TOM WOLF, GOVERNOR • PATRICK MCDONNELL, DEP SECRETARY

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The Pennsylvania Department of Environmental Protection (DEP) Bureau of Safe Drinking Water is proud to provide updates, information, explanations, and reminders to you with this edition of the Drinking Water News. In this issue:

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Your feedback and suggestions can be submitted to dagrube@pa.gov.

Consumer Confidence Report Resources

Nathan Radabaugh, Compliance Specialist, DEP Northcentral Region

Consumer Confidence Reports (CCRs) are a requirement for all Community Water Systems. CCRs must be delivered to all customers by July 1st each year. Regulations also require that a copy of the report be mailed to DEP by July 1st. By October 1st of each year, the CCR Certification Form must be sent to DEP. CCRs must be kept on file by a water system for 3 years after the date of delivery.

Although CCRs can seem like a complicated task every year, DEP provides resources to public water suppliers that are able to answer many of the questions that will arise while preparing a CCR. The link below provides access to all the DEP Safe Drinking Water forms. At that link you will find several resources related to the CCR. The first is the CCR Template and Instructions. DEP provides one version for groundwater-only systems and another for surface water/GUDI sources. This document provides step by step instructions for completing all parts of the CCR. Downloading the template in Word format allows the user to click in each section and fill in the information specific to their system.

The link also provides access to the CCR Completeness Checklist for Water Suppliers. This checklist can be used during the preparation of the CCR to help the preparer ensure all areas meet the content requirements. It serves as a valuable resource to help self-evaluate the completeness of the CCR. Your regional Safe Drinking Water staff are also an available resource when you have questions that are not answered by the provided DEP resources.

The CCR can also be used as a way for a Community Water System to post a required Tier 3 public notification. Posting a Tier 3 public notification with all required content in the violations section of the CCR meets the requirements of public notice for that violation. It is important to remember that the CCR must be distributed within the timeframe that the Tier 3 public notification is due in order to meet the timing requirements of the public notice. The system should also submit a Public Notice Certification to DEP for each public notice posted in the CCR.

- **Safe Drinking Water Forms**

Critical Record Retention for Public Water Suppliers

John Cairnes, Compliance Specialist, DEP Southeast Region

Retention of records is an often-overlooked necessity for public water suppliers. Besides the regulatory requirements for record keeping found in Pa. Code Title 25, Section 109.701(d), a public water supply generates an enormous amount of recorded data under regular operations, and much of it is critical for future operations.

Monitoring for regulated contaminants produces a large amount of critical records, and the required retention times for these records will vary by contaminant. Below is a partial list of regulated contaminants and the minimum required retention time for monitoring results, performance benchmarks, and compliance action records:

- Performance monitoring, except for turbidity, records of actions taken to correct MCL, MRDL or treatment technique violations, public notices: 3 years
- Bacteriological and turbidity samples, including turbidity samples taken for performance monitoring, records concerning variance and exemptions granted to a system, Level 1 and Level 2 assessment and records of associated corrective actions: 5 years
- Chemical contaminant samples (nitrate/nitrite, IOC, VOC, SOC), records of reports and communications related to sanitary surveys: 12 years

Monitoring records should include the date, time, location, and type of sample, as well as the name of the sample collector, the laboratory ID, analysis method and name of the analyzer along with the results. All of this information is found in bench sheets or lab reports and chain-of-custody forms, which should be retained as records.

Water suppliers should maintain a good working relationship with DEP-accredited labs, in the event that they need to replace lost lab reports or chain of custody forms. If you change labs, make sure you have a complete inventory of critical records before making the change.

All water suppliers should have copies of monitoring plans readily accessible. All community and non-transient, noncommunity water systems should have a Comprehensive Monitoring Plan available for review at all times.

Various forms of correspondence are often the most overlooked records that must be maintained to ensure efficient operation. Permit amendments, approval of monitoring waivers, Notices of Violations (NOVs), and sanitary survey results usually include accompanying correspondence from DEP. The importance of these records to water system operation is paramount. Permit correspondence often specifies changes in system operations. Monitoring waivers must be periodically renewed, or they will expire. All correspondence should be retained for at least five years. An ongoing awareness of these records, and the ability to review them on short notice can reduce missed deadlines and additional violations.

Permits and subsequent permit amendments must be retained for the life of a facility. Copies should be made available to operators. Other documents that require retention for the life of a facility include Operations and Maintenance Plans, Emergency Response Plans, Distribution System maps, and if applicable, a system's Cross-Connection Control plan. The Emergency Response plan must be updated at least annually, as stated in Pa. Code Title 25, Section 109.707(c), and DEP recommends that the service maps and other plans also be updated annually to ensure that the information contained therein does not become obsolete. Old plans may be discarded when they are updated by new ones.

