

April 22, 2009

Renee McClure
21000 HWY 52
Hudson, Colorado 80642

RE: Water Quality Analytical Results for Your Water Well (Permit # 204246)
NENE Section 4 – Township 1 North – Range 65 West
Weld County, Colorado; Complaint No. 200207912

Dear Ms. McClure:

On March 25, 2009 Terracon Inc. of Wheat Ridge, Colorado (Terracon), under direction of the Colorado Oil and Gas Conservation Commission (COGCC), sampled your water well and submitted these samples for laboratory analysis. The purpose of this water sampling was to determine if natural gas drilling and production activities in your area might have impacted your well water. The water sample collected by the Terracon was submitted to Evergreen Analytical Laboratory (Evergreen) in Wheat Ridge, Colorado, for analysis of inorganic chemical constituents, organic compounds associated with petroleum hydrocarbons, and methane gas. A copy of the Evergreen laboratory analytical report is enclosed. Additionally a sample of gas from your water well was collected for compositional analysis and submitted to Isotech Laboratories, In. (Isotech) in Champaign, Illinois. A copy of the Isotech report is also enclosed.

The Water Quality Control Commission (WQCC) of the Colorado Department of Public Health and Environment (CDPHE) has established drinking water standards for the protection of human health. The analytical results from the water samples from your well have been compared to applicable ground water and/or drinking water standards and are summarized below. Please keep in mind that these water standards were established for public drinking water supplies. Often people use and consume ground water from private wells that can exceed these standards.

COMPARISON OF INORGANIC ANALYTICAL RESULTS TO STANDARDS

(Please see enclosed Evergreen Laboratory Report)

- **Total Dissolved Solids (TDS):** CDPHE has established a TDS standard for human drinking water of 500 milligrams per liter (mg/l). The standard is called the secondary maximum contaminant level (SMCL) and is based on the aesthetic quality of the water (such as taste and odor) and is intended as a guideline for public water supply systems and is not an enforceable standard. Although CDPHE does not have an agricultural standard for TDS, other agencies recommend concentrations below 2,000 mg/l for irrigation, and below 5,000 mg/l for most livestock watering. TDS concentrations are related to the presence of naturally occurring elements and chemical compounds such as chloride, sodium, potassium, calcium, magnesium,

and sulfate.

TDS was detected in the water sample from your well at concentration of 969 mg/l, which is above the CDPHE SMCL, less than the recommended maximum concentration for irrigation, and less than the recommended maximum concentration for most livestock watering.

- **Sodium (Na):** Although CDPHE does not have a standard for sodium, people on salt restricted diets should be aware of the Na concentration in the water they drink. A concentration of drinking water with a concentration of sodium less than 20 mg/l is recommended by some for people on salt restricted diets or for people suffering from hypertension or heart disease. Sodium occurs naturally in the ground water in many areas at concentrations that exceed the recommended level.

Sodium was detected in the water sample from your well at a concentration of 419 mg/l, which is greater than the recommended level for people of salt restricted diets.

- **Fluoride (F):** CDPHE has established a fluoride (F) standard for human drinking water is 4.0 mg/l. Where fluoride concentrations are in the range of 0.7 mg/l to 1.2 mg/l, health benefits such as reduced dental decay have been observed. Consumption of fluoride at concentrations of greater than 2.0 mg/l can result in mottling of teeth. Consumption of fluoride at concentrations greater than 4.0 mg/l can increase the risk of skeletal fluorosis or other adverse health effects.

Fluoride was detected in the water sample from your water well at a concentration of 3.7 mg/l, which is less than the maximum human health drinking water standard.

Chloride (Cl): The CDPHE chloride standard (SMCL) for drinking water is 250 mg/l. Chloride concentrations in excess of 250 mg/l usually produce a noticeable taste in drinking water.

Chloride was detected in the water sample from your well at a concentration of 130 mg/l, which is less than the CDPHE SMCL.

- **Sulfate (SO₄):** The CDPHE sulfate standard for drinking water is 250 mg/l (SMCL). Although CDPHE does not have an agricultural standard for sulfate, other agencies recommend a concentration below 1,500 mg/l for livestock watering. Waters containing high concentrations of sulfate, typically caused by the leaching of natural deposits of magnesium sulfate (Epsom salts) or sodium sulfate (Glauber's salt), may be undesirable because of their laxative effects. Sulfate occurs naturally in the ground water in many areas in Colorado at concentrations that exceed the drinking water standard.

Sulfate was not detected in the water sample from your well.

