



**Testimony of Laura R. Dimino, Ph.D. Assistant Director
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Center for Rural Pennsylvania**

Pennsylvania Senate Democratic Policy Committee

Policy Hearing: Safeguarding Residential Water Wells
Columbia Crossing River Trails Center, 41 Walnut Street, Columbia,
PA 17512
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Good morning, Chairman Miller, Senator Malone, and other distinguished members of the Senate Democratic Policy Committee. Thank you for the invitation to speak before you today. My name is Dr. Laura Dimino, and I serve as the Assistant Director at the Center for Rural Pennsylvania. I am joined by Kaitlyn Goode, the Center's Data Visualization Specialist.

The Center is a bipartisan, bicameral legislative research agency of the General Assembly. The Center's legislative mandates include two broad charges: 1) conducting and sponsoring applied policy research to benefit our rural communities; and 2) maintaining a comprehensive collection of data to assist policymakers in meeting the needs of rural and small communities in Pennsylvania. Our role is to provide information to support your decisions about whether, and how, to act.

Today we are focusing on residential water well safety. We will summarize for you the key methods and findings of a 2009 study published by the Center, conducted by Swistock, Clemens and Sharpe from the Pennsylvania State University. In addition, the Center is about to release a new study by Dr. Faith Kibuye, also from the Pennsylvania State University, related to residential on-lot septic systems and private water well safety. The testimony below contains some excerpts directly from the reports. We are glad to know that our current research aligns with your ongoing interest and efforts.

Landscape of Regulation

Over 3 million rural and suburban Pennsylvania residents rely on

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private wells for drinking water. In 2009, it was estimated that each year, 20,000 new wells are drilled. While research has shown that many private wells in the state have failed at least one drinking water standard, Pennsylvania remains one of the few states without any private well regulations. Location, construction, testing, and treatment are largely the responsibility of the homeowner, which means water safety is in their hands.

Some counties and municipalities have passed ordinances, and educational efforts have been made to help support homeowners understand recommended maintenance and safety practices, including education programs by the Penn State Cooperative Extension.

Overall, it is estimated that 90 percent of residential homes with wells also have private septic systems on-site. The Kibuye study (*Assessing Homeowner Perspectives and Barriers to Maintenance of On-Lot Septic Systems in Rural Pennsylvania*, forthcoming, 2026) shows that approximately 25 percent of homes in the rural and suburban areas of Pennsylvania rely on on-lot septic systems to treat and dispose of domestic wastewater (Day et al., 2008). When those same homes are located outside centralized water supply service areas, residents tend to also use private water sources such as wells, springs, or cisterns for their domestic drinking water supply.

As with private wells, the responsibility for monitoring and maintaining septic systems *also lies with the homeowner*. While some municipalities in Pennsylvania have Sewage Management Programs (SMPs) that require homeowners to show proof of periodic on-site inspections and septic tank pumping, others do not. Therefore, in many parts of the state, septic system owners or users are voluntarily responsible for all maintenance, inspections, and monitoring needs. Given the variation in local ordinances and in enforcement mechanisms, the Kibuye study evaluates the extent to which homeowners are taking care of septic systems in accordance with EPA guidance.

Why is this important? In a conventional septic system, partially treated wastewater from the septic tank, herein referred to as septic effluent, is dispersed to soil absorption areas (e.g., sand mound, inground trench, or bed) by a series of perforated distribution pipes. The soil treatment area absorbs discharged effluent and further removes contaminants via physical, chemical, and biological processes in the subsurface as effluent percolates to recharge underlying groundwater supplies. Septic effluent can contain pathogens (e.g., bacteria, viruses, and protozoa), nutrients (i.e., nitrogen (N) and phosphorus (P)), heavy metals, and organic contaminants of emerging concern such as pharmaceuticals and personal care products (PPCPs), hormones, and per- and polyfluoroalkyl substances (PFAS). Some of these contaminants can negatively impact human health and result in undesirable ecosystem changes if effluent reaches receiving groundwater and surface water sources. Due to incomplete treatment in septic tanks and drainfields, as well as leaks from old or poorly maintained septic systems, these contaminants have been detected in adjacent groundwater and surface water sources (Digaletos et al., 2023; Kibuye et al., 2019; Lusk et al., 2017; Murphy et al., 2020; Richards et al., 2016; Schaidler et al., 2016a). Pathogens can result in human health concerns, creating household or communal concerns such as waterborne illnesses, if drinking water sources are affected (Borchardt et al., 2011; Murphy et al., 2016). Additionally, nitrates above safe drinking

water limits (10 mg/L) can be fatal to children by limiting oxygen transfer in the body, and heavy metals, such as arsenic, barium, and lead, are carcinogenic (US EPA, 2024).

The Pennsylvania Sewage Facilities Act (Act 537) outlines provisions for all municipalities to develop a sewage facilities plan and, through their trained Sewage Enforcement Officer (SEO), to manage the permitting and installation for the construction of individual and communal septic systems (PA DEP, 1966).

