Drinking Water Quality: Public Water Systems and Private Wells

Background

Public Water Systems

A major use of New Jersey's water resources is for drinking water supply. About 1.2 billion gallons of potable water are used in New Jersey each day, with 88 percent of the state's population receiving its drinking water from public water systems, while the remainder is supplied by private wells. About half the State's population receives its drinking water from surface water, the rest from ground water. To protect public health, the USEPA has set standards for approximately 90 primary contaminants. NJDEP incorporates all the federal standards in its rules, but it also has the authority to implement standards which are more stringent than the federal level, for which it has done so for more than 20 additional contaminants. Public water suppliers must monitor for these contaminants based on the type of water system and the source of the drinking water.

A public water system is defined as a water system that pipes water for human consumption that has at least 15 service connections or regularly serves at least 25 individuals 60 days or more per year. EPA classifies public water systems according to the number of people they serve, the source of their water, and whether they serve the same customers year-round or on an occasional basis. Public water systems are classified in to one of three types. A Community Water System (CWS) supplies water to the same population year-round. The CWS is a public water system which serves at least 15 service connections or 25 year-round residents (e.g., Municipal Water Utility). A non-transient non community (NTNC) water system regularly serves water to at least 25 of the same people at least 6 months out of the year (e.g., schools, businesses, and hospitals). A transient non-community (TNC) water system is one that serves at least 25 people a day 60 days out of the year and does not meet the criteria for the other two types of systems. Public water systems may use treated ground water and/or surface water as a water source.

Historically, New Jersey's regulation of drinking water focused on total coliform bacteria and a limited number of inorganic, organic and radiological parameters. In 1983, the New Jersey Legislature gave the NJDEP authority to require water systems to monitor for a list of 22 hazardous contaminants which were mainly volatile organic contaminants (VOCs), including solvents, degreasers, and components of gasoline. The Legislature also established the New Jersey Drinking Water Quality Institute to develop standards, or maximum contaminant levels (MCLs), for these contaminants in drinking water and to make recommendations to the Department

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regarding the drinking water program. Today there are MCLs for 26 VOCs in New Jersey.

DEP later expanded its focus to include naturally occurring radiological contaminants in Community Water Systems. In 1996, New Jersey began analyzing radiological samples within 48 hours of collection and discovered a naturally occurring, short-lived radioisotope called radium-224. Radium-224 is most often found in the Kirkwood-Cohansey aquifer system of southern New Jersey. In 2004, New Jersey required Community Water Systems to analyze for gross alpha particle activity using this 48-hour rapid gross alpha test. More recently, in 2018 New Jersey required that NTNC water systems analyze for radionuclides.

The USEPA continues to consider revision and expansion of the federal drinking water regulations while the NJDEP has amended the State rules governing drinking water at a higher frequency as part of its commitment to use the best available science to protect human health and the environment and improve drinking water quality. For example, the 2000 Federal Radionuclide Rule required community water systems to monitor for a variety of new radionuclides beginning in 2005 and 2006.

In 2018 the NJDEP expanded this requirement to include non-transient non-community systems, such as schools and office parks. Revisions in 2002 to the federal Surface Water Treatment Rules ensure increased protection against microbial contamination (viruses, *Giardia* and *Cryptosporidium*) that may be present in surface water systems. In January 2006, New Jersey's arsenic drinking water standard of 5 micrograms per liter (or parts per billion, ppb) went into effect, which is among the most stringent MCLs for arsenic in the nation. In 2009, the USEPA-adopted Ground Water Rule went into effect to provide an increased protection against microbial pathogens in public water systems with ground water sources. In 2012, risk-targeted monitoring for the federal Stage 2 Disinfection/ Disinfectant Byproduct Rule began at New Jersey's largest water systems; compliance determinations with the current disinfection byproduct MCLs will protect public health by supplementing existing drinking water regulations. In 2016, New Jersey implemented the federal Revised Total Coliform Rule, which represented a shift to treat total coliform as an indicator of a potential pathway of contamination in the distribution system and emphasizes a proactive approach to identifying and fixing problems to improve public health protection.

In recent years, NJDEP has established MCLs for three per- and polyfluoroalkyl substances (PFAS) and 1,2,3-trichloropropane (1,2,3-TCP). In 2018 an MCL of 13 ng/ L for perfluorononanoic acid (PFNA) and an MCL for 1,2,3-TCP of 30 ng/L was established, and monitoring requirements began for these compounds soon after. In 2020, MCLs for perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) of 14 and 13 ng/L, respectively, were formally adopted. All public water systems included monitoring for PFOA and PFOS within the first quarter of 2021. Testing for 1,2,3-TCP in private wells under the Private Well Testing Act began in April of 2019 and began for PFOA, PFOS, and PFNA in December of 2021.

