Water Well Educational Guide

District Health Department #2

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West Branch, MI 48661
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Recommended Reading
For On-Site Water Well Owners

Please take time to review this Water Well Educational Guide. This packet contains important information regarding the construction, operation and maintenance of your water supply system, and addresses important water quality issues and water sampling requirements.

Reducing the Risk of Groundwater Contamination by Improving Drinking Water Well Conditions Through Education

A. TYPES OF WELLS

1. Drilled wells (rotary and auger)
2. Driven wells (cable tool, jetted, etc.)
3. Dug wells (crock wells)

B. COMMON CAUSES OF WELL COMTAMINATION

1. Manmade contaminants that have entered the aquifer.
2. Naturally occurring contaminants in the aquifer.
3. Surface water contamination due to poor grouting.
4. Contamination from an improperly abandoned well.
5. A leaking fuel storage tank.

OTHER CONDITIONS THAT COULD AFFECT QUALITY OF WATER

1. Location of well.
2. Distances from potential contamination
3. Groundwater flow.
4. Water treatment devices.
5. Proper construction of the groundwater supply system.
6. Leaching from pipes carrying the water.

D. FINDING REGISTERED/LICENSED WELL CONTRACTORS

1. District No. 2 Health Department Offices
2. Michigan Dept. of Environmental Quality (MDEQ)
   (517) 241-1389
3. Telephone directory under "Water Well Drilling and Service".
4. Neighbors with wells
5. Well drilling equipment/pump dealers
6. Local building contractors

E. QUESTIONS FOR POTENTIAL WELL CONTRACTORS

1. Ask to verify the well contractor's current state registration. or contact District Health Department No. 2 or the Michigan Dept. of Environmental Quality (MDEQ).
2. What type of casing and screen material is used? Will the screen be removable for future replacement if necessary?
3. Are their any water quality problems in my area that may re quire a deeper well or that will require the installation of water treatment equipment?
4. What amount do I pay if no water is found, if not enough water is found, or if poor quality water is obtained? *These items should be discussed and agreed upon between the owner and the well driller before the work begins.*
5. How much will it cost to seal my old abandoned well and why should it be sealed? *A well no longer in use can be a channel for contamination, can ruin your new well, and is required by law to be properly plugged. The cost of abandonment should be discussed with the well driller and included in the overall cost.*
6. What is the guarantee and/or warranty on your work? What equipment is covered under warranty and for how long? *These items should be discussed between the well driller and the property owner and agreed upon before work begins.*
7. How much site restoration will be done when the job is complete? *Well drilling rigs and support vehicles can make ruts in lawns, damage landscaping, and the drilling process can be messy. Make sure you know what the contractor will do and what you will be expected to do. Discuss these items with the well driller before work begins and include any site restoration into the overall cost.*
8. Where on the property do you recommend placing the well and why? *A well must be located where it is not subject to contamination and where it is accessible for maintenance.*

HOME OWNER RESPONSIBILITIES

The home owner shall provide the well drilling contractor with as much accurate information as possible pertaining to locations of existing wells, septic tanks and drain fields, neighbors septic tanks and drain fields, potential sources of contamination, property lines, fuel storage tanks, chemical storage, old dumps, etc., and any other pertinent information .

G. SOME THINGS TO CHECK FOR WHEN YOUR WELL IS COMPLETED

1. The casing should extend 12" or more above the ground surface.
2. The casing should not be easily moved and there should not be any open spaces around the casing.
3. Proper isolation: a well it must be at least 50' from potential sources of contamination such as septic tanks, drain fields, buried fuel tanks, etc..
4. A sampling tap for water sampling is required and should be near the pressure tank, pointed downward and at least 8" above the floor or ground level.
5. Make sure you receive a copy of the well log for your records and that the well driller has sent copies to District Health Department No. 2 and to the Michigan Department of Environmental Quality (MDEQ) for their files.

H. WHEN YOU HAVE A COMPLAINT

1. First discuss your concerns with the well contractor.
2. If you are not satisfied after your discussion with the well contractor, you may file a complaint with District Health Dept. No. 2 (989) 345-5020

I. HOW TO FILE A COMPLAINT

1. If you cannot resolve a problem by discussing the matter with the well driller or the health department, you may choose to file a written complaint.
2. Obtain and complete a complaint form by contacting the Michigan Department of Environmental Quality, Well Construction Program, (517) 335-8299 or contact any District Health Department No. 2 office.
3. The Michigan Department of Environmental Quality (MDEQ) and the District Health Department No. 2 have no authority or jurisdiction to investigate or mediate certain types of business practice complaints such as pricing, overcharging, product warranties, or contractual disputes.

J. RECOMMENDED MAINTENANCE

1. Periodic checking of well components such as well cap, vent, and electrical conduit connection for signs of damage and provisions to exclude insects.
2. Annual water testing. Sampling bottles can be obtained at any office of District Health Department No. 2.
3. Keep the well area clean and accessible and keep all potential contaminants as far away as possible.

K. HAULED WATER SYSTEMS

If you are requesting a water supply system that involves hauled water and/or stored water components there are additional regulations that apply. Contact DHD2 for more information.

PLUGGING ABANDONED WELLS

What is an abandoned well?

An abandoned well is a well that is no longer in use or that is in such disrepair that groundwater can no longer be obtained from it. Wells that are contaminated and pose a health risk also meet Michigan's legal definition of an abandoned well.

