Minnesota Drinking Water 2015 Annual Report for 2014

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Minnesota Department *of* Health

DRINKING WATER PROTECTION

Minnesota Drinking Water 2015 Annual Report for 2014

Minnesota Department of Health,
Environmental Health Division,
Section of Drinking Water Protection
PO Box 64975, St. Paul, MN 55164-0975
651-539-3005
www.health.state.mn.us/divs/eh/water/

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Executive Summary

Ask Minnesotans if they know of a baby who had "Blue Baby Syndrome," and the answer is most likely "no." The prevention of new cases of Blue Baby Syndrome is a major public health achievement made possible by the efforts of the Minnesota Department of Health (MDH) and many partners in drinking water protection across the state.

MDH is responsible for safeguarding the quality of drinking water and enforcing the federal Safe Drinking Water Act (SDWA) in Minnesota. Preventing and treating nitrate contamination in drinking water, the theme for this year's annual report, is an issue that affects many public water systems in Minnesota.

Nitrate nitrogen (nitrate) comes from many sources, including fertilizers, manure, septic systems, and natural decomposition of organic matter. Concentrated sources of nitrate can release excessive amounts of nitrate and can contaminate water sources. Infants (less than six months old) who drink water or formula made with water with high levels of nitrate can become critically ill and develop methemoglobinemia, which is also known as Blue Baby Syndrome.

MDH ensures safe and sufficient public drinking water supplies through a strategic series of safeguards from sources in rivers, lakes and groundwater until the drinking water reaches the tap. The safeguards include three basic strategies of prevention, treatment and monitoring.

- Prevention focuses on controlling potential sources of pollution and managing land uses in the area where rain drains to become groundwater that supplies a well. Prevention activities also include plan review, advice on construction of water treatment and distribution facilities, and inspection of these facilities on a regular basis.
- Treatment measures, including routine disinfection, are used to make the water safe to drink.
- Monitoring of public water supplies for more than 100 potentially harmful contaminants on a routine basis is a critical element in the state's enforcement responsibilities that ensure safe drinking water.

Without sustained prevention efforts, effective treatment, and continued vigilance in monitoring, Blue Baby Syndrome and other health conditions related to nitrate in drinking water could once again become a threat to Minnesotans' health. Successful efforts to reduce nitrate contamination in our sources of drinking water will reduce treatment costs and also keep out other contaminants that could also follow nitrate's pathway to contaminant drinking water. Nitrate provides an apt illustration of the strategic system essential to ensuring safe public drinking water everywhere in Minnesota, now and in the future.

Introduction

"Water is gold, and it is getting more valuable."

These words of U. S. Environmental Protection Agency administrator Gina McCarthy illustrate how ensuring the safety of our drinking water is one of the most fundamental, and most critical, responsibilities of modern public health. Safe drinking water has been a key ingredient in some of the greatest public health achievements of the last half-century, including the dramatic reductions in disease and improvements in longevity that we now tend to take for granted.

The value of our water resources goes beyond even public health and the health of our environment. Jobs and economic development also depend on communities having a reliable source of clean and safe water.

The many partners in drinking water protection need to remain vigilant to protect the progress that has been made over the past decades and, for that matter, the past century. The Minnesota Department of Health (MDH) is strongly committed to safeguarding the quantity and quality of our drinking water, and as part of that commitment, it routinely monitors all of Minnesota's public water supply systems for a broad range of chemical, radiological, and biological contaminants. Monitoring is part of a multi-barrier approach that includes protecting water sources and treatment of water to make it safe to drink.

MDH believes that educating the public about water quality issues is an important element of drinking water protection. Since 1995, it has been releasing annual summary reports to help achieve that goal. Like previous reports in the series, this year's report covers test results and actions taken during the preceding calendar year.

New this year is a focus on nitrate, a growing chemical threat to Minnesota's drinking water.

We hope this information will provide the people of Minnesota with a clearer picture of what is being done to protect the quality of their drinking water and what our monitoring efforts reveal about the success of those efforts.

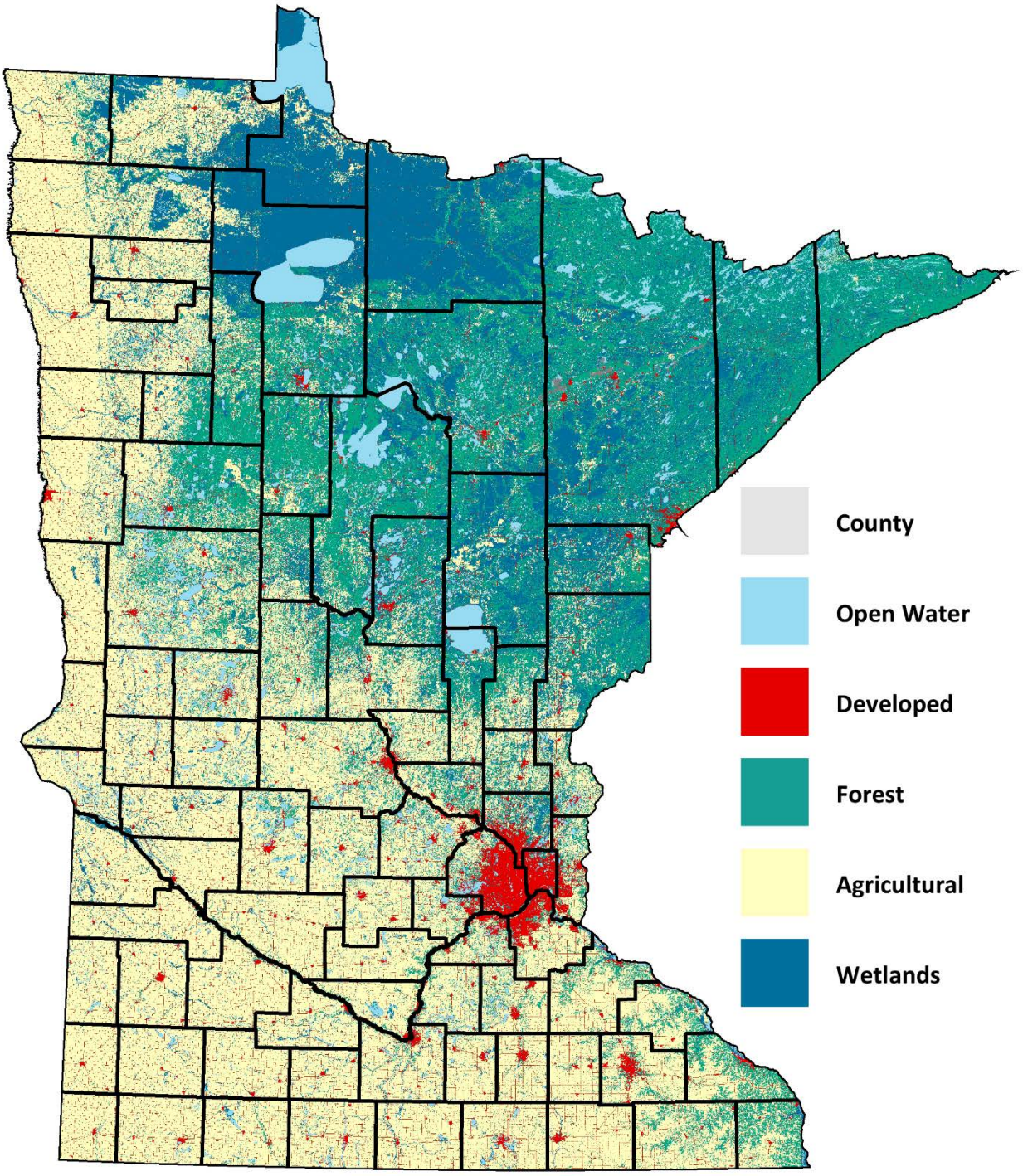
Nitrate/Source Water Protection

Nitrate in drinking water is a public health concern. Nitrate is also an environmental concern for aquatic organisms, and it contributes to hypoxia or the "dead zone" in the Gulf of Mexico. Nitrate is an essential plant nutrient critical for crop production; it can be present in fertilizers or produced by microorganisms in the soil from organic and inorganic nitrogen sources. It is also made by microorganisms as they break down sewage or manure.

