Health Consultation

Nitrite Generation in a Granular Activated Carbon Filter

BAYTOWN TOWNSHIP GROUNDWATER CONTAMINATION SITE

WASHINGTON COUNTY, MINNESOTA

EPA FACILITY ID: MND982425209

NOVEMBER 9, 2007

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

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Prepared By:

The Minnesota Department of Health
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry
U.S. Department of Health and Human Services

FOREWORD

This document summarizes public health concerns at a groundwater contamination site in Minnesota. It is based on a formal site evaluation prepared by the Minnesota Department of Health (MDH). A number of steps are necessary to do such an evaluation:

- Evaluating exposure: MDH scientists begin by reviewing available information about environmental conditions at the site. The first task is to find out how much contamination is present, where it is found on the site, and how people might be exposed to it. Usually, MDH does not collect its own environmental sampling data. We rely on information provided by the Minnesota Pollution Control Agency (MPCA), U.S. Environmental Protection Agency (EPA), and other government agencies, businesses, and the general public.

- Evaluating health effects: If there is evidence that people are being exposed—or could be exposed—to hazardous substances, MDH scientists will take steps to determine whether that exposure could be harmful to human health. The report focuses on public health—the health impact on the community as a whole—and is based on existing scientific information.

- Developing recommendations: In the evaluation report, MDH outlines its conclusions regarding any potential health threat posed by a site, and offers recommendations for reducing or eliminating human exposure to contaminants. The role of MDH in dealing with individual sites is primarily advisory. For that reason, the evaluation report will typically recommend actions to be taken by other agencies—including EPA and MPCA. However, if there is an immediate health threat, MDH will issue a public health advisory warning people of the danger, and will work to resolve the problem.

- Soliciting community input: The evaluation process is interactive. MDH starts by soliciting and evaluating information from various government agencies, the organizations responsible for cleaning up the site, and the community surrounding the site. Any conclusions about the site are shared with the groups and organizations that provided the information. Once an evaluation report has been prepared, MDH seeks feedback from the public. *If you have questions or comments about this report, we encourage you to contact us.*

Please write to: Community Relations Coordinator
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I. Summary of Background and History

The Baytown Township Groundwater Contamination site (the site) was first discovered in 1987, and investigation and response actions by state and local entities have been ongoing since that time. The site is primarily the result of the disposal or spillage of a relatively large quantity of trichloroethylene (a.k.a. trichloroethene, or TCE) at what was once a metal fabricating shop located in the city of Lake Elmo; other minor sources may also exist. The site consists of an area of groundwater contamination that is in excess of six square miles, and affects four major groundwater aquifers. MDH has enacted a Special Well Construction Area (SWCA) at the site to regulate the construction of new wells. The boundaries of the SWCA, which essentially define site, are shown in Figure 1. Also shown in Figure 1 are the location of the suspected source and the Lake Elmo Airport, a major surface feature at the site.

Several hundred private water supply wells in Baytown and West Lakeland Townships and the City of Bayport have been impacted by the TCE contamination. The highest current concentration of TCE in a private well (approximately 100 micrograms per liter; μg/L) has been found at the Lake Elmo Airport. Exposure to TCE above health-based criteria in private wells [e.g. the MDH Health Risk Limit (HRL) of 5 μg/L] is currently being prevented by requiring property owners to have new private water supply wells constructed to deeper, clean aquifers where possible, or by large, whole-house granular activated carbon (GAC) filtration units for existing private wells and new private wells where a clean aquifer is not available or feasible and concentrations of TCE exceed the HRL.

GAC filters are typically provided by the Minnesota Pollution Control Agency (MPCA). However, for wells on properties platted after April 9, 2002, GAC filters are not provided by the MPCA. To protect public health in these cases, Baytown and West Lakeland Townships, with the assistance of MDH, enacted ordinances to ensure that newer homes not provided GAC filters by the MPCA will have appropriate GAC filter systems installed and maintained by the homeowners. To date, approximately 170 GAC systems are in place on private wells in Baytown and West Lakeland Townships and the City of Bayport due to levels of TCE above the HRL, and are being tracked and managed by the MPCA or the two townships. Additional private well owners with levels of TCE below the HRL have installed GAC filter systems on their own.