- Total Nitrate (NO₃) + Nitrite (NO₂) as Nitrogen (N): The CDPHE total nitrate (NO₃) + nitrite (NO₂) as nitrogen (N) for standard for human drinking water is 10 mg/l. Nitrate and nitrite are common contaminants in ground water from agricultural sources, such as fertilizer and animal, including human, wastes. They are known to cause infant cyanosis or “blue baby disease” in humans and, at concentrations greater than 100 mg/l as nitrogen (N), may be dangerous to livestock. High concentrations of nitrate and nitrite in ground water are known to occur in agricultural areas in Colorado.

Total nitrate/nitrite, as N was not detected in the water sample from your well.

- Iron (Fe): The CDPHE standard for human drinking water for iron is 0.3 mg/l (SMCL). Small amounts of iron are common in ground water. Iron may produce a brownish-red color in laundered clothing, can leave reddish stains on fixtures, and impart a metallic taste to beverages and food made with it. After a period of time iron deposits can build up in pressure tanks, water heaters, and pipelines, reducing the effective flow rate and efficiency of the water supply.

Iron was detected in the water sample from your well at a concentration of 0.126 mg/l, which is less than the CDPHE SMCL water standard.

- Selenium (Se): The CDPHE selenium standard for human drinking water is 0.05 mg/l and the agricultural standard is 0.02 mg/l. Excessive selenium (Se) (concentrations greater than 0.05 mg/l) can cause loss of hair and/or fingernails as well as adverse effects on the central nervous system. Selenium (Se) occurs naturally in the ground water in many areas of Colorado at concentrations that exceed the drinking water standard.

Selenium was not detected in the sample from your water well.

- Calcium (Ca), Potassium (K), and Magnesium (Mg) were also tested for in your water. There are no standards from CDPHE for these parameters. In addition, the COGCC also collected samples for metals and the Table 1 (attached) presents the analytical laboratory results. Please note that Primary standard (P) is the CDPHE Human Health Standard and the Secondary standard (S) is the CDPHE secondary maximum contaminant level (SMCL).

**Table 1
 MCCLURE WATER WELL**

METAL/INORGANIC	March 25, 2009 Sample Concentration (in Milligrams per liter [mg/l])	CDPHE Water Quality Standard (P – Primary S-Secondary) (in Milligrams per liter [mg/l])
Arsenic (As)	0.0501	0.05 (P)
Barium (Ba)	0.0731	2.0 (P)
Calcium (Ca)	2.69	NS
Cadmium (Cd)	ND	0.005 (P)
Chromium (Cr)	ND	0.1 (P)
Potassium (K)	2.1	NS
Manganese (Mn)	0.0105	0.05 (S)
Magnesium (Mg)	0.908	NS
Lead (Pb)	ND	0.05 (P)

NS – no standard

ND – not detected in the sample

ORGANIC COMPOUNDS ASSOCIATED WITH PETROLEUM HYDROCARBONS

- Benzene: CDPHE's basic ground water standard for benzene is 5 micrograms per liter ($\mu\text{g/l}$). **Benzene was not detected in the sample from your water well.**
- Toluene: CDPHE's basic ground water standard for toluene is 1,000 $\mu\text{g/l}$. **Toluene was not detected in the sample from your water well.**
- Ethylbenzene: CDPHE's basic ground water standard for ethylbenzene is 680 $\mu\text{g/l}$. **Ethylbenzene was not detected in the sample from your water well.**
- Total Xylenes (sum of m,p, and o-xylene): CDPHE's basic ground water standard for total xylenes is 10,000 $\mu\text{g/l}$. **Total xylenes were not detected in the sample from your water well**

METHANE GAS CONCENTRATION

- **Methane was detected in the sample from your water well at a concentration of 10 mg/l.**

Methane gas alone is physiologically inert and non-toxic to humans. Normal breath exhalation contains 1 to 99 ppm of methane (parts per million [ppm] is the same units as mg/l). The presence of methane in drinking water does not present a known health hazard to humans or other animals via ingestion; however, methane in domestic water supplies can be associated with undesirable and potentially serious side effects. Methane gas dissolved in water “exsolves” when exposed to the

atmosphere and dissipates rapidly because it is lighter than air. This is often responsible for the “fizzing” observed in water wells that may contain methane gas. If the methane occurs at a high enough concentration and if it is allowed to accumulate in a confined space, such as a well pit, crawl space, closet, etc., an explosion hazard can be established. In addition, if methane concentrations in well water are high, then pockets of free gas form within the water and cause the well pump to cavitate and no longer bring water to the surface.

Methane gas is common in water wells in Colorado. It occurs naturally and the source of the methane is commonly from one or more of the sources listed below.