Nitrate is a contaminant that affects drinking water in many public water systems in Minnesota and throughout the Midwest. Nitrate is a nitrogen-oxygen compound that is found naturally in very low concentrations in ground and surface water but in much higher concentrations in areas affected by human activities. Concentrated sources of nitrate—including fertilizers, manure, and human sewage—can release excessive amounts of nitrate, which can dissolve into groundwater as well as move to surface waters in runoff or through agricultural drain tile lines. Certain geologic settings, such as sand and gravel deposits and shallow limestone formations, are more prone to nitrate contamination of groundwater; in addition, certain types of wells (shallow wells, hand-dug wells, tile wells, and ungrouted or improperly grouted wells) are more vulnerable to nitrate contamination.

Roughly half of Minnesota's land is in agricultural production, primarily in the southern and western parts of the state. Up to 20 million acres of Minnesota is in row-crop production annually. Row crops, which include corn, soybeans, sugar beets, and potatoes, are a major contributor to Minnesota's economy. However, since soils in row-crop production can lose nitrate during the non-growing season, these lands are the biggest influence on Minnesota's ground and surface water nitrate levels. Waters affected by such land uses may also have other contaminants associated with those activities, such as pesticides. Decisions about land use are primarily driven by economic considerations. This is important to consider as we address problems related to nitrate and other contaminants.

Minnesota Land Cover



Source: Jin, S., Yang, L., Danielson, P., Homer, C., Fry, J., and Xian, G. 2013. A comprehensive change detection method for updating the National Land Cover Database to circa 2011. Remote Sensing of Environment, 132: 159 – 175

Public Health and Nitrate

Infants (fewer than six months old) who drink water with high levels of nitrate can become critically ill and develop methemoglobinemia, which is also known as “Blue Baby Syndrome.

Until the mid-1940s, the connection between nitrate in drinking water and methemoglobinemia was not known. Dr. H. H. Comley of the University of Minnesota discovered the cause-and-effect relationship and published a study considered to be a landmark in public health. The Minnesota Department of Health followed with its own study that confirmed Comley’s findings.

From January 1947 through July 1949 MDH found 146 cases of methemoglobinemia in infants, mostly in southwestern Minnesota, that resulted in 14 deaths. Once the medical community learned of the relationship between methemoglobinemia and nitrate, the number of cases dropped from 129 in 1947 to 12 in 1949.

Education and knowledge are key factors in preventing methemoglobinemia, particularly for private well owners. Well codes have also played a major role in preventing cases. Since 1975, owners of new wells have been required to test for nitrate-nitrogen as well as total coliform bacteria before the well is placed into service. After that, owners of private wells are responsible for monitoring the quality of the water of their well.

Public water systems are monitored regularly for nitrate and other contaminants as part of the Safe Drinking Water Act. Any public supplier that exceeds the drinking water standard of 10 milligrams per liter (mg/L) must take corrective actions, which include notifying residents of the situation and possibly supplying them with a different source of water, such as bottled water. These systems must explore options and develop a way to reduce the nitrate levels in the water.

Minnesota's Public Drinking Water Supply Systems

Although the Safe Drinking Water Act (SDWA) initially focused mostly on water treatment, over the years it has been amended to encompass other means, including source water protection, water-operator training, communication, and below-market-rate loans for capital improvements needed by public water systems to remain in compliance with SDWA.

SDWA determines if water is safe to drink by using standards for a variety of contaminants—both naturally occurring and those that result from human and animal activity—that may be found in drinking water supplies. The SDWA affects all water systems that serve water to the npublic (in general, to more than 25 people on a regular basis) in the United States in addition to all U. S. territories and commonwealths as well as tribal reservations. The SDWA does not apply to private wells or bottled water (although bottlers in Minnesota who have their own source of water are regulated as noncommunity public water systems).

The Minnesota Department of Health has delegated authority from the U.S. Environmental Protection Agency to regulate approximately 6,900 public water supply systems in Minnesota. This figure includes 961 community systems, which provide drinking water to people in their places of residence. The community systems include 729 municipal systems, serving towns or cities and 232 systems that provide water to manufactured home parks, nursing homes, and treatment or correctional facilities.

In addition, MDH regulates about 6,000 "noncommunity" systems that provide water to people in schools, lodging facilities, and businesses that are not connected to community systems. They can be resorts, restaurants, highway rest stops, and state parks. (The Minnesota Department of Natural Resources estimates that as many as 8.4 million people are served each year by state parks.)

Like community water systems, noncommunity systems are required to meet the standards of the federal Safe Drinking Water Act. Should there be any issues with water quality, the owner of the system is responsible for identifying, correcting, and paying for corrective actions. For nitrate problems, these actions can include drilling a new well, installing a treatment system, or connecting to another public water system.

IMPACTS OF NITRATE ON COMMUNITY PUBLIC WATER SYSTEMS

A growing number of public water systems in Minnesota are concerned about increasing nitrate levels in their source water and are managing for nitrate using treatment and other options, including managing land use, taking a well out of service, drilling a new well, connecting to a nearby public water system, and blending high-nitrate water with lower-level nitrate water.

While there was no violation of the Safe Drinking Water Act limit for nitrate for community public water systems in 2014, the number of community systems using a variety of strategies to reduce nitrate has increased. Since 2008, the number of community public water supply systems with nitrate treatment has increased from six to eight. This change also means that the number of people served by systems actively treating for nitrate has increased from approximately 15,000 to 50,000 people. Three of those systems also blend in in combination with treatment. One additional system only blends to reduce nitrate at this time.

IMPACTS OF NITRATE ON NONCOMMUNITY PUBLIC WATER SYSTEMS

A review of 2014 nitrate results show that approximately 10 percent (600 of the 6,000) of noncommunity systems in the state have groundwater sources affected by surface contaminant sources that discharge nitrate:

- About 105 noncommunity system's had water sources with nitrate at or above the maximum contaminant level (MCL) of 10 milligrams per liter (mg/L).
- About 230 had sources at or above 5 mg/L.
- About 260 had sources at or above 3 mg/L.

The financial impact of fixing the problem can be a strain on small business owners. For example, if each of the 105 water systems at or above the nitrate MCL needed to invest $10,000 to replace the source (drilling a new well), install treatment, or connect to city water, the systems would represent $1.05 million in capital investment. This cost does not represent operation and maintenance costs or for systems that are required to employ a class D water operator.

