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OPPORTUNITIES FOR FREE BASELINE WATER QUALITY TESTING

The Colorado Water and Energy Research Center (CWERC) believes that groundwater monitoring is a key aspect of minimizing the potential environmental impacts of oil and gas extraction in Colorado, which is why the Center developed a monitoring guide that helps water well owners track their groundwater quality and quantity over time.

CWERC is not alone in its enthusiasm for groundwater monitoring. Colorado regulators, watershed groups, and energy industry officials alike recognize the importance of collecting pre- and post-drilling groundwater quality data in areas of oil and gas development. This widespread support of environmental monitoring means that **free groundwater quality testing** is available to some water well owners living in areas of natural gas extraction under **state regulations**.

Since drafting of the CWERC monitoring guide began, the state's oil and gas regulator (the Colorado Oil and Gas Conservation Commission, or COGCC) approved groundwater quality monitoring regulations that require oil and gas operators to collect baseline water samples from water wells statewide. Those rules built upon existing groundwater monitoring rules focused on three specific locations in Colorado – the Wattenburg Field in and around Weld County, the San Juan Basin near Durango, and the Raton Basin near Trinidad. The previous rules will remain in place in those areas.

Because groundwater monitoring is time consuming and expensive (**$500-700 for the Full Index** of analytes and **$180-210 for the Indicator** analytes in the CWERC guide), CWERC encourages well owners to take advantage of any free baseline testing that might be available to them under state rules or other programs. (If you live in Weld County, for example, the county Department of Public Health & Environment is offering testing for Volatile Organic Compounds at no cost to residents with domestic wells. Call 970-304-6415 for more information.) To understand which regulations apply to you and what they cover, please refer to the summaries of COGCC's groundwater monitoring regulations at the end of this document. To understand how these monitoring regulations compare to CWERC's groundwater monitoring program, please refer to the next section.

POSSIBLE GAPS IN THE GROUNDWATER MONITORING RULES

All of the regulations described below are positive steps in the direction of groundwater monitoring. COGCC's rules require that baseline water quality data be gathered by trained professionals at no expense to the well owner. All of the regulations include a comprehensive list of tests. As mentioned above, groundwater quality monitoring is time consuming and expensive, so reach out to the operator drilling in your proximity to find out if your well will be sampled under the COGCC regulations. **Unfortunately, the regulations may not cover every single water**

well in areas of natural gas extraction. The rules also differ slightly by location when it comes to how many groundwater samples must be collected and when. These potential gaps might inspire you a) to set up a groundwater monitoring program of your own as per the CWERC monitoring guide, and/or b) to negotiate a groundwater monitoring program in the process of deciding the terms of your Surface Use Agreement with an operator. For more details about the possible gaps in these regulations, please read on.

- **State rules do not guarantee that *your* well will be tested.** Private water well owners cannot control whether their well will be sampled under the COGCC's new sampling rules or their existing geographic-area baseline sampling rules. The regulations encourage operators to sample all water wells within one-half mile of an oil or gas well, but they do not require it. Operators retain ultimate discretion over which water wells they sample if more than one or two exist in close proximity to a new oil or gas well. As a result, **there is no guarantee that *your* well will be sampled under any of these regulations or programs**. (Your odds are the best under COGCC's new rules, since they require operators to sample all available water wells within one-half mile radius of a new oil or gas well (up to four). The new rules do not apply to the Greater Wattenburg Area or the San Juan and Raton coalbed methane basins, however.)
- **There won't be any sampling around old gas wells, only new ones.** COGCC's new sampling rules apply only to areas where new wells are being drilled or existing well pads are being expanded. Water quality data is just as important in areas where gas development has already occurred, particularly in places where existing gas wells are being hydraulically fractured or "re-stimulated" for a second or third time. **If you live near existing oil and gas wells, and if your water well hasn't already been tested under one of COGCC's older groundwater monitoring rules, it might not be tested by an operator.**
- **Operators are required to collect only one baseline sample.** By collecting only one baseline sample, it is impossible to capture seasonal changes in water quality, which can be both natural and significant in some groundwater systems. For example, groundwater chemistry can vary considerably by season in shallow alluvial groundwater systems in river valleys, particularly if there is irrigated agriculture in the area. **At least two water samples – collected in fall and spring – are necessary to estimate water chemistry's natural seasonal range**. Without understanding groundwater's seasonal diversity, it may be difficult to tell whether a change in water quality is the result of oil and gas development, or the product of natural cycles. This uncertainty may not favor private water well owners.
- **Operators may not collect enough post-drilling samples.** Long-term groundwater quality monitoring is important because water moves very slowly through most aquifers. COGCC's rules for coalbed methane basins require collection of post-drilling samples at 1, 3, and 6-year intervals after well completion. COGCC's new statewide rules require collection of post-drilling samples at six-to twelve months and 5-6 years after well completion. Both of these rules are reasonably comprehensive. In contrast, COGCC's rule for the Greater Wattenburg Area requires that only one post-drilling sample be collected, between six and twelve months after well completion. **This may not be enough sampling to provide for long-term tracking of water quality over the full lifecycle of a natural gas well.**
- **Operators do not have to measure depth-to-water in water wells.** COGCC's rules do not require that operators measure depth-to-water in the water well. CWERC recommends

that water well owners track the water levels in their wells in addition to their groundwater chemistry. In areas of coalbed methane development in particular, natural gas operators withdraw significant quantities of deep groundwater in order to free methane gas from saturated coal seams. **These groundwater withdrawals have unknown effects on regional groundwater flow patterns.**

