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Pre-Gas Drilling Drinking Water Testing—An Educational Opportunity for Extension

Abstract

The increase in shale gas drilling in Pennsylvania has resulted in thousands of landowners receiving pre-drilling testing of their drinking water. Landowners often have difficulty understanding test reports resulting in low awareness of pre-existing problems. Extension and several partners developed a program to improve understanding of pre-drilling water tests. Educational workshops with various companion publications and websites were used by 79% of participants, and follow-up evaluations found that nearly all were able to understand their test reports and that 80% had taken actions on their water supplies. The program represents an emerging educational opportunity for Extension in shale gas drilling regions.

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Introduction

Shale gas drilling continues to expand in many parts of the U.S. For homeowners using individual water wells or springs for drinking water, the intensive nature of shale gas drilling creates concerns about pollution from wastewater, spills, or methane migration to groundwater. Various studies have reported on the potential influences of gas drilling on groundwater supplies (Boyer & Swistock, 2011; Breen, Revesz, Baldassare, & McAuley, 2007; Buckwalter & Moore, 2007; Osborn, Vengosh, Warner, & Jackson, 2011; U.S. Environmental Protection Agency, 2004; Warner et al., 2012).

Within Pennsylvania, 30% or more of the residents in most counties where Marcellus gas drilling is occurring rely on shallow groundwater wells and springs for their drinking water (U.S. Census Bureau, 1990). Research before shale gas drilling began in Pennsylvania found that about 40% of these private drinking water supplies fail to meet federal drinking water standards due to naturally occurring pollutants, improper well construction, and various land uses (Swistock, Clemens, Sharpe, & Rummel, 2013). Over the past 20 years, Penn State Extension has developed a number of innovative educational tools in an effort to educate the large population of private water system owners in the state (Clemens, Swistock, & Sharpe, 2007).

Pennsylvania, like many other states with shale gas drilling, provides regulatory incentives for gas drilling companies to conduct pre-drilling or baseline water testing of private water wells and springs within certain distances of their drilling sites (Commonwealth of Pennsylvania, 1984). A recent study after shale gas drilling found that, while pre-drilling water testing was occurring on a large number of private water supplies adjacent to shale gas drilling sites, landowners often had difficulty understanding their water test results (Boyer, Swistock, Clark, Rizzo, & Madden, 2011). As a result, awareness of both health-related and aesthetic pre-drilling water quality problems was very low. That study concluded that additional educational resources focused on improving understanding of water test reports were needed to assist private water supply owners. As a result, Penn State Extension partnered with various agencies on a project funded by the Colcom Foundation in an attempt to improve the understanding and interpretation of pre-drilling water tests.

Methods

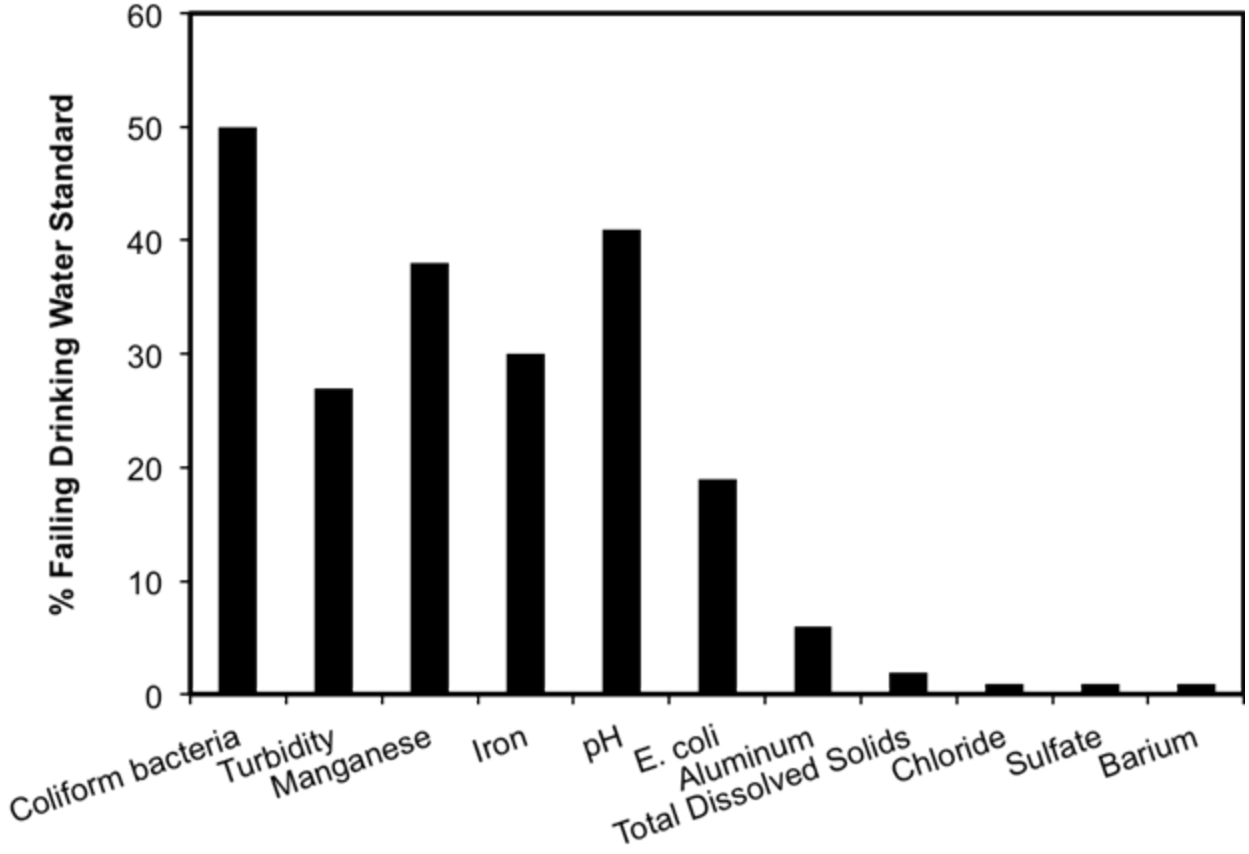
The project reported here focused on providing legally valid, chain-of-custody water tests collected by personnel from state-accredited water testing laboratories and professional interpretation of results by Penn State Extension water specialists for landowners in eight counties of north-central Pennsylvania. Water samples were analyzed for 21 water quality parameters associated with gas drilling pollutants. Testing was completed on 743 private water supplies in 2011 and 2012, including 597 wells, 145 springs, and one pond. Each landowner received results of his or her water tests, including an invitation to attend a workshop on Interpreting Your Pre-Drilling Water Test presented by Penn State Extension water specialists. One workshop was presented in each of the eight counties in the study.