No one knows exactly how many abandoned wells there are in Michigan, but experts estimate that there are more than one million! Each year, many wells are abandoned when they are replaced with new wells or when homes are connected to community water systems. An abandoned well that is not plugged, or that is improperly plugged, is a potential hazard to the health and safety of the people living around it.

What problems do abandoned wells represent and why must abandoned wells be plugged?

1. **They are a public safety hazard.** People (especially children) and small animals may be injured or killed by falling into larger wells or well pits that are left open.

2. **They are a health hazard because they serve as potential routes for groundwater contamination.** Some of these wells are poorly constructed or badly deteriorated, and can allow runoff water (carrying sediment, bacteria, fertilizer,

pesticides, and other chemicals) to flow directly down into the groundwater. This bypasses the natural filtering and degradation processes that take place as these materials move downward through the soil.

3. **They may allow contaminated or poor quality water to move between aquifers.** An abandoned well that connects two water bearing geologic formations (aquifers) of different quality may allow lower-quality water to migrate into and degrade a higher-quality aquifer.

4. **They may lead to unnecessary waste of water.** Particularly if the abandoned well is an artesian or flowing well.

5. **Merely capping an abandoned well is not enough** to prevent it from becoming a problem. In order to protect the health and safety of the people living near them, these wells must be properly plugged (or sealed) soon after abandonment.

6. **Well owners are required by state law to have their abandoned well(s) properly plugged**. This should be done soon after the well is taken out of use. You may save money by having your old well plugged at the same time a new well is being drilled. Protecting the quality of your new well by having your old well properly plugged is a wise investment.

7. You should also be aware that **you may be held potentially liable** under Michigan's Polluter Pay Law (1982 PA-307 as amended by 1990 PA-234) if groundwater contamination is shown to have been caused by your abandoned well.

8. **If you choose to keep your existing well** you may do so provided it does not cause an environmental or health related problem.

9. **If you choose to temporarily abandon your well** it must conform to proper construction and isolation requirements for he state well code.

Can I plug an abandoned well myself?

A well owner may plug only their own private well at his/her residence. However, the well owner may not plug another person's private well or any well that serves the public (Type II or Type III) even if that public well is located on their property. In most cases, driven wells and large diameter dug wells can be plugged by non-

professionals with a minimal amount of special equipment.

Be aware that poor well plugging practices are no better than an open well! The use of improper materials or methods can lead to groundwater contamination. Also, once a well has been improperly plugged, it is quite costly to correct, since the improper plugging material must be drilled out. Therefore, it is strongly recommended that a well owner retain the services of a Michigan licensed water well drilling contractor. Licensed drillers have the special tools, equipment, and skills needed to properly plug wells**.**

It is also of great importance to note that prior to plugging a well anything inside of the well must be removed so that the casing is open from top to bottom. In two (2) inch wells, any pitless adapter fittings and the drop pipe must be removed. In four (4) inch or larger wells, any pitless adapter fittings and the submersible pump must be removed. The screen need not be removed.

In order to help determine if you have an abandoned well on your property, you may conduct a visual inspection and look for evidence of an existing well, such as a pipe sticking out of the ground or perhaps an old rusted windmill or broken hand pump.

Some abandoned wells may be more difficult to identify. They may be or they have been buried and the only remaining evidence may be a depression in the ground or a damp or wet spot that may indicate that a flowing well was never properly plugged.

Some old wells that need to be properly plugged are found in well pits. **Well pits are not an acceptable location for well construction or placement and present several safety hazards.** Once an old well that was located in a well pit has been properly plugged, the pit should be filled in completely.

To help determine if you have an abandoned well on your property, you may wish to consult:

1. Former property owners. They may remember where a well was located.
2. Old photographs which may show windmills, sheds, houses, or other possible locations.
3. Well drillers who may remember (or have records) where they drilled a well that is no longer in use.
4. Fire insurance plans which may contain information about old wells.
5. Your local health department which may have records of wells in your area.

Recommendations For Well Plugging
Materials and Placement

Careful selection and use of materials are essential to effective well plugging. ***Never use waste materials for well plugging!*** Plugging materials are used to prevent water from migrating into or between aquifers. They are less permeable to water than native soil or rock. The following well plugging materials are approved for use in Michigan.

Neat cement - a mixture of one 94-pound bag of Portland™ cement (Type I or IA) to not more than six gallons of water.
Portland™ cement is readily available at building supply stores.

Concrete grout - a mixture of neat cement with 1 cubic foot of sand or aggregate added per bag of cement.

Bentonite clay **-** a swelling clay available as granules or powder that can be mixed with water to form a high solids slurry, or as chips or pellets that swell in water to form an effective plug. Bentonite clay can be purchased from water well drilling supply stores.

Neat cement, concrete grout, and high solids bentonite slurry must be placed continuously from the bottom of the well up to the surface through a pipe (1"- 2") extending to the bottom of the well. The grouting pipe is gradually withdrawn as the plugging material is placed. The use of neat cement or bentonite slurry **requires special mixing and pumping equipment** which well drilling contractors have.

