STATE OF COLORADO
OIL & GAS
CONSERVATION COMMISSION

DEPARTMENT OF NATURAL RESOURCES
Bill Ritter, Jr., Governor
1120 Lincoln St., Suite 801
Denver, CO 80203
Phone: (303) 894-2100
FAX: (303) 894-2109
www.cogcc.state.co.us

April 3, 2009

Renee McClure
21000 HWY 52
Hudson, Colorado 80642

RE: Stable Isotope and Gas Composition Analytical Results for Your Water Well
(Permit #2042460)
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 COGCC has not yet received the results of the general water quality samples collected from your well. We anticipate receiving those results within the next few weeks and will submit those results under another cover letter. Because you observed that gas from your water well could be ignited, the COGCC collected a sample of gas from your water well for compositional analysis and submitted to Isotech Laboratories, Inc. (Isotech) in Champaign, Illinois. A discussion of these sample results and a copy of the Isotech report is enclosed.

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, in which your water well is completed, 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 (those C3 through C6 gasses discussed above) are present that would indicate the presence of thermogenic gas.

Isotopic Analysis of Methane

- The deuterium/hydrogen isotope ratio for the methane in the water sample from your water well is –277.0 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/ Near Surface Microbial Gas" which is methane gas of a biogenic origin.

CONCLUSION

Based on the analysis of the gas content and stable isotopes of methane for the gas from your water well, the methane gas present is the product of natural bacteriological activity and unrelated to any oil & gas activities in your area.

The additional water quality sample results for your well are anticipated to be finished within the next few weeks. As discussed above, the COGCC will send you those sample results under a separate cove letter. 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
Mikel Cox – Noble Energy
Paul Schneider – Kerr McGee/Anadarko

ISOTECH

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

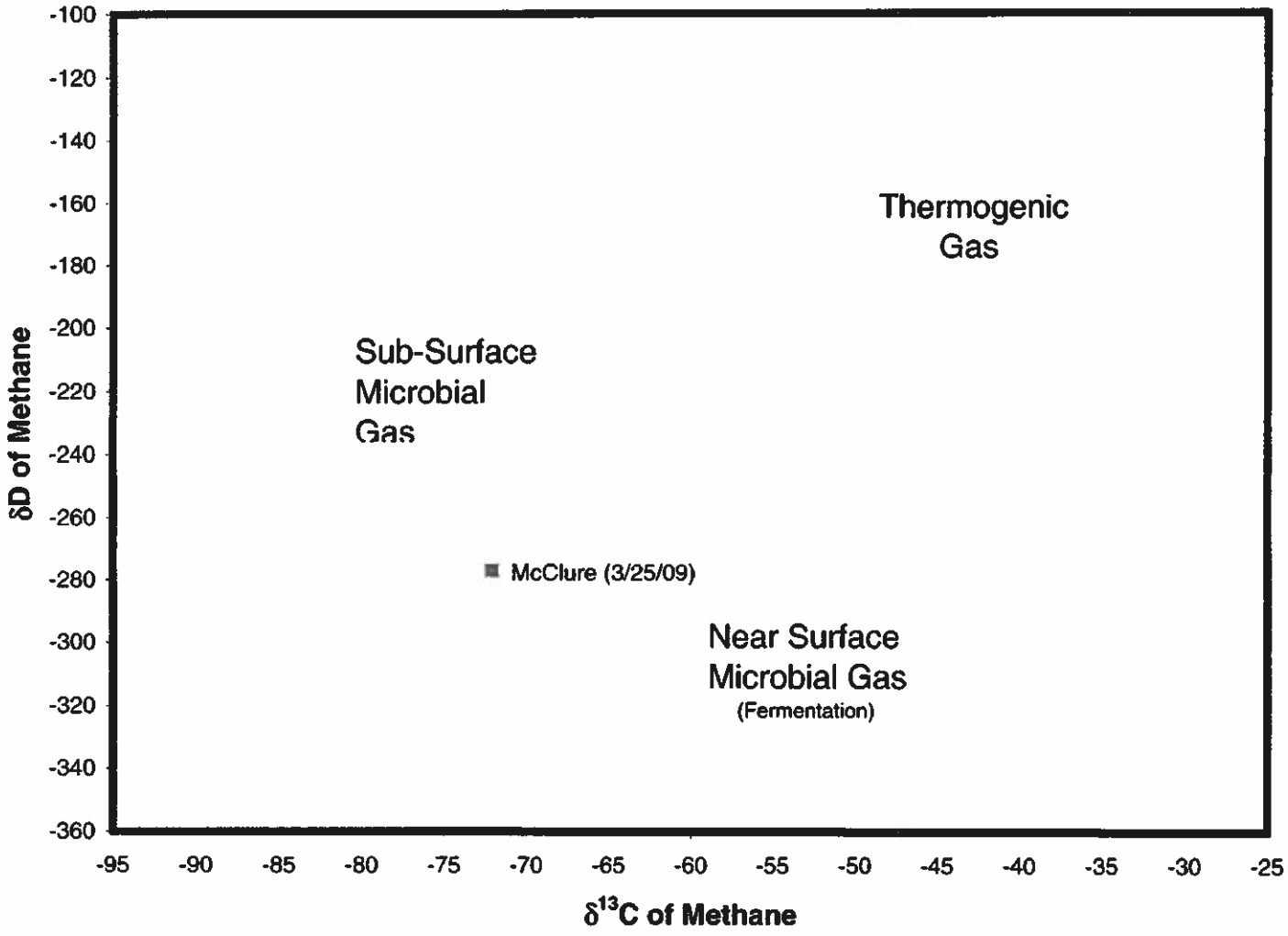
Specific gravity, calculated: 0.661

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. %

Typical Compositional Ranges of Methanes - McClure



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April 7, 2009

Renee McClure
21000 HWY 52
Hudson, Colorado 80642

RE: Methane Mitigation Information for your Water Well
Section 4 – Township 1 North – Range 65 West
Weld County, Colorado; Complaint No. 200207912

Dear Ms. McClure:

As you are aware gas sampling of your water well shows that your well water contains methane gas of a biological origin. Biogenic methane gas is not uncommon in water wells in Weld County.

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. You should be aware that the methane gas in your water well may be at a high enough concentration that precautions should be taken to adequately vent your water system to avoid potential gas accumulations.

I have attached several "fact sheets" regarding several simple, cost effective measures that you may consider installing on your water system to vent your well of any contained methane gas. The information ranges from some simple well venting caps to a more involved cistern type of a system.

The additional water quality sample results for your well are anticipated to be finished within the next few weeks. As discussed in my April 3, 2009 letter, the COGCC will send you those sample results under a separate cove letter. 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
Mikel Cox – Noble Energy
Paul Schneider – Kerr McGee/Anadarko

200207912

804 Grand Ave.
Platteville, CO 80651

Tel: 970.785.5000
After Hours: 303.939.8585
Fax: 970.785.5099
www.nobleenergyinc.com

North America Division

noble energy

RECEIVED
APR 09 2009
COGCC

April 7, 2009

Ms. Renee McClure
21000 HWY 52
Hudson, Colorado 80642

RE: Water Well Sampling Results
21000 HWY 52
Hudson, Colorado 80642

Dear Ms. McClure:

On March 25, 2009, LT Environmental, Inc. (LTE), under the direction of Noble Energy, Inc. (Noble), conducted sampling of your domestic well at 21000 Highway 52 in Hudson Colorado. The purpose of the sampling was to determine if surrounding oil and natural gas production activities have impacted your water well.

General water quality parameter results have not been received from the laboratory as of the date of this letter. Noble expects these results within the next few weeks.

Gas samples collected from your well were submitted to Isotech Laboratories of Champaign, Illinois (Isotech) for analysis of gas composition and methane isotopes. Those results are quite similar to those obtained separately by the Colorado Oil and Gas Conservation Commission (COGCC), and reported to you in COGCC's letter of April 3, 2009. A summary of the results obtained by Noble is presented below.