It's a good idea for water suppliers to have more than one copy of most critical records, especially if the system employs a circuit rider to operate the water system. If a water supplier gives their only copy of a permit, waiver or monitoring information to a circuit rider, those records could be lost if the water supplier decides to change circuit riders and forgets to recover critical records. Copies of monitoring plans should be shared with contracted water testing labs but, as with circuit riders, do not give the lab your only copy of a plan.

DEP keeps records of all regulatory and enforcement actions it takes. DEP records can replace some lost system records, but be advised that DEP records are often voluminous and finding a specific document can be time consuming. The records staff at regional offices can help, but their resources are limited. Water suppliers may find it quicker and easier to review their own system records at a convenient time and replace any lost records before it becomes a necessity.

Drinking Water State Revolving Fund (DWSRF)

Matt Shope, Compliance Specialist, DEP Northeast Region

The 1996 Amendments to the Federal Safe Drinking Water Act (SDWA) enabled the Environmental Protection Agency (EPA) to create the Drinking Water State Revolving Fund (DWSRF). DWSRF is a financial assistance program to enable public water systems and states accomplish the objectives of the Safe Drinking Water Act to protect the public health. The funding of the assistance is appropriated through Congress and then awarded by the EPA through capitalization grants to each state based on their "Drinking Water Infrastructure Needs Survey & Assessment."

The DWSRF programs operate like infrastructure banks with requiring the states to match only 20% of the funds. The funds are loaned through a revolving system with payment on the loan principal while managing loan interest earnings. States are permitted to distribute the funds through loans based on their own ranking process but is required to prioritize projects with the most risks to human health, ensure compliance with the SDWA, and assist systems most in need according to affordability criteria.

Projects that are the primary focus of the program include infrastructure replacement of service lines regardless of pipe material and ownership, including service lines from the public water main and corrosion control optimization which includes the control planning and design with applicable capital infrastructure projects.

Additionally, non-profit organizations may encourage public interest and encourage utilization of the DWSRF program. A recent example is the Environmental Policy Innovation Center's Lead-Free Water Challenge. The Center's mission is to actively address lead-free service line replacement by helping *"small municipalities (with a population size of roughly 5,000-35,000) interested in replacing lead service lines launch programs by offering technical assistance, connections to resources and funders, and information-sharing through peer networks."* This approach combines the efforts of Federal, State, and non-profit organizations cooperating to address environmental justice and protecting the public health.

The Pennsylvania Infrastructure Investment Authority (PENVEST) serves citizens of the Commonwealth by funding sewer, stormwater and drinking water projects. PENVEST works with the Department in identifying public water systems that meet the focus goals of the DWSRF program.

Fresh Country Air

Aaron Ward, Water Program Specialist, DEP Central Office

Not too long ago I and a friend were returning from a trip to the store. Driving through the Lancaster County countryside and enjoying the openness of the country setting when the necessary work of a farmer (or perhaps a custom hauler) caused my friend to have a rather dramatic reaction to the fresh country air. Following the facial contortions you might imagine, truck windows were quickly rolled up and the trip home hastened.

The spreading of manure and biosolids is a necessary part of farming and no one can argue against that. However, for as much as the nutrients in manure and biosolids are beneficial to crops when applied appropriately there are other things that can be found in that material that can be harmful to humans if consumed. As such, while manure and biosolids have their place in a farmer's field they have no place in our surface water and ground water supply.

Thankfully, regulations are in place to provide protection of the water supply and those who use the water. These regulations include setbacks, the amount of distance between a well or surface water body and the line where farmers and custom haulers can land apply manure. These regulations include other features designed to protect the water supply including ground cover and land application rates. If you are adept at reading regulations and would like to go straight to the source you might want to review the following legislation and regulations: Act 394 of 1937; Act 38 of 2005; 25 PA Code 83.294; 25 PA Code 271.915. If you are interested but would like a more down to earth review of these regulations, information regarding nutrient management and manure spreading can be found, among other places, on the Penn State Extension website at: Act 38 Law and Regulations — Pennsylvania Nutrient Management Program — Penn State Extension (psu.edu). Without a doubt, regulations governing the land application of manure can be complicated; if you are concerned about a specific situation involving manure or biosolids land application near a surface water body or well, it may be best to read the next few paragraphs of this article.

So, what should you do if you're concerned that a farmer or custom hauler is spreading manure too close to your well? There are a couple places you could reach out to, among them are: the farmer/landowner, your county conservation district, Penn State Extension and DEP.