SUMMARY OF COGCC GROUNDWATER MONITORING RULES

1. Statewide Testing – as Required by COGCC's New Statewide Groundwater Baseline Sampling and Monitoring Rule 609

Where? Anywhere in Colorado with oil and gas development**,** with the exception of the Greater Wattenburg Area and Coalbed Methane Basins, which are covered by their own specific rules (see #2 and #3, below)

Which Water Wells? COGCC's statewide groundwater baseline sampling and monitoring rule went into effect in May of 2013. Under this rule, oil and gas operators must collect baseline samples from **up to four water wells within a one-half mile radius** of a new oil or gas well, multi-well site, or dedicated injection well. If more than four water wells exist within that radius, the operator is encouraged to sample the closest wells that will provide the most thorough picture of the groundwater system. For example, operators are encouraged to sample the shallowest and deepest wells, as well as those located downhill and uphill from the oil and gas site (known as "downgradient" and "upgradient" in groundwater terms). If a well has been tested in the sampling area in the previous 18 months, the operator may not have to collect a new sample.

How Often Are Samples Collected? The pre-drilling baseline sample shall be collected **within the 12 months prior** to the oil or gas well's conductor pipe installation (i.e, the beginning of the drilling process). The operator must collect **one** follow-up monitoring sample between **six and twelve months** after the oil or gas well is completed. An additional sample must be collected between **five and six years** following well completion. All samples should be collected following COGCC's Model Sampling and Analysis Plan, published in May 2013 and available on the agency's homepage under "Hot Topics" (http://cogcc.state.co.us/RR_HF2012/Groundwater/FinalRules/Model_SAP_05012013.pdf).

What Gets Tested? The **initial pre-drilling baseline test** includes laboratory analysis of pH, specific conductance, total dissolved solids (TDS), dissolved gases (methane, ethane, propane), alkalinity, major anions (bromide, chloride, fluoride, sulfate, nitrate and nitrite as N, phosphorus), major cations (calcium, iron, magnesium, manganese, potassium, sodium), other elements (barium, boron, selenium and strontium), presence of bacteria (iron related, sulfate reducing, slime forming), total petroleum hydrocarbons (TPH), and BTEX compounds (benzene, toluene, ethylbenzene and xylenes). Field observations such as odor, water color, sediment, bubbles, and effervescence must also be documented.

The **post-completion monitoring samples** must be analyzed for total dissolved solids (TDS), dissolved gases (methane, ethane, propane), major anions (bromide, chloride, sulfate, and fluoride), major cations (potassium, sodium, magnesium, and calcium), alkalinity, BTEX compounds (benzene, toluene, ethylbenzene and xylenes), and total petroleum hydrocarbons (TPH).

What Happens if the Operator Finds Something Unexpected? If any water sample contains more than 1mg/L of methane, any BTEX compounds (benzene, toluene, ethylbenzene and xylenes), or petroleum hydrocarbons, the operator must notify COGCC immediately. If a water sample contains more than 1 mg/L of dissolved methane, compositional analysis must be performed to determine whether the methane came from a deep natural gas deposit (thermogenic methane) or whether it came from a shallow, unrelated source (biogenic methane). If thermogenic gas is present, if the methane concentration is at or above 10 mg/L, or if the methane concentration increases by more than 5 mg/L between sampling periods, the operator must notify the COGCC and the water well owner immediately.

Does the Well Owner Get to See the Results? The operator must provide copies of all laboratory results to the well owner, the COGCC, and the local government within three months of collecting the samples.

2. Testing in the Wattenburg Field – as Required by COGCC under Rule 318A.e.(4)

Where? The Greater Wattenburg Area (central and southern Weld County; northern Broomfield County; eastern Larimer, Boulder, and Jefferson counties; and northern Adams County)

Which Water Wells? COGCC has required operators to collect groundwater samples in the Greater Wattenburg Area – a region of intense gas development – since 2006. The agency updated its Greater Wattenburg Area rules slightly in early 2013 as part of its comprehensive groundwater monitoring rulemaking. Starting in May of 2013, COGCC will require the baseline sampling of **one water well per governmental quarter section** (one-quarter square mile) before the drilling of a new oil/gas well, the first well on a multi-well pad, or a dedicated injection well. If a sample has been collected within the area in the preceding five years, no new sampling is required. If there is no water well within the quarter section, the operator may sample a water well within one-half mile radius of the new oil or gas well. If multiple wells exist in the sampling area, operators are encouraged to prioritize the **closest, deepest, operational domestic well**. The pre-drilling baseline sample shall be collected **within the 12 months prior** to the oil or gas well's conductor pipe installation (i.e, the beginning of the drilling process).