When an average of results from community water systems are found to be greater than the drinking water standards, these systems are required to take the necessary steps to safeguard the public and to either remove the contaminants from the water systems through treatment or use an alternate source of drinking water. Systems are also required to provide the public with notification of an exceedance or violation. Depending on the nature of the exceedance or violation and the potential threat to public health, public notice may be required almost immediately upon confirmation of the result or within 12 months. Annual public notification is also required as per the 1999 Consumer Confidence Report Rule. Under this rule, water quality results and educational materials are provided to the consumer by July 1st every year. Many community water systems post these reports on their internet websites. New Jersey has had an 85-95% compliance rate with this rule since 1999.

Status and Trends

Drinking water is a direct route of potential human exposure to microbiological and chemical contaminants. To protect public health, the USEPA has set standards for approximately 90 contaminants and the NJDEP has incorporated all those standards, as well as for more than 20 additional contaminants. These primary standards are known as maximum contaminant levels (MCLs). Public water systems must monitor for these regulated contaminants based on the type of water system and the source of the drinking water. Since 1996, which is when radiological contaminants were added to NJ's monitoring requirements, 92 percent or more of the community water systems in New Jersey have met the microbiological, chemical, and radiological MCL each year. As previously stated, a community water system is a type of public water system that supplies water to the same population year-round.

As can be seen in Figure 1, *Percent of Community Water Systems Meeting All Primary Standards,* microbiological rule compliance decreased in 2010 and 2011. This decrease was most likely due to the implementation of the federal Ground Water Rule, which became effective in December 2009 for water systems using groundwater. The Ground Water Rule requires water systems to sample for *E. coli* bacteria in wells anytime coliform bacteria are detected in routine monitoring. Microbiological compliance was also affected by the unprecedented flooding of water systems by Hurricane Irene and Tropical Storm Lee in August and September 2011. Compliance with the microbiological standards has improved in recent years. Violations of this rule require swift action by water systems to address the problem as well as public notification.

Compliance with all chemical and radiological standards improved between 1996 and 2004 from 92 to 99 percent in community water systems. Since 2005, compliance has varied between 93 and 97 percent (see Figure 1, *Percent of Community Water Systems Meeting All Standards*). As new rules are implemented, compliance generally decreases slightly until the affected water systems are able to address their contamination and return to compliance. One of the last major rules that went into effect was the Arsenic Rule in 2006. Changes to monitoring requirements for disinfection byproducts were made due to the implementation of the 2012 Stage 2 Disinfection/Disinfectant Byproduct Rule and compliance with this rule played a role in the rate of compliance.

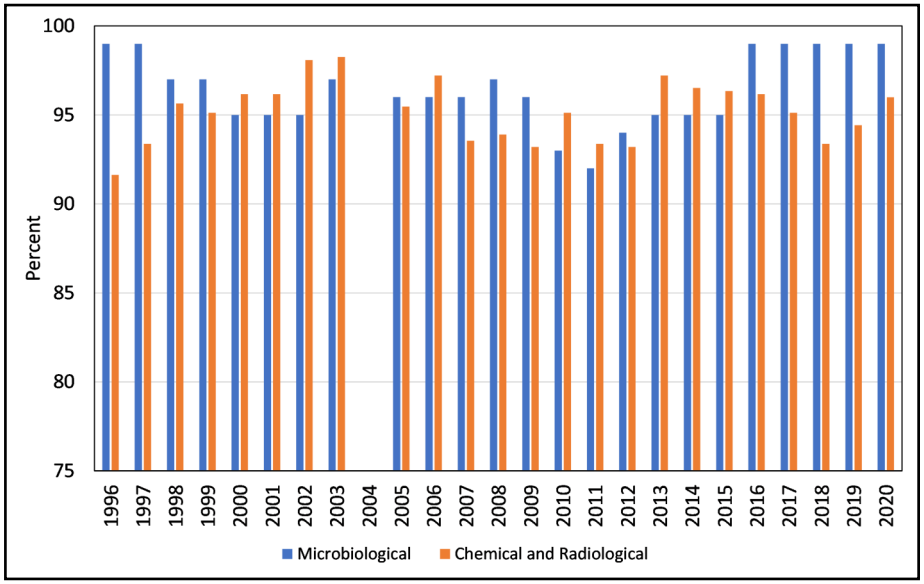

Figure 1. Percent of Community Water Systems Meeting All Primary Standards
2004 data contains potential discrepancies and so is not presented here