If you are concerned about manure spreading that is happening close to your water supply, perhaps the first thing to consider doing is to simply go and talk to the farmer. Make sure that he and his hauler (if he uses a custom hauler) is aware of the water supply and the water supply's location. Farmers are people too and a simple, neighborly conversation may be all it takes to establish where the setback line should be and to maintain protection of your water supply. If a face-to-face conversation isn't possible or doesn't work, a phone call to either your county conservation district or the Department of Environmental Protection (DEP) may be the best, next course of action. Conservation Districts are local entities and may be a good resource to reach out too. You can find contact information for your county conservation district at pacd.org. County conservation districts are local entities created by the Conservation District Law. Not every conservation district is structured the same or has the same authority and resources so you will need to speak with your specific conservation district to determine if they are able to help you.

Certainly, DEP is available to respond to manure spreading complaints. If all else fails, DEP is able to assist you if you have concerns about manure or biosolids being spread too close to a well. You can find the best contact number for DEP by going to dep.pa.gov and looking for the DEP office in your region (as defined the county where your well is located). Click on "About DEP" and from that drop-down menu click on Contact DEP. A map showing the six DEP regions should load on your screen. Click on the appropriate regional office link and then, on the right-hand side of your screen click on Phone Directory. Scroll down until you find contact information of the Waterways and Wetlands Program. Folks in the Waterways and Wetlands program of your regional DEP office will be best able to respond to your manure spreading concerns. If manure spreading is occurring in real-time and you want to speak with someone immediately, but it is after hours, you can reach out to DEP's emergency response program and someone will be able to assist you.

So, the bottom line to all of this is this: farmers have a right to farm and that includes spreading manure, however manure does not belong in the water supply. Manure setbacks can be found in certain regulations and are generally 100 feet from a well or water body. If you find a farmer or custom hauler is spreading too close to your water supply you can talk to the farmer, call your county conservation district, or call DEP.

Essentials of pH Analysis

Rick Kirby, Compliance Specialist, DEP Northeast Region

When pH is too high, chlorine disinfection is ineffective; when pH is too low, the water may be corrosive. By regularly monitoring pH levels, you can prevent major problems in your distribution system as well as assure adequate disinfection. pH analysis is a critical component of corrosion control treatment and when calculating log inactivation at a surface water treatment plant. To ensure the accuracy of pH analysis when conducted for compliance purposes, pH measurements should be conducted by an appropriately certified operator using equipment that utilizes an approved drinking water method. EPA Method 150.3 is an approved drinking water method and defines the necessary steps to calibrate and verify pH meters and to analyze water samples. (Those operators that monitor pH for compliance purposes should download the full document from nepis.epa.gov and add it to their laboratory Standard Operating Procedures).

Suitable equipment and tools matter. pH analyzers may be handheld, bench-top, or continuous. Whatever equipment you have must be capable of use of user calibration or have documentation of initial calibration from the manufacturer. Temperature compensation is also necessary and may be automatic or manually input at the time of analysis. Results must be reported to the nearest 0.1 pH unit. When selecting an analyzer, the Department strongly recommends that any compliance monitoring meter is capable of user calibration since it is unlikely that one initially calibrated by the manufacturer will meet method requirements for any significant length of time.

Accurate data is essential for proper monitoring of systems. For truly continuous monitoring of pH, the meter must also continuously record the readout, be equipped with an alarm, and be capable of calibration by the operator when conducting calibrations or verifications. Due to potential variations, the sample port for verification by a handheld or bench-top meter should be as near as possible to the continuous meter probe location. Probes for continuous monitoring may be flow-through, pipe mounted, or immersion. Probes should be installed for constant contact with the sample stream even when the plant is not in operation to prevent their malfunction as well as assure accuracy.

Procedures for monitoring pH levels is a matter of quality assurance. To calibrate, manufactures' reference buffers are available in both liquid and powder forms. Follow the manufacturers recommendations for calibrating your specific instrument. Adhere to the buffer expiration dates and change buffers that have been used no less than weekly to prevent contamination. Samples should be collected in clean glass or plastic containers. Samples need immediate analysis because changes in temperature or CO2 in the sample will change the pH. During analysis, the sample should be gently swirled either manually or with a mechanical stirring device. As with all laboratory analysis, all pertinent information including analyst name or initials, time of sample collection and analysis, temperature, and pH result should immediately be recorded in the daily log.

Calibrations for bench-top, portable, and continuous monitoring pH meters using removable probes must be completed at least weekly or at the time of measurement for systems that monitor less frequently. Calibrate each meter according to the manufacturer's instructions at a minimum of two pH levels that bracket the expected pH of the samples and are approximately 3.0 or more pH units apart. After calibration, analyze another reference pH buffer (e.g., pH 7 buffer) for calibration verification. The result must be within +/- 0.1 pH units of the true value. If the meter cannot be calibrated to read within +/- 0.1 pH unit it must be repaired or replaced. Following calibration of a new or repaired meter, each meter and each analyst must pass an Initial Demonstration of Capability (IDC) by analyzing four reference pH buffers. The standard deviation and the mean of the analysis results must be within +/- 0.1 pH units to pass the IDC.