Bentonite chips are effective well plugging materials that are simple to use. These materials do not require special mixing or pumping equipment and are placed into a well by pouring. The large particle size (3/8"-3/4") falls rapidly through the water. However, bridging may occur if the bentonite is poured too fast or if fine powder which accumulates in the shipping container is not sifted out. Bridging occurs when the plugging material fails to fall to the bottom of the well casing and accumulates above an open space. The bridge may collapse later, resulting in an incomplete and ineffective seal. The chips have a greater chance of bridging in small diameter wells and in deep wells. A pouring rate not to exceed 10 pounds of material per minute is recommended for 4 inch diameter or larger wells. For 2 or 3 inch diameter wells, a rate not to exceed 5 pounds per minute is recommended. When plugging 1¼" driven wells, the chips should be placed individually.

Bentonite chips should be poured into the well through a funnel with a spout about ½ the diameter of the well. A simple trough made with a wire mesh bottom that has ¼ inch openings can be placed on the edge of the funnel to sift out the fine powder in the bentonite bags as they are being poured. During plugging, check the well periodically with a pipe or a weighted tape to make sure that bridging has not occurred. If a bridge has formed, it should be broken with the pipe or drilled out. Once the chips have been brought to the top of the well casing, water should be poured in to expand the bentonite above the water in the well.

Below are some examples of the amount of material used in plugging a well. The amount of material you will need will vary with each well and the type and brand of material used. It is important to remember that you follow the manufacturer's instructions.

Well			Feet of Well Plugged	
Diameter	Volume per Linear Feet		Neat Cement	Bentonite Chips
(inches)	(cubic feet)	(gallons)	(per 94 lb bag)	(per 50 lb Bag)
1 ¼	0.01	0.07	118	70
2	0.02	0.17	51.3	31.3
3	0.05	0.38	23.1	14.3
4	0.09	0.66	13.4	7.9
5	0.14	1	8.5	5.1

WELL WATER TERMS AND DEFINITIONS

Abandoned well - A well which is no longer used, a well that is in such disrepair that its continued use for the purpose of obtaining groundwater is impractical, a well which is a threat to groundwater resources, a well which is or may be a health or safety hazard.

Aquifer - An underground layer of rock, sand, or gravel that contains groundwater in sufficient quantity to supply a well.

Artesian well - A well that penetrates a confined aquifer. That water level in these wells rises above the upper surface of the aquifer due to the pressure in the confined aquifer. If the water pressures is great enough, the well will overflow.

Bedrock – A collective of continuous geologic material such a limestone, shale, sandstone, or granite.

Bentonite – A clay which is used for grouting.

Borehole – A circular hole drilled into the ground for the purpose of constructing a well to remove groundwater.

Casing – Steel or plastic pipe installed while constructing a well to prevent collapse of the well borehole and entrance of contaminants and to allow placement of a pump or pumping equipment.

Confined aquifer – Aquifers that are located between layers of relatively impermeable materials and are consequently under pressure. Also known as an artesian aquifer.

Contaminant – A biological, physical, chemical, or radiological component in water that is or may become injurious to the public health, safety, or welfare.

Drilled wells - Constructed by auguring an oversized borehole and installing the casing into the borehole. Drilled wells are commonly 5 inches in diameter but many older wells are 2 inches in diameter.

Driven well – Wells constructed by driving assembled lengths of pipe into the ground with percussion equipment or by hand. These wells are often smaller in diameter (2 inches or less), less than 50' feet deep, and can be installed in areas of relatively loose soils such as sand.

Dry hole – An open borehole or cased borehole that does not produce water in sufficient quantity for the intended use.

Grout – Placement of cement or bentonite to seal the wells annular space or to seal an abandoned well.

Ground water – Water beneath the surface of the earth which saturates the pores and fractures of sand, gravel, and rock formations.

Hardness – A characteristic of water caused primarily by the presence of various salts, calcium, magnesium, and iron. Water is "soft" if the content of these materials is low, "hard" if the content is high.

Pitless adapter – A device which provides above grade access to the well and to the parts of the water supply system within the well allowing the well to stay free of contaminants.

Potable water — Water which is free from contaminants in concentrations that may cause disease or harmful physiological effects, such that the water is safe for human consumption.

Pressure tank – A closed water and air storage container that modulates has an effect on the water supply system pressure within a selected range.

Turbidity – A measure of water cloudiness caused by the amount of suspended matter in the water.

Unconfined aquifer – An aquifer with the water table as its upper boundary. Because the aquifer is not under pressure the water level in a well is the same as the water table outside the well. An unconfined aquifer is near to the earth's surface causing it to be easily recharged but may be more easily contaminated.

Well cap – A device used to cover the top of well casing pipe to prevent the entrance of contaminants into the top of the well casing.

Well log – A record of information about a specific well. One copy each shall be filed with District Health Department No. 2, Michigan Department of Environmental Quality, the well owner, and the well contractor.

WATER TREATMENT DEVICES

The National Sanitation Foundation (NSF), 1-800 NSF-MARK, is one source for information on water treatment devices. The Water Quality Association (WQA), 630-505-0160, is another source. NSF (a non-profit organization) and WQA (a not-for-profit trade organization) test, rate, and certify water treatment devices. To gain certification, the device must pass performance objectives and meet policy standards. Before certifying a product, the NSF and the WQA:

A. Verify all contamination reduction claims for types and amounts.
B. Perform structural integrity testing.
C. Perform toxicological assessments.
D. Test for chemical leaching into the water from the device.
E. Review claims and advertising.

Water softeners remove some iron and hardness, but are not intended to be used to remove contaminants. Water softeners operate by exchanging iron, calcium, and other hardness metals with sodium, potassium or other exchange media.