Gas Composition

Compounds detected during the gas composition analysis included methane and ethane, compounds which comprise biogenic gas. As you know from recent meetings and correspondence with COGCC, biogenic gas is commonly found in water wells throughout Weld County, Colorado that are completed in the Laramie-Fox Hills (LFH) Aquifer. The LFH Aquifer has multiple continuous coal seams which are known to produce biogenic gas.

As seen in the attached analytical report, certain heavier hydrocarbon compounds, ethylene through hexanes, were not detected in the gas sample from your water well. These compounds are indicative of thermogenic gas. These results from the gas composition analysis performed for Noble are in general agreement with the results obtained by COGCC, and would appear to be consistent with COGCC's conclusion that the gas present in the water well is shallow biogenic

gas and does not indicate that the aquifer has been impacted from surrounding oil and natural gas production activities.

Isotopic Analysis of Methane

The deuterium/hydrogen isotope ratio for methane gas in the sample collected from your well is -280.3 parts per mil. The carbon 13/carbon 12 isotope ratio for methane gas in the sample collected from your well is -73.29 parts per mil. These results are also in general agreement with those obtained by COGCC.

Conclusion

Analytical results for gas composition and stable isotopic analysis of gas obtained by Noble from your water well are in general agreement with those obtained by COGCC. The remaining analytical results from your water well sample will be submitted to you under separate cover once received by Noble's contractor.

Please call us at 970-785-5000 if you have any questions or comments regarding this report.

Sincerely,

NOBLE ENERGY, INC.

Mike Cox
Environmental Coordinator

Attachment

cc: Debbie Baldwin, COGCC

ATTACHMENT 1

GAS COMPOSITION AND ISOTOPIC

ANALYTICAL REPORT

ISOTECH
ISOTECH LABORATORIES INC

ANALYSIS REPORT

Lab #:	159180	Job #:	11200
Sample Name/Number:	Renee McClure		
Company:	LT Environmental		
Date Sampled:	3/24/2009		
Container:	Dissolved Gas Bottle		
Field/Site Name:			
Location:			
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	0.088	0.099			
Hydrogen	nd	nd			
Argon	0.43	0.37			
Oxygen	2.30				
Nitrogen	29.00	22.95			
Carbon Dioxide	0.23	0.26			
Methane	67.90	76.27	-73.29	-280.3	
Ethane	0.048	0.054	-46.67		
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: 689
Specific gravity, calculated: 0.692

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. %

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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 (SO_4): 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 (NO_3) + Nitrite (NO_2) as Nitrogen (N): The CDPHE total nitrate (NO_3) + nitrite (NO_2) 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 (µg/l). **Benzene was not detected in the sample from your water well.**

- Toluene: CDPHE's basic ground water standard for toluene is 1,000 µg/l. **Toluene was not detected in the sample from your water well.**

- Ethylbenzene: CDPHE's basic ground water standard for ethylbenzene is 680 µg/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 µg/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.

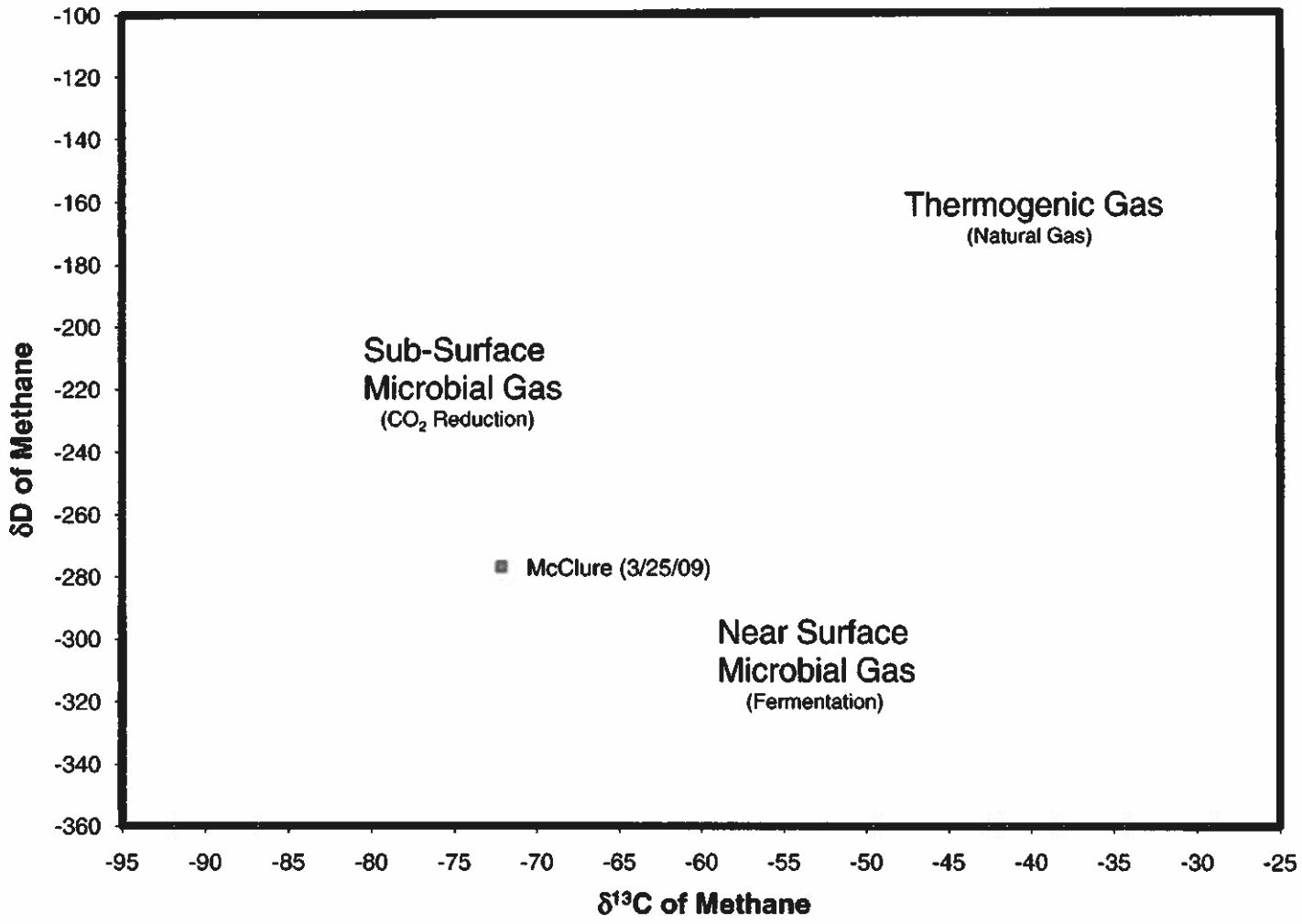
Respectfully,

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



ISOTECH
ISOTECH LABORATORIES INC

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®

Isotech Laboratories, Inc.
1308 Parkland Court
Champaign, IL 61821-1826

INVOICE

Ph (217)398-3490 FAX (217)398-3493 FEIN# 37-1181669

Sold To:
Colorado Oil & Gas Cons Comm
1120 Lincoln St.
Room 801
Denver, CO 80203

Ship To
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		1.0	ea	120.00	120.0(
Conventional C & H isotope anal. of methane		1.0	ea	210.00	210.0(
Compound-specific C isotope analysis of gas components		1.0	ea	66.00	66.0(

I HEREBY CERTIFY THAT I HAVE RECEIVED THE ARTICLES LISTED ABOVE, THAT I HAVE CAREFULLY INSPECTED, WEIGHTED, 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.

