case Study #3:

2002, New York
Etiologic Agent: *Giardia lamblia*
Number of persons affected: 6

At least 6 people became ill at a mobile home park when a power outage created a negative pressure condition in the distribution system. Contaminated water entered the distribution system through either a cross connection inside a manufactured home or a leaking water pipe that was near sewer crossings.

Case Study #4:

2002, Massachusetts
Etiologic Agent: *Legionella* species
Number of persons affected: 16

Over a 2-week period, 15 residents and an employee of a nursing facility contracted Legionnaires disease. Laboratory testing for *Legionella* was positive in samples from the water distribution system. A water main break was reported near the facility 1 month before the outbreak and might have allowed introduction of *Legionella* into the system.

Case Study #5:

2006, Indiana
Etiologic Agent: *Campylobacter*
Number of persons affected: 32

A new water main was installed without a permit. The water main was pressure tested and left under pressure with nonpotable water, resulting in a cross connection hazard.

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These catastrophic failures could be explained as unfortunate and rare events. However, several studies have been conducted that suggest water-related disease is more common than previously thought.

Research Study (Payment, Franco and Siemiatycki, 1993):

In 1991, researchers examined the illness patterns over a 15-month period of 300 households equipped with RO filters and 300 households that drank normal tap water.

- The rate of intestinal illness increased with the amount of tap water consumed.
- The study reported a 35% lower rate of gastrointestinal illness in the households that drank RO filtered water.
- When the rate of gastrointestinal illness was calculated by zones in the distribution system, people who lived at the end of the distribution system had rates of illnesses twice as high as people living near the treatment plant or close to a booster chlorination station.

If waterborne pathogens are very common in the environment external to water distribution mains, and we experience 237,000 main breaks each year, why don't we have more WBDOs?

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According to the EPA and NAS:

- WBDOs are under-recognized and under-reported.
- The national estimate of risk from distribution system deficiencies is that as many as 800,000 to 25 million cases of acute gastrointestinal illness per year may be caused by distribution system deficiencies.

In 2002, EPA released nine white papers on distribution system issues. The white papers covered the following topics:

1. Cross connections
2. New or repaired water mains
3. Finished water storage
4. Deteriorating infrastructure
5. Intrusion
6. Nitrification
7. Biofilm
8. Affects of water age
9. Permeation and leaching

In 2010, EPA released their final "*Priorities of the Distribution System Research and Information Collection Partnership"* report.

- This report establishes 10 high priority project areas and goals.
- One of the 10 project areas involves health effects associated with low or negative pressure events in distribution systems. The goal of this project area is to obtain information on the incidence and severity of adverse health effects occurring among customers who are impacted by low or negative pressure events.

Thirty-two (32) states (including PA) have policies or regulations regarding when water supply warnings are required for loss of pressure or negative pressure situations.

Regulatory Language:

§ 109.701(a)(3)(iii)(G) One-hour reporting requirements. A public water supplier shall report the circumstances to the Department within 1 hour of discovery when circumstances exist which may adversely affect the quantity or quality of drinking water including, but not limited to, 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.

- Not all main breaks are a health concern. This new language ensures we are alerted to situations with real potential to cause adverse effects.

§ 109.702. Operation and maintenance plan. The operation and maintenance plan must generally conform to the guidelines contained in the Department's Public Water Supply Manual and contain at least the following information: … Procedures for repairing and replacing water mains that conform to the Department and water industry standards.

- This new requirement ensures that water suppliers have written SOPs in their O&M Plan.

§ 109.711. Disinfection of facilities prior to placing them into service. After repairing a facility or performing other activities which place the facility out of service, and before returning the facility to service, the public water supplier shall disinfect the facilities in accordance with the most recent procedures established by the American Water Works Association.

Public Water Supply Manual (page 190):

All new, cleaned or repaired water mains shall be disinfected in accordance with AWWA's Standard C651 for Disinfecting Water Mains. The specifications shall include detailed procedures for the adequate flushing, disinfection and microbiological testing of all water mains. At least one satisfactory bacteriological sample must be obtained from the water main and analyzed by a certified laboratory before the main is placed into service. Where the main must be returned to service as soon as possible, the "slug" method may be used.

Walk Through of Policy for Loss of Positive Pressure Situations:

Notes: _____

AWWA Standard C-651-05 – Disinfecting Water Mains:

AWWA Standard C-651-05 includes procedures for disinfecting newly constructed mains; mains that have been removed from service for planned repairs or maintenance; **mains that have undergone emergency repairs because of physical failure**; and mains that continue to show the presence of coliform bacteria.