Calibrations for continuous monitoring pH meters utilizing non-removable probes are conducted by comparison grab samples with a bench-top or portable pH meter after that meter has passed its calibration and IDC. The results must be within +/- 0.2 pH units of the meter used for grab sample analysis to pass the calibration and IDC.

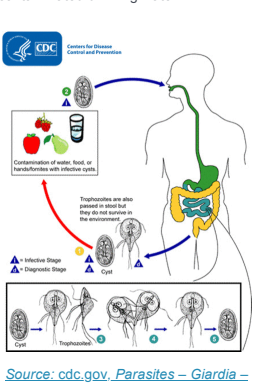
With each bench-top, portable, and continuous monitoring pH meter with a removable probe, daily verification is required with a single reference pH buffer or at the time of measurement for systems that monitor less frequently. The calibration verification sample must be within +/- 0.1 pH units of the true pH value. A continuous monitoring pH meter with a non-removable probe must also be verified daily or at the time of measurement for systems that monitor less frequently with a comparison grab sample analyzed by a bench-top or portable pH meter. The comparison sample must be within +/- 0.2 pH units. Any meter that does not pass the calibration verification must be recalibrated, repaired, or replaced to bring the readings within the required parameters.

By following the guidelines of EPA Method 150.3, you will maintain pH monitoring compliance as well as prevent possible future problems. If you have any questions or concerns, contact your sanitarian for further guidance.

Request Of Designation of Treatment Segments for Calculation of 1-LOG Giardia Inactivation

Gail Guenther, Compliance Specialist, DEP Southwest Region

Giardia lamblia (Giardia) is a parasitic microorganism that, once introduced, lives in the small intestine of a variety of animals, including humans, and causes giardiasis. Symptoms of giardiasis often include cramping, diarrhea, nausea, vomiting and bloating. One of the most common methods of contracting giardiasis is by the consumption of contaminated drinking water.



Source: cdc.gov, Parasites – Giardia – Pathogen and Environment

Federal and Pennsylvania regulations require public water suppliers to treat surface water or surface water-influenced sources for Giardia for the protection of public health. According to the U.S. Environmental Protection Agency, Giardia cysts are likely to be present in all surface waters. *Source: U.S. EPA, "Giardia: Drinking Water Fact Sheet," September 2000.* The cysts protect the microorganism with an outer shell that resists chlorine treatment and is difficult to inactivate via disinfection. As a result, adequate filtration, in addition to disinfection, is essential to ensure that Giardia is effectively removed from, or inactivated in, susceptible drinking water sources.

Under the treatment technique requirements of Section 109.202(c)(1) of DEP's Safe Drinking Water regulations, 25 Pa. Code § 109.202(c)(1), public water systems must provide treatment of surface water and GUDI (groundwater under the direct influence of surface water) sources that achieves at least 99.9% (3-Log) removal and inactivation of Giardia cysts. While much of this process involves the physical removal of Giardia, the combined total effect of disinfection processes utilized in a filtration plant must achieve at least 90% (1.0-Log) inactivation of Giardia cysts.

To assure that public water systems are successfully implementing the treatment technique requirements, 25 Pa. Code § 109.301(1)(v) requires public water suppliers to calculate the log inactivation of Giardia at least once per day during expected peak hourly flow, as well as whenever the residual disinfectant concentration at the entry point falls below the minimum value specified in 25 Pa. Code § 109.202(c). This is particularly important to ensure that inactivation is continuing to occur in the event a system's residual disinfectant concentration drops below the regulatory minimum. In that event, systems must continue to calculate the log inactivation every four hours until the residual disinfectant concentration at the entry point is at or above the specified minimum value.

Over time, DEP discovered that some public water suppliers were having trouble correctly calculating the log inactivation occurring within their systems. In some instances, incorrect baffling factors were used, monitoring for chlorine, pH or temperature was conducted at the wrong location, or suppliers were basing inactivation on segments that were after service connections.

To assist public water suppliers in calculating their log inactivation and assure that the calculations are performed correctly, DEP created a form for suppliers to use to demonstrate and request designation of appropriate treatment segments to effectively provide 1.0-Log inactivation of Giardia from surface water and GUDI sources. Form number 3940-FM-BSDW0569, titled "Request of Designation of Treatment Segments for Calculation of 1-Log Giardia Inactivation," guides public water suppliers through a detailed identification and description of their disinfection treatment segments and processes, including contact time calculations, baffling factors and monitoring locations. Detailed instructions and appendices with useful information, examples and links are included with the form.