SIGNATURE DATE 4/22/09

McCLURE WATER WELL
WELD COUNTY
CoGCC COMPLAINT # 200207912

Freight	
Total Invoice	396.0(
Payment Received	
Total Due (USD)	$396.0(

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

20020791


McClure
Day 8
4-01-09
4:25pm
Iron Related Bacteria
(detected)
Slime Forming Bacteria
(Not Detected)
Sulfate Reducing Bacteria
(Not detected)
Iron Related Bacteria
2 4 6 8 9
Days to Present
Slime Forming Bacteria
2 3 4 6 7
days to Present
BART™
Sulfate Reducing Bacteria
2 4 6 8 9
Days to Present
BART™
McClure Water Well
BART™ TEST RESULTS
Sampled: /25/2009

Fac ID 705495

STATE OF COLORADO
OIL & GAS
CONSERVATION COMMISSION

01984779

DEPARTMENT OF NATURAL RESOURCES
Bill Ritter, Jr, Governor
1120 Lincoln St Suite 801
Denver, CO 80203
Phone (303) 894-2100
FAX (303) 894-2109
www cogcc state co us

September 30, 2008

Mike W Markham
19231 Weld County Road 22
Ft Lupton, CO 80621

RE Water Quality Analytical Results for Domestic Water Well (Permit #63252)
Section 8 – Township 2 North – Range 65 West
Weld County, Colorado, Complaint No 200190138

Dear Mr Markham

On May 23, 2008, the Colorado Oil & Gas Conservation Commission (COGCC) sampled your water well and submitted the water samples for laboratory analysis The purpose of the water sampling was to determine if natural gas drilling and production activities in your area might have impacted your water well The water samples were delivered to Evergreen Analytical Laboratory (Evergreen) in Wheat Ridge, Colorado for analysis of organic and inorganic compounds A separate water sample was delivered to Empact Analytical Systems, Inc (Empact) in Brighton, Colorado for gas compositional analyses Copies of the Evergreen and Empact laboratory analytical reports are included in Attachments A and B

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 water well were compared to applicable ground water and/or drinking water standards and are summarized below These water standards were established for public drinking water supplies

COMPARISON OF INORGANIC ANALYTICAL RESULTS TO STANDARDS

(Please see enclosed Evergreen Laboratory Report, Attachment A)

- 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 samples from your water well at concentrations of 788 mg/l, which is greater than 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 water well at a concentration of 287 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 3.3 mg/l, which is less than the CDPHE public 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 water well at a concentration of 73.7 mg/l, which is less than the CDPHE SMCL.

- Sulfate (SO_4) 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 water well.

- Total Nitrate (NO_3) + Nitrite (NO_2) as Nitrogen (N) The CDPHE total nitrate (NO_3) + nitrite (NO_2) 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 water 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 water well at a concentration of 18.1 mg/l, which is greater than the CDPHE SMCL water standard.

- Manganese (Mn) The CDPHE standard for human drinking water for manganese is 0 05 mg/l (SMCL) and the agricultural standard is 0 2 mg/l Manganese concentrations in excess of 0 05 mg/l may cause the water to leave a black stain and/or have a bitter metallic taste.

  Manganese was detected in the water sample from your water well at a concentration of 0.299 mg/l, which is greater than the CDPHE SMCL water standard and greater than the agricultural 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.

- Alkalinity, Bromide (Br), Calcium (Ca), Potassium (K), Magnesium (Mg), Bicarbonate (HCO_3) and Carbonate (CO_3) 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
MARKHAM WATER WELL

METAL/INORGANIC	May 23, 2008 Sample Concentration (in Milligrams per liter [mg/l])	CDPHE Water Quality Standard (P – Primary S-Secondary) (in Milligrams per liter [mg/l])
Alkalinity (Total)	579	NS
Bicarbonate	542	NS
Carbonate	37.0	NS
Bromide (Br)	0.64	NS
Calcium (Ca)	6 15	NS
Chloride (Cl)	73.7	250 (S)
Fluoride (F)	3 3	4 0 (P)
Iron (Fe)	18.1	0 3 (S)
Potassium (K)	2 88	NS
Manganese (Mn)	0 299	0 05 (S)
Magnesium (Mg)	3 07	NS
Nitrate (NO3-N)	ND	10 0 (P)
Nitrite (NO2-N)	ND	1 0 (P)
pH	8 64 pH units	NS
Selenium (Se)	ND	0 05 (P)
Sodium (Na)	287	NS
Specific Conductance	1200 *µmhos/cm*	NS
Sulfate (SO4)	ND	250 (S)
Total Dissolved Solids	788	500 (S)

NS – no standard
ND – not detected in the sample

ORGANIC COMPOUNDS ASSOCIATED WITH PETROLEUM HYDROCARBONS
(please see Attachment A)

- Benzene CDPHE's basic ground water standard for benzene is 5 micrograms per liter (µg/l) **Benzene was not detected in the sample from your water well.**

- Toluene CDPHE's basic ground water standard for toluene is 1,000 µg/l **Toluene was not detected in the sample from your water well.**

- Ethylbenzene CDPHE's basic ground water standard for ethylbenzene is 680 µg/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 µg/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 14 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 2 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

GAS COMPOSITION

The gas produced from the oil/gas wells around the subject water well 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 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 water sample collected from your water well indicated that methane (C1) and ethane (C2) were detected (Attachment B) Typically, the naturally occurring biogenic gas in the Laramie-Fox Hills aquifer contains only C1 and C2 The presence of propane (C3), iso-butane (iC4), normal butane (nC4), iso-pentane (iC5), normal pentane (nC5), and hexane (C6) would indicate a potential impact from thermogenic gas originating from deeper gas producing formations

Since these constituents were not identified in the gas sample, it is unlikely that the dissolved methane in your well water has a thermogenic origin

BACTERIA OCCURENCE

COGCC 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 Your well water showed the presence of the IRB and SRB SFB were absent in your well water (Attachment C)

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

- **Aggressive populations of 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 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 slime 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.**

WATER WELL DISCUSSION/RECORDS REVIEW

Colorado Division of Water Resources records indicate that your well is 530 feet deep and is completed in the north central part of the Laramie-Fox Hills aquifer. Water from the well is a sodium bicarbonate type of water typical of the central and north central regions of this aquifer (*Chapter 6, 6 1 Denver Basin in Ground Water Atlas of Colorado, Colorado Geological Survey*

Special Publication 53, 2003) We have reviewed water well drilling logs for several water wells (including your water well) in your immediate area. Many of these wells are completed in the Laramie/Fox Hills aquifer and these wells have water chemistry similar to your well

CONCLUSION

The water sample collected from your water well did not exceed the CDPHE primary drinking water standards for the constituents analyzed and the secondary drinking water standards were exceeded for iron, manganese and Total Dissolved Solids

There are no indications of any oil & gas related impacts to your water well

Dissolved methane in the well water appears to be biogenic in origin The gas exists in sufficiently high concentrations that an explosion hazard could exist if the methane were able to accumulate in a confined space Care should be taken to ventilate confined spaces where well water is used

The positive iron related bacteria and sulfate reducing bacteria result from your water well indicates that treating the well water for bacteria may help to improve the water quality Included in Attachment D is a COGCC water well booklet entitled, "*How Well Do You Know Your Water Well?*" This booklet contains useful information about water wells including a water treatment decision guide, ways to maintain your well, and chlorination techniques for disinfecting your well if you have bacterial contamination This booklet is also available on the COGCC website at http //cogcc state co us

If you have any questions or would like to discuss these matters further, please contact me at via e-mail (john axelson@state co us) or by phone at (303) 637-7178

Respectfully,

John Axelson, P G
Environmental Protection Specialist, Northeast Region
Colorado Oil and Gas Conservation Commission

Enclosure(s)

