

# SURVEILLANCE BRIEF

Wisconsin Environmental Public Health Tracking Program

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## WHAT'S IN YOUR WATER? A LOOK AT PRIVATE WELL WATER QUALITY IN WISCONSIN

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**SUMMARY** - Nearly four in every 10 homes in Wisconsin rely on private wells for their water supply. Well owners are responsible for testing their own well water quality but many do not test often enough or at all.

Bacteria, nitrate, and arsenic are three of the most common private well contaminants in Wisconsin. High levels of untreated bacteria, nitrate, or arsenic can lead to short- and long-term health problems.

Public health professionals should be familiar with the common contaminants in their area and encourage their residents to test according to recommendations of the Wisconsin Department of Natural Resources (DNR).

Private well owners should test annually for bacteria and nitrate and for other contaminants as recommended by DNR.

## BACKGROUND

It's estimated each Wisconsinite uses 50-69 gallons of water every day.<sup>1</sup> For over half of Wisconsin homes, that water comes from public water supplies. About 900,000 homes—or four in every 10 households—rely on private wells for their water source.<sup>1,2</sup>

The Safe Drinking Water Act, enacted in 1972, allows the Environmental Protection Agency to set safe levels for contaminants that might be in our water, and other federal laws outline how often public water supplies must be tested and reported back to customers and governmental agencies.

Unlike public water users, well owners are responsible for testing their own water. The Wisconsin DNR requires bacteria testing for newly drilled wells, but there are no requirements for continued monitoring.<sup>3</sup> Subsequently, many well owners tend to not test their wells regularly or at all. A 2015 study

estimated just half of Wisconsin households tested their wells in the last 10 years, and of those, only 22% tested in the past one to five years.<sup>4</sup>

Since many contaminants cannot be seen, smelled, or tasted, irregular testing or lack of testing can let unsafe water go untreated and can make well water users sick.<sup>2</sup> Some populations, such as pregnant women, infants and young children, the elderly, and people living with chronic conditions, can be more affected by unsafe water.<sup>2</sup>

A 2013 study of wells tested under a program for low-income families with pregnant women or young children found 47% of private water samples contained levels above a groundwater standard for at least one contaminant, underscoring the importance of testing.<sup>5</sup>

## COMMON CONTAMINANTS IN PRIVATE WELL WATER

While well owners can test for over a dozen potential contaminants in private well water, bacteria, nitrate, and arsenic are among the most common Wisconsin contaminants. The University of Wisconsin-Stevens Point Well Water Quality Viewer is a resource for better understanding water quality (to access, search “UW Stevens Point Well Water Viewer” in your search engine).<sup>6</sup> On the viewer, users will find decades of data from 14 types of well water tests.

### Bacteria

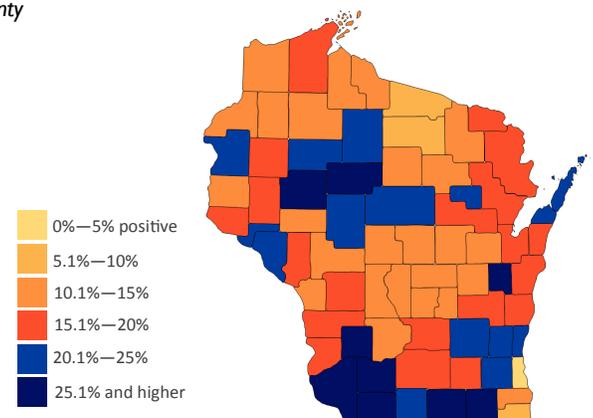
While coliform bacteria are a common type of bacteria that generally are not thought to cause illness, a positive total coliform bacteria test indicates a possible pathway for harmful bacteria and other pathogens to enter the well. DNR recommends well owners test for total coliform bacteria at least once per year or if there’s a change in their water’s appearance, smell, or taste.<sup>2</sup> The well code is based on the premise that a properly constructed well should provide bacteriologically safe water continuously without the need for treatment.