General information on the geology and hydrogeology of the area, previous investigations, and past response activities at the site were most recently summarized in a Public Health Assessment (MDH 2004). Further response actions by the MPCA at the source of the TCE contamination are under consideration and will be evaluated in an upcoming Health Consultation. This Health Consultation will focus on an issue that has arisen with the use of GAC filter systems as a long-term response action for TCE contamination in private wells.

Public Well Sampling at the Lake Elmo Airport

Several wells impacted by the TCE contamination at the Baytown site are regulated as public water supplies by the MDH Drinking Water Protection (DWP) program. Two such wells are located at the Lake Elmo Airport, and serve commercial businesses, or other organizations at the airport. One of these wells serves the St. Croix Civil Air Patrol (Hangar 39E) at the Lake Elmo Airport. This well (unique well number 575604) was installed in 1996, is 71 feet deep, and draws water from the relatively shallow surficial groundwater aquifer. Because it was known when the well was installed that it would likely be contaminated with TCE, MDH, the Metropolitan Airports Commission (MAC), and the St. Croix Civil

Air Patrol agreed that the well would not be used for drinking or cooking purposes, and that the taps would be posted as such. Bottled water is provided by the St. Croix Civil Air Patrol for drinking and cooking purposes. This was deemed an acceptable approach as the hangar is used for weekly meetings of the St. Croix Civil Air Patrol and intermittently for other activities. Water from the well is used primarily for flushing toilets, washing dishes, and general cleaning such as floor mopping. As a result, water use is reportedly very low, averaging only a thousand gallons per year or less. In contrast, MDH typically assumes that average home water use is approximately 300 gallons per day, or over 100,000 gallons per year.

The most recent sample for volatile organic compounds (VOCs) from the well, collected in April of 2004, had a TCE concentration of 14 μg/L. The level of TCE in the well has been relatively consistent over time. Because the level of TCE is higher than MDH health-based criteria, the well was fitted with a large GAC filter system by the MPCA in July of 2002. This was done even with the understanding that water is not to be used for drinking or cooking to prevent exposure from inhalation or dermal contact. The GAC filter system consists of two 90-pound cylinders of GAC in series, and has been in place and operating since it was installed in 2002. A schematic diagram and photograph of the GAC filter system at the St. Croix Civil Air Patrol hangar are shown in Figure 2.

Nitrite-Nitrogen Testing

Under the federal Safe Drinking Water Act (SDWA), source water wells serving public water supplies must be sampled for nitrite-nitrogen at least once, usually during the first inspection by MDH staff. Nitrite is occasionally found in the environment, but is more commonly produced by the bacterial conversion of nitrate (NO_3), a common contaminant in groundwater from natural and man-made activities, to nitrite (NO_2). The Discussion section below presents more information about nitrate and nitrite in the environment, and the potential public health concerns. In April of 2006, MDH staff collected a routine water sample for analysis at the MDH Public Health Laboratory for total nitrite-nitrogen from the well at the St. Croix Civil Air Patrol. A sample was also collected for total nitrate + nitrite nitrogen. The samples were collected post-GAC treatment; that is after the water had passed through the GAC filter system.

Surprisingly, total nitrite-nitrogen was detected after the GAC filter, at the point the water enters the distribution system, at a concentration of 1.1 milligrams per liter (mg/L). This unusual result (which had not before been seen in a well of this type by MDH DWP staff) exceeded the EPA Maximum Contaminant Limit (MCL) for total nitrite of 1.0 mg/L, initiating further investigation. The MCL for total nitrate-nitrogen is 10 mg/L. Over the next year, additional samples were collected by MDH to track the nitrite level over time and try to determine the source. The data from these sampling events were as follows:

Table 1: MDH Monitoring Data, 2006-07, Hangar 39E

Sample Date	Sample Location	Analysis	Result (mg/L)
4/21/2006	Post-GAC Filter	Nitrate + Nitrite Nitrogen, Total	2.7
		Nitrite-Nitrogen, Total	1.1
4/25/2006	Post-GAC Filter	Nitrite-Nitrogen, Total	1.2
		Ammonia Nitrogen, Total	<0.05
5/2/2006	Pre-GAC Filter	Nitrite-Nitrogen, Total	<0.01
	Between GAC Filters	Nitrite-Nitrogen, Total	0.06
	Post-GAC Filter	Nitrite-Nitrogen, Total	0.92
9/1/2006	Pre-GAC Filter	Nitrite-Nitrogen, Total	<0.01
	Post-GAC Filter	Nitrite-Nitrogen, Total	0.68
3/13/2007	Pre-GAC Filter	Nitrite-Nitrogen, Total	<0.01
	Post-GAC Filter	Nitrate + Nitrite Nitrogen, Total	4.7
		Nitrite-Nitrogen, Total	1.4