1. Methane is commonly found as a gas in coal or black shale seams in the subsurface.
2. Methane is commonly found as a byproduct of the decay of organic matter and the presence of bacteria in water wells can provide the conditions favorable for the production of methane either from the activity or decay of bacteria.

As the result of extensive testing for methane gas in water wells throughout Colorado, concentrations of methane gas below 1 mg/l are considered harmless, with concern for possible hazards from the methane increasing at concentration levels in well water at 7 mg/l and higher. You should be aware that the methane gas in your water well is at a high enough concentration that precautions should be taken to adequately vent your water system to avoid potential gas accumulations. I have included some additional information on mitigation of methane gas from home water wells that may be of interest.

GAS COMPOSITION

The gas produced from the oil/gas wells around your home is “thermogenic” methane. Thermogenic methane gas is formed by the thermal breakdown of organic material in rocks resulting from high temperatures created by deep burial. With the methane are other higher carbon number compounds (“heaver”) such as propane (C3), iso-butane (iC4), normal butane (nC4), iso-pentane (iC5), normal pentane (nC5), and hexane (C6). Biogenic methane gas occurs in most near-surface environments and is a principal product of the decomposition of buried organic material. In Weld County many of the coal zones in the Laramie/Fox Hills aquifer contain biogenic methane gas.

Laboratory results of the gas sample collected from your water well show that methane (75.33 percent) and ethane (0.066 percent) were detected along with nitrogen (22.74 percent), oxygen (1.14 percent), argon (0.38 percent), and carbon dioxide (0.34 percent). The nitrogen, oxygen, argon, and carbon dioxide are components of air and the presence of methane (C1) with ethane (C2) is typical of the naturally occurring biogenic gas in the Laramie/Fox Hills aquifer. No “heaver” carbon compounds that would indicate a thermogenic gas impact are present.

Isotopic Analysis of Methane

- The deuterium/hydrogen isotope ratio for the methane in the water sample from your water well is -277 parts per mil (‰).

- The carbon-13/carbon-12 isotope ratio for the methane in the water sample from your water well is -72.15 ‰.

Isotopic Cross-Plot

I have included a cross-plot of the stable methane isotopes for your water well sample to help discuss the sample results for your well. On the cross-plot you will notice the area near the top right corner as defined a “Thermogenic Gas”. This is the area of the cross-plot that the natural gas produced by the gas wells in the Denver Basin and where the production gas sample plot. Your well plots in the area to the left defined as “Sub-surface Microbial Gas (CO₂ Reduction)” which is methane gas of a biogenic origin.

BACTERIA OCCURENCE

Terracon also collected samples of your well water for the determination of the presence of bacteria using the Biological Activity Reaction Test (**BART™**) for the following; Iron Related Bacteria (IRB), Sulfate Reducing Bacteria (SRB), and Slime Forming Bacteria (SFB). In addition, an estimation of the size of the population and/or the rate at which they can metabolize and/or grow to generate an observable change or reaction was made. This reaction rate is referred to as the “aggressivity” of the bacterial population. The aggressivity levels of the bacteria are described as **Not Detected, Non Aggressive (Background), Moderately Aggressive, Very Aggressive, or Extremely Aggressive Levels**. I have included a photograph of the BART kits.

Iron Related Bacteria: Although not usually harmful, iron related bacteria (IRB) can become a nuisance by plugging the well pump, causing red staining on plumbing fixtures and laundered clothing, building up red, slimy accumulations on any surface the water touches, and causing what may appear to be a oily sheen on standing water. In rare cases, IRB may cause sickness.

- **Moderately aggressive IRB bacteria were detected in the water sample from your well.**

Sulfate Reducing Bacteria: Sulfate reducing bacteria (SRB) are serious nuisance organisms in water since they can cause severe taste and odor problems. These bacteria reduce sulfate that occurs naturally in the water and generate hydrogen sulfide (H₂S) gas as they grow. In turn, the hydrogen sulfide (H₂S) gas is a nuisance because it smells like rotten eggs, it initiates corrosion on metal surfaces, and it reacts with dissolved metals such as iron to generate black sulfide deposits.

- **SRB bacteria were not detected in the water sample from your well.**

Slime Forming Bacteria: Although not usually harmful, Slime Forming Bacteria (SFB) also can become a nuisance by plugging well pumps and causing slimy accumulations on plumbing fixtures and standing water. Slimes often are gelatinous in nature and may range in color from white, to red, to black. As slim bacteria mats grow they create an environment in which complex associations of other strains of bacteria can develop.