Pathogens can cause a number of gastrointestinal illnesses that result in diarrhea, cramps, nausea, headaches, and other potentially serious health complications.<sup>7</sup> Pathogens in well water can usually be traced to fecal contamination from septic systems, leaking sanitary sewers, or manure that seeped into groundwater supplies.<sup>7</sup>

From 1988 to March 2017, 79,579 private well tests were recorded and 12,726 (16%) were positive for total coliform bacteria (Figure 1).<sup>6</sup>

FIGURE I. Positive Bacteria Tests in Private Wells in Wisconsin<sup>6</sup>

By County



### Nitrate

Nitrate is Wisconsin’s most commonly found groundwater contaminant, and about one-third of well owners have never tested for it.<sup>8</sup> To address this concern, Wisconsin’s well construction code was updated, effective October 1, 2014, to require newly drilled wells to have a nitrate test.<sup>9</sup> Elevated levels of nitrate can occur when water comes in contact with agriculture or turf fertilizer, animal waste, septic system effluent, or wastewater.<sup>8</sup>

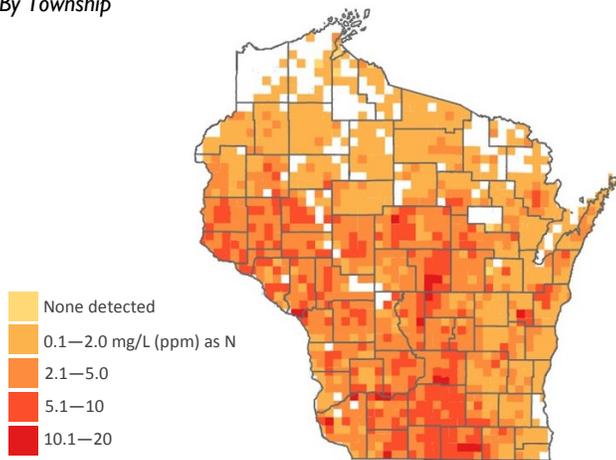
The national maximum contaminant level for nitrate-nitrogen is 10 parts per million (ppm); to protect health, experts recommend drinking water should contain no more than 10 ppm of nitrate-nitrogen.<sup>10</sup> Everyone should avoid long-term consumption of water with nitrate levels more than 10 ppm.<sup>8</sup>

Women who are pregnant or could become pregnant and babies should not consume water that exceeds this standard (either by drinking or eating foods prepared with the water, such as soups, juices, and coffee) because the health risks are even more severe for these populations. The amount of nitrate in breast milk might increase slightly while a woman is lactating, so breastfeeding women should consider avoiding drinking water with nitrate-nitrogen levels greater than 10 ppm.<sup>10</sup>

Babies less than six months old who ingest water with nitrate-nitrogen levels above 10 ppm are at elevated risk of methemoglobinemia—or “blue baby syndrome”—a condition that limits the blood’s ability to carry oxygen.<sup>10</sup>

**FIGURE 2. Average Nitrate-Nitrogen Concentration for Private Wells in Wisconsin<sup>6</sup>**

By Township



There is some evidence of an association between exposure to high nitrate levels in drinking water during the first weeks of pregnancy and certain birth defects; however, further scientific study is needed to confirm this association. Nonetheless, these studies support the need for caution when addressing the consumption of water with nitrate levels greater than 10 ppm by women who are or may become pregnant.<sup>8</sup>

From 1988 to March 2017, 73,517 tests were recorded and 10% had greater than 10 ppm nitrate-nitrogen (Figure 2).<sup>6</sup> Other studies support the Well Water Viewer figure and also found approximately 10% of all Wisconsin wells are impacted with nitrate-nitrogen at a concentration greater than 10 ppm.<sup>8</sup>

**Arsenic**

Arsenic is a naturally occurring element that can be found in soil and rock and is a common contaminant in certain parts of Wisconsin. Under normal conditions, this doesn't present a problem; however, certain conditions can cause arsenic to dissolve and enter the groundwater. Geological formations and glacial sand and gravel deposits in specific areas of the state can cause higher levels of arsenic in our groundwater and subsequently in private wells.<sup>11</sup>

The geological formations that make high arsenic levels more likely are present in northeastern Wisconsin (Florence and Marinette counties), eastern Wisconsin (near Winnebago and Outagamie counties), and

southeastern Wisconsin (Washington and Jefferson counties).<sup>11</sup> While arsenic is more common in these areas, it can be found anywhere in the state.<sup>12</sup>

The maximum contaminant level for arsenic is 10 parts per billion (ppb). Drinking water with levels of arsenic above 10 ppb over a long period of time increases risk of skin changes (appearance of small “corns” or “warts” and unusual pigmentation), high blood pressure, circulatory system problems, diabetes, and cancer.<sup>13,14</sup>