The total nitrite-nitrogen level fluctuated somewhat over the course of the year. Ammonia nitrogen was determined not to be contributing to the results, and nitrite is not present in the raw well water. Two separate tests for coliform bacteria in the distribution system were negative. Nitrate is commonly detected in private wells in this area of Washington County due to the geology of the area and the aquifers used for drinking water wells, and the many (mainly man-made) sources of nitrate, including past agricultural activities. In fact, nitrate above 5 mg/L had been detected previously in two wells serving a commercial aviation business and the MAC maintenance facility at the Lake Elmo Airport.

It appeared that the nitrite was being produced in the GAC filter system, presumably from the conversion of nitrate in the raw well water to nitrite. It also appears that the nitrite is being generated primarily in the second GAC vessel, as evidenced by the very low nitrite level between the two GAC units in the May 2006 sample. It was suspected that the extremely low water use of this well allows water to remain in the GAC vessels for long periods of time, resulting in bacterial growth. Certain bacteria (which are not detectable using a standard coliform bacteria test) can convert nitrate to nitrite.

Because of the continued exceedance of the MCL for total nitrite-nitrogen, on April 11, 2007, MDH issued a formal Notice of Violation (NOV) to the St. Croix Civil Air Patrol. The NOV required that the St. Croix Civil Air Patrol cease using the water for drinking or cooking purposes (which was a condition of installing the well), that a notice be posted warning people that the water was contaminated (see Figure 3), and that alternate water be provided until the problem was remedied. It also proposed several possible remedies, including:

- Connection to a community water supply;
- Construction of a new well;
- Reconstruction of the existing well;
- Blending the water with a clean source; or
- Treatment to remove the nitrite.

Because the nitrite exceedance was a result of a treatment system installed by another public agency to correct a different contamination issue, MDH has refrained from further enforcement action against the St. Croix Civil Air Patrol to allow for further study of the situation and ultimately, correction of the problem.

On July 11, 2007, MPCA and MDH staff again collected samples from the well and GAC system at the St. Croix Civil Air Patrol Hangar 39E, and a private hangar (11E) known to have lower than average water use. Samples were collected by an MPCA contractor for total nitrite-nitrogen, nitrate-nitrogen, and ammonia-nitrogen. To determine if purging some water (approximately 25 gallons) through the GAC system would have an effect on nitrite levels, samples were collected both before and after purging. The samples were analyzed by Interpoll Laboratories, Inc. in Circle Pines, Minnesota. The data were as follows:

Table 2: MPCA Monitoring Data, 7/11/2007

Hangar	**Sample Location**	**Analysis**	**Result (mg/L)**
39E	Post-GAC Filter Initial Sample	Nitrite-Nitrogen, Total	1.5
39E	Post-GAC Filter, 2 Minutes Purge	Nitrite-Nitrogen, Total	1.4
39E	Pre-GAC Filter 12 Minutes Purge	Nitrite-Nitrogen, Total	<0.1
		Nitrate-Nitrogen, Total	4.4
		Ammonia-Nitrogen, Total	<0.05
39E	Post-GAC Filter 12 Minutes Purge	Nitrite-Nitrogen, Total	1.3
		Nitrate-Nitrogen, Total	5.2
		Ammonia-Nitrogen, Total	<0.05
11E	Post-GAC Filter, Initial Sample	Nitrite-Nitrogen, Total	0.24
	Post-GAC Filter, 12 Minutes Purge	Nitrite-Nitrogen, Total	0.16
		Nitrate-Nitrogen, Total	6.4
		Ammonia-Nitrogen, Total	<0.05

The Hangar 39E results confirmed earlier MDH results, and indicate that flushing small volumes of water through the GAC filter has relatively little effect on nitrite levels (approximately 13% reduction). After twelve minutes of purging, the total nitrate level was higher in the post-GAC sample than in the pre-GAC sample, indicating that some conversion of nitrite back to nitrate was occurring as well. The Hangar 11E samples showed a much lower initial nitrite level, perhaps because overall water use is higher for this well, and it appears to pump water at a faster rate. Flushing this well for 12 minutes (approximately 70 gallons) resulted in a 33% reduction in total nitrite.