- **SFB bacteria were not detected in the water sample from your well.**

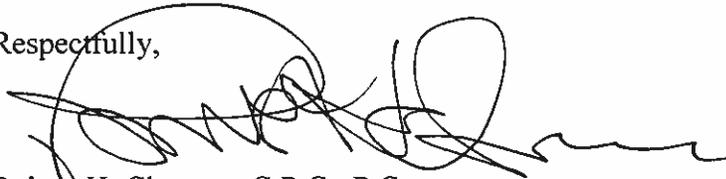
CONCLUSION

Because your water exceeded the CDPHE drinking water (SMCL) standard for total dissolved solids (TDS), and the health advisory for sodium (Na), and because you or your livestock and/or pets drink your water, you may wish to discuss the possible health effects of continued consumption with your physician and/or veterinarian. There are no indications of any oil & gas related impacts to your water well.

The Colorado Oil & Gas Conservation Commission has participated in the publication of a general information pamphlet on water supply wells. Although the pamphlet was written for water well owners in Southwest Colorado, much of the information presented is applicable to any water well within the state and includes a simple well disinfection procedure to help control nuisance bacteria.

If you have any questions or would like to discuss these matters further, please contact me at the COGCC in Denver via e-mail (robert.chesson@state.co.us) or by phone at 303-894-2100, extension 5112.

