



Methane Gas and Your Water Well

A Fact Sheet for Domestic Water Well Owners

**Kentucky Department for Environmental Protection
Division of Water**

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High concentrations of methane in enclosed structures can lead to an explosion. Water wells located in pump houses, well pits, basements or any enclosed structure should be properly vented as a safety precaution to prevent the buildup of methane. The following is an explanation of methane gas occurrence in wells and some suggested practices to help keep your well and your well house safe.

Naturally occurring gases, such as methane and hydrogen sulfide, may be present in some wells. These gases occur naturally in the subsurface, accumulating in voids within the rock and as dissolved gas in groundwater. Methane and hydrogen sulfide can enter a well through damaged or corroded well casing, improperly sealed well casing, uncased formations, and as dissolved gases being released from groundwater present in the well. Methane and hydrogen sulfide gases, in the right mixture with air, can be highly explosive. A lower explosive limit (LEL) value defines the percentage of gas in air that is explosive. If the concentration is below the LEL, there is not enough of the gas in the air to ignite. Once the concentration reaches the LEL, any ignition source can set off an explosion. Ignition sources include: light switches; pump relays; heat from light bulbs or engines; natural gas appliances such as furnaces and hot water heaters (including the pilot light); lit cigarettes, and other flame or spark sources.

What is Methane?

Methane is a colorless, odorless gas and is the chief constituent of natural gas. It is especially prevalent in coal beds, but occurs in non-coal rocks as well. Methane is lighter than air, so it will rise easily from within the well to the surface. Methane is highly flammable, with an LEL of 5.3 percent. Because methane is colorless and odorless, it can accumulate undetected to explosive levels in well bores and enclosed structures if not properly vented.

What is Hydrogen Sulfide?

Hydrogen sulfide is a colorless gas with a strong rotten egg odor. Most hydrogen sulfide odors are associated with hydrogen sulfide gas dissolved in groundwater that is released when exposed to the atmosphere. Hydrogen sulfide may also occur in the presence of methane. Hydrogen sulfide's LEL is 4.0 percent, making it more flammable than methane. However, hydrogen sulfide is denser than air, therefore it does not rise out of the well naturally (it must be carried or forced out), and does not

pose as much of an explosion risk as methane does. Additionally, hydrogen sulfide is corrosive to metals; it can corrode steel well casing sufficiently to allow methane to enter the well that proper well construction had previously sealed out.

Recommended Venting Procedures for Wells Not Enclosed in Structures

For wells located outside of any structure, simply installing a vented well cap (Figure 1) provides sufficient venting prior to water entering the home. These well caps are designed to use on wells equipped with a pitless adapter (a device designed for the water pipe to exit the well below ground level).



Figure 1. Vented well cap.

A sanitary seal (Figure 2) is used on wells where the water pipe exits the well through the top of the well casing. These seals consist of a rubber gasket between metal flanges. When the bolts on the metal flange are tightened, the rubber gasket seals against the well casing, electrical conduit, discharge pipe and well vent tube.



Figure 2. Sanitary seal.

The well vent tube should be inserted approximately six to twelve inches into the well below the sanitary seal (Figure 3). The well vent tube should extend above the sanitary seal to a level above possible flooding, secured in position and sealed watertight in the sanitary seal. The upper end of the well vent tube should be turned down to prevent the entry of rainwater and it should be screened with 24-mesh or smaller durable screen, or filtered in such a manner as to prevent the entry of insects or small animals. The well vent tube should be large enough to allow the equalization of air pressure in the well; a minimum of one-half inch diameter is recommended.

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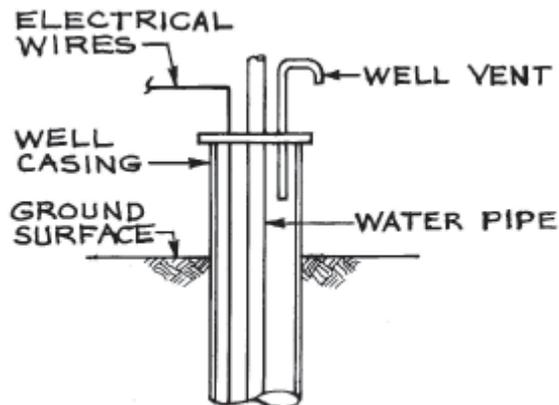


Figure 3. Recommended venting procedures for wells not enclosed in structures.

Recommended Venting Procedures for Wells Located in Enclosed Structures

When a well is located inside of a structure, such as a well house or even a home, the well vent tube must vent gas outside of the structure, as shown in Figure 4. A sanitary seal (Figure 2) that seals tightly against the well casing should be used. All openings through the sanitary seal should be properly sealed to prevent methane from escaping into the structure. Vented well caps (Figure 1) or well caps that do not have a gasket seal should not be used.

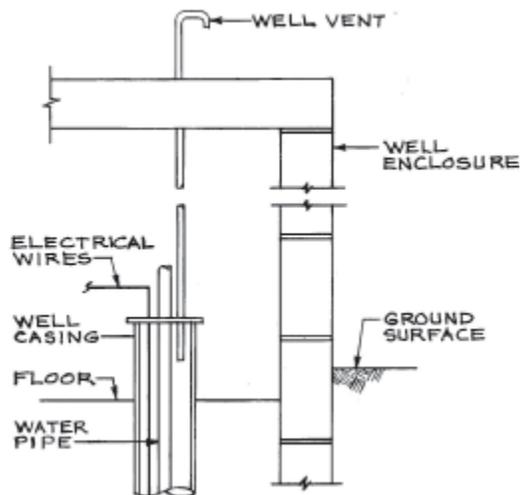


Figure 4. Recommended venting procedures for wells located in enclosed structures.