The two most commonly used water treatment devices to remove contamination (such as arsenic) for homes are reverse osmosis and distillation. Both types of units can be very effective. However, both require regular maintenance. Each has certain benefits over the other and each unit treats for different types of contamination.

A comprehensive water test should be performed before choosing which type and brand of water treatment device to use. A written performance guarantee should be provided with any equipment purchased.

The steps to take before purchasing a water treatment device should include:

A. Have the drinking water tested for the potential contaminants by a state certified laboratory.
B. Call NSF or WQA and tell them the results.
C. Get a list of certified products from NSF.
D. Review the warranties and guarantees on each product.
E. Check maintenance schedules and maintenance costs.
F. Find out what products are available in your area.

Drilling a new well or using quality bottled water certified from an approved source may also be options for wells with water quality problems.

WATER SAMPLING REQUIREMENTS

Residential Wells

State law requires that at least one safe bacteriological sample be obtained from a new, repaired, or reconditioned water supply before placing the water supply system into service. This sample must be collected from a faucet after all traces of chlorine disinfectant have been flushed out. The well driller or pump installer must inform the home owner of this requirement; however, it is the home owner's responsibility to collect the sample(s), or have the sample(s) collected. Partial Chemistry (Nitrate) sampling is strongly recommended. The health department may require additional sampling near contamination sites.

Water Supplies That Serve The Public

State law requires that at least two consecutive safe bacteriological water samples at least 24 hours apart and one safe nitrate sample be obtained from a new, repaired or reconditioned water supply before placing the water supply into service. The bacteriological samples must be collected from the distribution system after the water supply system has been disinfected and after all traces of chlorine have been flushed out. It is the water supplier's responsibility to have the required samples collected. The health department may require additional sampling near contamination sites.

Water sampling bottles can be obtained at most local health departments

WATER SAMPLING INSTRUCTIONS

A. <u>Coliform and Partial Chemistry Test</u>

Use only approved sample bottles such as State laboratory test bottles "Unit #30 - Water Bacteria Test" and "MDEQ Unit #32 - Partial Chemistry. Some private labs also test for coliform and partial chemistry. Contact the private laboratory for the appropriate sample bottle.

General Sampling Procedures:

1. Select a clean faucet and remove such attachments as aerators, connectors, etc.
2. You may want to submerse or spray faucet with chlorine bleach.
3. Allow the cold water to run for five minutes at full flow at the sampling point.
4. Reduce the flow to the size of a thin pencil and collect the sample directly into the bottle.

B. <u>Volatile Organics</u> (Can be from leaking fuel storage tanks)

State Laboratory test bottles are "Organic Solvents" and "MDEQ Unit #36VO - Volatile Organic Substances." Some private labs also test for volatile organics; i.e., organic solvents including TCE. Contact the private laboratory for the appropriate sample bottle.

1. Take the sample from a raw, cold water faucet which is not connected to a softener, filter, or other appliance. Remove the aerator if one is present.
2. Allow the cold water to run for five minutes at full flow at the sampling point.
3. Reduce the flow to the size of a thin pencil and collect the sample directly into the bottle.
4. Fill the bottle to the top making sure no air bubbles remain in bottle. Turn bottle upside down after securing the cap, and check to make sure there are no air bubbles. If there are air bubbles, add more water and repeat the process.

C. <u>Arsenic Test</u> (Usually naturally occurring but can be man made)

State Laboratory test bottle is "MDEQ Unit #36ME - General Metals." Some private labs also test for arsenic. Contact the private laboratory for the appropriate sample bottle.

1. Take the sample from a raw, non-mixing, cold water faucet which is not connected to a softener, filter, or other appliance. Remove the aerator if one is present.
2. Run cold water for five full minutes before gathering sample.
3. Reduce the flow to the size of a thin pencil, remove the top from the bottle, fill the bottle to the top, and cap the bottle.

CAUTIONS FOR ALL WATER SAMPLING

Any laboratory must be state certified for drinking water for the particular sample that is being analyzed.

1. **Do <u>not</u>** open the bottle until ready to collect the sample.
2. **Do <u>not</u>** touch the inside of the cap or bottle.
3. **Do <u>not</u>** rinse the bottle prior to sampling.
4. **Do <u>not</u>** use any other container for collection or transport other than the one provided.
5. **Do <u>not</u>** allow the water from the outside surface of the faucet to drip into the bottle.
6. **Do** refrigerate the sample until it is delivered. Ship, deliver, or mail the sample as soon as possible.

BACTERIOLOGICAL ANALYSIS

Evaluation of bacteriological quality of drinking water is done using "coliform" testing for a group of bacteria found in the intestinal tract of warm blooded animals, surface water, soil, and decaying vegetation. A positive result may indicate that a water supply is not properly protected from contamination. The "Colilert" procedure or membrane filtration also detects E. coli, an organism that originates from intestinal tracts of warm blooded animals. If E. coli is detected, it is more likely that the water supply may contain disease causing organisms resulting from fecal contamination.

