## Methane in Well Water

Methane gas is occasionally found in Minnesota groundwater and wells. It is not known to be a health hazard when ingested. However, methane can be flammable and explosive when mixed with air, and it can displace oxygen if released into a confined space, resulting in asphyxiation. Methane can also cause problems with the operation of the well pump and water system. Methane from the well and water system should be vented to the atmosphere, outside of enclosed spaces such as well houses or homes. Removal of methane from water commonly involves aeration.

## Methane

Methane ($CH_4$) is a simple hydrocarbon of one carbon atom and four hydrogen atoms. Methane gas is colorless, tasteless, and odorless. The smell of "natural gas" is from a chemical added to make it more easily detected. "Swamp gas" is mostly methane, so is "natural gas." Most methane in Minnesota groundwater is caused by decomposition of vegetation or other organic materials, mixed in with sediments, thousands or even millions of years ago.

## Methane in Wells

Most wells in Minnesota do not contain methane. Those that do, likely less than 1 percent, are primarily wells drilled into glacial sediments. Methane occurrence is unpredictable – the presence in one well is generally not a predictor that it will occur in other nearby wells. Even though the methane in a well may have been created by the same processes that produce modern "swamp gas," the presence of a nearby swamp is not a predictor that methane will occur in a well, nor is the modern swamp the likely methane source. Methane can be dissolved in water much like the bubbles (carbonation) in soda. When water containing methane is pumped to the surface, the temperature rises, and the pressure drops, which causes the methane to be released from the water, just as the bubbles in soda are released when the container is opened. Heating the water will speed the release of methane. That is why a methane or other gas problem is often worse at a hot water faucet.

## Health and Safety

Studies have not linked ingestion of water containing methane to any short term (acute) or long term (chronic) health effects, however very little research has been done. While most methane in well water is not related to contamination, in some cases methane can be produced from sewage, solid wastes, or other sources containing health-related contaminants. For those reasons, it is recommended that methane-producing wells be tested for coliform bacteria and nitrate nitrogen.

Methane concentrations in air between 5 percent and 14 percent can ignite and explode. This concentration can be reached if the gas is allowed to accumulate in a poorly ventilated area. A spark from a control switch in a well house, or a flame from a water heater in a basement could ignite the methane, with disastrous results.

Methane is lighter than air, so it will rise to the ceiling of a building, and displace oxygen. If the oxygen content should fall low enough, unconsciousness and death can occur. Therefore, it is important to vent methane outside of any building or enclosed space.

## Testing for Methane

A "sputtering" or "spitting" faucet, or a gurgling noise from the well may indicate the presence of methane, or other dissolved gases. Visible gas bubbles in a water sample may also be a clue that methane is present. The water may appear clear with bubbles, milky, frothy, or have a bluish tint. However, the presence of gas bubbles or a sputtering faucet may not be due to methane, but may be due to other dissolved gasses, or air entering the water system. Some water testing laboratories can test your water for methane. This involves a specialized sample collection process. Laboratories are listed in the telephone directory under "Laboratories – Testing."

## Venting

Minnesota rules require new wells to have a vented cap or cover. The well vent prevents a vacuum, and helps to release gases such as methane or hydrogen sulfide. However, older wells may not be vented. A variety of well caps are available that have a built-in vent on the underside of the cap. Separate down-turned vents are also available. It is important to install these caps and vents to properly vent the well, and to prevent flood water, contaminants, or insects and small animals from entering the well. Water storage tanks and water treatment tanks should also be vented. Vents should extend outside, above the ground surface, and away from any building.

## Methane Removal and Treatment

Methane will not be removed by common water treatment devices such as sediment filters, water softeners, or carbon filters. Most removal or treatment techniques involve aeration. A gas shroud, attached to a submersible pump in the well, may provide relief in some circumstances. Fittings that drain back or aerate water into the well have been used, but are not particularly effective, and may cause other problems such as well corrosion or plugging.