The well vent tube should extend outside of the well enclosure, as shown in Figure 4, and terminate a minimum of 18 inches above the ground surface and

above known flood elevations. The upper end of the well vent tube should be turned down to prevent rainwater from entering. It should be secured in position and screened with 24-mesh or smaller durable screen, or filtered in such a manner as to prevent the entry of insects or small animals. The well vent tube should be large enough to allow the equalization of air pressure in the well; a minimum of one-half inch diameter is recommended. You should periodically inspect your well venting system to ensure it is functioning properly.

Additional Precautions

In addition to venting the well, you may wish to vent the structure in which the well is located, in case methane does enter the structure. There are a variety of vents available, such as roof vents, attic vents, etc. used to vent attics of houses. You may also consider purchasing commercially available gas monitors that sound an alarm if flammable gases are detected. Separate monitors are available for natural gas (methane) and hydrogen sulfide.

Methane and/or hydrogen sulfide may be dissolved in groundwater, and may not leave the well water until it arrives at the faucet, resulting in the accumulation of gas in the home. In this case, well venting alone will not remove these gases. Commercially available treatment systems are available to remove these gases before they enter a home. Most of these treatment systems involve aeration of the water, which forces the gases out through a sealed vent system to the outdoors.

Be sure all wiring meets local electric codes and that no wires are exposed. Bare electrical wires can cause arcing and sparking, which can ignite gas if present in a flammable concentration. You may consider installing intrinsically safe switches and light fixtures, and intrinsically safe electric pump motors (for surface mounted pumps). Intrinsically safe electric motors, switches and fixtures are designed to prevent arcing and sparking. Do not store or use fuels, solvents or other pollutants in the well house or other enclosure. Vapors from these materials may accumulate in the structure and result in explosive levels. In addition, spills of these materials may lead to contamination of the well.

Water Well Construction and Inspection

Proper well construction and routine well maintenance, including disinfection, help ensure your well provides a safe water supply. The following are general recommendations.

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Well casing serves two purposes: it prevents collapse of the well boring during drilling, and it helps prevent contaminants and gas from migrating into the well. Your well should have a minimum of 20 feet of casing below the ground surface. The amount of casing required will vary depending on the depth to groundwater and the type of soils and bedrock in which the well is installed. The well casing should extend a minimum of four inches above ground surface and be fitted with a well cap or sanitary seal.

The space between the casing and the sides of the well bore, called the borehole annulus or annulus, provides a direct conduit for surface water and pollutants to reach the water table if improperly sealed. The annulus should be sealed with drill cuttings, neat cement or bentonite. Be sure the outside of the well casing is sealed at the ground surface or floor of the structure. This prevents pollutants from seeping into the well.

Well owners should periodically visually inspect the condition of their well casings for holes or cracks. Steel casing may be corroded by hydrogen sulfide. Examine the casing above ground as well as inside the casing using a flashlight. Push on the casing. If it moves from side to side, the well casing seal has failed and the well casing may also be damaged. Listen for the sound of water trickling into the well when the pump is not running. Running water means the well casing may be broken or corroded.

A tight-fitting, tamper-resistant, vermin-proof well cap must be installed to prevent the surface entry of insects, small animals, surface water, and pollutants into your well. All piping and electrical connections to the well casing or well cap should have watertight seals. All holes in the well cap or seal should be used or have a watertight plug.

Well Maintenance

As a well owner, you are responsible for maintaining your well. Protecting Your Well and Water Supply - a Groundwater Protection Plan for Domestic Well Owners, is available for download from the Division of Water's *Water Well Related Concerns* Web page (linked from the *Well Drillers Program* Web page), or by calling the Division of Water.

All wells should meet current construction standards. If a well is no longer in service, all plumbing connections should be disconnected to prevent methane from entering structures. A certified driller should be hired to properly plug unused wells to prevent groundwater contamination. Gasoline, motor oils, pesticides, and other pollutants should not be used or stored in the vicinity of a well or inside a structure in which a well is located.

You should disinfect your well annually. Well disinfection procedures are outlined in our Routine Well Maintenance and Disinfection Guide, which is available for download from the Division of Water's *Water Well Related Concerns* Web page (linked from the *Well Drillers Program* Web page) or by calling the Division of Water. You should have your well water tested annually for coliform bacteria. Your local health department can provide this service, or you may consider using a private laboratory.

Certified Water Well Drillers

Kentucky law requires that only a Kentucky Certified Water Well Driller may construct, repair or plug a water well. The Directory of Certified Drillers is available on the Division of Water's *Well Drillers Program* Web page or by calling the Division of Water.

If you have any questions regarding your well, please contact the Division of Water or a certified water well driller in your area.

Contact Information

Division of Water, Well Drillers Certification Program
200 Fair Oaks Lane <http://www.water.ky.gov>
Frankfort, Kentucky 40601 (502) 564-3410

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