

VILLAGE OF BEAR LAKE, MICHIGAN WELLHEAD PROTECTION PROJECT

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“What lies beneath?

DEQ: Some Groundwaters tainted with nitrates in Manistee, Mason counties; several homes affected.”

High levels of nitrates flowing in underground plumes have found their way into the drinking water of several Manistee and Mason counties.

The organic contaminant has been detected in excess of the Michigan Department of Environmental Quality (DEQ) standards of 10 parts per million (ppm) in 13 private wells between the two counties.

Bottled water from the state's Emergency Drinking Water Fund has been provided to residents at some of the wells, and in seven cases, new wells have been dug to lower depths to tap waters from the clean aquifers.

"Nitrates at levels over 10 parts per million are of concern to us." said Jim Lerg, Environmental Health Manager. District #10 Health "You wouldn't want to feed this stuff to infants."

Large amounts of nitrate in drinking water are a cause of a disease called methemoglobinemia, a blood disorder that renders the hemoglobin in an individual's red blood cells less capable of transporting oxygen from the lungs to the rest of the body. It primarily affects infants under six months of age.

Disputed research has also linked nitrates to stomach cancer, birth defects, hypertension, enlarged thyroid gland and lymphoma.

Because its origin typically lies in sewage disposal systems, run-off from barnyards, fertilized fields, and industrial waste, nitrates can also indicate the presence of other contaminants.

In Manistee and Mason counties, the DEQ has fingered a source that combines both fertilizers and industrial waste - the historic land application of secondary sludge produced by the Packaging Corporation of America's Filer City mill.

From 1986-1997, the nitrogen-rich by product of the plant's cardboard making process was used to fertilize garden plots, fields, golf courses and nurseries. [Click here to view a map of sludge distribution](#)

"The thought behind it was 'here is some organic rich material that will help the soil retain moisture,' said DEQ geologist William Duley. "Between the two counties, it was applied to literally hundreds of sites. The MDEQ believes that the high levels of the nitrates at two sites emanates from the sludge applied fields."

This spring, the DEQ directed District #10 Health Department officials to sample all wells within a quarter mile of 52 sites that received 100 or more truckloads of the sludge.

"Some sites had quite a bit of the stuff dumped on there; those that received the higher amount of industrial sludge were targeted for sampling," said Lerg. "We were instructed to take samples within a

quarter mile of the dump site in the supposed direction of groundwater flow. In some cases, we did exceed that quarter mile based on judgment.”

Manistee County Areas of concern

In Manistee County out of 180 possible samples, 114 were tested, and seven tests came back with nitrate levels of 10 ppm or higher.

While this isn't a high percentage overall, there are places in the county that would be considered "areas of concern," Lerg said. "For the most part, most of the wells sampled have pretty good water quality but there are areas of where nitrates might be an issue," he said.

Manistee's municipal system is not one of them due to the amount of nitrate testing required by the state, Lerg added. According to City of Manistee Water Department secretary Cathy Boyle, the City tests for nitrates on the first and second Mondays and Wednesdays of every month at five wells in town, including one at the Manistee Blacker Airport.

"We've never had a problem with high nitrates," Boyle said. "Hardness maybe, some chloride levels, but not nitrates."

Monthly or annual testing is not required of private residents, and few take the initiative unless they suspect something is wrong.

Problem first detected in 1999.

It was a required test needed for a real estate transaction on West Fox Farm Road that first indicated a problem in 1999, when former Filer Township residents Stephen and Cindy McLintock had moved to Traverse City and were trying to sell their home. Their test returned levels of nitrates almost three times the amount allowed by the DEQ.

While living on Fox Farm Road, Cindy McLintock gave birth to a child three months early who died of asphyxia due to extreme prematurity. The family later took the Hramor Tree Farm across the street and PCA to court, maintaining that the loss of their child was due to the nitrates in the water caused by the overapplication of sludge on the farmer's property. The case was settled out of court in May 2002, but the fallout prompted an onslaught of further DEQ testing at former sludge dump sites.

Since then, two tree farms — the Hramor Tree farm on West Fox Farm Road, and a former PCA/ Tenneco tree farm on Nine Mile Road in Onokama have been rendered "contaminated" due to the high concentration of nitrates in the groundwater. A hay field on Free Soil Road has also been targeted as a possible contamination site.

Hramor Tree Farm owner:- Mike Morin now has 30 test wells currently monitoring nitrate levels on his property, as stipulated by the DEQ. Between 1984-1996, he applied over 3,000 loads of secondary sludge to his seedlings. "You could see a visible benefit," Morin said. "We would grow small trees from seed and they would be taller and healthier because of the moisture and the nutrient retention. At the time it had nothing to do with groundwater. We always felt good about what was going on."