Attachment A – Evergreen Laboratory Analytical Report
Attachment B – Empact Laboratory Analytical Report
Attachment C - Biological Activity Reaction Test Results
Attachment D - Booklet - "*How Well Do You Know Your Water Well?*"

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

REFERENCE

Ground Water Atlas of Colorado, Special Publication 53, 2003 Colorado Geological Survey, Department of Natural Resources, Denver, Colorado

ATTACHMENT A

Evergreen
Analytical
Laboratory

June 07, 2008

John Axelson
Colorado Oil & Gas Conservation Comm
9203 E 155th Dr
Brighton, CO 80602

Lab Work Order 08-3556
Client Project ID Markham WW

Dear John Axelson

Enclosed are the analytical results for the samples shown in the Laboratory Work Order Summary The invoice is included with this report or has been mailed to another party as indicated on the chain of custody

The enclosed data for testing performed at Evergreen Analytical Laboratory (EAL) have been reviewed for quality assurance A case narrative is included to describe any anomalies associated with the samples or data

EAL will dispose of all samples one month from the date of this letter If you want samples returned, please advise us by mail or fax as soon as possible

A copy of this project report and supporting data will be retained for a period of five years unless we are otherwise advised by you A document retrieval charge will apply

Thank you for using the services of Evergreen Analytical If you have any questions concerning the analytical data, please contact me Please direct other questions to Client Services

Sincerely,

Carl Smits

Carl Smits / Kaprie Hollman
Quality Assurance

001

WORK ORDER Summary Evergreen Analytical, Inc. 08-3556

Rpt To John Axelson
Colorado Oil & Gas Conservation Comm
9203 E 155th Dr
Brighton, CO 80602
(303) 637-7178

Email To john axelson@state co us

5/23/2008 3 30 33 PM

Client Project ID Markham WW

QC Level LEVEL I+

Comments Report EDD and PDF

Sample ID	Client Sample ID	Matrix	Collection Date	Date Received	Test Code	Test Name	Hold	MS	Date Due	Hold Time
08-3556-01A	Markham WW	Groundwater	5/23/08 1000	5/23/08	8021_W *	8021 BTEX			5/29/08	6/06/08
08-3556-01B	Markham WW	Groundwater	5/23/08 1000	5/23/08	200 7_T *	200 7 Total Metals			6/09/08	11/19/08
08-3556-01B	Markham WW	Groundwater	5/23/08 1000	5/23/08	200 8_TR *	200 8 Total Metals			6/09/08	11/19/08
08-3556-01C	Markham WW	Groundwater	5/23/08 1000	5/23/08	ANIONS_NonDW *	300 0 Anions by IC			6/09/08	5/25/08
08-3556-01C	Markham WW	Groundwater	5/23/08 1000	5/23/08	C/A_BAL	Cation / Anion Balance calculation			6/09/08	
08-3556-01D	Markham WW	Groundwater	5/23/08 1000	5/23/08	MEEP_W *	RSK175M Methane			6/09/08	6/06/08
08-3556-01E	Markham WW	Groundwater	5/23/08 1000	5/23/08	F_W	Fluoride			6/09/08	6/20/08
08-3556-01F	Markham WW	Groundwater	5/23/08 1000	5/23/08	ALK_WGRP *	Alkalinity			6/09/08	6/06/08
08-3556-01F	Markham WW	Groundwater	5/23/08 1000	5/23/08	COND_W	Specific Conductance @ 25°C			6/09/08	6/20/08
08-3556-01F	Markham WW	Groundwater	5/23/08 1000	5/23/08	PH_DW	E150 1 pH			6/09/08	5/24/08
08-3556-01F	Markham WW	Groundwater	5/23/08 1000	5/23/08	TDS_W	Total Dissolved Solids (TDS)			6/09/08	5/30/08

Definitions * - Test Code has a Select List

002

CHAIN OF CUSTODY RECORD / ANALYTICAL SERVICES AGREEMENT **

Page 1 of 1

Evergreen Analytical Laboratory Inc.

4036 Youngfield St
Wheat Ridge, Colorado 80033
(303) 425-6021
FAX (303) 425-6854
(877) 737-4521
info@evergreenanalytical.com

CLIENT INFORMATION

Mail **Original** Report to OGCC
Attn John Axelson
Address 9203 E. 155th Dr
City Brighton State CO Zip 80602
Tel # 303 637 7178 Fax # 7179 E mail john.axelson@state.co.us

REPORT ALSO BY ☐ FAX ☐ PDF ☐ EDD
REPORT CHROMATOGRAMS ☐ NO

Mail Invoice to Same
Attn
Address
City State Zip
Tel # Fax #
Project ID# Markham WW
PO Quote
Sampler John Axelson

NOTE. *Identify Known Hazards Below*

Report Results by (Date)
Standard 2 working weeks ☒
UST Analyses per Fee Schedule ☐
* Rush ☐ less than 24 hrs, 150% ☐ 1 - 2 work days, 100%
☐ 3 - 5 work days, 50% ☐ 6 9 work days, 25%
*Subject to surcharge & exceptions noted in fee schedule

CONFIRMATION OF SAMPLE RECEIPT REQUIRED? ☐ YES

SAMPLE IDENTIFICATION	DATE SAMPLED	TIME	No of Containers	MATRIX: 1)Drinking Water or 2)Discharge Water or 3)Ground Water (circle one)	Soil / Solid / Air / Gas	Oil / Sludge / Wipe	TCLP VOA/BNA/Pest/Herb/Metals (circle)	Volatile Organics 8260/624 (circle)	Semi-volatile Organics BNA, PAH, PNA 8270/625 (circle)	Chlorinated Pesticides 8081/608 (circle)	Organophosphorous Pesticides 8270	PCBs/8082/608/screen (circle)	Herbicides 8151	BTEX 8021/602/8260/MTBE (circle)	TVPH 8015mod / 8260 (circle)	TEPH 8015mod (Diesel)	Total Metals-DW / NPDES / SW846 (circle & list metals below)	Dissolved Metals DW / SW846 (circle & list metals below)	Oil & Grease 1664 / 9071 (circle)	TRPH 418.1	Anions 300.0 (circle below)	Methane	Alkaline Group	TDS	Conductivity	pH		For Laboratory Use Only
Markham WW	5/23/08	10:00	9	3										X			X				X	X	X	X	X	X		WO # 08-3556
																												BOF # NA
																												C/S (O) M / M
																												C/S (I) M / 40
																												Temp °C 3.4 / Ice ✓
																												Seals Present Y / N / NA
																												Samples Pres Y / N / NA
																												Headspace Y / N / NA
																												By
Sample Fraction														A			B				C	D	E	F	F	F		

Instructions Ca, Fe, Mn, K, Mg, Na, Cl, NO_2, NO_3, Br, SO_4, CO_3, HCO_3, F, Se Provide anion/cation report

** **Important Note**: See reverse side for Terms and Conditions

Anions Bromide, Chloride, Nitrate, Nitrite, O-Phosphate, Sulfate (Circle)

Relinquished by (Signature)	Date/Time	Received by (Signature)	Date/Time	Relinquished by (Signature)	Date/Time	Received by (Signature)	Date Time
[signature]	5/23/08 13:25	[signature]	5/27/08 13:25				

Evergreen Analytical, Inc. **Date.** *07-Jun-08*

Client Project ID· Markham WW
Lab Order *08-3556*

CASE NARRATIVE

SAMPLE RECEIVING

Sample(s) were hand delivered to the laboratory by the client
The temperature of the sample(s) upon arrival was 8 4 °C
Sample(s) were received in good condition, in the proper container, and within holding times
Sample(s) were preserved properly , VOC sample(s) were marked as preserved on the bottle labels
VOC sample(s) were received with no headspace present JD

QUALITY ASSURANCE (QA)

Analyses performed on samples in this work order by EAL meet the requirements of the EAL Quality Assurance Program unless otherwise explained Analyses of RCRA samples meet the requirements of NELAC and Utah Rule R444-14 unless otherwise explained CMS

CLIENT SERVICES

There are no anomalies to report EKH

GENERAL CHEMISTRY

The anion sample required a dilution due to matrix interference affecting nitrate This raised the reporting limit for nitrate There are no other anomalies to report JML/MM

METALS ANALYSIS

There are no anomalies to report WKH

GAS CHROMATOGRAPHY

Method 8021_W There are no anomalies to report MDS

Method RSK175M There are no anomalies to report MDS

Evergreen Analytical, Inc.