The data show that nitrate is affecting source water quality and has an economic impact on the system owners. There is also an economic impact on the state, as well. It takes additional resources to manage the water quality of those systems.

Prevention

A multi-barrier approach of prevention, treatment, and monitoring is used. Prevention is a key first step.

According to the U. S. Environmental Protection Agency, it costs about 10 to 30 times more money to clean up contaminated drinking-water wells than it does to prevent the contamination. Therefore, protecting drinking-water sources makes sense from two perspectives: public health and economic.

The SDWA's multi-barrier approach assures that public water supplies deliver drinking water that meets all appropriate standards. Source water protection planning is the first step in prevention and protection. Also important is MDH plan review of key public water system infrastructure construction projects.

Examples of Source Water Protection to Address Nitrate

In Minnesota, approximately 75 percent of people get their drinking water from groundwater. The systems relying on surface water typically serve those living in large cities like Minneapolis, St. Paul, St. Cloud, and Duluth. Both surface water and groundwater originate as precipitation. In some areas the transition from rain or snow to groundwater occurs rapidly, on the order of hours or days, and in other areas it takes decades or centuries.

The Source Water Protection Unit at MDH works on protecting water as it moves through the landscape to surface or groundwater sources. The focus is on centralized locations where

communities pump their drinking water, and special attention is paid to areas that are more vulnerable to contamination.

Key to these efforts is managing land use. Source water protection approaches generally target potential sources of contamination at or near the land surface to make sure they are managed properly relative to protecting a public water system's water supply. Of the potential contaminants facing public water systems in Minnesota, one of the most common is nitrate.

A community facing nitrate issues in its water supply has access to tools, assistance, and resources to prevent or reduce contamination. Planners work with the community to identify land uses that are contributing nitrogen, while scientists recommend strategies that will be most effective based on the area's geology. The community chooses activities that best suit its needs, and MDH helps deliver them. Grants are available from the Clean Water Fund for concrete actions benefiting source water protection.

THE INFLUENCE OF THE GLOBAL MARKET FORCES ON NITRATE IN SMALL-TOWN MINNESOTA: EDGERTON

Edgerton, a small farm community in Pipestone County, has had a roller-coaster ride with nitrate over the past 25 years. The flux of nitrate levels in this community tells the story of how global economic forces affect drinking water protection here in Minnesota.

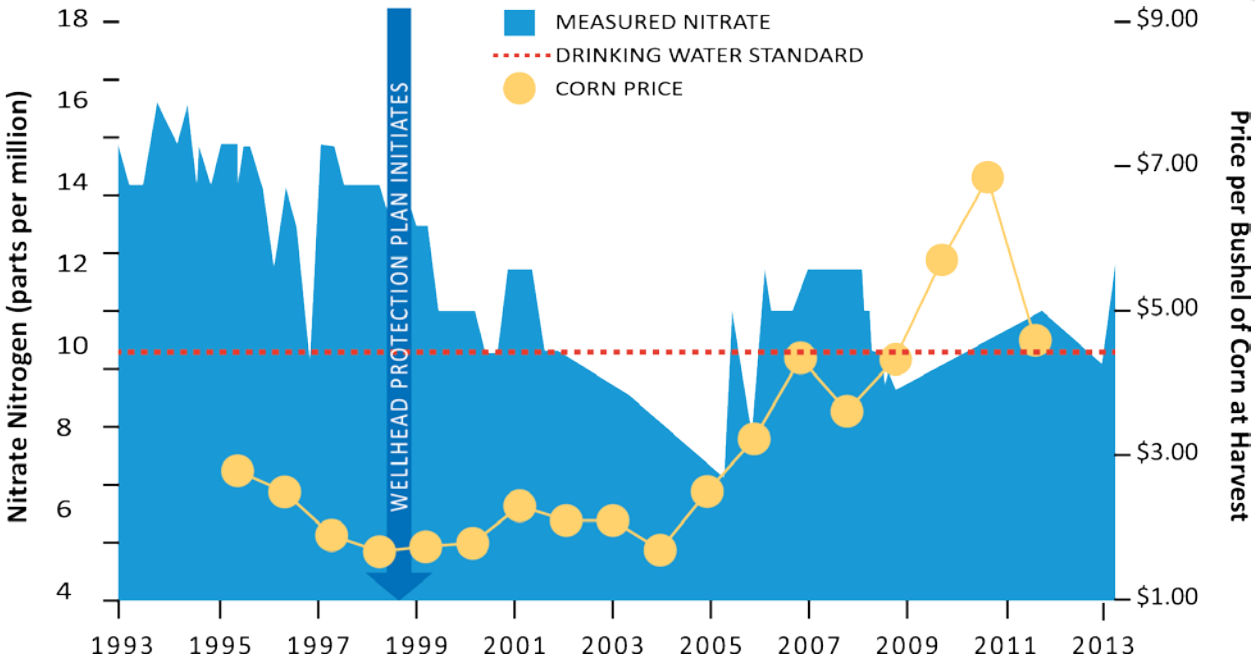
Nitrate has been a growing problem for Edgerton since the 1980s, and in the late 1990s the city had to construct a water treatment plant to provide safe drinking water.

At the same time, the city began working with MDH to develop a Wellhead Protection Plan to reduce nitrate in its groundwater source through prevention activities. Edgerton's approach focused on limiting agricultural sources of nitrate by encouraging innovative fertilizer application practices. The city also heavily promoted the U.S. Department of Agriculture Conservation Reserve Program, which pays landowners to convert land in sensitive areas from row-crop production to perennial vegetation. Alternative land uses were popular among landowners at the time because crop prices were relatively low.

As management measures took hold, nitrate levels in source water declined by approximately 50 percent. The drinking water standard for nitrate in treated water is 10 mg/L and the city, now receiving source water with levels around 7 to 8 mg/L, was able to reduce its treatment costs for a few years. However, in 2005, a number of factors resulted in corn prices increasing dramatically. The conservation incentives were no longer a match for agricultural production. Much of the land previously enrolled in the Conservation Reserve Program reverted to row-crop production. At the same time, nitrate levels in groundwater rapidly increased, along with the financial burden of treatment plant operation.

Global crop-market trends drive agricultural land uses. Edgerton has been hit especially hard by this reality. Unlike many communities, the city has only one viable source of groundwater, a source that is highly vulnerable to contamination due to the type of soil and how close the water is to the surface. Experts at the city, MDH, and organizations such as the Minnesota Rural Water Association are able to work with challenged communities to provide safe drinking water; however, a sustained effort from all partners is needed in the face of the changing environment and economy.

Nitrate in Untreated Edgerton Source Water and Corn Prices



Nitrate was measured by MDH staff at various sampling sites in Edgerton's drinking-water system. All measurements are verified and tracked with a government data base. Corn prices were taken from the U. S. Department of Agriculture Heartland Recent Costs and Returns: Corn (1996-2013).

A WATER-WILDLIFE PARTNERSHIP: WORTHINGTON

Many cities in Minnesota are known for their surface-water features. The southwestern Minnesota city of Worthington, known for its 880-acre Lake Okabena, is a prime example.

While surface water is an integral part of the city and its culture, groundwater is the backbone of the water supply for Worthington's 12,000 residents.