But while the land applications of the secondary sludge was permitted through a Program for Residuals Management (PERM) issued by the Surface Water Quality Division of the MDEQ, possible violations may have occurred at Morin's and other sites, Duley said. "The permit contained a number of criteria such as setbacks from roads, wells, steep slopes, surface water and homes. Part of the criteria was that PCA could not contaminate the groundwater. That they violated that portion of the permit is truly the case," Duley said.

[a map of sludge distribution is available on this web site](#)

While PCA chose not to comment, correspondence signed by PCA Environmental Manager Rick Brown indicates that the plant "does not believe the biosolids application is the source of elevated nitrates in drinking wells."

"PCA is not convinced that it's their problem and they have their own studies saying that the sludge wouldn't be harmful," Duley said. The "lack of cooperation" from the plant has prompted the DEQ to initiate an enforcement action against the mill to recover costs for the well drilling, water testing and bottled water that the DEQ has already incurred.

The agency will also ask for future funding to perform tests on other sites that had the sludge application. Fines of up to \$25,000 per day for every day the plant was not in compliance with the permit can also be imposed, said DEQ Water Division Enforcement Specialist Rick Ruzs.

"We know of two sites where PCA was directly responsible, and we don't believe that we're getting complete cooperation with the party" Ruzs said. "Our unit's responsibilities is to take the next step beyond that."

A 1999 change of ownership, of the plant from Tenneco, Inc. to its subsidiary Tenneco Packaging (now called "PacTiv") has complicated matters, but the DEQ will pursue action against both current and former owners of the plant. They have also put the Hramor Tree Farm on notice.

Attorney General could get involved.

If they cannot reach an agreement with the plant and the landowner, they may refer the case to the State Attorney General's Office, Ruzs said. In the meantime, the DEQ is still in the process of investigating the contamination in both counties and Duley expects that they will have more information in the next six months. "We want to get a good database and find out where the hot spots are," Duley said. "We want to make sure that we have all the facts and get those who need to be on safe water. We are plowing through the data to make sure that we're doing things in a safe, thorough matter."

Nitrates are a fairly common problem in Michigan due to the amount of agriculture in the state, he added. There are so many nitrates that a Jan. 2001 Michigan Department of Agriculture (MDA) Domestic Supply Well Baseline Study Report considers them the "most widespread pollutants found in the state's groundwater."

Though opinions diverge on whether the allowable standard of 10 ppm is too much or not enough protection, cases of 10 ppm levels or higher are on the rise, according to the Michigan Environmental Council (MEC).

The environmental watchdog organization maintains that levels over the legal limit have tripled in recent years. As about half of Michigan's residents get their water from private wells, dangerous levels of nitrates could potentially impact 100,000 people, the MEC said.

But Lerg said that while these numbers should not cause a panic, they should generate awareness, especially in areas of Manistee and Mason Counties that may have had a large amount of sludge applied to the land.

While the sanitarians tested many sites, they had to leave door hangers on others, and pinpointing the direction groundwater flows is always considered a "guessing game," he said. "Time has elapsed and groundwater moves," Lerg said. "I don't think there's a fire storm going on, but in certain areas, people should get their water sampled."

For information on well water testing, contact the Manistee County District #10 Health Department at (231) 723-3595.

The department will provide bottles free of charge for testing within the designated areas. Other tests will be assessed a \$14 fee, plus postage.

Questions And Answers

What is nitrate?

Nitrate (NO₃) is a form of nitrogen combined with oxygen. It can be converted in the body to nitrite (NO₂). The major adult intake of nitrate is from food rather than water; but sometimes excessive amounts of nitrate get into drinking water.

How does nitrate get into drinking water?

It can get into drinking water if a well is improperly constructed, or located where it is subject to contamination sources. Typical sources of nitrate include; sewage disposal systems, run-off from barnyards or fertilized fields, industrial wastes, or nitrates that are naturally occurring in the soil, as found in some parts of Michigan.

What illnesses can nitrate cause?

Large amounts of nitrate in drinking water are a cause of a disease called methemoglobinemia, a blood disorder primarily affecting infants under six months of age.

Also, because nitrate contamination can be related to human, animal, or industrial waste practices, excessive levels of nitrate in drinking water may indicate potential for the presence of other types of contaminants which may cause health problems.

What is Methemoglobinemia?

Methemoglobinemia is a condition in which the ability of the red blood cells to carry oxygen is reduced. The acutely poisoned person will have a blue discoloration of the skin due to the reduction of oxygen in the blood system and must be attended by a physician immediately.

Why are infants more susceptible than adults to nitrate-induced methemoglobinemia?

There are four reasons.

One: Infants have a lower stomach acidity which allows growth of bacteria capable of converting nitrate to nitrite. Nitrite can change hemoglobin to methemoglobin which cannot carry oxygen.

Two: Young infants still have considerable amounts of fetal hemoglobin which is more easily converted to methemoglobin than the adult hemoglobin.