RESULTS OF COLIFORM ANALYSIS

Result Code	This Means:
ND	"Not Detected" – No coliform organisms were detected in the water sample. The sample met the state drinking water standard for bacteriological quality at the time of sampling. (Similar results may be reported as negative, absent, or "0".)
POS	"Positive" – Coliform organisms were present in the water sample. Safety cannot be assured. Collection of an additional sample to confirm the original result is recommended. An investigation into the cause of the problem by a qualified person is advised. (Similar results may be reported as present or any number from 1 to 200)
EC-POS	"E-coli detected" – E. coli organisms were detected in the water sample. E. coli organisms are found in the intestines of warm blooded animals, and as such, their presence in a water supply is considered an indication of sewage contamination. Precautions are recommended in the use of the water supply. These results are the same as fecal coliform positive; however, E. coli results indicate sewage contamination with more certainty.
Any Code	Coliform organisms may die during the sample holding time (time from collection to sampling). The laboratory will comment that results may not be representative/valid if the sample holding time is longer than 48 hours. The federal standard for a coliform holding time limit for public water supplies is 30 hours (24 hours proposed)

PARTIAL CHEMICAL ANALYSIS

The Michigan Department of Environmental Quality laboratory analyzes drinking water for eight chemical parameters in a routine testing procedure referred to as a partial chemical analysis. Below is a table of these parameters and associated problems.

Except for fluoride and nitrate, the levels listed below are general guidelines. State drinking water standards have been established and are listed for these two chemicals.

Test results are reported in milligrams per liter (mg/l) for all parameters.

TEST RESULTS IN MILLIGRAM/LITER (mg/l)

Test	Excellent	Satisfactory	Objectionable	Problem
Iron	0-0.2	0.2-0.5	Over 0.5	Staining, Turbidity taste, Odor
Sodium	0-20	20-250	Over 250	Taste, Special diets may require water of lower sodium content
Nitrate as N	0	1-10	Over 10	Nitrate Poisoning - especially in infants
Nitrite	0-0.2	0.2-1.0	Over 1.0	Nitrite Poisoning - especially in infants
Hardness $CaCO_3$	25-100	100-250	Over 250 or less than 25	Scaling of water fixtures, soap scum at high levels, corrosion at low levels.
Sulfate	0-20	20-400	Over 400	Laxative, taste, odor, scaling in boilers/heat exchangers
Chloride	0-20	20-250	Over 250	Taste, corrosion
Fluoride	0.8-1.7	0.7-2	Over 4.0 (state drinking water standard is 4.0)	Low levels are beneficial in preventing tooth decay. High levels may cause mottling of the teeth.

District Health Department No. 2
PUBLIC HEALTH FACT SHEET
COLIFORM BACTERIA

What are coliform?

Coliform are generally considered harmless bacteria when encountered in low concentrations in their natural environment. However, some specific types of coliform are harmful and may cause disease. Certain coliform bacteria such as fecal coliform or E. coli have their origin in the intestinal tract of humans and all other warm blooded animals and as such are found in sewage. The coliform group of bacteria is used as the indicator organisms providing evidence that the sanitary integrity of the water supply may have been compromised.

Why is it important to test for coliform bacteria?

Due to their origin, coliform are widespread in our environment, easy to find and fairly easy to identify. They are therefore excellent indicator organisms which when found in drinking water alert us to the potential presence of harmful organisms which are not specifically tested for.

What if a water sample tests positive for coliform?

Because of how common coliform bacteria are, incidental contamination of water samples may occur. If a water sample yelds a positive result i.e. unsafe resampling is typically recommended before any physical intervention with the water supply system is attempted. If the second sample is also unsafe a licensed well drilling contractor should be contacted to evaluate the system, make necessary repairs and properly disinfect the well and distribution system.

For more information; contact District Health Department No. 2

PUBLIC HEALTH FACT SHEET
NITRATE (NO3)

What Are Nitrates?

Nitrates are a form of Nitrogen that is combined with Oxygen. Ammonia and its chemical by-products, entering the soil from animal or human wastes are naturally converted to Nitrates. Nitrates can also be converted from fertilizers containing Nitrogen. Nitrates may be naturally occurring in groundwater. However, they generally occur due to present or past activities on the ground surface. (For Example: Farming, lawn fertilizers, and septic systems) Nitrates found in groundwater are often thought of as an indicator of open pollution pathways from the ground surface. When present, particularly at high levels, they should signal the need for additional chemical testing.

Can I tell if my water contains high levels of Nitrates without sampling?

No. Nitrate contamination can not be identified by looking at, tasting, or smelling the water. The only way to identify nitrate contamination is to have the water tested.

Who is affected by high levels of Nitrates?

1. Infants under one (1) year of age, with the greatest risk for infants under 3 months.
2. Infants that are breast fed, whose mothers drink well water containing nitrates above recommended levels.
3. Premature infants or infants with special health problems.
4. The fetus of a pregnant woman drinking well water containing nitrates above recommended levels.

What are unsafe levels of Nitrates in drinking water?

Levels at or above 10 mg/l (PPM)

What are the health effects?

Infants and young children consuming water with high levels of nitrates can suffer from a serious condition known as Methemoglobinemia (blue baby syndrome). This affects the child's blood and its ability to absorb oxygen, resulting in a bluish color. Adults and older children are generally not affected, unless the levels are extremely high.

Can Nitrates cause cancer?

Nitrates have been shown to interact with many compounds in the diet to form N-nitrosamines, which have proven to be carcinogenic in test animals. Cancers of the stomach and intestines are the main concerns. Studies to date have not provided convincing evidence of an increased cancer risk.

What can be done with water that contains high Nitrates?