- Pennsylvania code for on-lot septic systems (PA DEP, 2025) requires that private water supply sources have isolation or setback distances of at least 50 and 100 feet from septic tanks and drainfields, respectively.
- In contrast, surface water sources should have a minimum of 25 feet of isolation from septic tanks and 50 feet from drainfields.
- Additionally, current regulations require a minimum of 4 feet of vertical setback distance of suitable unsaturated soil between the bottom of the drainfield and a limiting zone of impervious bedrock or seasonal high water table. Both vertical and horizontal setback distances allow for soil to act as a natural filter for contaminants in wastewater before effluent can reach groundwater and surface water sources.
- However, depending on the underlying geology, soil properties, density of septic systems in a region, and private water system construction features, larger setback distances may be needed to protect drinking water sources (Blaschke et al., 2016).

There are also regulations about maintenance of septic systems. The United States Department of Environmental Protection (US EPA) recommends that septic systems be professionally inspected every three years, and septic tanks be pumped every three to five years or when an inspection indicates that the accumulated sludge in septic tanks exceeds 30 percent of their volume capacity. These guidelines have been adopted by state regulatory bodies such as the Pennsylvania Department of Environmental Protection (PA DEP) but are *not enforced* at the state or federal level. Unlike public sewer systems that are monitored and maintained by local municipalities, sanitation districts, or utilities, on-lot septic systems are typically maintained by individual homeowners after they are installed.

The lack of policies and effective oversight on septic system maintenance, monitoring, and inspections can result in undocumented septic system failures and chronic pollution discharges to water resources (Withers et al., 2014). Septic system users/owners may choose not to follow recommended maintenance schedules unless there are obvious signs of septic failure, such as ponding of septic effluent in the yard, backflow of sewage into the home, sewer odors, etc. Unlike municipal water supplies, private water system owners and users are solely responsible for their own water supply testing, treatment, and maintenance to ensure drinking water safety. Because estimates are that most private

water system users/owners (74 percent) do not frequently test their drinking water sources (Swistock et al., 2009), chronic septic system failures that are not noticeable can contaminate drinking water sources.

Study Design 2009

The 2009 study by Swistock, Clemens and Sharpe focused on the impact of natural factors (geology), land use, and well construction features on water quality. Over two years, 170 trained volunteers conducted visual inspections of wells, plumbing and the immediate surrounding areas, and collected water samples from 701 private wells, across most counties in the state (the report has a map showing the distribution of wells studied). In addition, a survey was sent to 450 well owners who received water test results in 2006; they responded 6-12 months later and return rate was just over 64 percent. Water was analyzed for eight contaminants, including lead, Total Coliform, and E. Coli bacteria.

Key Findings 2009

Well Construction

Best practices in well construction, or recommended design features, include the following five features: the well has a metal or plastic casing; the well head is visible and above ground, as opposed to buried in its entirety; the well has a sealed, sanitary cap on it to prevent ground level contaminants from entering the well (such as run-off or animals); the casing and cap are sealed with cement/grout; and the ground surrounding the well is sloped away from the top of the well or the well head.

- Of all 701 wells sampled, 13 percent were buried; most were drilled prior to 1970, although eight were drilled after 1990. Six percent of the total sample were older, hand-dug wells.
- Of those wells visible above ground, 16 percent had sanitary, sealed well cap; 62% had a standard cap, typically a thin cover on top of aluminum or plastic.
- Visual inspections indicated that 18 percent had a cement seal visible at the top, although they could not confirm whether seals extended down the entire casing.
- An estimated 5 percent had both a sanitary cap in conjunction with cement sealant.

Water Testing Results

Health related pollutants may be symptomless and have no obvious tastes or odors. Documenting the impact of polluted drinking water on the health of residents using private water supplies is difficult because most pollutants require long-term exposure and mimic the effects from other air- or food-borne pollutants. Those that create acute effects, such as bacteria, can have symptoms similar to common viral or bacterial illnesses.

- About 41 percent of samples from the private wells tested in this study failed at least one safe drinking water standard; the good news is that of these, 89 percent failed only one of eight possible contaminants.
- About a third of wells had Coliform bacteria, which is similar to national rates for private water. Unfortunately, E. coli bacteria were found in 14 percent of private wells; this should be absent from drinking water.
 - After testing, most bacterial contamination appears to have resulted from animal waste which likely came from ground water. No specific land use activities were correlated with bacterial contamination, but DNA fingerprinting of E. coli bacteria from wells found that the majority were from animal sources. This was more likely in the southwest and southeastern parts of state. (Lancaster County is in the southeast region for this study)
 - Analyses show that good well construction – more recommended design features – makes contamination by Coliform or E. coli less likely. Soil moisture, at the time of sampling, was the most important factor in explaining the occurrence of bacteria in wells.
- Twelve percent of first-draw water samples had elevated lead levels. This was more common in south central and southeastern PA.
 - Given the pH levels of water (acidic), researchers concluded this is most likely from corrosion of metal in plumbing components. Lead contamination was found to be largely from metal plumbing components that were exposed to acidic and soft raw groundwater.
 - Of the homes with lead in water samples, 70 percent had plumbing installed before 1991, when the federal Lead and Copper Rule was passed, prohibiting use of lead solder and fixtures.
- The findings indicated that bedrock geology was statistically significant in explaining variations in all of the water quality parameters, with the exception of arsenic.
- Nitrate concentrations in wells were statistically correlated with the distance to the nearest cornfield and other crop fields.
- About half of the homeowner participants in this study had never had their water tested properly, which resulted in low awareness of water quality problems.
- Overall, up to 80 percent of the well owners that were shown to have unhealthy drinking water took steps to successfully avoid the problem within one year after having their water tested.

