

**BEST MANAGEMENT PRACTICES  
FOR PRE-DRILLING WATER SAMPLING**



**April 28, 2005**

# Groundwater Sampling

Oil and gas wells are drilled through shallow freshwater aquifers. In order to protect freshwater from contamination, State permitting geologists carefully review oil and gas company applications for permits to drill. The State permitting geologists place requirements on permits to ensure groundwater aquifer protection. The permit requirements are enforced through the Division of Mineral Resources Management (DMRM) Regulatory [Enforcement Program](#). State inspectors witness and document drilling operations for environmental safety to protect natural resources, including fresh water.

As an added measure of verification, the State may require oil and gas companies to sample water wells before a crude oil or natural gas well is drilled. Oil and gas companies are required to submit water well sampling data to the [Ohio Department of Natural Resources, Division of Mineral Resources Management \(DMRM\)](#). DMRM will maintain the sampling data. The sampling data will serve as background or historic groundwater quality information. Should the need arise, the background information will be used by the DMRM Technical Section to conduct hydrologic investigations of domestic water supplies. If a private water supply is impacted by oil and gas operations, the DMRM Technical and Enforcement Sections work with the property owner and the oil and gas company to resolve the problem. This State service is provided without cost to the property owner.

The following sections summarize procedures and protocol to ensure water well samples are collected and tested to provide useful background information. Links to [USEPA](#) and [OEPA](#) websites are provided for more detailed discussions of each topic.

## Water Sampling

Water samples must be collected and analyzed utilizing proper sampling and laboratory protocol, including the use of proper sample containers, preservation methods, observing holding times, use of chain of custody, analysis by appropriate test methods, laboratory certification, and laboratory QA/QC. Without attention to these and other details, water analyses may be of little or no value.

## The Plan

Water sampling should begin with the design of a water-sampling plan. The plan may be simple. The State may require an oil and gas company to sample all domestic wells in a given area. The plan may be more involved. An oil and gas company may choose to sample beyond the area required by the State. Sampling may be based on hydrology, geology, aquifer characteristics, or any number of other factors.

**Step 1** – Define the limits of the water well sampling area.

**Step 2** – Develop a list of property owners, addresses, and telephone numbers.

Property owner information may be obtained at the county courthouse or through [county auditors websites](#). [Water well records](#) may be researched through the Ohio Department of Natural Resources, [Division of Water](#) or [county health department](#).

**Step 3** – Contact the property owner to obtain permission to sample each domestic water well. If a property owner refuses access to a domestic water well,

DMRM will require proof of refusal if the well is within the limits of a required sampling area (information to include; was the refusal in person or over the phone, date of attempted sample, who refused and why, were there secondary direct or phone contacts to attempt to obtain an sample). The documentation of “refusal” can be submitted along with the laboratory results that are submitted to DMRM (Step 10).

**Step 4** – Determine which chemical and physical parameters are to be analyzed. The State will require certain parameters to characterize pre-drilling water quality.

Water Sampling Testing Parameters		
Barium	Dissolved Ba	ug/l
Calcium	Total Ca	mg/l
Iron	Dissolved Fe	ug/l
Magnesium	Total Mg	mg/l
Potassium	Total K	mg/l
Sodium	Total Na	mg/l
Chloride	Cl	mg/l
Conductivity	at 25° C	umohs/cm
pH	SU	
Sulfate	SO <sub>4</sub>	mg/l
Alkalinity	Total CaCC <sub>3</sub>	mg/l
Total dissolved solids		mg/l

**Step 5** – Contact an [Ohio EPA certified laboratory](#). The laboratory should be Ohio EPA certified for each parameter to be tested. This provides certain quality assurances that the laboratory results will be accurate. The laboratory should follow generally accepted [Laboratory Test Methods](#) for each parameter being tested. The laboratory you select should be willing to provide quality assurance, quality control information for your samples.

**Step 6** – With [test parameters](#) identified and a laboratory selected, review [sampling protocol](#), [preservation methods](#), sample holding times, and chain of custody with the laboratory manager. The laboratory can provide [sample](#)

[containers](#), preservatives, and chain of custody and laboratory report forms.