Following review, DEP will use the information to create appropriate special conditions to the system's operation permit. The Department encourages all surface water and GUDI water system suppliers to complete and submit these forms to their regional offices. Public water suppliers also should feel free to reach out to their regional technical staff with any questions they may have.

Completing a Service Line Inventory: Are Your Records in Order?

Sabrina Haydt, Water Program Specialist, DEP Central Office

As a public water system (PWS) regulated under Title 25 Pa. Code Chapter 109, it is your responsibility to know what material the pipes in your distribution system are made of. This includes water mains, service lines (both PWS & customer owned), valves, and connectors; in other words, any infrastructure that touches the drinking water in your distribution system. These requirements are laid out in both the System Map section of Chapter 109 (§109.706) and the Lead and Copper Rule (LCR) found in Subchapter K. Section 109.706 specifies that your PWS shall maintain a detailed map of the water system, with one of the required elements being that it includes the "size, location and construction material of pipes". In addition, §109.1103(g) of the LCR requires your PWS to conduct a materials evaluation of the water system, with the intent of identifying enough sample sites to conduct lead and copper tap monitoring. The inventory that you develop should then be updated when changes to the distribution system occur, such as adding new service connections, replacing service lines, or acquiring new customers from another existing water system. This ensures that your LCR sample sites are always being collected from the appropriate locations to meet the Tiering requirements specified in §109.1103(g).

So how does a PWS go about undertaking a monumental task such as identifying the location and material of all the pipes in your distribution system? The best place to begin is with your records; a records review should be the first step in completing an inventory. Unfortunately, the "filing system" at many water systems includes stacks of papers on the floor in an unused office or closet; a disorderly sampling of papers shoved into a filing cabinet; or old boxes rotting away in a treatment building. If any of this generally describes your water system, now is the time to start looking through and organizing some of those old files. To conduct a thorough inventory of your distribution system, you should be looking at tap cards from initial service installations, service/repair tickets, plumbing permits/amendments, plumbing codes/ordinances and distribution maps/drawings.

Once you've determined that you have these records here are some tips on the next steps:

- Fix errors in the records.
- Identify holes in the records and fill in missing pieces by conducting a records review at the town/city code enforcement or community development department. *Warning: Be careful when using building construction data in cities, because often the existing service line is used when a structure is rebuilt after an old one is torn down.*
- Scan paper records and add them to a database to make them more easily accessible.
- Ensure that your PWS has staff available for reviewing records, if not, can you hire part time (or full time depending on PWS size) staff to focus on organizing and fixing your records?
- Ensure that your PWS staff know how to properly read records to obtain the necessary information.
- Are you completing any water meter or water main upgrades? Ensure that you're documenting pipe size and material during these upgrades, including checking the pipe material entering the customer's home, and properly filing them with your other records.
- Does your system already use a platform such as GIS? If so, you can use that to document your inventory results AND can be used to develop your system map.

In closing, a records review is a good first step in developing a system map and completing an inventory of your distribution system. It will likely not be the only method you will use to identify pipe material, but a thorough records review is essential to determine what other methods you may need to use and where to focus your energy. This can save your PWS a lot of time and money in the long run, and who doesn't like more time and money?

The Importance of Properly Sampling for Bacteria

Andrew Kaufman, Compliance Specialist, DEP Southwest Region

Ever since humans have existed, they have needed or used water in one form or another, and to date, the most common usage of water has been for consumption. But for as long as humans have been consuming water there have existed other creatures which also utilize water, and they range from the macro organisms we commonly see every day in the form of animals, to the microscopic organisms we sometimes forget even exist.

While we tend to forget about these microscopic organisms, we need to remember that they still have the ability to harm us. Drinking water containing one of these organisms, for instance *E. coli*, can result in mild symptoms such as gastrointestinal distress or more severe flu-like symptoms such as fever, nausea, headaches and fatigue and in extreme cases death. Without having the water you are consuming adequately tested for these pathogens, a person may be unaware that their drinking water was the source of these problems.

To combat the outbreak of waterborne illnesses due to harmful microbes the EPA enacted the Total Coliform Rule (TCR) in 1990 and later the Revised Total Coliform Rule (RTCR) in 2013. The RTCR which is currently in place seeks to require that all Public Water Systems (PWS) have their distribution water tested for Total Coliform bacteria on at least a monthly basis in order to help ensure the safety of all of those who could consume the system's water.

As much as the RTCR has helped to ensure the safety of our Public Water System's drinking water it can be rendered less effective if proper sampling locations are not selected or proper sampling procedures are not followed.