Program Results and Impacts

More than half of the private wells and springs tested failed at least one health-based water quality standard for parameters such as coliform bacteria, *E. coli* bacteria, turbidity, or barium (Figure 1). Many additional water supplies failed drinking water standards for aesthetic pollutants, including manganese, iron, pH, total dissolved solids, chloride, or sulfate. In addition, 8% (n=60) of water supplies contained very hard water, and 14% (n=101) contained measurable concentrations of methane gas before shale gas drilling occurred.

Figure 1.

Percent of 743 Private Water Wells and Springs in North-Central Pennsylvania That Failed Drinking Water Standards Based on Pre-Drilling Water Tests



Water test workshops in each of the eight study counties included approximately 2 hours of presentation along with time for one-on-one consultation with landowners. Each landowner also received various Penn State publications on interpretation of water tests and general management of private drinking water supplies.

Workshops were attended by 585 landowners representing over 79% of the water supplies that were tested during this project. The high percentage of landowners who attended one of the educational workshops attests to the general difficulty in understanding complex water test reports and the interest in learning about proper management of private drinking water supplies.

On-site paper evaluations were given to all workshop attendees. Sixty-eight percent (n=395) of attendees completed and returned an evaluation with the following results:

- 99% (n=392) were more aware of the existing contaminants in their private water supply
- 95% (n=377) understood all information on their water test reports (5% (n=18) were unsure)
- 95% (n=376) would recommend the workshop to others
- 85% (n=336) intended to take some action after attending the workshop including:
    - 62% (n=244) plan to protect the area around their water supply

- 53% (n=210) plan to regularly test their water supply
- 52% (n=207) plan to visit various websites to obtain further information
- 39% (n= 155) plan to take various actions to improve their water supply

Attendees' opinions of the workshops were also important given the controversial nature of potential water supply impacts from shale gas drilling. Most, 95% (n=376), of respondents felt that the workshops provided unbiased, research-based information. Interestingly, the remaining 5% (n=19) were evenly split between feeling that the workshops were biased for or against shale gas drilling.

Valid email addresses were provided for 381 landowners who attended a workshop. An online (SurveyMonkey) survey was sent to these landowners within a few months after the workshops, with 54% (n=206) responding to the survey. Sixty-four percent (n=131) of respondents indicated that they had talked to others about what they learned at the workshop, and nearly 80% (n=160) had already taken actions on their water supplies since attending a workshop including:

- Disinfection to remove bacteria, 22%, (n=45)
- Improve water supply construction, 17%, (n=36)
- Installed water treatment, 10%, (n=21)
- Designate wellhead protection area, 9%, (n=19)
- Used the state website to monitor locations of nearby gas drilling, 8%, (n=16)
- Conduct additional water testing, 5%, (n=11)
- Purchased a portable conductivity meter to monitor water supply, 2%, (n=5)
- Stipulated water supply protections in a gas lease, 2%, (n=5)
- Various other actions, 12%, (n=25)

Conclusions

Increasing number of private water supplies are being tested before shale gas drilling activity, either in response to regulatory incentives or landowner interests. The reports produced from this testing are complex and often cited by landowners as difficult to interpret. Past research at Penn State on baseline testing along with observed interest and evaluation results from the study reported here suggest that private water supply owners who receive pre-gas drilling water testing actively seek unbiased educational resources to better understand the meaning of these reports. Penn State Extension has previously created web tools, such as the Drinking Water Interpretation Tool <http://www.psiee.psu.edu/water/dwit.asp> and written publications

<http://pubs.cas.psu.edu/FreePubs/pdfs/AGRS090.pdf> to assist landowners with water test interpretation. These resources in conjunction with workshops similar to those provided in the project provide private water system owners with the resources and professional interaction necessary to make important management decisions about their drinking water. Given Extension's expertise and available educational resources in this area nationwide, this represents an emerging educational opportunity for Extension in shale gas drilling regions.

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