Three: Infants are deficient in certain enzymes that are able to convert methemoglobin back to normal hemoglobin.

Four: In relation to body weight, an infant consumes a much larger volume of water than an adult.

What is "excessive" nitrate?

The United States Environmental Protection Agency (EPA) has established a Maximum Contaminant Level (MCL) value for nitrate (as nitrogen) at 10 milligrams per liter (mg/l) and nitrite at 1.0 mg/l for public water system. The Michigan Department of Environmental Quality has adopted these standards. Public water supplies with nitrate levels above 10 mg/l or nitrite above 1 mg/l are required to notify the health department and take corrective action. Private water supply owners with excessive nitrate or nitrite should contact their local health department or family physician for assistance.

Is there a treatment for the removal of nitrate from drinking water?

The technology for removal of nitrate from drinking water does exist. Reverse Osmosis, ion exchange and distillation are three possible methods. This equipment requires frequent, careful maintenance and sampling to achieve and confirm effective operation. Improperly installed, operated, or maintained, equipment can result in nitrate passing through the treatment process and in some cases concentrating the nitrate above the incoming levels.

Bacteriological problems can also develop in improperly installed and poorly maintained systems.

Therefore, it is the position of the Michigan Department of Environmental Quality that an alternate source of drinking water that meets the nitrate standard be developed where possible. The local health department should be consulted for information on deepening wells or changing aquifers to reduce nitrate

levels. If a nitrate removal system is to be used, one with National Sanitation Foundation (NSF) or equivalent certification should be selected. Public water systems must obtain health department approval prior to installing this type of treatment equipment.

Boiling water will not remove nitrate and may concentrate it.

How often should samples be collected?

All community and noncommunity public water supplies using groundwater are required by law to sample at least once every year for nitrate and once every three years for nitrite.

If results exceed 5 mg/1 for nitrate or .5 mg/1 for nitrite, quarterly sampling (one sample every three months) is required. Private water systems are not generally required to sample for nitrate on a routine basis. However, if nitrate contamination is known to the area, or a sample indicates nitrate or nitrite levels approaching the drinking water standards, periodic sampling is recommended.

Can a water supply be properly evaluated on the basis of one laboratory analysis for nitrate?

No. For example, a sample may be collected during dry weather from a poorly located and improperly constructed well near a barnyard, and found to contain little, if any nitrate. The same well sampled following a rain could contain a nitrate concentration of 100 mg/1, or more. Therefore, a sanitary survey is necessary to fully evaluate the supply and determine what may be done to eliminate or reduce the nitrate contamination. Such a survey includes information of the well depth, construction, location from potential sources of contamination, area geology and groundwater quality. Periodic sanitary surveys are required for community and non-community public water systems.

What kind of container should I use for collecting a sample for nitrate determination?

Any laboratory certified for nitrate analysis of drinking water can provide you with the proper container. The regular partial chemical sample container furnished by the Michigan Department of Environmental Quality is used by that lab for nitrate analysis. Local health departments have a supply of these bottles or they can be ordered directly from the laboratory. Ask for Unit 32 when ordering and indicate test code R when submitting a sample to the DEQ lab.

When a water sample is analyzed for nitrate, how are the results reported?

The state laboratory reports results to the person submitting the sample. Community and noncommunity public water supplies must always include their water supply serial number (WSSN) when submitting samples for analysis to insure proper identification. Nitrate results are reported to the Michigan Department of Environmental Quality as milligrams of nitrogen (N) per liter of water (mg/1, N). Other labs may report milligrams of nitrate (NO₃) per liter of water (mg/1, (NO₃)). Nitrite is reported as NO₂. It is essential to know which units are used for reporting because they differ by a factor of 4.4. In other words, 10 mg/1, N can also be reported as 44 mg/1, NO₃. Most laboratory reports will indicate which unit is used.

REFERENCES

Drinking Water and Health, Safe Drinking Water Committee, Advisory Center on toxicology, Assembly of Life Sciences, National Research Council, National Academy of Sciences; Washington, D.C, 1977, Library Of Congress Catalogue Card Number 77-089284, pp. 441-425.

Winton, E.E., Tardiff, R.G., and McCabe L.J., Nitrate in Drinking Water, Jour AWWA, 63:95 (January 1971)

For more information contact the Michigan Department of Environmental Quality PO. Box 30630, Lansing, Michigan 48909-8130, your local health department or your physician. EQC2033 Authority: 1978 PA 368

[The State of Michigan Wellhead Protection Program](#) (WPP) is designed to protect the integrity of current and future water supply for the Village of Bear Lake.

The Village relies on two wells drilled in to a primary aquifer. The WPP seeks to determine from which direction our water supply reaches the wells which in turn will help identify any future potential for contamination and help plan for future water wells and land use.