4036 Youngfield Street, Wheat Ridge, Colorado 80033-3862
(303) 425-6021

Client Sample ID:	Markham WW	**Lab Work Order**	08-3556
Client Project ID:	Markham WW	**Lab Sample ID:**	08-3556-01A
Date Collected:	5/23/08	**Sample Matrix:**	Groundwater
Date Received:	5/23/08		

AROMATIC VOLATILE ORGANICS

Method: SW8021B **Prep Method: SW5030B**

Date Prepared:	5/23/08	**Lab File ID:**	TVB20523\014R	**Dilution Factor:**	1
Date Analyzed:	5/23/08	**Method Blank:**	MB2052308		

Analytes	CAS Number	Result		LQL	Units
Benzene	71-43-2	U		1 0	µg/L
Toluene	108-88-3	U		2 0	µg/L
Ethylbenzene	100-41-4	U		2 0	µg/L
m,p-Xylene	1330-20-7	U		2 0	µg/L
o-Xylene	95-47-6	U		2 0	µg/L
Surr 1,2,4-Trichlorobenzene (S)	120-82-1	92	QC Limits:	60-140	%REC

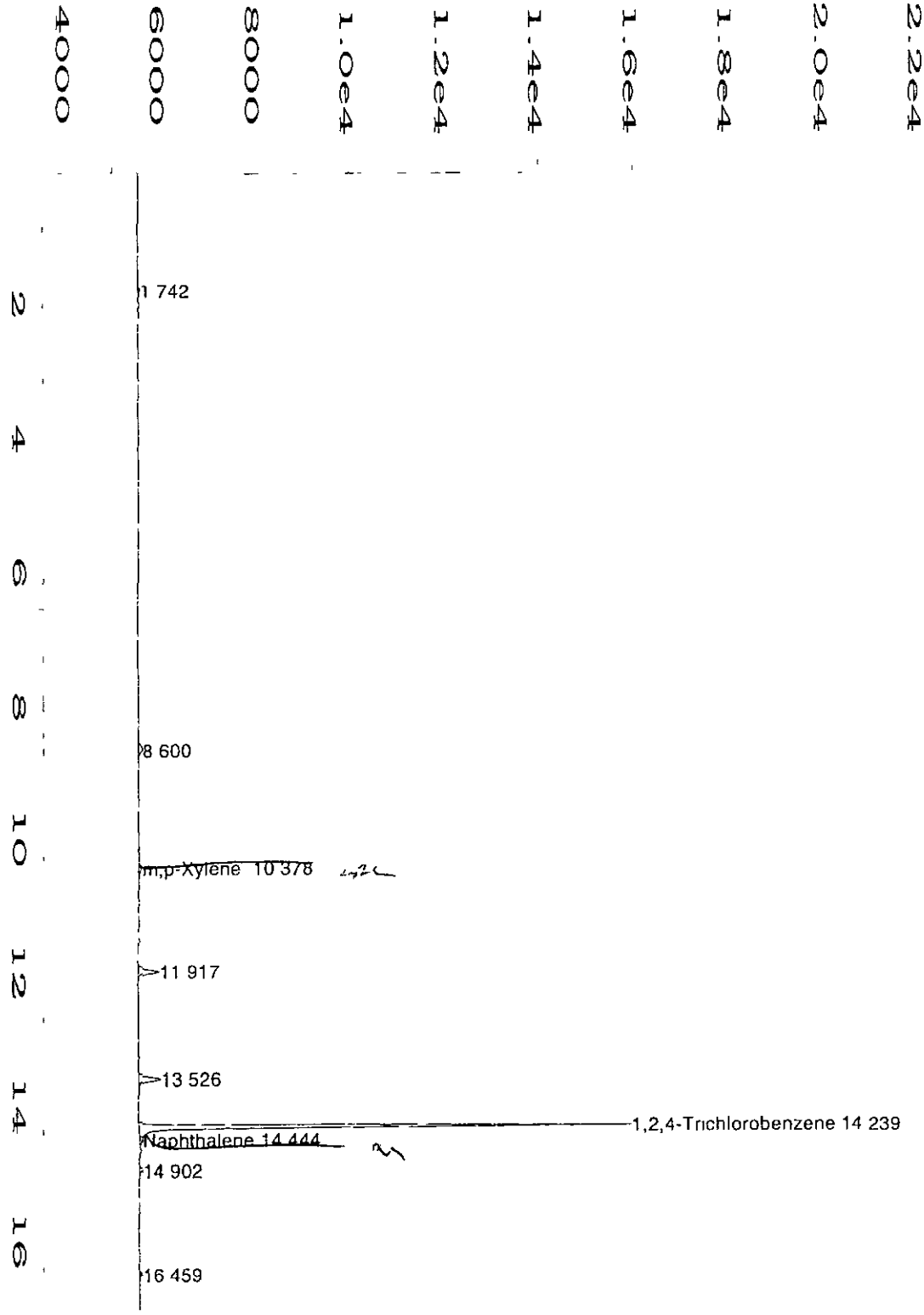
Analyst Approved

Notes Total Xylenes consist of three isomers, two of which co-elute The Xylene RL is for a single peak Confirmation analysis was not performed

Qualifiers
B - Analyte detected in the associated Method Blank, value not subtracted from result
E - Extrapolated value Value exceeds calibration range
H - Sample analysis exceeded analytical holding time
J - Indicates an estimated value when the compound is detected, but is below the LQL
S - Spike Recovery outside accepted limits
U - Compound analyzed for but not detected
X - See case narrative
* -Value exceeded the Maximum Contamination Level (MCL), TCLP limit, or if compound is undetected, LQL exceeds MCL

Definitions
LQL - Lower Quantitation Limit
Surr - Surrogate

Print Date 5/27/08



Data File Name	C \HPCHEM\2\DATA\TVB20523\014R0101.D		
Operator	Marcus Stephenson	Page Number	1
Instrument	TVHBTEX2	Vial Number	14
Sample Name	08-3556-01A	Injection Number	1
Run Time Bar Code		Sequence Line	1
Acquired on	23 May 08 06 08 PM	Instrument Method	TW21201I MTH
Report Created on	23 May 08 06·26 PM	Analysis Method	BW20516.MTH
Last Recalib on	19 MAY 08 01·56 PM	Sample Amount	0
Multiplier	1	ISTD Amount	
Sample Info	SAMP DF=1 T1=~~607~~		

Evergreen Analytical, Inc.

