

Wyoming Department of Environmental Quality Water Quality Division

Sampling and Testing Water Wells in Areas of Oil and Gas Development

The Wyoming Department of Environmental Quality (WDEQ) has developed this guideline in response to public concern about potential impacts to water wells due to industrial activity, such as oil and gas exploration and development. Water well owners are concerned with maintaining the quality of their water. Periodic sampling and testing of well water is important to initially determine that well water is suitable and safe for drinking water purposes, and to monitor for potential changes in water quality or presence of contaminants over time. Testing can help answer the question of whether a well has been impacted by industrial activity. Water samples may be collected by the well owner or by an independent third party, however, test results from water samples collected by a well owner may not be recognized in legal proceedings.

It is important to collect water well samples prior to drilling or other industrial activity to establish 'baseline' water quality conditions. Mineral and surface owners may be able to negotiate water well testing, both pre-and post-drilling, as part of their mineral lease or surface use agreement.

Water can be tested for hundreds of water quality analytes and parameters. Ideally, well water should be tested as described in WDEQ's *Guideline for Sampling and Testing Well Water Quality* (see link below). However, for those who do not wish to go to this extent and expense, the following relatively inexpensive 'indicator' analytes, parameters, and chemical compounds may provide a level of comfort for monitoring potential effects from oil and gas development:

Mineral and metal indicators: conductivity, pH, Total Dissolved Solids (TDS), alkalinity, barium, calcium, magnesium, sodium, chloride, sulfate, fluoride, nitrate, lead, arsenic, iron, and total organic carbon.

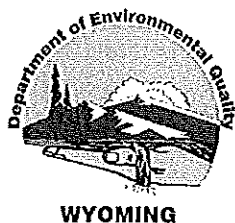
Chemical indicators: TPH-DRO and TPH-GRO (Total Petroleum Hydrocarbons – Diesel Range Organics and Gasoline Range Organics); and BTEX (Benzene, toluene, ethylbenzene, and xylenes).

Laboratories can provide information on how to collect a water sample, or provide for sample collection. Laboratories can also help with the selection of additional, or alternative water quality analytes and 'indicators' for other types of potential contaminants.

Laboratory analyses for mineral and metal water quality 'indicators' can be obtained for as little as \$150 from the Wyoming Department of Agriculture lab at (307) 742-2984. Lab analyses for chemical indicators is more expensive and may cost a few hundred dollars, or more, but are more likely to detect contamination associated with a variety of different oil and gas related activities.

For more information regarding potential sources of contamination, establishing baseline quality of well water, sampling frequency, evaluation of sample results, and laboratories available to the public please refer to WDEQ's *Guideline for Sampling and Testing Well Water Quality* available on WDEQ's website at <http://deq.state.wy.us/wqd/groundwater/index.asp>.

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Guideline for Sampling and Testing Well Water Quality

The Wyoming Department of Environmental Quality (WDEQ) has developed this Guideline to provide basic information to well owners interested in evaluating water well quality for domestic use. Well owners may find the information in this guideline useful in understanding how and when to collect water well samples, what to sample for, and laboratories that perform water quality analyses. The information presented in this guideline is intended to assist well owners in making informed decisions, but well owners are also encouraged to seek professional advice and assistance related to their specific situation or concern.

Potential Sources of Groundwater Contamination

Virtually all types of land use activities have the potential to impact water supplies. Common land use activities that are known to have impacted water supplies include: agricultural, residential, government, commercial, and industrial (including mining and oil and gas development). Water wells can also be impacted by naturally occurring sources of contamination (e.g. arsenic, selenium, fluoride, radium, etc.) at levels that may cause health concerns. Well owners should become familiar with the various types of land use activities within their area in order to understand the types of chemical constituents that are often associated with them and that may impact groundwater. Please refer to the table of potential sources and contaminants available on DEQ's website at <http://deq.state.wy.us/wqd/groundwater/index.asp> that further describes potential sources of contamination and the types of materials and chemical constituents that are commonly associated with them.

Establishing 'Baseline' Quality of Well Water

DEQ recommends that all domestic wells be initially sampled and analyzed for **Tier 1** (with the exception of disinfection by-products and disinfectants), **Tier 2** and **Tier 3** constituents as described below:

Tier 1 (Safe Drinking Water) constituents include those potential drinking water contaminants for which the US EPA has established safe drinking water levels (*National Primary Drinking Water Standards*), and levels that ensure the aesthetic (taste, odor, etc.) quality of drinking water (*Secondary Drinking Water Standards*). These include certain microorganisms, metals, inorganic minerals and chemical compounds, organic chemicals, and radionuclides known to be potentially harmful or otherwise affect the aesthetic quality of drinking water. A copy is available on DEQ's website at <http://deq.state.wy.us/wqd/groundwater/index.asp>. A Tier 1 analysis is very expensive and may cost upwards of a few thousand dollars to complete.

Tier 2 and Tier 3 ('Indicators') constituents are a limited set of potential contaminants that can be used to indicate changes in well water quality, and possibly detect the presence of water well contamination. They typically consist of several minerals and metals that occur naturally in ground water, physical parameters (e.g. pH), and one or more chemical constituents usually associated with potential sources of contamination in the area of the well. Different 'indicators' recommended by other agencies and laboratories may be equally suitable for establishing baseline water well quality and monitoring for potential contamination over time. The more comprehensive the list of constituents, the better, when determining whether well water is suitable for domestic use or has been impacted by a potential source of contamination.

Tier 2 constituents include: conductivity, pH, Total Dissolved Solids (TDS), alkalinity, barium, calcium, magnesium, sodium, chloride, sulfate, fluoride, nitrate, lead, arsenic, iron, and total organic carbon. A Tier 2 analysis is relatively inexpensive and will likely cost less than a couple hundred dollars to complete.