Groundwater for water supply is hard to find in the Worthington area, so Worthington Public Utilities (WPU) has long made an effort to protect the resources on which it relies. Since 2006, the city, along with other local partners, has contributed nearly $2 million to help set aside 520 acres of intensive agricultural land for conservation.

One of their most significant efforts was in 2014, when a critical piece of agricultural land in the city's drinking water supply management area went up for auction. The 150-acre parcel of land comprises an area in which the groundwater is particularly vulnerable and connects to other existing conservation areas. Recognizing the benefits that parcel acquisition and protection would bring to wildlife habitat, drinking water protection, and surface water quality, allowed WPU to bring together a broad-based coalition of partners to raise the $850,000 needed to purchase the land. This successful effort culminated in a special dedication of the "Worthington Wells Wildlife Management Area" at the 2014 Minnesota Governor's Pheasant Opener.

Worthington, along with Little Falls and Alexandria, was declared a Source Water Protection Leadership Community by MDH for leading efforts to protect sources of drinking water.

A coalition of the following groups made the purchase possible: Nobles County Pheasants Forever Chapter and Pheasants Forever's Build a Wildlife Area fund, E.O. Olson Trust, Okabena/Ocheda Watershed District, the Minnesota Department of Natural Resources, corporate sponsors, and local residents and businesses. Photo courtesy of Phesants Forever.

COMMUNITY AND NONCOMMUNITY WELLS: AN INTEGRATED APPROACH

Battle Lake, a community in northern Minnesota, discovered a high nitrate issue through water sampling in noncommunity wells. The impact on the community and surrounding area concerned officials, especially as they discovered additional problems through further sampling.

The sampling indicated that groundwater in the vicinity contained significant levels of nitrate. The flow of this groundwater was toward Battle Lake, prompting concerns that it could affect city wells. MDH developed a nitrate monitoring plan for the community. The plan's two components were water quality monitoring and groundwater flow monitoring. The tasks included evaluating nitrate trends, determining if the water quality was a result of human impacts on the environment, and estimating the rate of change in the community and surrounding areas.

Nitrate sampling data have been collected for many years, providing a potentially powerful set of information. The historical data were evaluated within the context of current information to give a clear picture of the nitrate impact in the water. An integrated and coordinated approach was implemented, including the community and noncommunity water sources as well as the broader source water protection area.

A new well, drilled at a local business, has seen a significant drop of nitrate in the water. Other businesses have also noticed a decrease in the last couple of years. According to a public-health sanitarian in the area, he has been watching the noncommunity systems in the area and notices that, "nitrate levels seem to be trending downward."

The community is taking an active role by developing a second phase of the monitoring plan, which will further track the nitrate levels and identify potential solutions.

The integrated approach and research model successfully helped to discover and assess the situation. Another outcome is the re-use of noncommunity compliance data to protect community wells. Applying this model in the future may assist other communities in the state to identify problem areas in advance and to develop a plan to address and correct a water quality issue.

Examples of Treatment to Reduce Nitrate

Treatment is another way of reducing nitrate in water; however, it can be costly as demonstrated in the following examples of communities in Minnesota that have built treatment plants to reduce levels of nitrate.

CLARA CITY

The central Minnesota city of Clara City had been supplying bottled water to pregnant women and families of infants for years before constructing a new treatment plant that became operational in 2002. Clara City had high levels of nitrite because of ammonia in its groundwater; the nitrite occurred as a biological reaction with the ammonia. Clara City tried various options, such as cleaning the transmission main that supplied water to the city, but nothing had a lasting effect. The city searched for other water sources that had lower levels of ammonia, but 10 separate test wells drilled at different locations did not find a water source that could provide sufficient quantity. Roger Knapper, Clara City's public works superintendent, said the test drilling done to the east of the city showed "great water, but not enough of it."

With other options exhausted, the city decided to build a new treatment plant that had pressure filters followed by reverse-osmosis treatment. Reverse osmosis is a membrane process that works against the natural process of osmosis by using pressure to force water through a semipermeable membrane that allows water molecules to pass through, while discharging undesirable elements, such as nitrate, nitrite, sulfate, hardness, radium, and arsenic. Put another way, reverse osmosis is essentially a high-pressure filter that removes contaminants as small as molecules.

The process is effective, but membrane filtration is not cheap. The total project cost (which included a new water tower, new well, and installation of new water mains) was $3.2 million, a sizable investment for a city of approximately 1,300 people (about $2,500 per resident). Clara City funded the project with a low-interest loan from the Minnesota Public Facilities Authority and a grant. To pay back the loan, the city increased its water rates from $1.25 per 1,000 gallons to $3.00 per 1,000 gallons, a sizable increase.

Clara City now provides safe water to its residents, which is the most important issue. But the residents are paying significantly more to receive that water.

LINCOLN-PIPESTONE RURAL WATER SYSTEM

Rural water systems were established in the United States more than 50 years ago to supply safe water in water-challenged rural areas. The first such systems in Minnesota began in the 1970s. Three are in the southwestern part of the state, an area where good water is often hard to find. Lincoln-Pipestone Rural Water System (RWS) serves an area with quantity and quality issues. In the summer of 1997 Lincoln-Pipestone RWS exceeded the maximum contaminant level for nitrate, requiring corrective action.

The system explored its options and chose a chose a treatment process using reverse-osmosis. The new treatment began working in late 1999, and nitrate levels were greatly reduced, meeting the drinking-water standard.

HASTINGS

For much of its history the city of Hastings—a thriving community of 22,000, with many residents who commute daily to the nearby Twin Cities—served its citizens water straight from its wells with the only treatment being the addition of fluoride for dental protection. Hastings groundwater sources are exceptionally low in iron and manganese, naturally occurring contaminants that can affect aesthetic qualities at higher concentrations. However, over time, nitrate in two of its wells increased and approached the drinking water standard. The city explored options and constructed a new treatment plant with anion-exchange to treat the water from the two wells with measurable levels of nitrate. About 60 percent of the water from these wells goes through the anion-exchange vessels; the rest bypasses the system and is blended with the treated water, bringing down the concentrations to levels consistently below the drinking water standard. The treatment process is the same as softening. The new treatment plant became operational in 2010, allowing Hastings to continue to supply its residents with safe water.

Some noncommunity public water systems (those that serve water to people outside of their homes) have also overcome challenges.

BAR AND RESTAURANT IN OTTER TAIL COUNTY

The water source at a bar and restaurant in Otter Tail County has a history of exceeding the maximum contaminant level for nitrate in its drinking water. The Minnesota Department of Health issued a notice of violation to the business that required corrective actions.

The business made attempts to resolve the issue by drilling a new well to obtain a different water source, but these efforts failed. It was determined that the installation of an anion-exchange water treatment unit was the solution they were looking for, one that would reduce nitrate level in the water to meet the drinking water standard.

For most noncommunity water systems the primary responsibility is to run their day-to-day operations. These water systems do not provide water as a service but as an ancillary function to the operation of their business. The cost of treatment was approximately $5,300. The business applied for and received a Source Water Protection grant to help with the installation of the treatment system. This resulted in a dramatic decrease in nitrate level in the drinking water and a return to protecting the public's health.