Review sample [delivery methods and procedures](#) with the laboratory manager.

**Step 7** – Schedule sample collection with each property owner. It is important to verify treatment equipment and that filters have been by-passed before a sample is collected. Failure to do so may lead to water sample results that are not representative of true aquifer water quality. Property owners should be present when a sample is collected.

**Step 8** – Before samples are collected, each container should be labeled. Your laboratory may specify label information. General [labeling](#) information is listed on the DMRM website. It is important to label and identify sample containers that contain acid preservatives. It is important to document the sampling event. A [chain-of-custody form](#) should accompany each sample. Generic chain of custody forms are available on the Division of Mineral Resources Management website; see [Best Management Practices for Pre-Drilling Water Sampling, Water Sampling Collection Form](#) (pdf).

**Step 9** – Water samples must be representative of the aquifer(s) being produced. The water well should be pumped a sufficient length of time necessary to purge the volume of the water well at least three times. Certain parameters are most accurate if measured at the time of sample collection. Procedures for the [field measurement](#) of these parameters may be reviewed in the U.S. Geological Survey (USGS) [National Field Manual for the Collection of Water-Quality Data](#). These parameters are identified at: Division of Mineral Resources Management [Best Management Practices \(BMPs\) for Pre-Drilling Water Sampling](#), Step 4 - Water Sampling Testing Parameters.

**Step 10** – Laboratory reports should be forwarded to the [Division of Mineral Resources Management](#), the property owner, and local government (if requested).

## LINKS & REFERENCE OUTLINE

### OHIO DEPARTMENT OF NATURAL RESOURCES

[www.dnr.state.oh.us/](http://www.dnr.state.oh.us/)

### ODNR - DIVISION OF MINERAL RESOURCES MANAGEMENT

[www.dnr.state.oh.us/mineral/tabid/10352/Default.aspx](http://www.dnr.state.oh.us/mineral/tabid/10352/Default.aspx)

- [STAFF DIRECTORY](http://www.dnr.state.oh.us/tabid/10360/Default.aspx)
- [PERMITTING SECTION](http://www.dnr.state.oh.us/tabid/17942/Default.aspx)
- [ENFORCEMENT SECTION](http://www.dnr.state.oh.us/tabid/17872/Default.aspx)
- [INSPECTORS](http://www.dnr.state.oh.us/tabid/10355/Default.aspx)

### ODNR - DIVISION OF WATER

[www.dnr.state.oh.us/water/tabid/3252/Default.aspx](http://www.dnr.state.oh.us/water/tabid/3252/Default.aspx)

- [WATER WELL LOG ON-LINE SEARCH](http://www.dnr.state.oh.us/water/maptechs/wellogs/appNEW/Default.aspx)

### FORMS

- GROUNDWATER SAMPLING RECORD
- CHAIN-OF-CUSTODY
- CHEMISTRY LABORATORY REPORT
- LABELS

### TEST PARAMETERS

- INORGANIC
- ORGANIC
- PHYSICAL
- TRIP BLANKS
- DUPLICATE SAMPLES
- SPLIT SAMPLES
- PDWS
- SDWS

## LABORATORY TEST METHODS

- [ASTM \(www.astm.org/\)](http://www.astm.org/)
- [USEPA \(www.epa.gov/epahome/index\)](http://www.epa.gov/epahome/index)
- [USGS \(www.usgs.gov/\)](http://www.usgs.gov/)
  - [NATIONAL FIELD MANUAL FOR THE COLLECTION OF WATER-QUALITY DATA \(http://water.usgs.gov/owq/FieldManual/\)](http://water.usgs.gov/owq/FieldManual/)

## LABORATORIES, CERTIFIED

- [LABORATORY CERTIFICATION \(www.epa.ohio.gov/ddagw/labs.aspx\)](http://www.epa.ohio.gov/ddagw/labs.aspx)
- [COMMERCIAL LABORATORIES CERTIFIED TO PERFORM CHEMICAL ANALYSES ON PUBLIC DRINKING WATER \(www.epa.ohio.gov/ddagw/labs.aspx\)](http://www.epa.ohio.gov/ddagw/labs.aspx)
- [QUALITY ASSURANCE/QUALITY CONTROL \(http://www.epa.ohio.gov/portals/28/documents/labcert/chemman.pdf\)](http://www.epa.ohio.gov/portals/28/documents/labcert/chemman.pdf)