On July 26, 2007, MDH DWP staff returned to the St. Croix Civil Air Patrol hangar to collect additional samples for nitrite, nitrate, and other parameters that could further clarify what was occurring within the GAC system. The samples were collected after purging the GAC filter system for approximately 15 minutes (approximately 35 gallons of water). Some parameters were measured in the field using direct reading instruments (dissolved oxygen, pH, temperature); samples were also collected for analysis using field test kits (nitrite) and for analysis by the MDH Public Health Laboratory (total nitrite-nitrogen and total nitrate-nitrogen). Bacterial testing was conducted using simple test kits manufactured by Droycon Bioconcepts, Inc., Regina, Saskatchewan. These test kits consist of a test bottle that is incubated for a set period of time, and then visually examined to provide a semi-quantitative estimate of the bacterial activity in the water sample.

Table 3: MDH-DWP Monitoring Data, 7/26/2007, Hangar 39E

Parameter	Hangar 39E Raw Well Water	Hangar 39E Between GAC Filters	Hangar 39E After GAC Filter
Nitrite, field test, mg/L	0.005	0.102	0.353
Nitrite-Nitrogen, Total, mg/L (MDH lab)	<0.01	0.14	1.6
Nitrate-Nitrogen, Total, mg/L (MDH lab)	4.4	1.9	3.2
Denitrifying bacteria, cfu/ml[1]	N/A	200,000	200,000
Nitrifying bacteria, cfu/ml	N/A	1,000	100,000
Total bacteria, HPC[2], cfu/ml	N/A	N/A	164
pH	7.5	N/A	7.12
Dissolved oxygen, mg/L	7.13	N/A	0.27
Temperature, degrees celsius	12.7	N/A	12.6

[1] colony forming units per milliliter of water N/A = not analyzed
[2] Heterotrophic plate count

Laboratory nitrite-nitrogen and nitrate-nitrogen results were similar to previous samples. The field nitrite test kit appeared to underestimate the nitrite level, at least at the higher concentration in the after GAC sample. The most interesting aspect is the results for denitrifying bacteria, which show high numbers in both GAC cyclinders. These bacteria reduce nitrate to nitrite under low oxygen conditions - which are clearly present. Dissolved oxygen went from 7.13 mg/L in the raw well water to 0.27 mg/L after both GAC units. Interestingly, high numbers of nitrifying bacteria are also present in the second GAC unit, converting some of the nitrite back to nitrate as evidenced by the higher nitrate level after the second GAC unit than was found after the first GAC unit. These results overall confirm that bacteria capable of producing nitrite have colonized the GAC units, and that low water flow and long residence time is allowing the bacteria to convert nitrate present in the raw well water to nitrite, resulting in nitrite concentrations in the treated water above health-based regulatory criteria.

Private Well Samples

To further investigate whether nitrite generation could be occurring in GAC filter units installed in private homes, the MPCA directed their contractor to collect samples from four homes in Baytown Township where GAC filters had been installed, water use was reportedly low, and elevated nitrate had been previously detected in that well or neighboring wells. Washington County, as a service to their citizens, has a program where residents can have their well water tested for nitrate and coliform bacteria for a small fee. Washington County staff provided data from this program to MDH and the MPCA. The data show that elevated nitrate levels are present in Baytown and West Lakeland Townships, with nitrate levels in the 4-6 mg/L range being common, with some wells at levels in the 8-10 mg/L range. As of this time, results are available for two of the four private wells at the site. In the first well, nitrite was below detection limits in the post-GAC sample, indicating that water use is likely high enough to keep the GAC filter system flushed and prevent the growth of denitrifying bacteria. The nitrate level in the raw well water in this well was 5.7 mg/L. In the second well, nitrate was 5.1 mg/L in the raw well water; nitrite was detected at a concentration of 0.03 mg/L after the GAC filter. Further testing is planned, especially if the opportunity is presented to collect samples from a well that has not been in use due to an extended absence.