A very important part of collecting samples at the appropriate locations comes following the system's monitoring plan also known as Total Coliform Sample Siting Plan. The forms for these plans can be found on PADEP's eLibrary. Monitoring plans for PWS are system specific and based upon system type (Community vs. Noncommunity) and population being served. These variables change the frequency of testing, number of samples required, and sample site locations for each individual PWS so that no two plans are the same and each one is custom designed to best suit that system.

Since each monitoring plan is created to be based specifically off that system's current circumstances it is imperative that these plans are reviewed periodically and updated to reflect the ever-changing state of their corresponding system. The recommended period to review your system's monitoring plan is at least once annually, although it generally is a very good practice to make appropriate updates to any plans as changes are made to and occur within your system. Some examples of these changes are as a PWS grows in customer base and correspondingly expands in both distribution size and/or population. This can also happen if a system decreases its customer base and correspondingly reduces their population or removes distribution components. In these cases, not only does the number and frequency of required samples change in relation to this expansion or contraction

While how your Total Coliform Sample Site Plan is set up is mostly based off of established rules and guidelines as far as sample frequency and number of samples, what is possibly the most important factor, that of sampling locations, is usually determined by those who know that PWS best, the operators. Since these operators run and maintain these systems day in and day out, they are best suited to determine the optimal locations for sampling to represent the health of their system most accurately. If these same operators happen to neglect or too infrequently update their system's monitoring plans, there can be a rather negative impact on a system's health and therefore the health of those it is serving. In short, if the bacteria monitoring plan does not transition as the system does it can no longer accurately represent the overall health of the PWS.

Additionally, the procedures used to take bacteriological samples are also essential. A water sample taken at a dirty sample tap point or improper handling of the sample container could lead to a positive bacteria result that is not indicative of the water serving that tap. Any positive result that occurs requires at least three separate check samples be collected and analyzed; if those check samples were improperly collected it could lead to more positives which could require costly remedies to fix the "positive presence of bacteria" in their system through public notices, investigations, and professional consultations. Any improperly collected samples therefore do not realistically depict the current state of that water as pathogens could be present.

Guides and instructions for coliform sampling should be provided by the system's lab, but can also be easily found online, such as the "Quick Guide To Drinking Water Sample Collection" published by the EPA.

While it will always remain important for every PWS to review internally and keep up to date revisions of their monitoring plans, it is equally as important for these systems to be regularly sharing each new revision with their DEP representative. However, keep in mind that in order for sample results to be properly accounted for, any monitoring plan revisions will need to be submitted to the Department within 30 days so that the correct changes can be attributed to your system. After all, not only does this regular communication allow the Department to keep up to date on sampling frequency, amount, and locations for each individual system, but it also creates the opportunity for open conversation and feedback between both entities.

All's Well that Ends Well: Well Abandonment

Gina Kellett, Compliance Specialist, DEP Northeast Region

When a groundwater well has reached the end of its productive life, it becomes time to abandon the well. One would think that abandoning a well would consist of capping the well and walking away. However, the proper abandonment of a groundwater well requires a few steps.

The Water Well Drillers License Act (Act 610) includes information for the abandonment of wells and makes the owner of the well responsible for properly sealing an abandoned well according to the rules and regulations of the Department of Conservation and Natural Resources (DCNR).

Well abandonment procedures depend on the reason for the abandonment and the condition of the well, but regardless, proper well abandonment looks to accomplish the following:

1. Eliminates a pathway for contamination and migration of contamination
2. Eliminates the hazard of the physical hole in the ground of the well
3. Prevents changes in the aquifer system

The first step in properly abandoning a well is well characterization. It is important to know the way the well was constructed and the geology/hydrogeology of the area.

The second step is to prepare the well by removing any obstructions. This means pulling any pumps, pipes, wiring, and air lines from the well. It may also be necessary to remove the well casing if it will not jeopardize the integrity of the well. If the well is already in poor condition, it may be necessary to redrill the well.

The third step is to obtain the correct materials and conduct the proper method of filling the well. Materials that can be used are aggregate, sealants, and bridge seals. Aggregates are materials that eliminate the open space of the well but allow the flow of water, materials such as gravel and sand. Sealants are materials that prevent the flow of water and provide a watertight barrier to water migration in the well. These materials are usually Portland cement-based grouts, bentonite clay, or a combination of the two. Bridge seals are used to isolate portions of the well or provide structural integrity to support other well abandonment materials. These seals are commonly made by installing a plug made of neoprene, wood, or a pneumatic or mechanical packer.

Again, determining the proper method of abandoning a well depends on geology, hydrogeology, well construction, and water quality. Therefore, it is important to conduct research on the well and the surrounding area prior to beginning the abandonment procedure. Additionally, it may be beneficial to consult with professional geologists and hydrogeologists to assist in the research.