Sec. 1.1 Scope

This standard describes essential procedures for the disinfection of new and repaired potable water mains. New water mains shall be disinfected before they are placed in service. Water mains taken out of service for inspection, repair, or other activities that might lead to contamination of water shall be disinfected before they are returned to service.

Sec. 4.2 Basic Disinfection Procedure

1. Inspecting materials to be used to ensure their integrity.
2. Preventing contaminating materials from entering the water main during storage, construction, or repair and noting potential contamination at the construction site.
3. Removing, by flushing or other means, those materials that may have entered the water main.
4. Chlorinating any residual contamination that may remain, and flushing the chlorinated water from the main.
5. Protecting the existing distribution system from backflow caused by hydrostatic pressure test and disinfection procedures.
6. Documenting that an adequate level of chlorine contacted each pipe to provide disinfection.
7. Determining the bacteriological quality by laboratory test after disinfection.
8. Final connection of the approved new water main to the active distribution sustem.

The Standard includes details about how each of these steps should be performed. These procedures can be used for all water main activity.

The Standard also includes another section that is specific to cutting into or repairing existing mains.

Sec. 4.7 Disinfection Procedures When Cutting Into or Repairing Existing Mains

The following procedures apply primarily when existing mains are wholly or partially dewatered…

1. ***Trench treatment***. …Liberal quantities of hypochlorite applied to open trench areas will lesson the danger from this pollution…
2. ***Swabbing with hypochlorite solution***. The interior of pipe and fittings … used in making the repair shall be swabbed or sprayed with a 1% hypochlorite solution before they are installed.
3. ***Flushing***. Thorough flushing is the most practical means of removing contamination introduced during repairs…
4. ***Slug chlorination***. Where practical, in addition to the procedures previously described, the section of the main in which the break is located shall be isolated, all service connections shut off, and the section flushed and chlorinated as described in Sec. 4.4.4…
5. ***Bacteriological samples***. Bacteriological samples following procedures in 5.1.3 shall be taken after repairs are completed to provide a record for determining the procedure's effectiveness… Daily sampling shall be continued until two consecutive negative samples are recorded.

- After the appropriate procedures have been completed, the existing main may be returned to service prior to the completion of bacteriological testing in order to minimize the time costomers are without water.
- Leaks or breaks that are repaired with clamping devices while the mains remain full of pressurized water may present little danger of contamination and therefore may not require disinfection.

Scenario: Loss of Positive Pressure Situation

ABC Water Authority

- CWS serving 1,500 people
- None of the on-site distribution crew members are certified operators
- The O&M Plan contains a copy of AWWA Standard C-651-05
- The line break is located in an area served by on-lot septic systems. Water lines were recently extended to serve drinking water in this area due to known overloaded septic systems.

Timeline of Events	
8:00 AM	The Water Authority receives several complaints of water outages.
8:30 AM	Distribution crew members arrive on site, observe standing water in the street and suspect a water line break.
10:00 AM	A trench is dug and crew members observe a visible rupture in the main. The trench is filled with water.
10:30 AM	The trench is dewatered and further inspection reveals water is no longer leaking from the break.
11:00 AM	Crew members begin repairs.
3:00 PM	Repairs are completed. The lines are flushed.
3:30 PM	The main is returned to service.

Questions:

1. **Should this system have notified DEP within 1 hour?**

2. **If yes, when did the time clock start?**

3. **Should this system have issued a BWA?**

4. **Were repairs completed as per Standard C-651-05 and DEP's policy?**

5. **Did this system incur any violations?**

6. If yes, what follow-up actions should this system and/or DEP take?

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Summary:

Key Points:

- Access the PN webpages to use various resources.
- The integrity of the distribution system is considered the final barrier in the multiple barrier approach to providing safe drinking water.
- Waterborne pathogens are very common in the environment external to water distribution mains.
- An estimated 237,000 water main breaks occur each year.
- From 1971 – 2006, there were 119 waterborne-disease outbreaks associated with distribution system deficiencies. These outbreaks were associated with more than 18,000 illnesses.
- WBDOs are under-recognized and under-reported.
- Water suppliers need to adhere to AWWA Standard C-651-05 and the Department's Policy to prevent pathogens from reaching consumer's taps.