Respectfully,

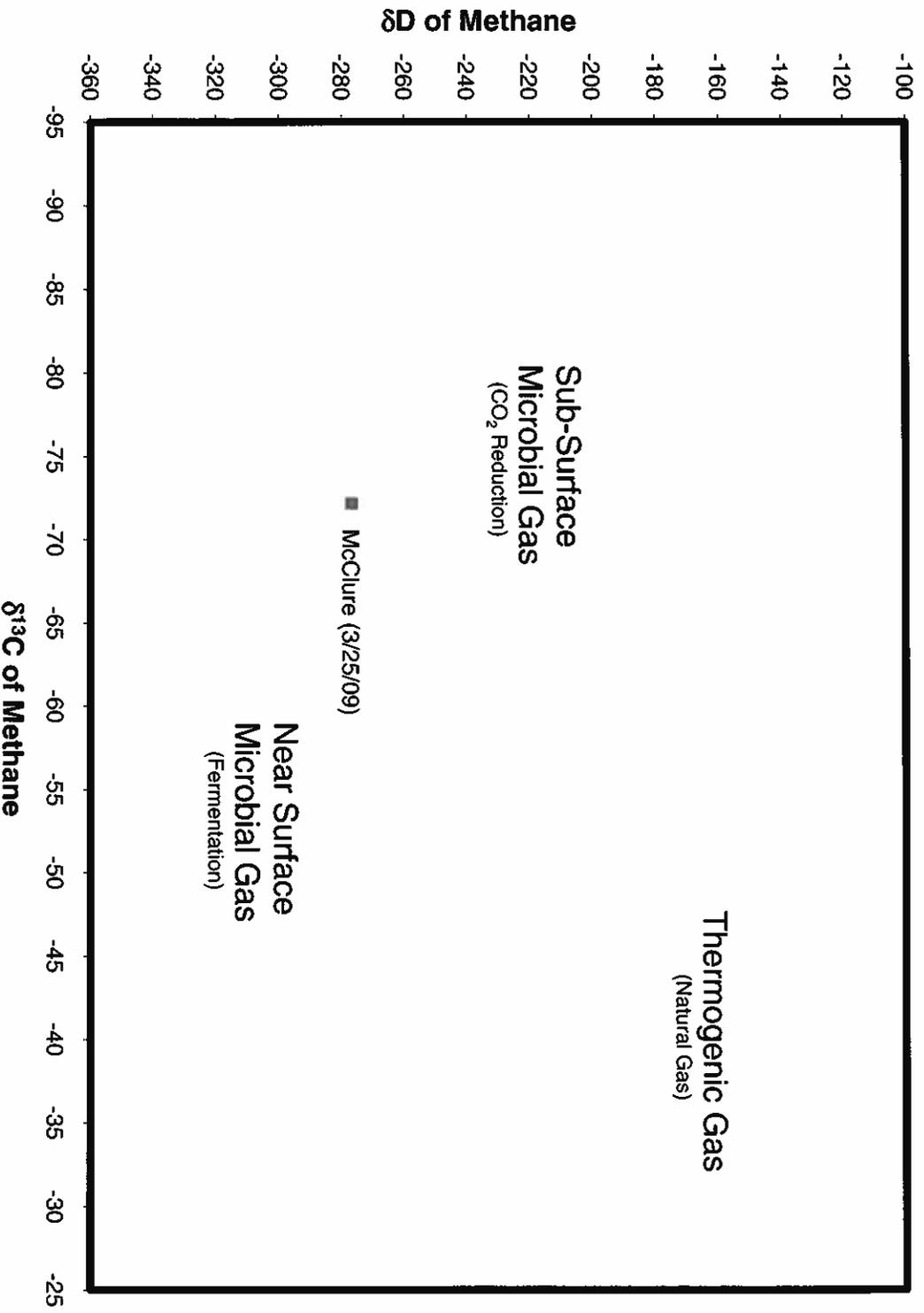


Robert H. Chesson, C.P.G., P.G.
Environmental Protection Specialist

Enclosures

cc: Dave Neslin – COGCC w/o enclosures
Debbie Baldwin – COGCC w/o enclosures

Typical Compositional Ranges of Methanes - McClure





ANALYSIS REPORT

Lab #: 159187 Job #: 11202
 Sample Name/Number: McClure Water Well
 Company: Colorado Oil & Gas Conservation
 Date Sampled: 3/25/2009
 Container: Dissolved Gas Bottle
 Field/Site Name:
 Location: Hudson, CO
 Formation/Depth:
 Sampling Point:
 Date Received: 3/26/2009 Date Reported: 4/01/2009

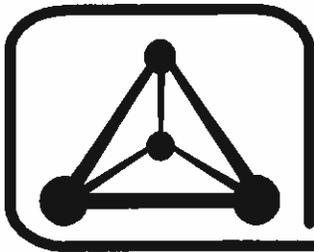
Component	Chemical mol. %	Chemical Air Free vol. %	Delta 13C per mil	Delta D per mil	Delta 15N per mil
Carbon Monoxide -----					
Hydrogen Sulfide -----	nd	nd			
Helium -----	nd	nd			
Hydrogen -----	nd	nd			
Argon -----	0.38	0.35			
Oxygen -----	1.14				
Nitrogen -----	22.74	19.55			
Carbon Dioxide -----	0.34	0.36			
Methane -----	75.33	79.67	-72.15	-277.0	
Ethane -----	0.066	0.070	-46.58		
Ethylene -----	nd	nd			
Propane -----	nd	nd			
Iso-butane -----	nd	nd			
N-butane -----	nd	nd			
Iso-pentane -----	nd	nd			
N-pentane -----	nd	nd			
Hexanes + -----	nd	nd			

Total BTU/cu.ft. dry @ 60deg F & 14.7psia, calculated: 765
 Specific gravity, calculated: 0.661

Remarks:

Analysis is of gas extracted from water by headspace equilibration. Analysis has been corrected for helium added to create headspace. Helium dilution factor = 0.43

nd = not detected. na = not analyzed. Isotopic composition of carbon is relative to VPDB. Isotopic composition of hydrogen is relative to VSMOW. Calculations for BTU and specific gravity per ASTM D3588. Chemical compositions are normalized to 100 percent. Mol. % is approximately equal to vol. %



ISOTECH®

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Page: 1

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Denver, CO 80203

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Robert H. Chesson
Colorado Oil & Gas Commission
1120 Lincoln St, Suite 801
Denver, CO 80203

Invoice #: 12333
Invoice Date: Apr 21, 2009
Purchase Order #: OE PHA 09000000003
Terms: 5% 15 days, Net 30 days. No discount if paid with credit card.

Description	Job #	Qty	Units	Price	Total
Project: McClure Water Well Sample collected 3/25/2009	11202				
Full compositional analysis of gas samples		1.0ea		120.00	120.00
Conventional C & H isotope anal. of methane		1.0ea		210.00	210.00
Compound-specific C isotope analysis of gas components		1.0ea		66.00	66.00

I HEREBY CERTIFY THAT I HAVE RECEIVED THE ARTICLES LISTED ABOVE, THAT I HAVE CAREFULLY INSPECTED, WEIGHED, COUNTED OR MEASURED THE COMMODITIES AND FOUND THEM IN GOOD CONDITION AND COMPLYING WITH THE SPECIFICATIONS GIVEN OR THAT THE SERVICES WERE SATISFACTORY, EXCEPT AS NOTED.

 4/22/09
SIGNATURE DATE

MCCLURE WATER WELL
WELD COUNTY
COGCC COMPLAINT # 200207912

Freight	
Total Invoice	396.00
Payment Received	
Total Due (USD)	\$396.00

Past due balances are subject to a finance charge of 1.5% per month