Tier 3 constituents are 'indicator' chemical compounds often associated with a potential source of contamination. A Tier 3 analysis can cost between a couple hundred to several thousand dollars to complete, depending upon the type and number of constituents to be analyzed by the laboratory.

Sampling Frequency

Upon completion of **Tier 1, Tier 2 and Tier 3** analyses to establish 'baseline' conditions, it is important to continue to periodically collect samples from the well in order to evaluate whether well water quality has changed over time, or not. Ideally, follow up samples should be analyzed for **Tier 1** constituents on a schedule similar to that required for public water systems, or more frequently if there is a noticeable change in the taste, color, or odor of well water. Generally, for groundwater-supplied public water systems EPA requires sampling and analyses for inorganic and synthetic organic contaminants and radionuclides every three years; volatile organic contaminants every 5 years (or annually if detected in prior samples); and nitrate and nitrite annually. Well owners may consider eliminating the need to analyze for constituents associated with sources of contamination which they believe pose little, if any threat to their water supply.

Unfortunately, the cost for Tier 1 analysis can be very expensive. Alternatively, less expensive sampling and lab analyses can be a useful way to periodically screen for changes in water well quality provided that the well owner understands the limitations of not completing a Tier 1 analyses on schedule. One alternative may be to rotate the sampling schedule by completing a Tier 1 analysis as scheduled in order to evaluate the safety of the well water for drinking water purposes, then complete less expensive Tier 2 and Ties 3 'indicator' sampling during Year 2 and annually or bi-annually thereafter in order to evaluate 'indicators' of potential contamination.

Well owners may wish to consider negotiating water well testing, both pre-and post-drilling, as a condition to their mineral lease, or surface use agreement. Obtaining baseline water well quality and periodic sampling and analysis may be beneficial to both parties.

Sample Collection and Laboratory Analysis

Water well testing should be arranged through a certified water testing laboratory and water well samples should be collected by an unbiased professional. This could be an employee of the water testing laboratory. Doing so can add significantly to the cost of water well testing but may be vital to the admissibility of the sample results if a legal action related to pollution of the water well ensues. It is unlikely that test results from water samples collected by the water well owner will be recognized in legal proceedings, however, well owners are encouraged to consult their own attorneys for professional advice.

It is also important to request laboratory methods that achieve a low detection limit in order to detect the presence of contaminants at low levels. Generally, the lower the detection limit, the more expensive the water quality analysis.

Before selecting a lab it may be prudent to check the laboratory's certifications. Preferred labs are certified by US EPA. Consult the 'Environmental' or 'Water Testing' sections of your local Yellow Pages for a list of laboratories within your area.

The Wyoming Department of Agriculture laboratory in Laramie also provides some analytical services and is EPA certified. For more information, contact the lab at 307-742-2984 or visit them online at: <http://wyagric.state.wy.us/images/stories/pdf/forms/aslab/labfees.pdf>.

Evaluating Sample Results

Tier 1 sample results should be compared to the safe drinking water levels listed on US EPA's Primary Drinking Water Standards table available on DEQ's website at <http://deq.state.wy.us/wqd/groundwater/index.asp>. If a sample result for any "primary" constituent exceeds its safe drinking water level (Maximum Contaminant Level (MCL)) listed on the table, the US EPA considers the water not safe for drinking water purposes. In these situations, well owners should discontinue use of the well until an assessment of water treatment alternatives has been completed. The cause may, or may not be associated with man-made contamination. For instance, some areas in Wyoming have naturally occurring constituents in ground water (e.g. arsenic, selenium, fluoride, radium, etc.) that exceed the safe drinking water level. If the cause of contamination is suspected to be a result of some type of human activity, well owners are encouraged to contact DEQ's Spill and Complaint hotline at 307-777-7781 or provide information online at DEQ's website (<http://deq.state.wy.us/>) by clicking on the link "Got a Spill?".

Tier 1 sample results should also be compared to the aesthetic drinking water levels listed on US EPA's Secondary Drinking Water Standards table available on DEQ's website at <http://deq.state.wy.us/wqd/groundwater/index.asp>. If a sample result for any "secondary" constituent exceeds its aesthetic drinking water level (Secondary Standard) listed on the table, the water may be safe for drinking water purposes, but may have problems with taste, appearance, or odor. Again, the cause may, or may not be associated with manmade contamination. Well owners should contact their local health department or county conservation district office, or visit DEQ's website at <http://deq.state.wy.us/wqd/groundwater/index.asp> for further information on water treatment.

Usually one sees only minor fluctuations in Tier 2 water quality results over time. Tier 2 sample results should also be compared to US EPA's Primary and Secondary Drinking Water Standards table as described above. If Tier 2 sample results illustrate an increasing trend in constituent concentration over time (i.e. over several sampling periods) the well owner is encouraged to consult with the local DEQ Water Quality Division office in Cheyenne, Sheridan, Lander, or Casper.

Tier 3 sample results should be compared to US EPA's latest edition of "*Drinking Water Standards and Health Advisories*" available on DEQ's website at <http://deq.state.wy.us/wqd/groundwater/index.asp>. If a sample result for any constituent exceeds its safe drinking water level (Maximum Contaminant Level (MCL)) or its drinking water equivalent level (DWEL) listed on the table, the US EPA considers the water to be not safe for drinking water purposes. In these situations, well owners should discontinue use of the well until an assessment of water treatment alternatives has been completed. The cause may, or may not be associated with man-made contamination. If the cause of contamination is suspected to be a result of some type of human activity, well owners are encouraged to contact DEQ's Spill and Complaint hotline at 307-777-7781 or provide information online at DEQ's website (<http://deq.state.wy.us/>) by clicking on the link "Got a Spill?".

For Further Information:

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