Site Visit

MDH Site Assessment & Consultation Unit staff participated in the collection of the July 11, 2007 samples at the Lake Elmo Airport, and have made numerous site visits to the Baytown site for sample collection, community meetings, and local government meetings.

II. Discussion

Evaluation of Toxicity and Exposure to Site Contaminants

Nitrate (NO_3) is a naturally occurring chemical found in air, soil, water, and plants. Much of the nitrate in our environment comes from decomposition of plants and animal wastes. Nitrate and other nitrogen compounds are also a major component of natural and man-made fertilizers. Nitrate in water is tasteless, odorless, and colorless. Nitrate can also be found in many food products, including meat, milk and dairy products, grains, fruits, and vegetables.

Natural levels of nitrate in Minnesota groundwater are usually quite low (less than 1 mg/L of nitrate-nitrogen). Elevated nitrate levels in groundwater are often caused by run-off from barnyards or feedlots, excessive use of fertilizers, or poorly constructed or failing septic systems. Nitrate levels can change over time, particularly if a well fails or its integrity is otherwise compromised. A study of over 850 private wells in the Midwestern U.S. by ATSDR and the Centers for Disease Control and Prevention (CDC) showed that nitrate levels remained stable in paired samples collected 16 months apart, indicating that frequent measurements of individual wells may not always be necessary (Ruckart et al 2007). This is supported by data collected by Washington County, which show that a few individual wells sampled over an extended time period have relatively little variation in nitrate levels. Nevertheless, both MDH and Washington County recommend that private well owners test their wells for nitrate every two or three years, especially if nitrate has been detected in the past. Private well owners are also recommended to have their well water tested annually for coliform bacteria, which can exacerbate the health effects of high nitrate and cause adverse effects on the gastrointestinal tract.

Wells most vulnerable to nitrate contamination include shallow wells, dug wells, and wells with a damaged, leaking casing or fittings. Nitrate contamination of a well is often regarded as a first sign of deteriorating groundwater quality.

Nitrite (NO_2) in the environment is typically produced through natural bacterial processes, from either nitrate (by denitrifying bacteria) or ammonia (by nitrifying bacteria). Nitrite is usually not stable in the environment. Nitrogen compound conversion processes occur constantly in the environment and are referred to as the nitrogen cycle. Nitrite is also present in many food products, including cured meats, baked goods, and vegetables.

Both nitrate and nitrite are absorbed quickly in humans, and also excreted quickly in the urine. Some absorbed nitrate (approximately 5-10%) is secreted in saliva and converted to nitrite by bacteria in the mouth (Mensinga et al 2003).

Exposure to nitrate or nitrite in drinking water primarily poses a risk to infants under six months of age. Bacteria present in an infant's digestive system can convert nitrate to nitrite. Nitrite can interact with the oxygen-carrying compound in blood, hemoglobin, reducing the ability of the infant's blood to carry oxygen. This condition is called "blue baby syndrome" (or "methemoglobinemia"). As the condition worsens, the baby's skin turns a bluish color, particularly around the eyes and mouth. If nitrate or nitrite levels in the water are high enough and prompt medical attention is not received, death can result. Blue baby syndrome has been known to occur after just one day of exposure to high nitrate water. As an infant matures, its stomach acidity increases, reducing the numbers of nitrite-producing bacteria. After six months of age, the conversion of nitrate to nitrite in the stomach is generally no longer a concern. There are others who may also be susceptible to nitrate/nitrite-induced methemoglobinemia, however, including pregnant women, people with reduced stomach acidity (due to disease or medication), and people with certain blood disorders. In addition, genetic factors could lead some individuals to be more susceptible to the effects of nitrate or nitrite in drinking water (Faustman et al 2000).

Nitrate in drinking water is usually thought of as being of low toxicity to healthy adults (Mensinga et al 2003). Adults in volunteer studies have consumed large amounts of nitrate with no ill affects. In fact, the average adult in the U.S. consumes about 20-25 milligrams of nitrate-nitrogen every day in food, largely from vegetables. The toxicity associated with nitrate exposure is usually believed to be from the conversion of nitrate to nitrite. From an epidemiologic standpoint, however, the potential health effects of chronic exposure to low levels of nitrate in drinking water has not been studied extensively, and further studies would be useful in determining if there is a relation between nitrate exposure in drinking water and cancer or adverse reproductive outcomes (van Grinsven et al 2006; Manassaram et al 2006). Ingested nitrate can ultimately be converted to n-nitroso compounds, many of which are known or suspected carcinogens.