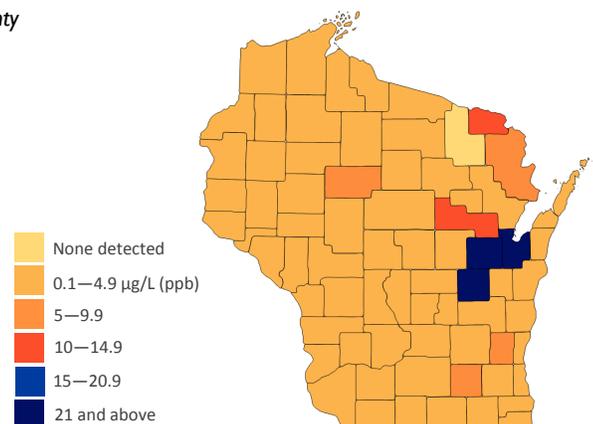
DNR recommends every well owner test for arsenic at least once. If arsenic is found, the well owner should test for it again annually.<sup>2</sup> From 1988 to March 2017, 14,699 tests were recorded and 511 (3%) measured arsenic levels above 10 ppb (Figure 3).<sup>6</sup>

**Other Contaminants**

While tests for bacteria, nitrate, and arsenic are recommended for all wells, well owners can conduct many other water quality tests. Experts recommend other tests based on other factors, including the location of the well and who is drinking the water. DNR has a fact sheet that outlines other common tests and when they are recommended ([dnr.wi.gov/files/pdf/pubs/dg/dg0023.pdf](http://dnr.wi.gov/files/pdf/pubs/dg/dg0023.pdf)).<sup>2</sup> Well owners can contact DNR (608-266-0821 ) or their local health department ([dhs.wisconsin.gov/lh-depts/counties.htm](http://dhs.wisconsin.gov/lh-depts/counties.htm)) to learn more about what to test for, how to interpret test results, and how to address an unsafe level of a particular contaminant.

**FIGURE 3. Positive Arsenic Tests in Private Wells in Wisconsin<sup>6</sup>**

By County



## BARRIERS TO PRIVATE WELL TESTING

There are a number of factors that may prevent private well owners from testing their wells. Some well owners are unaware that their well should be tested or lack knowledge about how to go about getting it tested. In a recent survey of private well owners in Wisconsin, only half of participants said they had the information they needed to be able to test their wells.<sup>4</sup> Other well owners didn't test their well because they did not perceive a problem with the water quality. For example, their water tasted, smelled, and appeared fine, they did not believe the water quality was compromised. Finally, the price of well water testing may also be a limiting factor for well owners. Bacteria and nitrate tests cost approximately \$20 each and a metal package test costs approximately \$50.<sup>15</sup>

## RECOMMENDATIONS

### For Local Public Health Departments

**Review data** on the UW-Stevens Point Well Water Quality Viewer (to access, search "UW Stevens Point Well Water Viewer" in your search engine) and be familiar with common contaminants in your area.

If you have a lab, **consider adding your data to the Well Water Quality Viewer**. Contact Kevin Masarik ([kevin.masarik@uwsp.edu](mailto:kevin.masarik@uwsp.edu)) for more information.

**Work with partners to promote testing** and make it as convenient for customers as possible (e.g., [dhs.wisconsin.gov/publication/p01595.pdf](http://dhs.wisconsin.gov/publication/p01595.pdf)).

If you have a lab and offer well tests, **make your reports back to customers as clear and simple as possible** (e.g., [dhs.wisconsin.gov/publications/p01595c.pdf](http://dhs.wisconsin.gov/publications/p01595c.pdf)).

### For Private Well Owners

**Test your well once a year for nitrate and bacteria or if you notice a change in your water's smell, taste, or appearance.** You can order test kits from a certified water testing lab, which include private labs, some health departments, and the Wisconsin State Lab of Hygiene.<sup>15</sup>

**Know the common contaminants in your area** by reviewing DNR materials or talking to your local health department or DNR office.<sup>2</sup> Test for them as appropriate.

## CONCLUSIONS

Well owners in Wisconsin are responsible for testing the water quality of their own wells, but many do not test often enough or at all. Many water contaminants cannot be seen, smelled, or tasted, and testing the water is the only way to know it's safe to drink. Bacteria, nitrate, and arsenic are some of the most common well water contaminants in Wisconsin. Health department professionals should be familiar with common contaminants in their area and encourage well owners to test their wells. Private well owners should test their well each year for bacteria and nitrate and for other contaminants as indicated by the DNR.

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## ABOUT TRACKING

The Wisconsin Environmental Public Health Tracking Program is your source for environmental public health data on Wisconsin communities.

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