## Aeration

Aeration is the process of mixing air into water and venting the gas to the outside atmosphere. Aeration can remove methane, as well as other gasses such as hydrogen sulfide (rotten egg smell).

Treatment devices range from the simple to the complex. The simplest is to use a pressure tank without a bladder or diaphragm, often referred to as a "galvanized" tank. An air release valve, vented to the atmosphere, releases the methane. This system is relatively simple and inexpensive, and does not require a second pump or tank, but is relatively inefficient at treating large volumes of water or removing large quantities of methane.

A more effective, but more complicated, system is to add an aspirator or aerator to the inlet of a water storage tank. An air pump or compressor will speed up the methane removal, but adds expense and maintenance.

Waterfall, diffusion, or mechanical aerators are devices that more effectively mix air with the water, resulting in more rapid and efficient removal, but increased cost and maintenance. Some systems involve a storage/treatment tank system with spray aerators enclosed in the tank. Use of an unpressurized treatment tank will require two pumps and two tanks – a well pump and a re-pressurizing pump, and a treatment tank and a pressure tank. Retention times of several minutes are typically needed to allow release of the methane. Air separators, similar to devices used on hot water heating systems to remove air, have also been used to remove methane.

Vents, air release valves, and other mechanical parts can fail, or freeze if not properly installed and maintained. Systems that use a nonpressurized tank may be subject to airborne contamination of the water supply if not carefully installed and maintained. All systems should be designed to be sanitary, avoid cross connections, and be vented outside.

## Gas Shroud

Methane or other gas problems can sometimes be reduced or eliminated in a well by installing a gas "shroud." A gas shroud is a pipe or tube inserted over a submersible pump that is open above the pump and sealed at the bottom to the pump. Methane rises through the water column in the well, leaving methane-reduced water in the shroud. This method requires a larger casing, and only works for wells that pump relatively small quantities of water at one time.

## Pumping Problems

The presence of methane, or other gases, may cause pumping problems, including low water yield. Some manufacturers have developed modifications to submersible pumps for gaseous wells.

## Resources

Search for Accredited Laboratories
(www.health.state.mn.us/labsearch)

## MDH District Offices

625 North Robert Street
P.O. Box 64975
St. Paul, Minnesota 55164-0975
651-201-4600 or 800-383-9808
health.welldisclosures@state.mn.us
www.health.state.mn.us/wells

705 Fifth Street Northwest
Bemidji, Minnesota 56601
218-308-2100

11 East Superior Street
Duluth, Minnesota 55802
218-302-6166

1505 Pebble Lake Road
Fergus Falls, Minnesota 56537
218-332-5150

3333 West Division Street
St. Cloud, Minnesota 56301
320-223-7300

1400 East Lyon Street
Marshall, Minnesota 56258
507-476-4220

18 Wood Lake Drive Southeast
Rochester, Minnesota 55904
507-206-2700

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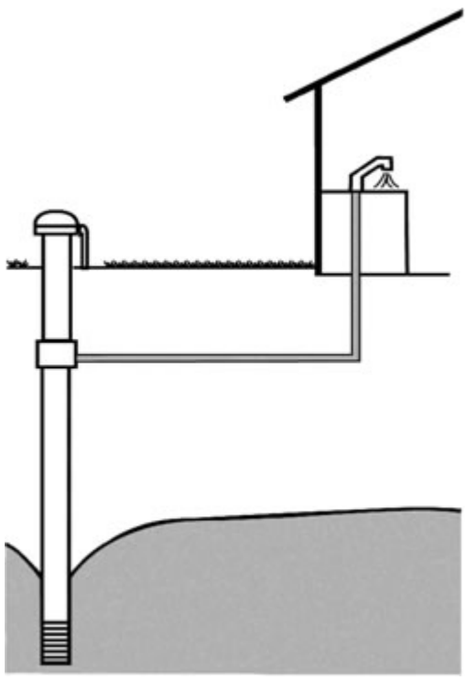

DEPARTMENT OF HEALTH

**Well Management Section**
**Environmental Health Division**