The owner/consultant that is abandoning the well is required to notify both the DEP and DCNR Department of their intent at least ten (10) days prior to filling/sealing the well. After the well is abandoned, the owner/consultant needs to report the abandoned well to DCNR's Bureau of Topographic and Geologic Survey. To obtain the form to report the well, you can visit DCNR's eLibrary.

The completed form should be submitted to:
Water-Well Drillers Licensing Service
Pennsylvania Geological Survey
3240 Schoolhouse Road
Middletown, PA 17057-3534

More information regarding the abandonment of wells can be found on DCNR's eLibrary.

Disinfection Byproducts: A Few Case Studies

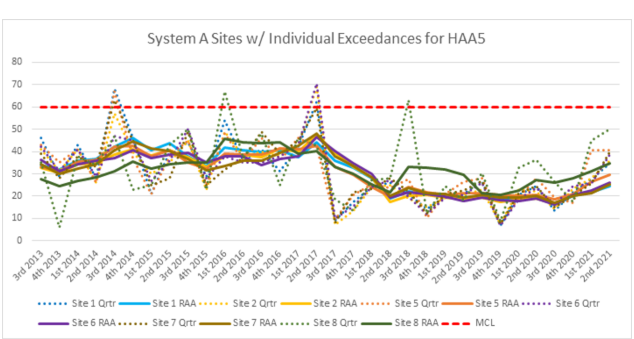
Drew Hoffman, Compliance Specialist, DEP Southcentral Region

Water systems that struggle with Disinfection Byproducts (DBP) typically do so because they have organic material in their source water that isn't sufficiently removed prior to the addition of an oxidizing disinfectant chemical, such as chlorine, because there is an excessive amount of time for the disinfectant to react with organics in the water, or a combination of both. Water temperature also plays an important factor, with warm water months being prime time for DBP forming chemical reactions. There are two main groups of regulated DBPs: Total Trihalomethanes (TTHM), comprised of chloroform, bromoform, bromodichloromethane and chlorodibromethane, with a Maximum Contaminant level (MCL) of 80 µg/L (80 ppb) and Haloacetic Acids (HAA5), comprised of monochloroacetic, dichloroacetic, trichloroacetic, monobromoacetic and dibromoacetic, with a MCL of 60 µg/L (60ppb).

When constructing a new system or modifying an existing system, it is important to consider the following factors. Both DBP groups form from disinfectant chemicals reacting with organics in the water over time. The more organics present in the water, the more disinfectant present in the water, and the more time the water has spent in piping or storage tanks after being treated, the more likely the DBPs are to form. HAA5 can degrade given enough time while TTHM will generally continue to increase in concentrations peaking at the "Maximum Residence" points of the system. Compliance with Stage 2 of the Disinfection Byproduct Rule is based upon the Locational Running Annual Average (LRAA), an average of the most recent four quarters for each individual sampling location.

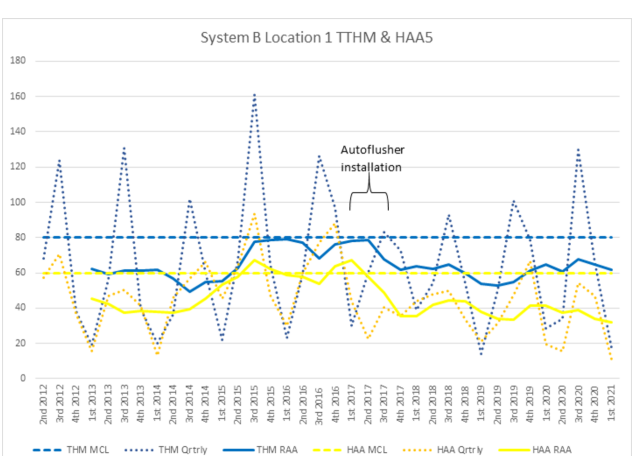
An additional point regarding DBPs is that if the MCL is exceeded at any location for TTHM or HAA5, the water system would need to calculate the Operational Evaluation Level (OEL). OEL is calculated (Q1+Q2+Q3+Q3)/4; therefore if a system's 1st quarter result is 28.6ppb, the quarter is 33.8ppb, and the 3rdquarter result is 130ppb, the system would calculate the OEL as (28.6+33.8+130+130)/4=80.6, which is an exceedance of the TTHM MCL of 80ppb for the OEL calculation. The system would in this case be required to contact DEP in writing and create an OEL exceedance report. The OEL's primary function is giving the system prior warning that they are at risk of exceeding the MCL and needed to take additional steps in order to stay below the MCL in the LRAA.