Water treatment can remove nitrates from water. Reverse osmosis, ion exchange, and distillation can be effective in nitrate removal. However, they may be expensive and require regular maintenance to remain effective. Constructing a new well or correcting the source of the nitrate contamination, if possible, may be the best solution.

Normal water softeners used for removing hardness are not effective in the removal of nitrates from well water.

For more information; contact District Health Department No. 2

District Health Department No. 2
PUBLIC HEALTH FACT SHEET

ARSENIC

What is Arsenic?

Arsenic is a naturally occurring metal-like material found in the environment in sand, gravel and bedrock. In the earth, arsenic is dissolved and absorbed into the groundwater. Some areas in Michigan have levels of arsenic in drinking water that are above the recommended health level.

Arsenic combines with other elements to form compounds that are white or colorless powders. Arsenic compounds are sometimes used in industry as a wood preservative and in insect and weed killers. Arsenic has no smell or taste in water so you cannot tell if arsenic is present in the water you drink unless you test it.

Should I test my well for arsenic?

Arsenic can be found sporadically through out the counties of District Health Department #2. Arsenic can occur in sand aquifers located in glacial deposits as well as in the bedrock formations themselves. High Arsenic levels have been found in sandstone formations throughout Michigan.

Since arsenic can be found in varying aquifers and locations throughout District Health Department #2, and sampling results vary from well to well, District Health Department #2 recommends that all well owners sample their wells for Arsenic.

How do I interpret my arsenic sample results?

On October 31, 2001, the United States Environmental Protection Agency (EPA) reduced the maximum contaminant level (MCL) for arsenic in drinking water from 50 to 10 parts per billion (ppb). Expressed in different units of measure, this level is the same as: 0.01 parts per million (ppm), or 10 micrograms/liter (µg/L).

The MCL of 10 parts per billion serves as an advisory or recommendation for a safe drinking water level of arsenic in private single family residential water wells. However, certain public drinking water supplies were required by law to meet the new standard by January 23, 2006.

If the arsenic level in your home exceeds the health advisory, the health department recommend you consider an alternative source of water for drinking and cooking. Bottled water can serve as alternative for these purposes.

Since the MCL for arsenic is a long term exposure standard protective against cancer, and is based on consuming two liters of water per day for a 70-year period, accidental consumption of water containing arsenic between 0.01 ppm and 0.05 ppm is not considered significant exposure.

What can I do if arsenic is found in my well?

Some options that are available to reduce or eliminate arsenic levels in your well are: Drilling a new well or deepening an existing well in an attempt to utilize a different, non arsenic containing aquifer; or installing a water treatment system to remove the arsenic from the water.

Contact a well drilling contractor and/or a water treatment company to determine the most feasible option for arsenic reduction measures.

What are the health effects associated with arsenic exposure?

The way arsenic affects our bodies is not fully understood. Many of the symptoms associated with exposure to high levels of arsenic such as thickening and discoloration of the skin, numbness of the hands and feet, stomach pain, nausea, vomiting and diarrhea, are also seen with other common illnesses, which makes it difficult for a doctor to recognize.

High levels of arsenic have been found to be harmful to the production of blood cells and may cause abnormal heart rhythm. Arsenic may also damage blood vessels and impair nerve function. In addition, arsenic may also cause skin changes in the form of corns or warts. These skin changes are not considered to be a health concern in their own right, but a small number of the corns may ultimately develop into skin cancer.

The Department of Health and Human Services has determined that arsenic is a known carcinogen, and in high levels, arsenic may cause lung cancer or even death.

How can I be exposed to arsenic?

Since arsenic is a natural part of our environment, most people are exposed to some amount of arsenic. A person could come in contact with arsenic in any of the following ways:

- The largest source of arsenic comes from the foods we eat. Some fish and seafood contain high amounts of *organic arsenic*. This type of arsenic is less harmful than the *inorganic form of arsenic* found in the ground water.

- Fortunately, arsenic at levels found in well water is not readily absorbed by the skin, so contact with water (showering, laundering, etc.) is not a significant risk. Arsenic from a water supply does not readily disperse into the air, so inhalation while taking a shower or while washing dishes is not a significant risk. Only water used for drinking and cooking is a health concern.

- Arsenic may be inhaled by breathing in dust or smoke that contains arsenic. Dust from certain industrial processes and the smoke from burning wood treated with preservatives may contain arsenic. Tobacco smoke contains very small amounts of arsenic.

- Direct contact with concentrated arsenic compounds may result in arsenic being absorbed through the skin. This type of exposure would be more likely to result from occupational exposure.

Is there a medical test to determine whether I have been exposed to arsenic?

There are several methods that can measure arsenic in your blood, urine, hair or fingernails. If you or your family members are concerned about health problems that may be related to arsenic in your well water, you should discuss them with your doctor and have your well water tested for arsenic.

For more information; contact District Health Department No. 2 or visit the Michigan Department of Environmental Quality website at www. Michigan.gov/deq.