Lead in drinking water is commonly recognized as posing significant health risks, however it is regulated under a different framework than other contaminants. EPA established a Maximum Contaminant Level Goal (MCLG) of 0 ppb for lead as it is understood that there is no 'safe' level of lead. However, this is not an enforceable limit. Instead, community, and NTNC water systems are required to take samples at taps throughout their distribution systems which are regularly used by their customers on a frequency designated by NJDEP. These sample sites must be prioritized by locations which are most likely to have higher amounts of lead (e.g., single family residences with lead service lines). If in a particular monitoring period, the 90th percentile of lead samples collected is greater than 15 ppb, then the water system would incur what is called an "Action Level Exceedance" (ALE). While this is not strictly a violation, it does provide an indicator that the water provided by the public water system may be corrosive, and thus, triggers a number of follow-up steps. These steps may include an increased frequency of monitoring, public notification, replacement of lead service lines, or evaluating and implementing corrosion control treatment. An ALE is considered resolved when the 90th percentile for lead is below 15 ppb for two consecutive monitoring periods. Copper in drinking water is also regulated using an ALE as a marker for treatment issues, however some of the steps that must be taken by water systems do vary from those needed for lead.

In 2015, the NJDEP conducted a self-evaluation of its implementation of the federal Lead and Copper Rule. Since that time the Department has made several improvements to its implementation and has expanded its evaluation based on the experience within New Jersey and across other states and cities as lead in drinking water became a nationwide issue. After the Department required water systems to re-evaluate and update sampling plans to ensure that sampling locations reflected the areas of highest risk, the occurrence of lead and copper detections increased (Figure 2).

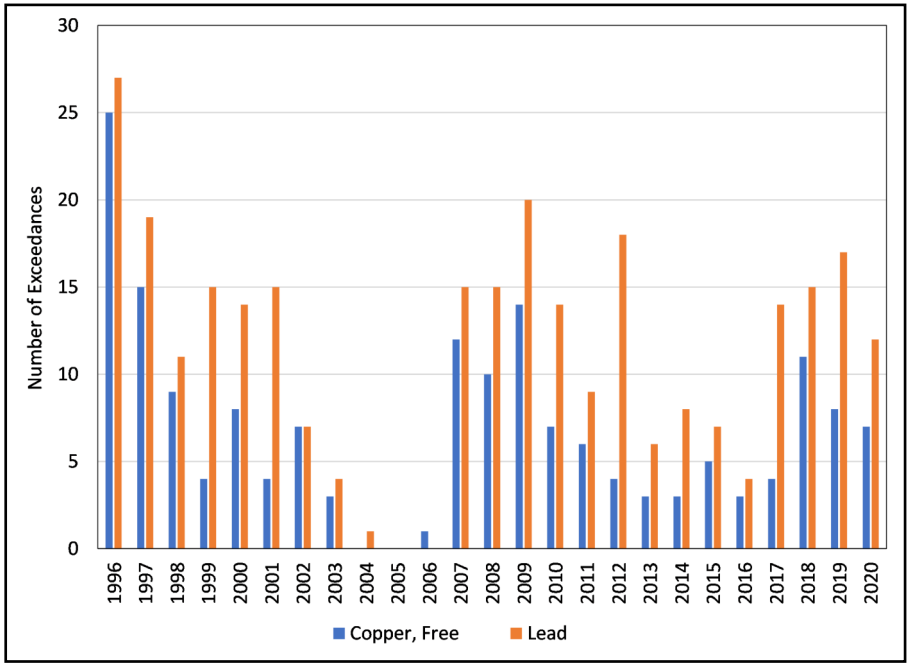

Figure 2. Action Level Exceedances at Public Water Systems in New Jersey
2004-2006 data contains potential discrepancies and so is not presented here

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In addition, New Jersey has recognized the importance of water quality parameter monitoring that includes pH, temperature, alkalinity, conductivity, and orthophosphate, for systems using corrosion control treatment for lead and copper, by implementing more stringent requirements where the federal rule allows. This includes requiring systems to submit and maintain water quality parameter sampling plans, and new routine compliance reviews of water quality parameters. As a result of this routine review an increase in lead and copper treatment technique violations has been observed.