The federal MCL for nitrate in public water supplies is 10 mg/L of nitrate-nitrogen. MDH has adopted the same value as its Health Risk Limit (HRL) for nitrate for private wells. These values are intended to protect newborns against blue baby syndrome. The MCL was established on the basis of several hundred reported cases of methemoglobinemia in the 1950s; because it was based on actual human exposure no uncertainty factors were used in its development (Manassaram et al 2006). Uncertainty factors are typically used to account for differences between animals and humans, and to account for individual

variability. The federal MCL for nitrite is 1 mg/L of nitrite-nitrogen. This value was derived by applying an uncertainty factor of 10 to the MCL for nitrate.

It is unlikely that significant exposure to nitrite levels above health concern has occurred at the St. Croix Civil Air Patrol hangar. Water from the well was never intended to be used for potable purposes, and bottled water has been provided for drinking and cooking purposes. However, if children below the age of six months consumed water with nitrite levels above the MCL, they could suffer from adverse health effects up to and including blue baby syndrome, even from a very short-term exposure.

This situation has identified the potential for nitrite generation under low water use conditions in GAC filter systems installed in a private home where infants could be present. Some 170 such filter systems have been installed in private homes at the Baytown Township Groundwater Contamination site by the state. In addition, approximately 50 identical systems are in place in private homes in a nearby area of Lake Elmo affected by perfluorochemical contamination in groundwater. An unknown number of GAC filter systems are in place on private wells in response to other contamination sites around the state of Minnesota. These filter systems are effective at reducing or eliminating chronic exposure to contaminants in water that could represent a long-term health risk. Carbon filters may also be used to help address taste and odor problems with water, or to remove hydrogen sulfide. The purpose of this document is to identify a potential concern (nitrite generation) with the use of these filter systems, and help prevent exposure to what could represent an acute short-term risk to infants or others susceptible to the effects of nitrite exposure.

With regards to the GAC filter system at the St. Croix Civil Air Patrol Hangar 39E, removing the whole-house GAC filter and replacing it with a smaller, single-canister GAC filter may remedy the situation. With a smaller canister, large volumes of water will not sit in the filter system for an extended time period, allowing bacteria time to convert nitrate to nitrite. It would also be easier to flush the system, helping to reduce the number of bacteria present. Such a system would have to be carefully monitored, however, to ensure the filter is changed at the appropriate interval. In the long-term, replacing the private wells at the Lake Elmo Airport with a community water supply, either from a single dedicated public water supply well or by connecting to an adjacent municipal water supply, would be a more effective solution. The MAC has proposed this as an alternative for evaluation in its draft long-term comprehensive plan for the Lake Elmo Airport (MAC 2007).

Child Health Considerations

ATSDR recognizes that the unique vulnerabilities of infants and children make them of special concern to communities faced with contamination of their water, soil, air, or food. Children are at greater risk than adults from certain kinds of exposures to hazardous substances at waste disposal sites. They are more likely to be exposed because they play outdoors and they often bring food into contaminated areas. They are smaller than adults, which means they breathe dust, soil, and heavy vapors close to the ground. Children also weigh less, resulting in higher doses of chemical exposure per body weight. The developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages. Most importantly, children depend completely on adults for risk identification and management decisions, housing decisions, and access to medical care.

It is not likely, given the use of the facility, that infants or small children were given water from the GAC filter system at the St. Croix Civil Air Patrol hangar.

III. Conclusions

The situation at the St. Croix Civil Air Patrol hangar has demonstrated that elevated nitrate in a private well that has been outfitted with a whole-house GAC filter system coupled with very low water use can result in the formation of nitrite within the filter unit at levels above health concern. More data are needed to better define these parameters and determine at what point(s) that the potential for nitrite generation becomes a real possibility. Because it is not known if exposure to nitrite in the raw well water at the St. Croix Civil Air Patrol hangar occurred, or to what extent the problem could exist in GAC filters installed at the Baytown site (or other sites), the situation represents an indeterminate public health hazard.