- A final portion of the survey provided to each well owner included opinion questions about perceived threats to their water supply, opinions of well regulations, and use of other sources of drinking water.
 - Most well owners were very satisfied with their private water well. Eighty-four percent were not willing to pay even \$10 per month to have access to public water. A total of 16 percent were willing to pay some monthly fee to have public water.
 - Well owners were generally concerned about their water quality but less so about their water quantity.
 - Well owners were most concerned about new housing developments as a threat to their water supply. Thirty-five percent of well owners ranked new housing developments as the biggest threat.

Policy and Education Implications

Results from this study suggest a combination of educational programs for homeowners and new regulations to overcome the largest barriers to safe drinking water.

Overall, 63 to 78 percent of well owners were supportive of potential regulations targeting well construction, well location, and well driller certification. Findings suggest that regulations are warranted to increase mandatory testing of private water wells at the completion of new well construction and before finalization of any real estate transaction.

While this study showed that education increased the use of sanitary well caps on existing wells, most well construction features need to be included at the time the well is drilled. Homeowners having new wells drilled are difficult to reach with educational programs and, as a result, the voluntary approach to encourage proper well construction has largely failed.

Given the benefits of well construction and the difficulty in reaching the target audience for new wells, statewide regulations requiring well construction components appear to be warranted.

Study Design 2026

Dr. Kibuye conducted a survey of septic system users to understand current maintenance practices and factors hindering proper septic system maintenance across Pennsylvania. The survey was completed by 656 people, with 56 and 44 percent of the respondents located in rural and urban counties, respectively. Unlike public sewer systems that are monitored and maintained by local municipalities, sanitation districts, or utilities, on-lot septic systems are typically maintained by individual homeowners after they are installed.

In addition, water tests were conducted. All samples collected were tested for general

water quality indicators such as pH and total dissolved solids (TDS); bacteria including total coliform and *E. coli*; trace elements including arsenic (As), aluminum (Al), barium (Ba), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), manganese (Mn), Nickel (Ni), and phosphorous (P); and dissolved salts such as nitrate (NO₃-N), chloride (Cl), and sulfate (SO₄).

A total of 145 study participants were selected for water testing, and 125 submitted their samples and received a water quality report within two weeks.

Key Findings 2026

The Center does not release specific findings of our funded research studies prior to publication; we expect that to happen within approximately two months. At that time, we will be sharing the executive summary with all members of the General Assembly. The full report will be available on our website, and of course, we would be glad to follow up with this committee at that time to discuss specific findings. Today, we will give you a general preview of what will be included in the final report.

The U.S. EPA recommends professional septic system inspections every three years and tank pumping every three to five years, or sooner if sludge levels exceed 30 percent of tank capacity. When published, the report will show that these practices are not being followed by most homeowners. Homeowners also report in high numbers that municipalities are not requiring proof that septic systems are maintained. being taken.

The average lifespan of septic systems is estimated to be 15 to 40 years (US EPA, 2025). A majority of septic systems in this study are over 20 years old, and a notable proportion are more than 40 years old, raising concerns around the potential environmental impacts from the aging infrastructure.

One hundred twenty-five private water sources were tested. The results will show that some violations of federal health-based drinking water standards have been found in wells. A preliminary overview of findings indicates that on properties where septic systems are not regularly maintained, contamination is more likely. Lower concentrations are observed on properties with deeper wells and longer isolation distances from septic systems.

We expect this forthcoming report to include policy considerations for regulatory change at the state level, municipal level recommendations, and suggestions for homeowner education.

Conclusion

The state of Pennsylvania has important responsibilities with regard to public health. The research we have released, and are about to release, supports the value of increased attention to how state and local government can promote the safety of the private water supply for millions of residents, as well as improve maintenance of private septic systems. At the Center for Rural Pennsylvania, we support data-informed policymaking. As you

consider strategies to improve water safety, the Center is here as a resource to provide information and data that can guide targeted, sustainable solutions. Thank you, again, for the invitation to speak before the Committee, and we are happy to answer any questions that you may have.