Because surface water sources tend to have higher quantities of organics, when designing a new surface water treatment plant, it is imperative that your system takes removal of organic material, usually measured as Total Organic Carbon (TOC) into account. Likewise, when laying out new distribution or adding storage for a water system, the effect on water age also needs to be taken into consideration. For existing systems however, the operator may need to adjust the system's operation or make modifications to the system in order to meet current standards for DBP. The following are case studies of systems which have implemented different measures to reduce their DBPs. Of note, a number of the systems in these case studies show resurgences during 2020 at some or all of their sites, which are suspected to be the result of changes in water usage due to COVID-19.



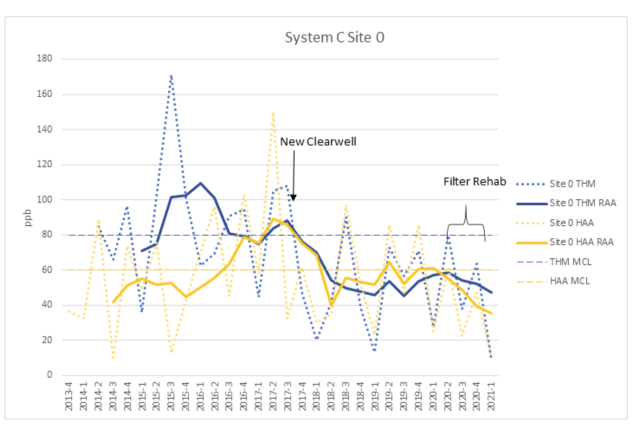
Above we can see the distinct seasonal variation for System A, with levels of DBPs spiking during warm weather months, in this case HAA5. While the LRAAs never put this system out of compliance, the system did have a number of exceedances at individual sites, a fact which doesn't look good on their Consumer Confidence Report (CCR). Keeping LRAAs below the MCL, despite seasonal spikes in HAA5 levels, was accomplished through careful monitoring and operation of their treatment plant and distribution system coupled with appropriate flushing of parts of distribution, closer monitoring of the dosage at chlorine booster stations, and cycling of storage tanks to decrease unnecessary excess water storage which was leading to high water age. System A was able to get better control of their HAA5 levels in recent years. For this system a more careful monitoring of their dosages of chlorine and ammonia were done in order to form monochloramine and less of the other, undesirable, chloramine types. Also having a visible effect on the graph, the system did a rehabilitation of their sedimentation basins during the course of 2017, which would appear to have improved their organics removal.

Below is a chart of one distribution sample location at System B, a system in which water temperature is clearly a major controlling factor for DBP formation.



With system B, we see the sample results of a location within the system where the individual sample exceeds the MCL on an almost routine basis. You will note however that this system has not exceeded the LRAA since 2016 and is therefore not out of compliance. To accomplish this, the system has installed auto-flushers that operate monthly in areas of known high water age. They have also reduced the time it takes for tanks to turnover from 12-16 days down to 2-3 days. This was accomplished merely by changing the operation of pumps and allowed the system to avoid installing more costly mixing systems within the tanks.

Even though this system has an apparent relapse of the issue in 3rd quarter 2020, we can see the 4th quarter and following year 1st quarter results were lower and kept the LRAA below the MCL. The DBP measurements during 1st quarter 2021 at this location were some of the lowest the system has had yet, suggesting that the general trend is in the right direction, and the steps the system has taken to reduce DBPs are working.



While organics removal at the plant, water age in distribution, and temperature of water throughout different stages of the system from source to tap all are major controlling factors, in system C, we see the effect of disinfectant dosage upon DBP formation.

In the 3rd quarter of 2017, this system constructed a new clearwell. Their old clearwell was small and forced them to dose chlorine disinfectant at a higher concentration in order to get sufficient kill or pathogen deactivation prior to their first customer. With the new larger clear well, the greater retention time gave the system the ability to dose chlorine at a lower concentration, and despite the increased amount of water age from retention in the clearwell, the ability to use a lower overall chlorine dosage to achieve the same level of disinfection was beneficial for significantly reducing DBPs. Visibly the system still had some struggles with HAA5 formation following the new clearwell. Further work at the treatment plant, namely rehabilitating filters in 2020 is hoped to further reduce the DBP formation via better TOC removal. The general trends would suggest that this is working for them.

A problem like DBPs is one that has multiple contributing factors: organic levels, disinfectant dosages, and water temperature. It should therefore not be surprising that multiple solutions are sometimes necessary to reduce DBP formation. Reducing water age via good management of turnover and mixing in distribution storage tanks or increased flushing of distribution pipes can help. Other factors such as improving organics removal or more careful disinfectant dosage should also be considered in the design and operation of a water system. When evaluating for DBPs consider improvements both the design & operation of both source treatment plant & distribution system as potential solutions.