Minimum Well Isolation Distances
Private Wells

The following lists sources of contamination and the well isolation distances required from those sources by state code

Abandoned well or boring that has not been plugged	**50 feet**
Agricultural chemical/fertilizer storage or preparation area	**50 feet**
Animal/Poultry yard	**50 feet**
Brine well/injection well	**150 feet**
Building or projection thereof	**3 feet**
Cemetery/graves	**50 feet**
Cesspool	**50 feet**
Chemical storage	**150 feet**
Contaminant plume, known (Part 201 or 213 sites, etc)	**150 feet**
Drainfield/drywell, privy/outhouse or similar on site sewage disposal system	**50 feet**
Footing drain **Recommend**	**10 feet**
Fuel/chemical storage tanks – underground or above grade and associated piping.	
A. Depot/tank farm	**300 feet**
B. Tanks 1,100 gal. or larger without secondary containment	**300 feet**
C. Tanks 1,100 gal. or larger with secondary containment	**300 feet**
Tanks less than 1,100 gal. which store motor or heating fuel for noncommercial purposes or consumptive use on the premises where fuel is stored	**50 feet**
E. Tanks less than 1,100 gallons which store motor fuel for commercial purposes	**50 feet**
F. Tanks located in a basement regardless of size	**50 feet**
Grease trap	**50 feet**

Kennels	**50 feet**
Landfill or dump sites (active or inactive)	**800 feet**
Septage waste land application area	**800 feet**
Liquid Petroleum tanks	**Recommend 10 feet**
Liquid waste draining into the soil	**50 feet**
Metering station for pipelines	**300 feet**
Municipal wastewater effluent or sludge disposal area (land surface application or subsurface injection)	**300 feet**
Oil or gas well	**300 feet**
Other wastewater handling or disposal unit	**50 feet**
Petroleum product processing or bulk storage facilities	**300 feet**
Pipelines	
A. Gasoline, oil, etc	**300 feet**
Property lines	**Recommend 10 feet**
All items listed below	**50 feet**
A. Seepage pit	
B. Septic tank	
C. Sewage holding tank	
D. Sewage lagoon serving a single family dwelling	
E. Sewage lagoon effluent – land application area	
F. Sewage or liquid waste draining into the soil	
G. Sewage pump chamber, transfer station, or lift station	
Sewers	
Buried gravity sewer (sanitary or storm) service weight or heavier ductile iron or cast iron, or schedule 40 PVC, all with watertight joints	**10 feet**
Buried pressure sewer (sanitary or storm)	**50 feet**
Buried gravity or pressure sewer (sanitary or storm) constructed of materials not meeting the specifications listed in the two categories above, or the materials are unknown	**50 feet**
D. Sewer line isolation from water line (plumbing code requirement)	**10 feet**

Sump pit	
A. Receiving other than household waste (footing drain, roof drain, etc.)	**10 feet**
B. Receiving household waste (laundry, softener backwash, sink waste etc.)	**50 feet**
Surface water (lake, river stream, pond, etc.)	**10 feet**
Unfilled space below ground surface (except an approved basement, basement offset, or crawl space beneath a single family dwelling	**10 feet**
Well isolation required between two wells (No Requirements)	**Recommend 10 feet**

ADVISORY:

Persons with homes in a subdivision, site condominium, or within the limits of a city may have local ordinances or deed restrictions that may effect the construction of a new water supply.

If you live in a subdivision or site condominium please check your deed restrictions to determine if there are limitations placed on water well construction.

If you live within the limits of a city or village please check with the local officials of that municipality to determine if there are ordinances or restrictions that may effect or prohibit the construction of a new water well on your property.

Contacts and References

Who to call about…..

Certified well water testing laboratories

A listing is available from the Water Division, Michigan Department of Environmental Quality, P.O. Box 30630, Lansing, MI 48909-8130 Telephone:(517) 335-9216 or online at www.michigan.gov/deq.

Interpreting well water test results

Contact your local health department offices or the Water Division, Michigan Department of Environmental Quality.
Telephone (517) 335-9216

Drinking water quality standards

U.S. Environmental Protection Agency's Safe Drinking Water Hotline. Call toll free 1-800-426-4791
Water Division, MDEQ at (517) 335-9216
Or your local health department offices.

Approved water treatment devices

Use only those devices certified by the National Sanitation Foundation (NSF), an independent testing laboratory. Call 1-800-NSF-MARK.

Locating possible sources of contamination

Well drilling contractors, pump installers, DNR district office water supply specialist, or local health department sanitarians.

A copy of your water well record (well construction report)

Contact the well drilling contractor who drilled the well, your local health department office, or the Geological Survey Division, Michigan Department of Natural Resources, 735 East Hazel Street, Lansing, MI 48912, Telephone (517) 334-6921

Water well abandonment

Contact your local health department or the Water Division, or the Michigan Department of Environmental Quality at (517) 335-9216

WATER WELL DISINFECTION

DHD2 recommends that you contact your registered water well drilling contractor to arrange for the disinfection of your water well.

However should you wish to disinfect your own water well, it is strongly recommended that you contact your water well driller or DHD2 for information.

If your home has a water treatment unit, such as a water softener, or a reverse osmosis (RO) distillation unit, it is recommended that you contact the manufacturer or an authorized representative prior to disinfection.

After the well has been disinfected and the chlorinated water has been in the system for approximately twelve hours, or over night, open the outside spigot(s) and discharge the water onto the ground or into a ditch first until the chlorine odor disappears. This will help keep large amounts of the chlorine from getting into your septic system and destroying the bacteria which it needs to function properly. Next, open all the faucets in the house, basement, garage, etc., until the chlorine odor is gone (This may take several hours or even longer in some cases).

Once all traces of chlorine have been removed, your well should be properly disinfected and you may sample/resample your well. A safe bacteriological water sample needs to be obtained prior to using the water for consumption and is required on new water wells. Sample bottles and additional sampling information are available at your local health department offices.