4036 Youngfield Street, Wheat Ridge, Colorado 80033-3862
(303) 425-6021

Client Sample ID: Markham WW
Client Project ID. Markham WW
Date Collected: 5/23/08
Date Received: 5/23/08

Lab Work Order 08-3556
Lab Sample ID: 08-3556-01
Sample Matrix: Groundwater

TOTAL METALS

Method. E200.7, Rev 4.4 **Prep Method: E200.7, Rev. 4.4**

Date Prepared 5/29/08 **Lab File ID:** 053008PM **Dilution Factor:** 1
Date Analyzed: 5/30/08 **Method Blank.** MB-15636 **Lab Fraction ID:** 08-3556-01B

Analytes	CAS Number	Result	LQL	Units
Calcium	7440-70-2	6 15	0 387	mg/L
Iron	7439-89-6	18 1	0 0700	mg/L
Magnesium	7439-95-4	3 07	0 150	mg/L
Manganese	7439-96-5	0 299	0 00500	mg/L
Potassium	7440-09-7	2 88	0 340	mg/L
Sodium	7440-23-5	287	0 400	mg/L

TOTAL METALS

Method: E200.8 **Prep Method: E200.8**

Date Prepared 6/3/08 **Lab File ID:** 080603A B\098SMPL D **Dilution Factor** 1
Date Analyzed 6/3/08 **Method Blank** MB-15658 **Lab Fraction ID:** 08-3556-01B

Analytes	CAS Number	Result	LQL	Units
Selenium	7782-49-2	U	0 00200	mg/L

Analyst

Approved

Qualifiers B - Analyte detected in the associated Method Blank, value not subtracted from result
E - Extrapolated value Value exceeds calibration range
H - Sample analysis exceeded analytical holding time
J - Indicates an estimated value when the compound is detected, but is below the LQL
S - Spike Recovery outside accepted limits
U - Compound analyzed for but not detected
X - See case narrative
* -Value exceeded the Maximum Contamination Level (MCL), TCLP limit, or if compound is undetected, LQL exceeds MCL

Definitions N A Not Applicable
LQL Lower Quantitation Limit
Surr - Surrogate

Print Date 6/5/2008

Evergreen Analytical, Inc.

4036 Youngfield Street, Wheat Ridge, Colorado 80033-3862
(303) 425-6021

Client Sample ID: Markham WW
Client Project ID: Markham WW
Date Collected: 5/23/08 1000
Date Received: 5/23/08

Lab Work Order 08-3556
Lab Sample ID: 08-3556-01
Sample Matrix: Groundwater

ANIONS BY IC

Method: E300.0 **Prep Method:**

Date Prepared: 5/23/08
Date Analyzed: 5/23/08 1816 **Method Blank:** MB 5/23/08 **Dilution Factor:** 1 **Lab Fraction ID:** 08-3556-01C

Analytes	CAS Number	Result	LQL	Units
Bromide	7647-15-6	0 64	0 20	mg/L
Sulfate	7778-80-2	U	0 50	mg/L

Date Prepared. 5/23/08
Date Analyzed· 5/23/08 1518 **Method Blank:** MB 5/23/08 **Dilution Factor:** 2 **Lab Fraction ID:** 08-3556-01C

Analytes	CAS Number	Result	LQL	Units
Chloride	7647-14-5	73 7	1 0	mg/L
Nitrite		U	0 40	mg/L

Date Prepared: 5/23/08
Date Analyzed: 5/23/08 1803 **Method Blank** MB 5/23/08 **Dilution Factor** 5 **Lab Fraction ID·** 08-3556-01C

Analytes	CAS Number	Result	LQL	Units
Nitrate		U	1 0	mg/L

Analyst **Approved**

Qualifiers
B - Analyte detected in the associated Method Blank value not subtracted from result
E - Extrapolated value Value exceeds calibration range
H - Sample analysis exceeded analytical holding time
J - Indicates an estimated value when the compound is detected, but is below the LQL
S - Spike Recovery outside accepted limits
U - Compound analyzed for but not detected
X - See case narrative
* -Value exceeded the Maximum Contamination Level (MCL), TCLP limit or if compound is undetected LQL exceeds MCL

Definitions
NA - Not Applicable
LQL - Lower Quantitation Limit
Surr - Surrogate

Print Date 5/27/08

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St , Wheat Ridge, CO 80033
(303)425-6021

Anion-Cation (Ion) Balance - Method 1030, Standard Methods, 20th Ed

EAL Sample ID	08-3556-01		08-		08-		08-		08-	
Client Sample ID	Markham WW									
Sample Result	mg/L	Meq/L	mg/L	Meq/L	mg/L	Meq/L	mg/L	Meq/L	mg/L	Meq/L
Anions										
Cl	73 7	2 079		0 000		0 000		0 000		0 000
SO_4		0 000		0 000		0 000		0 000		0 000
HCO_3 as $CaCO_3$	579	11 570		0 000		0 000		0 000		0 000
CO_3 as $CaCO_3$		0 000		0 000		0 000		0 000		0 000
NO_3		0 000		0 000		0 000		0 000		0 000
NO_3 as N		0 000		0 000		0 000		0 000		0 000
Br	0 64	0 008		0 000		0 000		0 000		0 000
Anions Total		13 656		0 000		0 000		0 000		0 000
Cations										
Ca	6 2	0 307		0 000		0 000		0 000		0 000
Mg	3 07	0 253		0 000		0 000		0 000		0 000
K	2 88	0 074		0 000		0 000		0 000		0 000
Na	287	12 484		0 000		0 000		0 000		0 000
Other		0 000		0 000		0 000		0 000		0 000
Cations Total		13 117		0 000		0 000		0 000		0 000
Ion Balance % Difference		**2.02**								

$$\% \text{ difference} = 100 \times \frac{(\text{sum cations} - \text{sum anions})}{(\text{sum cations} + \text{sum anions})}$$

RAK
Approved

Evergreen Analytical, Inc.

4036 Youngfield Street, Wheat Ridge, Colorado 80033-3862
(303) 425-6021

Client Sample ID.	Markham WW	Lab Work Order	08-3556
Client Project ID	Markham WW	Lab Sample ID	08-3556-01
Date Collected:	5/23/08 1000	Sample Matrix·	Groundwater
Date Received	5/23/08		

ALKALINITY

Method: SM2320B **Prep Method:**

Date Prepared	5/27/08	Lab File ID	67	Dilution Factor:	1
Date Analyzed	5/27/08	Method Blank.	MBLK 5/27/08	Lab Fraction ID:	08-3556-01F

Analytes	CAS Number	Result	LQL	Units
Total Alkalinity		579	5 0	mg/L CaCO3
Bicarbonate		542	5 0	mg/L CaCO3
Carbonate		37 0	5 0	mg/L CaCO3

SPECIFIC CONDUCTANCE @ 25°C

Method: SM2510 B **Prep Method:**

Date Prepared:	5/23/08	Lab File ID	79	Dilution Factor	1
Date Analyzed	5/23/08			Lab Fraction ID:	08-3556-01F

Analytes	CAS Number	Result	LQL	Units
Specific Conductance		1200	1 00	µmhos/cm

FLUORIDE

Method: SM 4500-F C **Prep Method:**

Date Prepared·	6/3/08	Lab File ID·	8	Dilution Factor.	1
Date Analyzed·	6/3/08	Method Blank	MBLK	Lab Fraction ID:	08-3556-01E

Analytes	CAS Number	Result	LQL	Units
Fluoride	16984-48-8	3 3	0 20	mg/L

E150.1 PH

Method: E150.1 **Prep Method:**

Date Prepared.	5/23/08	Dilution Factor·	1
Date Analyzed·	5/23/08 1430	Lab Fraction ID	08-3556-01F

Analytes	CAS Number	Result	LQL	Units
pH		8 64	1 00	pH Units

Analyst

RAK
Approved

Qualifiers
B - Analyte detected in the associated Method Blank, value not subtracted from result
E - Extrapolated value Value exceeds calibration range
H - Sample analysis exceeded analytical holding time
I - Indicates an estimated value when the compound is detected but is below the LQI
S - Spike Recovery outside accepted limits
U - Compound analyzed for but not detected
X - See case narrative
* -Value exceeded the Maximum Contamination Level (MCL), TCLP limit, or if compound is undetected, LQL exceeds MCI

Definitions
NA - Not Applicable
LQL - Lower Quantitation Limit
Surr - Surrogate

Print Date 6/5/2008

Evergreen Analytical, Inc.