RESORT IN NORTHERN MINNESOTA

The groundwater source at a business in northern Minnesota observed a steady increase in nitrate from 0.50 mg/L in 1999 to eventually exceed the nitrate drinking water standard of 10 mg/L in 2013. The Minnesota Department of Health issued a notice of violation to the business.

Drilling a new well to a greater depth to obtain a different aquifer was determined to be their best solution. A new location was found on the property to drill the deeper well. In addition, the old well had to be sealed so that it could no longer be used, preventing surface contaminants from moving into the aquifer. The new water source provides the resort with safe drinking water for their customers.

The resort relies heavily on its wells; it also values and relies on these sources to provide safe drinking water to its customers. As the family runs the day-to-day operations of the resort, it also protects the health of its customers and staff. The estimated cost of the new well was $18,000. The resort owner applied for and received a Source Water Protection grant to help pay for the new well. The resort is now pleased to be able to serve the public with safe and clean drinking water.

Monitoring to Protect Public Health

Source water protection and other prevention methods help keep contaminants out of the water supply. Treatment, done by communities and businesses, is a method to reduce contaminants, such as nitrate, if they get into the water.

The quality-control step is monitoring the quality of drinking water in public-water supply systems and is a joint responsibility of the engineers, public-health sanitarians, and the state's public water systems.

Local water supply systems are responsible for taking some of the required water samples, according to a schedule established by MDH. MDH staff collect the remainder of the required samples. Certified laboratories test the water samples for a broad variety of possible contaminants.

In 2014 nearly 4,000 nitrate samples (3,966 to be exact) were collected from community water systems with 8,005 taken from noncommunity systems during the year.

When it comes to complying with the testing requirements of the federal Safe Drinking Water Act, Minnesota has one of the best records in the nation.

Minnesota's public water supply systems are tested on a regular basis for bacteria, nitrate and other inorganic chemicals, radiological elements, and up to 118 different industrial chemicals and pesticides. The exact list of contaminants—and the testing schedule—vary from one system to another.

The Minnesota Department of Health also does assessments to determine how vulnerable a particular water supply may be to a specific contaminant. These vulnerability assessments take a number of factors into account:

- Are there natural geologic barriers that would tend to protect the water from contamination?
- How are the water wells in a particular system constructed?
- What kind of record does the system have?
- Have there been contamination problems in the past?

Based on considerations like these, a local water supply system might be required to test for a particular contaminant four times a year, once a year, once every three years, once every six years . . . or not at all. And not all systems will be tested every year.

Minnesota's testing efforts are tailored to the specific needs and requirements of each water supply system. That way, efforts can be targeted to where they're needed most to do the best possible job of protecting drinking water with the available resources.

A water supply system must take corrective actions—which include notifying its water users of a problem—if the level of a contaminant exceeds the drinking water standard. These federal standards are Maximum Contaminant Levels (MCLs) and are set by the United States Environmental Protection Agency. The MCL for a particular contaminant represents the lowest concentration at which that contaminant is believed to be a potential health concern.

Some contaminants do not have MCLs established for them. These "unregulated contaminants" are assessed using state standards known as health risk limits to determine if they pose a threat to human health. As with MCLs, health risk limits are conservatively set and are based on lifetime exposure. If unacceptable levels of an unregulated contaminant are found, the water supply system must inform its customers and is encouraged to take corrective actions.

MDH provides precise guidelines for taking the samples to ensure that they provide an accurate picture of water quality. The samples are drawn from water that has already been treated by the water supply system rather than from raw water taken directly from lakes, rivers, or wells. The various treatment methods used by water supply systems can drastically reduce the concentrations of various contaminants in the water.

Distribution

Nitrate activity is sometimes a result of ammonia in the distribution system—a biological reaction that occurs after water has left the treatment plant. Many water systems in Minnesota already have naturally occurring ammonia in their groundwater or add ammonia during their treatment process. Excess ammonia in water distribution systems promotes biological growth and nitrification, which converts ammonia to nitrate.

Public water systems are urged to regularly check each water source and to perform additional monitoring for ammonia within the distribution system if it is detected.

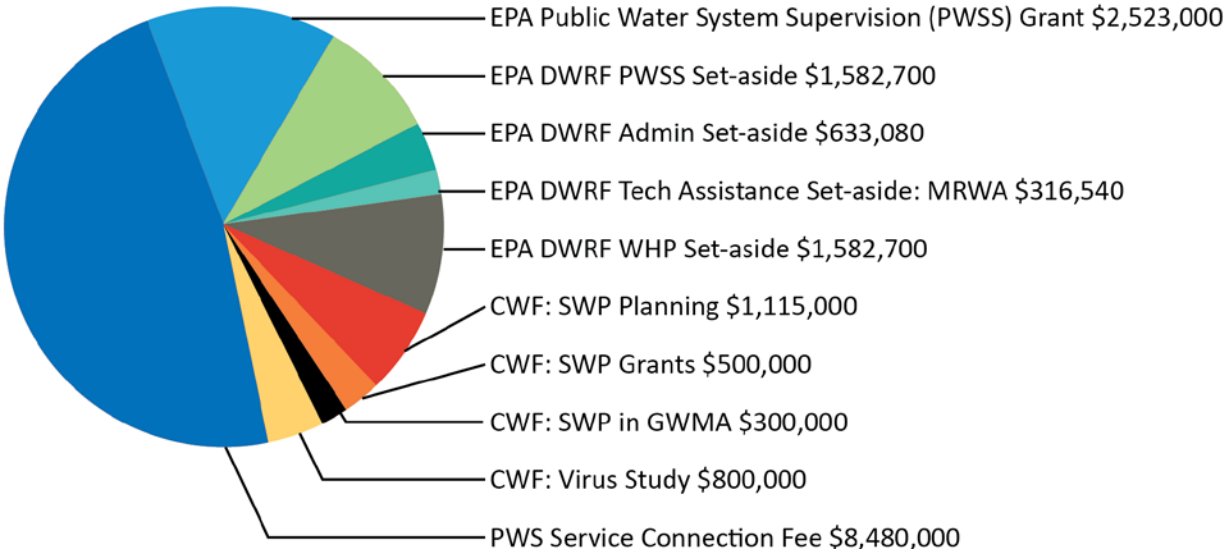
MDH Drinking Water Protection Activities and Resources

Funding

The annual budget of MDH's drinking water program is approximately $17.8 million. Funding comes from a variety of federal and state sources, with three primary sources of funding:

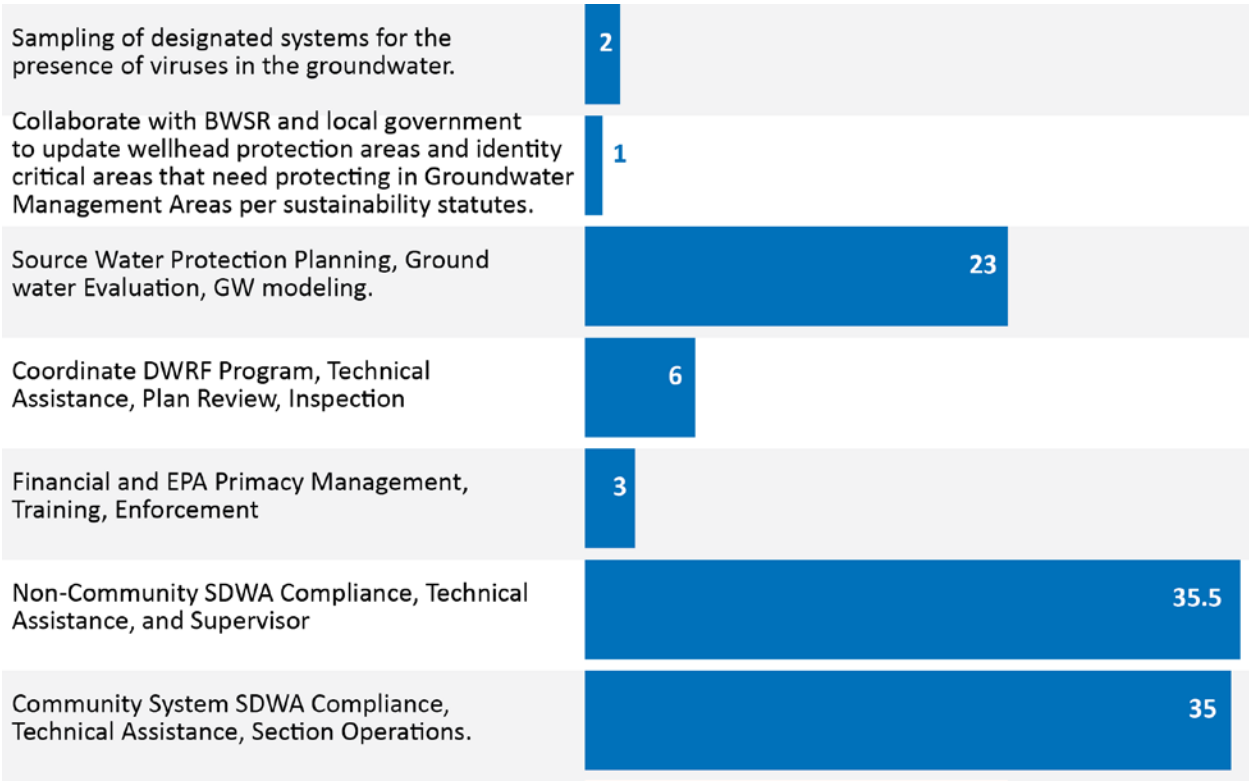
- **Public Water Supply (PWS) Service Connection Fee:** In 1992 the Minnesota Legislature established the service connection fee, which directs each municipal water system to collect an annual fee (currently $6.36) for each connection. These funds are sent to the Minnesota Department of Health to cover the costs of testing the nearly 6,900 public water systems in the state as well as to conduct inspections, develop protection plans, and provide technical assistance to these systems, which helps ensure that safe water is provided to people in Minnesota.
- **U. S. Environmental Protection Agency grants and set-asides:** EPA provides direct funding through grants to states and allows states to use a portion of the funds provided for Drinking Water State Revolving Fund (DWRF) programs to administer the requirements of the Safe Drinking Water Act and provide for source water protection.
- **Clean Water Fund:** On November 4, 2008, Minnesota voters approved the Clean Water, Land, and Legacy Amendment (Minnesota Constitution, Article 11, Section 15) to the constitution to *protect drinking water sources; to protect, enhance, and restore wetlands, prairies, forests, and fish, game, and wildlife habitat; to preserve arts and cultural heritage; to support parks and trails; and to protect, enhance, and restore lakes, rivers, streams, and groundwater.* The amendment specifies that at least 5 percent of the Clean Water Fund be dedicated to drinking water protection. The Minnesota Department of Health's initiatives supported by the Clean Water Fund mostly focus on source water protection.

Fiscal Year 2015 Drinking Water Budget: $17.8 million



Source: MDH internal data

MDH Drinking Water Protection Activities and # of MDH Staff Participants



Source: MDH internal data

Overall Goal

The Minnesota Department of Health has a goal of 97 percent of the state's population that is served by a community water system receives drinking water that meets drinking water standards. The goal has been reached and exceeded in recent years.

Year	%
2011	96.2 %
2012	99.0 %
2013	99.2%
2014	99.3%

Drinking Water Revolving Fund

The federal Drinking Water State Revolving Fund was established by Congress and is administered by EPA to help public water systems obtain financing for improvements necessary to protect public health and maintain compliance with drinking-water regulations. MDH, working through the Public Facilities Authority, provides below-market-rate loans to public water systems through its Drinking Water Revolving Fund (DWRF). In 2014, DRWF funded 22 projects totaling $31.2 million. For 2015, 99 projects, with a total cost of $183 million, are projected to move forward.

Since the program's inception in 1998, a total of $719 million in projects were funded through 2014.

Total Project Awards by State Fiscal Year

Fiscal Year	Number of Awards	Loans (millions)	Grants (millions)	Percent of Awards from Loans
1999	25	$42.40	$0.77	98%
2000	30	$40.46	$0.93	98%
2001	16	$18.62	$0.50	97%
2002	16	$16.96	$1.12	94%
2003	27	$52.22	$0.97	98%
2004	27	$71.87	$0.20	100%
2005	16	$36.96	$1.07	97%
2006	16	$21.04	$0.69	97%
2007	21	$87.26	$1.99	98%
2008	13	$22.79	$0.50	98%
2009	15	$24.63	$1.39	95%
2010	48	$81.67	$17.69	82%
2011	32	$75.21	$7.07	91%

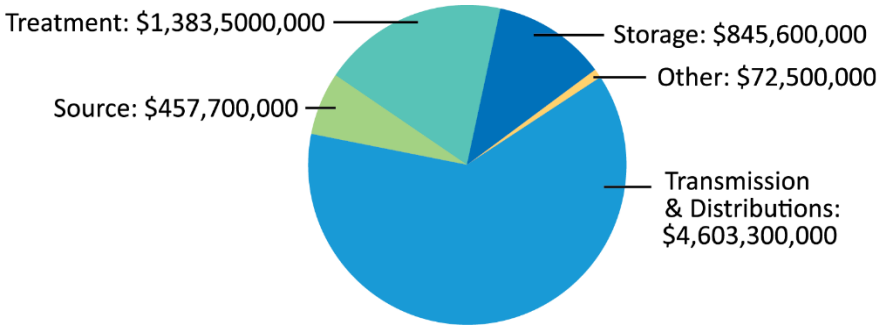
Fiscal Year	Number of Awards	Loans (millions)	Grants (millions)	Percent of Awards from Loans
2012	21	$42.57	$8.89	83%
2013	12	$6.08	$2.29	73%
2014	20	$25.45	$5.64	82%
2015	18	$58.97	$7.35	89%
Totals	**373**	**$ 725,26**	**$ 59.64**	**Average 92%**

Source: MDH internal data

Infrastructure Needs Survey

EPA conducts an assessment of the nation's drinking water infrastructure needs every four years and uses the findings to allocate funds for the states' Drinking Water State Revolving Fund programs. The most recent assessment results are reported in the 2011 Drinking Water Infrastructure Needs Survey and Assessment, which can be found at http://tinyurl.com/jwta7vw. The results of the survey determined that the 20-year drinking water infrastructure need for Minnesota is almost $7.4 billion. The pie chart shows a cost breakdown of the needs by project type (transmission/distribution, source, treatment, storage, and other).