IV. Recommendations

1. The MPCA (or other responsible government entity) should ensure that all private wells where GAC filter systems are to be used are tested for nitrate and coliform bacteria in the raw well water if the well has not been tested by the owner within the last two years.
2. All whole-house GAC filter systems and fittings should be disinfected prior to filling with granular activated carbon.
3. The MPCA, their designated contractor, or other government entity should carefully monitor water use in each GAC filter system in place in a private well to identify for low-water use systems.
4. Low water use wells with nitrate concentrations above 3 mg/L should be tested for nitrite at least once.
5. Homeowners with wells where GAC filter systems have been installed should flush the system thoroughly (at least two filter bed volumes) after periods of extended non-use, such as vacations.
6. Because there is no way to know with certainty when nitrite generation is occurring, private well owners with GAC filter systems and elevated nitrate should not give water from those systems to pregnant women or infants.
7. The GAC filter system at the St. Croix Civil Air Patrol hangar should be replaced with a smaller, single-canister unit or other suitable treatment system.
8. In general, GAC filter units should be selected so that 1-2 bed volumes are flushed daily through the system based on average water use.
9. The Metropolitan Airports Commission (MAC) should proceed with its evaluation of replacing private wells at the Lake Elmo Airport with a public water supply.

V. Public Health Action Plan

MDH's Public Health Action Plan for the site will consist of:

1. A letter to the MPCA, MAC, city, county, and township authorities advising them of these conclusions and recommendations;
2. Communication with local residents, especially those with GAC systems; and

3. A review of any additional available data including water use data and nitrate information, and participation in any meetings or other public outreach activities.

VI. References

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CERTIFICATION

This Baytown Township Groundwater Contamination Site Health Consultation was prepared by the Minnesota Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was begun. Editorial review was completed by the Cooperative Agreement partner.

Trent LeCoultre
Technical Project Officer, SPS, SSAB, DHAC, ATSDR

The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health consultation and concurs with the findings.