4036 Youngfield Street, Wheat Ridge, Colorado 80033-3862
(303) 425-6021

Client Sample ID:	Markham WW	**Lab Work Order**	08-3556
Client Project ID:	Markham WW	**Lab Sample ID**	08-3556-01
Date Collected:	5/23/08 1000	**Sample Matrix:**	Groundwater
Date Received	5/23/08		

TOTAL DISSOLVED SOLIDS (TDS)

Method: SM 2540C **Prep Method:**

Date Prepared	5/27/08	**Lab File ID**	20	**Dilution Factor:**	1
Date Analyzed.	5/27/08	**Method Blank:**	MBLK 05/27/08	**Lab Fraction ID.**	08-3556-01F

Analytes	CAS Number	Result	LQL	Units
Total Dissolved Solids		788	10 0	mg/L

Analyst **Approved**

Qualifiers
B - Analyte detected in the associated Method Blank, value not subtracted from result
E - Extrapolated value Value exceeds calibration range
H - Sample analysis exceeded analytical holding time
J - Indicates an estimated value when the compound is detected, but is below the LQL
S - Spike Recovery outside accepted limits
U - Compound analyzed for but not detected
X - See case narrative
* -Value exceeded the Maximum Contamination Level (MCL), TCLP limit, or if compound is undetected, LQL exceeds MCL

Definitions
NA - Not Applicable
LQL - Lower Quantitation Limit
Surr - Surrogate

Print Date 6/5/2008

Evergreen Analytical, Inc.

4036 Youngfield Street, Wheat Ridge, Colorado 80033-3862
(303) 425-6021

Client Sample ID.	Markham WW	**Lab Work Order**	08-3556
Client Project ID:	Markham WW	**Lab Sample ID:**	08-3556-01D
Date Collected:	5/23/08	**Sample Matrix:**	Groundwater
Date Received:	5/23/08	**Lab File ID:**	GAS0527010
Date Prepared:	5/27/08	**Method Blank:**	GB052708
Date Analyzed:	5/27/08	**Prep Factor:**	1 000
Percent Moisture	NA	**Dilution Factor:**	20 00

Method: RSKSOP175M **RSKSOP-175M HEADSPACE**
Prep Method: RSKSOP175M **Units: mg/L**

Analytes	CAS Number	Result	LQL
Methane	74-82-8	14	0 016

Analyst

Approved

Qualifiers See the case narrative for a discussion
B - Analyte detected in the Method Blank, value not subtracted from result
E - Extrapolated value Value exceeds calibration range
H - Prep or Analytical holding time exceeded
S - Spike Recovery outside acceptance limits
X - See case narrative
* -Value exceeded the Maximum Contamination Level (MCL), TCLP limit, or if compound is undetected, LQL exceeds MCL

Qualifiers U - Analyte not detected at or above the reporting limit
J - Estimated value below the LQL

Definitions NA - Not Applicable
LQL - Lower Quantitation Limit
MDL - Method Detection Limit
Surr - Surrogate Standard

Print Date 5/27/08

QUALITY ASSURANCE REPORTS

METHOD BLANKS (MB)

LABORATORY CONTROL SPIKES (LCS)

MATRIX SPIKES (MS/MSD)*

DUPLICATES (DUP)*

* For Metals or Wet Chemistry analyses: only included if requested

Evergreen Analytical, Inc

Date: *27-May-08*

Work Order: 08-3556

Client Project ID. Markham WW

ANALYTICAL QC SUMMARY REPORT

BatchID: R39394

Sample ID **MB2052308** SampType **MBLK** TestCode **8021_W** Run ID **TVHBTEX2_080523A** Prep Date **5/23/08** Units **µg/L**
Batch ID **R39394** TestNo **SW8021B** FileID **TVB20523\003R** Analysis Date **5/23/08** SeqNo **691342**

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	U	1 0									
Toluene	U	2 0									
Ethylbenzene	U	2 0									
m,p-Xylene	U	2 0									
o-Xylene	U	2 0									
Surr 1,2,4-Trichlorobenzene (S)	96 41	0	100	0	96 4	60	140	0	0		

Sample ID **LCS2052308** SampType **LCS** TestCode **8021_W** Run ID **TVHBTEX2_080523A** Prep Date **5/23/08** Units **µg/L**
Batch ID **R39394** TestNo **SW8021B** FileID **TVB20523\004R** Analysis Date **5/23/08** SeqNo **691343**

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	27 59	1 0	25 5	0	108	70	130	0	0		
Toluene	186 5	2 0	183 6	0	102	70	130	0	0		
Ethylbenzene	39 54	2 0	36 8	0	107	70	130	0	0		
m,p-Xylene	154 5	2 0	136 3	0	113	70	130	0	0		
o-Xylene	61 28	2 0	57 2	0	107	70	130	0	0		
Surr 1,2,4-Trichlorobenzene (S)	116 9	0	100	0	117	60	140	0	0		

Sample ID **08-3547-02AMS** SampType **MS** TestCode **8021_W** Run ID **TVHBTEX2_080523A** Prep Date **5/23/08** Units **µg/L**
Batch ID **R39394** TestNo **SW8021B** FileID **TVB20523\006R** Analysis Date **5/23/08** SeqNo **691345**

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	29 35	1 0	25 5	1 507	109	70	130	0	0		
Toluene	234	2 0	183 6	51 3	99 5	70	130	0	0		
Ethylbenzene	52 68	2 0	36 8	12 44	109	62	130	0	0		
m,p-Xylene	240 7	2 0	136 3	80 32	118	70	134	0	0		
o-Xylene	93 1	2 0	57 2	31 3	108	63	130	0	0		
Surr 1,2,4-Trichlorobenzene (S)	115 1	0	100	0	115	60	140	0	0		

Qualifiers

U - Not detected at or above the Reporting Limit
J - Analyte detected below quantitation limits
S Spike Recovery outside acceptance limits
E - Extrapolated value, value exceeds calibration range
R - RPD outside acceptance limits
B - Analyte detected in the associated Method Blank
H - Prep or analytical holding time exceeded
X See case narrative

Work Order: 08-3556

Client Project ID: Markham WW

ANALYTICAL QC SUMMARY REPORT

BatchID: R39394

Sample ID	08-3547-02AMSD	SampType	MSD	TestCode	8021_W	Run ID	TVHBTEX2_080523A	Prep Date	5/23/08	Units	µg/L
		Batch ID	R39394	TestNo	SW8021B	FileID	TVB20523\007R	Analysis Date	5/23/08	SeqNo	691346

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	29 63	1 0	25 5	1 507	110	70	130	29 35	0 949	30	
Toluene	237	2 0	183 6	51 3	101	70	130	234	1 27	30	
Ethylbenzene	53 49	2 0	36 8	12 44	112	62	130	52 68	1 54	30	
m,p-Xylene	243 6	2 0	136 3	80 32	120	70	134	240 7	1 17	30	
o-Xylene	94 34	2 0	57 2	31 3	110	63	130	93 1	1 32	30	
Surr 1,2,4-Trichlorobenzene (S)	114 8	0	100	0	115	60	140	0	0	0	

Qualifiers

U - Not detected at or above the Reporting Limit
J - Analyte detected below quantitation limits
S - Spike Recovery outside acceptance limits
E - Extrapolated value, value exceeds calibration range
R - RPD outside acceptance limits
B - Analyte detected in the associated Method Blank
H - Prep or analytical holding time exceeded
X - See case narrative

015

Evergreen Analytical, Inc

Date. *05-Jun-08*

Work Order 08-3556

Client Project ID Markham WW

ANALYTICAL QC SUMMARY REPORT

BatchID 15636

Sample ID	MB-15636	SampType	MBLK	TestCode	200 7_T	Run ID	ICP-OPTIMA 5300 DV_080530A	Prep Date	5/29/2008	Units	mg/L
		Batch ID	15636	TestNo	E200 7, Rev	FileID	053008PM	Analysis Date	5/30/2008	SeqNo	693572