20 Year Drinking Water Infrastructure Needs for Minnesota by Project Type
TOTAL NEED: $7.4 BILLION



Source: 2011 Drinking Water Infrastructure Needs Survey Assessment

Protecting Public Water Supply Investments in Infrastructure

Plan review and construction inspections are two key strategies for drinking water protection, to help identify potential problems that may allow contaminants to enter drinking water in wells, treatment, storage, and distribution systems (e.g., water mains). These also help protect financial investments in the infrastructure and are a cost effective way to identify problems before construction and operation.

Plan Review

Ensuring proper construction for new and renovated drinking water infrastructure is another way of preventing problems before they happen. The Minnesota Department of Health reviews plans and specifications for drinking water infrastructure projects, such as treatment plants, watermains, wells, and water towers. This protects public health, avoiding possible cross connections and improper treatment of water, helping consulting engineers and the water systems they advise to comply with construction standards and ultimately the Safe Drinking Water Act. It can also save companies and communities hundreds of thousands of dollars each year by having corrections made in the design phase rather than having to make costly modifications during the construction phase.

The totals for approved plans have risen steadily in the past few years, indicating growth following a recession.

A total of 480 plans for community water systems were approved in 2010, 432 in 2011, 587 in 2012, 639 in 2013, and 641 in 2014, broken down as follows:

- General water infrastructure, including water treatment plants - 40
- Storage facilities - 31
- Watermains - 546
- Wells - 24

Watermain approvals, a partial indicator of housing starts, increased from 360 in 2010 to 546 in 2014.

Construction Inspections

Since 1998, construction inspections have been completed for all Drinking Water Revolving Fund (DWRF) projects, with the exception of watermains. In 2012, MDH created a new position with the purpose of conducting inspections on non-DWRF funded projects. Based on the size of the project, both interim and final inspections are conducted. A breakdown of the number of construction inspections conducted in 2014 can be seen below.

Construction Inspections Conducted in 2014

	Interim	Final
DWRF	9	6
Non-DWRF	9	11
TOTAL	18	17

Source: MDH internal data

Monitoring Results for Calendar Year 2014

This is a summary of results of monitoring performed in 2014. In the case of a violation, a water system takes corrective actions. These actions include public notification to inform affected residents of the situation and if there are any special precautions they should take. In all cases noted here, residents were advised directly by the water system at the time the violation occurred.

All community water systems have also noted any violations in the annual water quality reports (also called Consumer Confidence Reports) they distribute to their residents. Information on a complete summary of monitoring results in 2014 is in the appendix.

Minnesota has about 960 community water suppliers, systems that serve water to people in their homes; most of these are municipal water systems. Other community water systems include manufactured home parks, housing developments, nursing homes, and prisons.

Minnesota also has about 6,000 noncommunity water suppliers, which serve water to people in places outside their homes. These can be schools and businesses that have their own water supply (that aren't on city water). They can also be resorts, restaurants, highway rest stops, and state parks.

Those, such as schools and businesses that serve the same group of people every day and are known as *nontransient* noncommunity systems. Those that serve different people each day are *transient* noncommunity water systems. Nontransient systems are monitored for the same group of contaminants as community water systems because the same people drink the water for extended periods of time. Though larger in number of systems, transient noncommunity systems do not need to be monitored as extensively as nontransient systems. Since they serve different people on a day-by-day basis, transient systems need to be sampled only for coliform bacteria and nitrate, contaminants that can cause immediate illness.

Pesticides and Industrial Contaminants

During 2014, MDH conducted 20,946 tests for pesticides and industrial contaminants in community water systems. No systems violated drinking water standards for these contaminants.

MDH conducted approximately 1,200 tests for pesticides and industrial contaminants in the 600 nontransient noncommunity water systems in the state. No systems violated drinking water standards for these contaminants.

Bacteriological Contamination

Eleven community systems, including 8 municipal systems, tested positive for bacteriological contamination in 2014

Standard procedures were followed in all of these cases. Systems were disinfected, flushed, and retested to ensure that any contamination problems had been eliminated. All of the residents served by the affected systems were informed of the situation.

The number of systems that tested positive for bacteriological contamination is in line with numbers from previous years.

All noncommunity water systems—transient and nontransient—are monitored for bacteriological contamination. There were 199 violations among the nearly 6,000 noncommunity systems, which worked with MDH staff to disinfect their systems and retest the water.

Nitrate/Nitrite

No community systems exceeded the standard for nitrate in 2014.

Fourteen noncommunity systems (transient and nontransient) exceeded the standard for nitrate in 2014. These systems notified the people who used the water, offering bottled water to those with infants, while working with MDH staff to remedy the problems.

Arsenic

Four community water systems, including 2 municipal systems, and 3 nontransient noncommunity water systems, exceeded the standard for arsenic by the end of 2014.

No restrictions were placed on water consumption although residents were notified of the situation. Residents were told that this was not an emergency situation and were advised to consult with their doctors if they have any special concerns. Each of these systems has either started or completed infrastructure changes or is studying alternatives to meet the maximum contaminant level (MCL).

For many years the MCL for arsenic in water was 50 micrograms per liter (µg/L) In 2006 the MCL was dropped to 10 µg/L. Systems that were in compliance with the previous MCL but had levels that would not comply with the revised standard began making plans and considering options for reducing their levels of arsenic. Approximately 40 systems were in this category. By management of the water supply and/or adding treatment, many have come into compliance with the stricter MCL. The others are continuing to work on the situation and have been communicating with their residents.

Radioactive Elements

Radiation occurs naturally in the ground, and some radioactive elements may work their way into drinking water.

Nine municipal water systems, exceeded the standard for radium 226 & 228 by the end of 2014; one municipal system exceeded the standard for gross alpha emitters.

No restrictions were placed on water consumption although residents were notified of the situation. Residents were told that this was not an emergency situation and were advised to consult with their doctors if they have any special concerns. Each of these systems has either started or completed infrastructure changes or is studying alternatives to meet the maximum contaminant level.

Noncommunity water systems are not regulated for radioactive elements.

Other Inorganic Chemicals

No community or noncommunity water systems exceeded the standard for inorganic chemicals in 2014.

Disinfection By-products

Two community water systems exceeded the standard for disinfection by-products in 2014. Both systems have resolved the issues and are now in compliance. No noncommunity water systems exceeded the standard.

Lead and Copper

As a result of the Lead and Copper Rule, implemented by the U. S. EPA in 1991, community water systems began sampling for lead and copper in 1992. These contaminants differ from others in that they are rarely present in source water. Rather, lead and copper may appear in water by dissolving from parts of the distribution system, often household plumbing. Monitoring for lead and copper is done in individual homes and on a case-by-case basis. Samples are taken after the water has been idle, resulting in elevated levels. If more than 10 percent of the homes sampled in a community are above the action level (15 parts per billion for lead and 1,000 ppb for copper), the water system will be in exceedance and must take corrective actions and begin an ongoing public education program. The actions include corrosion control measures, such as adjusting water chemistry to make it less corrosive or less likely to absorb lead and/or copper from the plumbing.

Since the initiation of the lead and copper monitoring program in 1992, more than 250 community water systems in Minnesota have exceeded the lead and/or copper action levels. Most systems have returned to compliance after implementing corrective actions; however, approximately 5 to 10 systems end each year with a lead or copper exceedance.