How Often Are Samples Collected? The pre-drilling baseline sample must be collected **within the 12 months prior** to the oil or gas well's conductor pipe installation (i.e, the beginning of the drilling process). The operator must collect **one** follow-up monitoring sample between **six and twelve months after the well is completed**. All samples should be collected following COGCC's Model Sampling and Analysis Plan, published in May 2013 and

available on the agency's homepage under "Hot Topics" (http://cogcc.state.co.us/RR_HF2012/Groundwater/FinalRules/Model_SAP_05012013.pdf).

What Gets Tested? The initial **pre-drilling baseline test** includes laboratory analysis of pH, specific conductance, total dissolved solids (TDS), dissolved gases (methane, ethane, propane), alkalinity, major anions (bromide, chloride, fluoride, sulfate, nitrate and nitrite as N, phosphorus), major cations (calcium, iron, magnesium, manganese, potassium, sodium), other elements (barium, boron, selenium and strontium), presence of bacteria (iron related, sulfate reducing, slime forming), total petroleum hydrocarbons (TPH), and BTEX compounds (benzene, toluene, ethylbenzene and xylenes). Field observations such as odor, water color, sediment, bubbles, and effervescence must also be documented. If the water sample contains more than 1 mg/L of dissolved methane, then compositional analysis must be performed to determine whether the methane came from a deep natural gas deposit (thermogenic methane) or whether it came from a shallow, unrelated source (biogenic methane). If test results indicate thermogenic gas, or a mixture, the operator shall determine source of the gas.

That **post-completion monitoring sample** must be analyzed for total dissolved solids (TDS), dissolved gases (methane, ethane, propane), major anions (bromide, chloride, sulfate, and fluoride), major cations (potassium, sodium, magnesium, and calcium), alkalinity, BTEX compounds (benzene, toluene, ethylbenzene and xylenes), and total petroleum hydrocarbons (TPH).

What Happens the Operator Finds Something Unexpected? If any water sample contains more than 1mg/L of methane, any BTEX compounds (benzene, toluene, ethylbenzene and xylenes), or petroleum hydrocarbons, the operator must notify COGCC immediately. If a water sample contains more than 1 mg/L of dissolved methane, then compositional analysis must be performed to determine whether the methane came from a deep natural gas deposit (thermogenic methane) or whether it came from a shallow, unrelated source (biogenic methane). If thermogenic gas is present, if the methane concentration is at or above 10 mg/L, or if the methane concentration increases by more than 5 mg/L between sampling periods, the operator must notify the COGCC and the water well owner immediately.

Does the Well Owner Get to See the Results? The operator must provide copies of all laboratory results to the well owner and the COGCC within three months of collecting the samples, and to the local government designee upon request.

3. Testing in Coalbed Methane (CBM) Basins – as Required by COGCC Under Rule 608(b)

Where? **The San Juan Basin** (Archuleta and La Plata Counties); **The Raton Basin** (Huerfano County and Las Animas Counties)

Which Water Wells? COGCC has required all operators that drill for coalbed methane (CBM) to collect baseline water quality data from nearby water wells since 2009. The agency did not change this rule when it updated its regulations in early 2013. Under the

testing rule, operators must sample water from **two water wells within one-half mile radius** of the proposed CBM well.

How Often are Samples Collected? One pre-drilling baseline sample must be gathered before the new gas well is drilled, and monitoring samples must be collected at **1-, 3- and 6-year intervals** after the well is completed.

What Gets Tested? All samples must be analyzed for major cations and anions (calcium, magnesium, potassium, sodium, carbonate, bicarbonate, chloride and sulfate), total dissolved solids, iron, manganese, selenium, nitrates and nitrites, dissolved methane, field pH, sodium adsorption ratio, presence of bacteria (iron related, sulfite reducing, slime and coliform), specific conductance and hydrogen sulfide.

What Happens the Operator Finds Something Unexpected? If the water sample contains more than 2 mg/L of dissolved methane, compositional analysis must be performed to determine whether the methane came from a deep natural gas deposit (thermogenic methane) or whether it came from a shallow, unrelated source (biogenic methane). If thermogenic gas is present, if the methane concentration is at or above 10 mg/L, or if the methane concentration increases by more than 5 mg/L between sampling periods, the operator must notify the COGCC and the water well owner immediately.

Does the Well Owner Get to See the Results? The operator must provide copies of all laboratory results to the well owner and the COGCC within three months of collecting the samples.