Background

Private Wells

Approximately 12% of the residents of New Jersey are provided their drinking water from a privately owned well. In 2002, in response to several instances of private well contamination, the New Jersey Legislature passed the New Jersey Private Well Testing Act (PWTA) in 2002. The PWTA is a right-to-know law that requires a seller or landlord of a property with a private drinking water well to test the private well water and disclose the results at that time of sale, or for landlords, every five years. The test results must be disclosed to tenants or potential buyers and submitted to the Department database, which local health officials can access but the results are otherwise confidential. As per the law, the Department maintains a summary of the data, in map form, at http://arcg.is/1CPkHyC. The sample tested is the "raw" or untreated water, so that the buyer or tenant is aware of the quality of the well water without treatment. Where treatment exists, the water quality of the water flowing from the tap is likely to differ from the raw water because it has been treated. Sample analysis must be performed by a lab that has been certified by the Department to analyze the Private Well Testing Act suite of parameters.

Under the PWTA, the water is tested for a subset of both the primary and secondary contaminants (https://www.state.nj.us/dep/watersupply/pwta/pwta_list.htm). Primary drinking water standards are known as maximum contaminant levels or MCLs. The PWTA requires that raw well water be tested for total coliform bacteria (and if positive, then e-coli or fecal coliform), nitrate, lead, 26 VOCs, 3 Synthetic Organic Compounds (SOCs) and as of December 1, 2021, three per- and polyfluoroalkyl substances or PFAS: PFOA, PFOS, and PFNA. Testing for mercury is required in nine southern counties, and uranium, which was added in September 2018, is required in 12 northern counties. In addition, testing for arsenic and gross alpha particle activity was also expanded to include all 21 counties in September 2018. Gross alpha activity is an indicator of radium or uranium, which results from local geology. Based on the geology in southern NJ, an elevated gross alpha result indicates the presences of radium. In the northern portion of the state, it can be indicative of either radium and/or uranium, thus testing for uranium is also required as part of the required suite of parameters in northern NJ. All well water samples are also analyzed for three secondary parameters: pH, manganese, and iron. Secondary standards are based on aesthetic considerations. The three SOCs mentioned above are 1,2,3-TCP, ethylene dibromide (EDB) and 1,2-dibromo-3-chloropropane (DBCP), and they became required analytes beginning in March 2019.

Status and Trends

In the period from September 2002 through December 2018, a total of 111,011 individual wells have been tested under the New Jersey Private Well Testing Act,

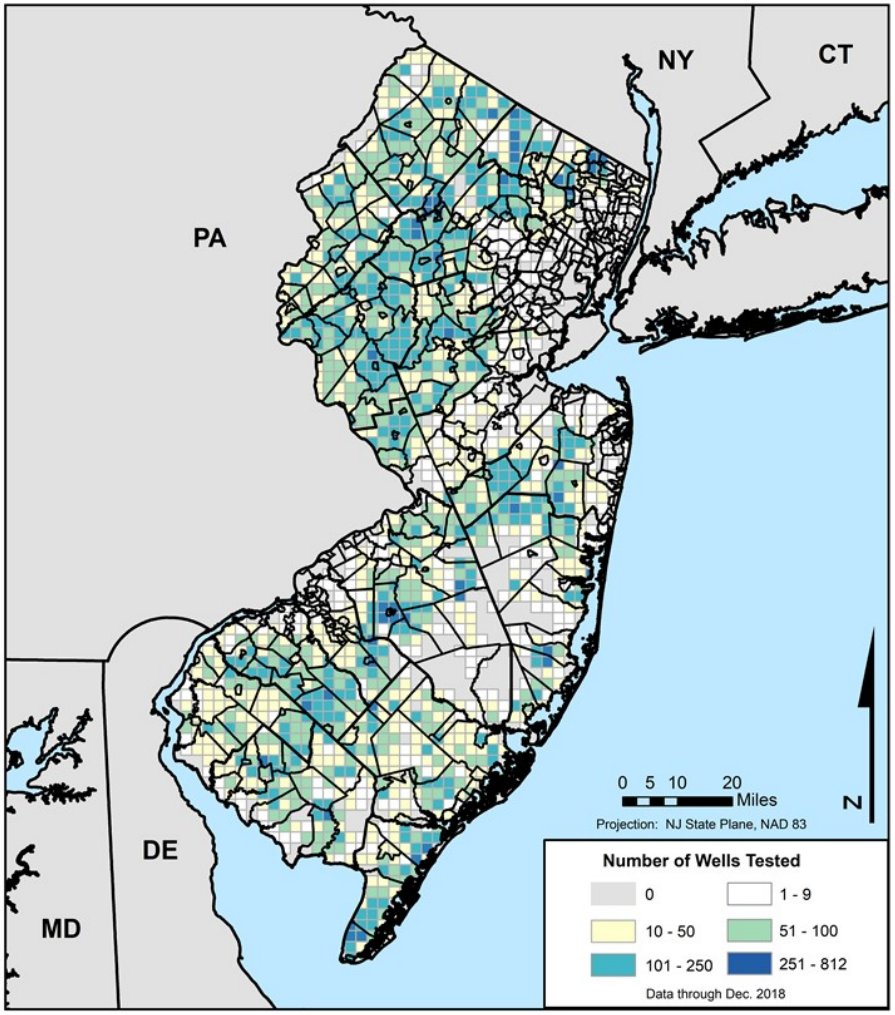

Figure 3: Number of Wells Tested as part of the PWTA through December of 2018.