In 2014, 2 community systems exceeded the lead action level, and 23 community systems exceeded the copper action level; 6 noncommuity systems exceeded the lead action level, and 5 noncommunity systems exceeded the copper action level. These systems are exploring options for getting back into compliance and conducting a public education program. MDH continues to work with these systems and has been doing its own education campaign since the early 1990s with information about lead and copper and simple precautions, such as flushing faucets when the water hasn’t been used for several hours, people can follow to reduce their exposure.

Conclusion

Monitoring test results for 2014 are consistent with previous years. Although we need to remain vigilant, Minnesotans can continue to have confidence in their drinking water.

MDH remains committed to protecting the high quality of our drinking water. The safety of our drinking water should never be taken for granted—but Minnesotans can be assured that their local water supply system is making every effort to ensure that their water is safe. And they can also be assured that the Minnesota Department of Health—and the broader public health community—are working to ensure that their confidence is well placed.

Personal decisions regarding everything from the products we use and how land is managed for industry and agricultural will have a telling effect on the future of our environment and ultimately our drinking water.

Professionals in the water industry work every day to protect and maintain our drinking water, but this is a role that extends to every person who uses water—in other words, everyone.

Appendix

Summary of Safe Drinking Water Monitoring Results for Minnesota

The summary includes results for both community and noncommunity public water systems in Minnesota in 2014. Public water supply systems include all systems that serve 25 or more people on a regular basis, or that have 15 or more service connections. There are 6,887 such systems in Minnesota, including:

- 961 community systems, which provide water to consumers in their places of residence, including 729 municipal systems.
- 5,926 noncommunity systems, which provide drinking water in settings like factories, schools, restaurants, and highway rest stops.

A report that lists all violations of the Safe Drinking Water Act in Minnesota for calendar year 2014 is available from the Drinking Water Protection Section, Minnesota Department of Health, Box 64975, St. Paul, MN 55164-0975. This is also available at:

- http://www.health.state.mn.us/divs/eh/water/cinfo/dwar/summary2014.pdf [6 pg/93K]
- http://www.health.state.mn.us/divs/eh/water/cinfo/dwar/pwsid2014.pdf [80 pg/437K]
- http://www.health.state.mn.us/divs/eh/water/cinfo/dwar/contaminant2014.pdf [91 pg/471K]

Individual water systems produce an annual report listing contaminants that were detected, even in trace amounts, during the previous calendar year. The individual water system may be contacted for a copy of this report.

We acknowledge the many citizens, professionals, organizations, and agencies that work to protect and restore our water resources and provide safe drinking water to Minnesota citizens. Some areas in Minnesota have aquifers so pristine that at this time they require no treatment to provide safe drinking water. However, our ground and surface waters can be contaminated both by natural processes and by our human activities, and demand for water keeps increasing across Minnesota. It is because of the work of these people as individuals and as members of businesses, organizations, and government agencies that anywhere in Minnesota, citizens can feel confident that the drinking water provided by public water supplies meets all federal drinking water standards.

Our thanks to:

Minnesota Rural Water Association

American Water Works Association and its Minnesota Section

Local government staff including counties, townships, and municipalities

Nonmunicipal public water system staff and operators

Landowners

Business and industry owners

Food, beverage, and lodging facilities owners and staff

Manufactured housing development operators

Schools and churches

Treatment and correctional Facilities

Board of Water and Soil Resources

Minnesota Pollution Control Agency

Minnesota Department of Natural Resources

Minnesota Department of Agriculture

Metropolitan Council

Environmental Quality Board

Clean Water Fund

Public Facilities Authority

Elkay

H2O for Life

U. S. and Minnesota Geological Survey

Minnesota Ground Water Association

Minnesota Water Well Association

Suburban Utility Superintendents Association

Water Resource Programs at Vermilion Community College, St. Cloud Technical and Community College, and the University of Minnesota

Association of State Drinking Water Administrators

U. S. Environmental Protection Agency

Safe Drinking Water Is Everyone's Job

Nitrate Contamination and Community Public Water Supply Systems

The table below lists community public water supply systems (PWS) with nitrate in their source water equal to or greater than the federal Maximum Contaminant Level (MCL) of 10 mg/L, and actions taken to provide drinking water that meets that federal standard. The table includes cost estimates based on the number of households served by the PWS.

Community PWS with source groundwater above 10 mg/L (January 1, 2011 to current)	Population (2013)	Past and Potential Future Actions	Estimated Capital Cost per Household (2013 dollars)
Adrian	1209	Wells sealed and treatment plant built.	$3,300
Brookhaven Development, Shakopee	45	Potential future new well.	$3,300
Chandler	270	Potential future hookup to LPRWS*.	Unknown
Clear Lake	525	Treatment plant to be replaced.	$7,600
Cold Spring	4,053	Potential new wells.	$1,100
Edgerton	1,189	Treatment plant built.	$3,400
Ellsworth	463	Well sealed and treatment plant built.	$3,500
Hastings	22,335	Treatment plant built.	$410
Leota	209	Interconnect to LPRWS* installed.	Unknown
Lincoln-Pipestone Rural Water System	12,271	Potential blending wells and treatment plant improvements.	$170
Park Rapids	3,709	Wells sealed, new well constructed, and treatment plant built.	$3,000
Rock County Rural Water System	2,256	Transmission main built to blend wells.	$44
Saint Peter	11,196	Treatment plant built.	$1,600
Shakopee	37,076	Transmission main built to blend wells.	$7
Sundsruds Court, Menagha	40	Treatment installed.	$430

*LPRWS = Lincoln Pipestone Rural Water System

The following lists community public water supply systems with source water nitrate levels in the 3 to 10 mg/L range that are working with the Minnesota Department of Health to slow or reverse nitrate pollution in their public water systems.

Altura 493

Atwater 1133

Austin Mobile Home Park 59

Balaton 645

Becker 4720

Bethany Water Company 60

Brookhaven Development 45

Chandler 270

Cold Spring 4053

Darfur 87

Elgin 1089

Glenwood 2594

Goodhue 1176

Hastings 22335

Kjellberg's 1000

Lewiston 1620

Melrose 3632

Mobile Manor Mobile Home Park 140

Oak Grove Mobile Home Park 60

Randall 600

Rice 1279

Rosemount 21000

Sauk Rapids 13083

Shakopee 3707

Utica 291

Valley Mobile Home Park 34

Verndale 559

Austin Utilities 24854

Battle Lake 875

Big Lake 10060

Bonnevista Terrace Mobile Home Park 800

Brownsdale 676

Canton 346

Chatfield 2794

Clearwater Well Company 65

Hiawatha Estates, Subds. I, II & III 95

Isanti Estates 267

Kasota 670

Kellogg 469

Lake City 5339

Lake Elmo 3216

Little Norway Trailer Court 60

Luverne 4709

Mankato 39624

Milan 369

Moose Lake 1259

Oak Park Heights 4654

Paynesvfille 2298

Perham 3000

Pine River 944

Pipestone 4317

Plainview 3340

Rockwood Estates 400

Roosevelt Manor 60

Roscoe 114

Saint Paul Park 5419

Scandia Water Company 35

Spring Grove 1330

Stillwater 18464

Timberlane Estates 64

Vermillion 451

Walker 941