[OHIO ENVIRONMENTAL PROTECTION AGENCY WEBSITE \(www.epa.state.oh.us/\)](http://www.epa.state.oh.us/)

[UNITED STATES ENVIRONMENTAL PROTECTION AGENCY \(www.epa.gov/\)](http://www.epa.gov/)

- [PUBLIC DRINKING WATER STANDARDS FOR OHIO \(www.epa.ohio.gov/portals/28/documents/StandardsList.pdf\)](http://www.epa.ohio.gov/portals/28/documents/StandardsList.pdf)
- [USEPA DRINKING WATER STANDARDS \(www.epa.gov/safewater/standards.html\)](http://www.epa.gov/safewater/standards.html)
- [CONTAMINENTS LIST & MCLS \(www.epa.gov/safewater/mcl.html\)](http://www.epa.gov/safewater/mcl.html)
- [NATIONAL CONTAMINANT OCCURRENCE DATABASE \(www.epa.gov/safewater/data/ncod.html\)](http://www.epa.gov/safewater/data/ncod.html)
- [ANALYTICAL METHODS FOR DRINKING WATER - INORGANIC CHEMICALS \(www.epa.ohio.gov/portals/28/documents/StandardsList.pdf\)](http://www.epa.ohio.gov/portals/28/documents/StandardsList.pdf)
- [ANALYTICAL METHODS FOR DRINKING WATER – ORGANIC CHEMICALS \(www.epa.gov/safewater/methods/pdfs/methods/organic\\_080521b.pdf\)](http://www.epa.gov/safewater/methods/pdfs/methods/organic_080521b.pdf)

## SAMPLING PROTOCOL

- [LINK TO USEPA WEBSITE \(www.epa.gov/safewater/standards.html\)](http://www.epa.gov/safewater/standards.html)
  - [COMPENDIUM OF ERT GROUNDWATER SAMPLING PROCEDURES \(http://www.epa.gov/region09/qa/pdfs/fieldsamp-ertsops.pdf\)](http://www.epa.gov/region09/qa/pdfs/fieldsamp-ertsops.pdf)
- [LINK TO USGS WEBSITE \(http://www.usgs.gov/\)](http://www.usgs.gov/)

- [NATIONAL FIELD MANUAL FOR THE COLLECTION OF WATER-QUALITY DATA \(http://water.usgs.gov/owq/FieldManual/\)](http://water.usgs.gov/owq/FieldManual/)
- [PREPARATIONS FOR WATER SAMPLING \(http://water.usgs.gov/owq/FieldManual/chapter1/Ch1\\_contents.html\)](http://water.usgs.gov/owq/FieldManual/chapter1/Ch1_contents.html)
- [SELECTION OF EQUIPMENT FOR WATER SAMPLING \(http://water.usgs.gov/owq/FieldManual/Chapter2/Ch2\\_contents.html\)](http://water.usgs.gov/owq/FieldManual/Chapter2/Ch2_contents.html)
- [COLLECTION OF WATER SAMPLES \(http://water.usgs.gov/owq/FieldManual/chapter4/html/Ch4\\_contents.html\)](http://water.usgs.gov/owq/FieldManual/chapter4/html/Ch4_contents.html)
- [PROCESSING OF WATER SAMPLES \(http://water.usgs.gov/owq/FieldManual/chapter5/html/Ch5\\_contents.html\)](http://water.usgs.gov/owq/FieldManual/chapter5/html/Ch5_contents.html)
- [FIELD MEASUREMENTS \(http://water.usgs.gov/owq/FieldManual/Chapter6/Ch6\\_contents.html\)](http://water.usgs.gov/owq/FieldManual/Chapter6/Ch6_contents.html)

#### SUPPLIES

- LINKS TO SUPPLIERS OF TEST EQUIPMENT, SAMPLE CONTAINERS, PRESERVATIVES, ETC.