Caution: Many wells, especially ones with a submersible pump, such as 4 and 5 inch wells, have electric cables running from the house to the well and down to the pump motor. These electric wires represent a severe electrical shock hazard. You may wish to consult with a well drilling contractor or a licensed electrician prior to attempting to open the well for disinfection.

Contamination Lists

DISTRICT HEALTH DEPARTMENT NO. 2
Alcona County
Iosco County
Ogemaw County
Oscoda County

This reference page discusses larger contamination sites that exist in every county. Water wells must be isolated from these sources of contamination to protect the water well. Michigan's Department of Environmental Quality (MDEQ) publishes periodic listings of contamination sites for leaking underground storage tanks and for other large scale contamination sites.

The MDEQ web sites for the listing of those contamination sites are:

1. MDEQ websites for a **listing** of Site Contamination, Part 201, and Leaking Underground Storage Tank Part 213, are located at: http://www.deq.state.mi.us/part201ss

2. The MDEQ website for a **map** of those Part 201 and Part 213 contamination sites is: http://www.mcgi.state.mi.us/environmentalmapper

If you have concerns that your proposed or existing water well site is near a larger source of contamination please contact:

1. The web sites listed above
2. Your Michigan registered water well drilling contractor
3. The District Health Department No 2 office in your county

The following page contains "Additional Contamination Sites" within the counties of District Health Department No. 2 that are not contained on the Part 201 or Part 213 MDEQ sites listing on the websites referenced above.

Note: There may be other sites of groundwater contamination in your county in addition to those sites discussed in this reference page. If you have reason to believe that there is contamination near your water well site please call the District health Department No. 2 office in your county.

Additional contamination Sites – District Health Department #2 listing by County

(Not included on state listings)

County	City	Site Address	Township	Town	Range	Section	Pollutant 1
Alcona	Alcona/Black River	US 23	Alcona	28N	09E	25&26	Methane Gas
Alcona	Lincoln	French Rd.	Haynes	27N	08E	30	Nitrates
Alcona	Lincoln	301 N. Lake	Hawes	27N	08E	36	Salt
Alcona	Lincoln	Within City limits	Hawes	27N	08E	City Limit	Nitrates
Iosco	Tawas	SE portion of Alabaster Twp.		21N	07E	several	Chlorides
Iosco	Whittemore	In and surrounding City Limits	Burleigh	21N	05E	03&10	Nitrates
Iosco	Oscoda	Beech St.	Oscoda	24N	09E	27	Salt
Iosco	Oscoda	Just north of Oscoda	Oscoda	23N	09E	33	Nitrates
Ogemaw	W. Branch	M-55 Near Morrison Rd.	Churchill	22N	03E	Several	Nitrates
Ogemaw	W. Branch	Seneca Trail Area	Mills	21N	03E	3	Nitrates
Ogemaw	W. Branch	South end of Simmons Road	W. Branch	22N	02E	34	Chlorides
Oscoda	Fairview	Within City Limits	Comins	27N	03E	Several	Nitrates
Oscoda	Mio	Caldwell Road	Comins	27N	03E	18	Old Dump

Note: there may be other sites of ground water contamination in your county in addition to those sites listed below. If you have reason to believe that there is contamination near your well site please call the District Health Department #2 office in your county.

SELECT WEBSITES WITH GROUNDWATER QUALITY INFORMATION

1. Michigan Department of Environmental Quality www.michigan.gov/deq The following information is a partial list of the groundwater information available on this website:

- Contamination Investigation
- Environmental & Drinking Water Testing Labs Directory
- Pollution Emergency Alerting System Information
- Scanned Water Well Record Retrieval System
- Fact Sheets & Brochures
- MDEQ Program Staff
- Water Well Construction
- Wellogic System
- Water Wellhead Protection
- Abandoned Water Wells
- Beach Monitoring System

Michigan State University – www.rsgis.msu/edu

Remote Sensing & GIS Research and Outreach Services (RS&GIS) is a non-academic program in the Department of Geography under the College of Social Sciences at Michigan State University. RS&GIS provides state-of-the-art remote sensing (RS), global positioning system (GPS), geographic information science (GIS) and cartographic services to the MSU campus, the State of Michigan, and other agencies.

RS & GIS also provides a website located at **http://ims.rsgis.msu.edu/viewer.htm** which provides mapping information depicting locations of Part 201 contamination sites, oil and gas wells and other sites. You can obtain information on many contamination sites throughout our district that are depicted on the map. You can also utilize this map to zoom in on the very site you are on. And, since this site is linked through Wellogic you may also be able to access a well record for that specific location or one near by.

3. United States Geological Survey – www.usgs.gov

Federal source for science about the Earth, its natural and living resources, natural hazards, and the environment. This following is a partial list of the groundwater information available on this website:

- Biological Resources
- Geological Information
- Maps/Mapping Information
- Water Resources Information
- Customer Service/Product Information
- Environmental Information
- Hazards Information
- Publications
- Regional Offices and Field Centers

4. United States Environmental Protection Agency www.epa.gov The mission of the Environmental Protection Agency is to protect human health and the environment. The following is a partial list of the groundwater information available on this website:

- Drinking Water and Health Basics
- Drinking Water Standards
- Regulations & Guidance
- Laws & Regulations
- Local Drinking Water Information
- List of Contaminants and MCLs
- Educational Resources
- Safe Drinking Water Act