Alan Yarbrough
Chief, State Program Section, SSAB, DHAC, ATSDR

Figure 1
Baytown Site Location and Special Well Construction Area

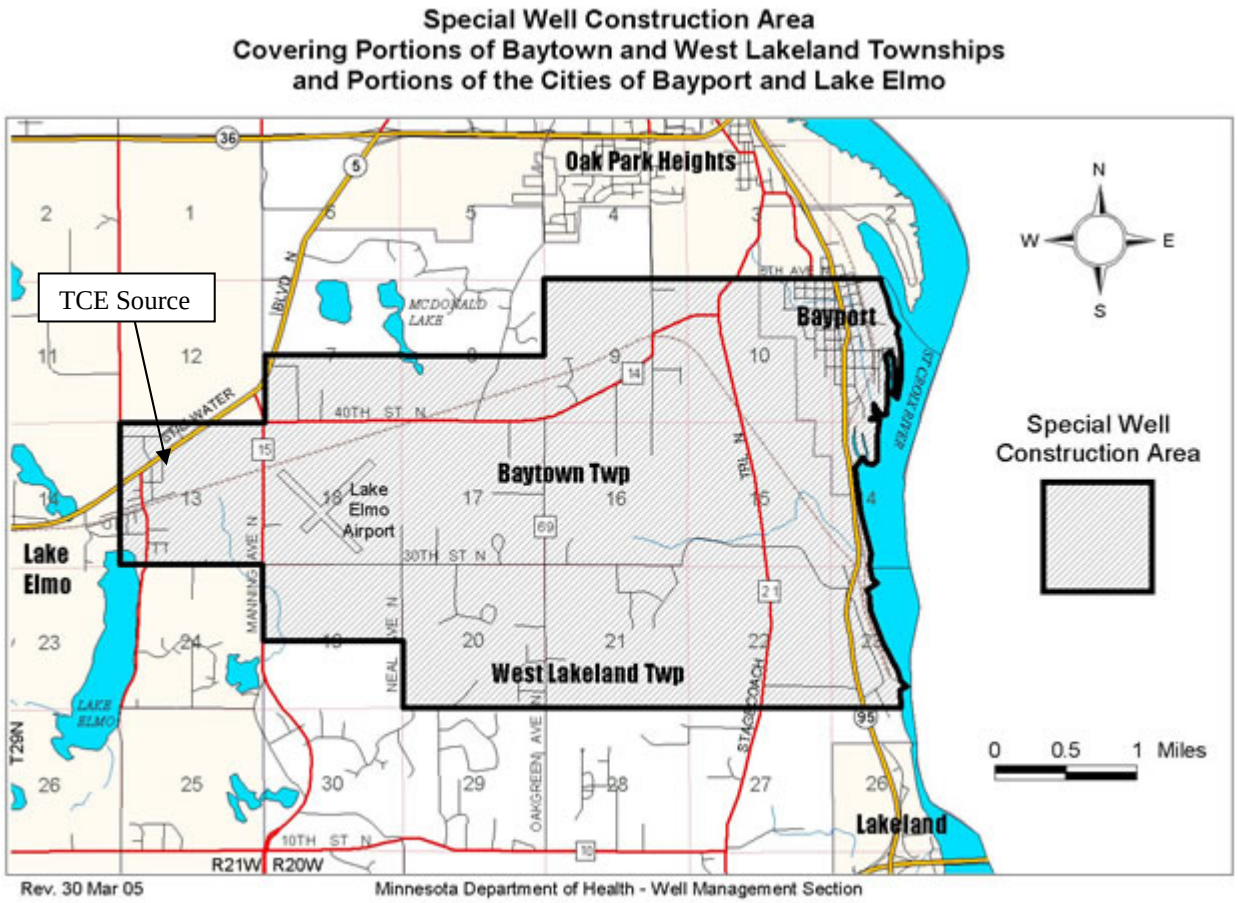

Figure 2

Schematic of GAC Filter and Photo of GAC Filter at St. Croix Civil Air Patrol

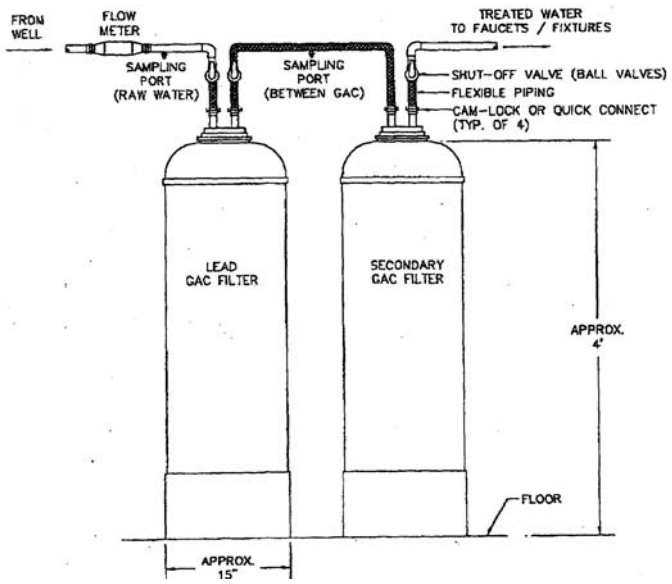

Figure 3: MDH Nitrite Notice

DRINKING WATER WARNING: Tests Show Elevated Levels of Nitrite

DO NOT DRINK THIS WATER

DO NOT USE THIS WATER FOR:

Drinking
Preparing Baby Formula
Preparing Other Beverages

For your safety, until the contamination problem has been corrected, safe drinking water is being provided as follows:

_____

_____

POSSIBLE HEALTH EFFECTS

Infants below the age of six months who drink water containing nitrite in excess of the maximum contaminant level could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue baby syndrome.

Symptoms in infants can develop rapidly, with health deteriorating over a period of days. Seek medical attention immediately if symptoms occur in a child less than six months old.

If you are pregnant or have other specific health concerns, you may wish to contact your doctor regarding the effects of nitrite in drinking water.

STEPS WE ARE TAKING

Until the contamination problem has been corrected, we are providing safe drinking water at the location listed above. The following steps are also being taken to correct the problem:

_____

_____

_____

If you have any questions, please contact us at:

_____

_____

MINNESOTA MDH DEPARTMENT OF HEALTH

Minnesota Department of Health
Drinking Water Protection Section
625 Robert Street North
St. Paul, MN 55155
651/201-4700

MDH Nitrite Public Notice