with an average of 9,100 homes being tested annually. Figure 2 is a map showing the number of private wells that have been tested in 2-mile by 2-mile grids. From this the relative number of wells tested in each municipality can be estimated. In some municipalities where public water is available, there are very few private wells to be tested, while in other municipalities, almost all of the water consumed comes from private wells.

The private well database provides information about the percent of private wells that meet the drinking water standards. Figure 3 is a summary of the percent of private wells that meet all required primary drinking waters or MCLs since 2006, which is when the new arsenic MCL became effective and was included under the PWTA. Since that date approximately 85% of the tested private wells in the state meet all primary New Jersey Drinking Water Standards that are included under the PWTA.

Figure 4: Percent of Private Wells that Meet all Primary Contaminant MCLs

An evaluation of the detection frequency for the monitored primary drinking water standards was performed. As can be seen in Figure 4, the MCLs for naturally occurring contaminants such as arsenic and gross alpha particle activity were the parameters that were exceeded most often in private wells. The MCLs for nitrate and bacteria (fecal coliform/*E. coli*) were the next most exceeded; with the likely origins being nonpoint source pollution (Dubrovsky, 2010 and Atherholt, 2013), such as agricultural runoff and leaching from nearby septic systems.

Finally, according to data reported under the PWTA and shown in Figure 4, VOCs and mercury which generally originate from point sources are rarely found in private wells.

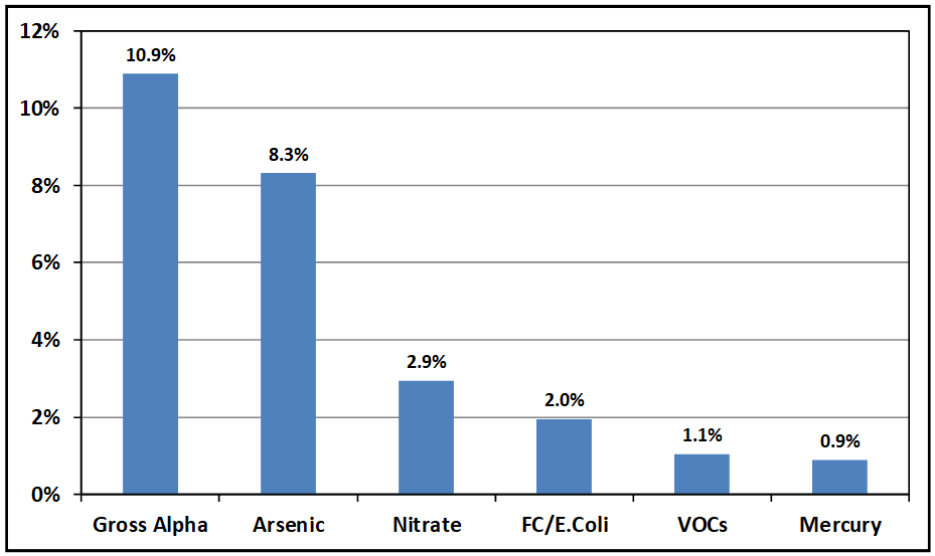

Figure 5: Percent of Wells that Exceed an MCL by Contaminant. FC (Fecal coliform)/*E. coli*: Labs have a choice to analyze for either fecal coliform or *E. coli* following a positive total coliform test. VOCs: Results summarize the percent of wells where at least one of 26 VOCs exceed the MCL.

More Information

NJDEP Drinking Water Watch and Compliance Violation Reports are available online at: https://www.state.nj.us/dep/watersupply/dwc_systems.html

For more information on private wells, visit the DEP's Web site www.state.nj.us/dep/dsr/dw/dw.htm or www.nj.gov/dep/pwta.

An interactive map summarizing results collected from the Private Well Testing Act can be found at http://arcg.is/1CPkHyC

References

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Much of the information on community systems in this report was provided by NJDEP's Division of Water Supply and Geoscience - Bureau of Safe Drinking Water and NJDEP's Division of Science.