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Calcium	U	0 387									
Iron	U	0 0700									
Magnesium	U	0 150									
Manganese	U	0 00500									
Potassium	U	0 340									
Sodium	U	0 400									

Sample ID	LCS-15636	SampType	LCS	TestCode	200 7_T	Run ID	ICP-OPTIMA 5300 DV_080530A	Prep Date	5/29/2008	Units	mg/L
		Batch ID	15636	TestNo	E200 7, Rev	FileID	053008PM	Analysis Date	5/30/2008	SeqNo	693573

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Calcium	10 36	0 387	10	0	104	74	120	0	0		
Iron	5 213	0 0700	5	0	104	76 6	115	0	0		
Magnesium	10 38	0 150	10	0	104	76 7	120	0	0		
Manganese	1 955	0 00500	2	0	97 8	72 4	109	0	0		
Potassium	10 34	0 340	10	0	103	70 9	115	0	0		
Sodium	10 53	0 400	10	0	105	80	120	0	0		

Qualifiers

U - Not detected at or above the Reporting Limit
J - Analyte detected below quantitation limits
S - Spike Recovery outside acceptance limits
E - Extrapolated value, value exceeds calibration range
R - RPD outside acceptance limits
B - Analyte detected in the associated Method Blank
H Prep or analytical holding time exceeded
X - See case narrative

Evergreen Analytical, Inc

Date *05-Jun-08*

Work Order 08-3556

Client Project ID: Markham WW

ANALYTICAL QC SUMMARY REPORT

BatchID 15658

Sample ID	MB-15658	SampType	MBLK	TestCode	200 8_TR	Run ID	ICPMS_080603A	Prep Date	6/3/2008	Units	mg/L
		Batch ID	15658	TestNo	E200 8	FileID	080603A B\091SMPL D	Analysis Date	6/3/2008	SeqNo	694615

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Selenium	U	0 00200									

Sample ID	LCS-15658	SampType	LCS	TestCode	200 8_TR	Run ID	ICPMS_080603A	Prep Date	6/3/2008	Units	mg/L
		Batch ID	15658	TestNo	E200 8	FileID	080603A B\092SMPL D	Analysis Date	6/3/2008	SeqNo	694616

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Selenium	0 02235	0 00200	0 02	0	112	85	115	0	0		

Sample ID	08-3556-01BMS	SampType	MS	TestCode	200 8_TR	Run ID	ICPMS_080603A	Prep Date	6/3/2008	Units	mg/L
Client ID	Markham WW	Batch ID	15658	TestNo	E200 8	FileID	080603A B\099SMPL D	Analysis Date	6/3/2008	SeqNo	694620

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Selenium	0 02401	0 00200	0 02	0 001856	120	70	130	0	0		

Sample ID	08-3556-01BMSD	SampType	MSD	TestCode	200 8_TR	Run ID	ICPMS_080603A	Prep Date	6/3/2008	Units	mg/L
Client ID	Markham WW	Batch ID	15658	TestNo	E200 8	FileID	080603A.B\100SMPL D	Analysis Date	6/3/2008	SeqNo	694621

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Selenium	0 02318	0 00200	0 02	0 001856	116	70	130	0 02401	3 50	20	

Qualifiers

U - Not detected at or above the Reporting Limit
J - Analyte detected below quantitation limits
S - Spike Recovery outside acceptance limits
E Extrapolated value, value exceeds calibration range
R RPD outside acceptance limits
B Analyte detected in the associated Method Blank
H - Prep or analytical holding time exceeded
X - See case narrative

Evergreen Analytical, Inc

Date: *27-May-08*

Work Order: 08-3556

Client Project ID Markham WW

ANALYTICAL QC SUMMARY REPORT

TestCode· **ANIONS_NonDW**

Sample ID	MB 5/23/08	SampType	MBLK	TestCode	ANIONS_Non	Run ID	IC-DX120_080523A	Prep Date	5/23/08	Units	mg/L
		Batch ID	R39415	TestNo	E300 0	FileID		Analysis Date	5/23/08	SeqNo	691574

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chloride	U	0 50									
Nitrite	U	0 20									
Bromide	U	0 20									
Nitrate	U	0 20									
Sulfate	U	0 50									

Sample ID	LCS ALLT218024	SampType	LCS	TestCode	ANIONS_Non	Run ID	IC-DX120_080523A	Prep Date	5/23/08	Units	mg/L
		Batch ID	R39415	TestNo	E300 0	FileID		Analysis Date	5/23/08	SeqNo	691573

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chloride	18 91	2 5	20	0	94 6	90	110	0	0		
Nitrite	18 83	1 0	20	0	94 2	90	110	0	0		
Bromide	19 57	1 0	20	0	97 9	90	110	0	0		
Nitrate	19 25	1 0	20	0	96 3	90	110	0	0		
Sulfate	29 47	2 5	30	0	98 2	90	110	0	0		

Qualifiers

U - Not detected at or above the Reporting Limit
J - Analyte detected below quantitation limits
S - Spike Recovery outside acceptance limits
E - Extrapolated value, value exceeds calibration range
R - RPD outside acceptance limits
B - Analyte detected in the associated Method Blank
H - Prep or analytical holding time exceeded
X - See case narrative

018

Evergreen Analytical, Inc

Date: *05-Jun-08*

Work Order 08-3556

Client Project ID. Markham WW

ANALYTICAL QC SUMMARY REPORT

TestCode. ALK_WGRP

Sample ID	MBLK 5/27/08	SampType	MBLK	TestCode	ALK_WGRP	Run ID	ALK_080527A	Prep Date	5/27/2008	Units	mg/L CaCO3
		Batch ID	R39402	TestNo	SM2320B	FileID	47	Analysis Date	5/27/2008	SeqNo	691442

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Alkalinity	U	5 0									

Sample ID	LCS	SampType	LCS	TestCode	ALK_WGRP	Run ID	ALK_080527A	Prep Date	5/27/2008	Units	mg/L CaCO3
		Batch ID	R39402	TestNo	SM2320B	FileID	48	Analysis Date	5/27/2008	SeqNo	691443

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Alkalinity	99 69	5 0	100	0	99 7	90	110	0	0		

Qualifiers

U - Not detected at or above the Reporting Limit
J - Analyte detected below quantitation limits
S - Spike Recovery outside acceptance limits
E - Extrapolated value, value exceeds calibration range
R - RPD outside acceptance limits
B - Analyte detected in the associated Method Blank
H - Prep or analytical holding time exceeded
X - See case narrative

019

Work Order: 08-3556

Client Project ID. Markham WW

ANALYTICAL QC SUMMARY REPORT

TestCode: COND_W

Sample ID LCS	SampType LCS	TestCode COND_W	Run ID COND_080523A	Prep Date 5/23/2008	Units µmhos/cm
	Batch ID R39380	TestNo SM2510 B	FileID 68	Analysis Date 5/23/2008	SeqNo 690975

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Specific Conductance	97 8	1 00	99 4	0	98 4	90	110	0	0		

Qualifiers

U - Not detected at or above the Reporting Limit
J - Analyte detected below quantitation limits
S - Spike Recovery outside acceptance limits
E - Extrapolated value, value exceeds calibration range
R - RPD outside acceptance limits
B - Analyte detected in the associated Method Blank
H - Prep or analytical holding time exceeded
X - See case narrative

020

Work Order. 08-3556

Client Project ID. Markham WW

ANALYTICAL QC SUMMARY REPORT

TestCode: F_W

Sample ID MBLK	SampType MBLK	TestCode F_W	Run ID F_080603A	Prep Date 6/3/2008	Units mg/L
	Batch ID R39565	TestNo SM 4500-F C	FileID 1	Analysis Date 6/3/2008	SeqNo 694212

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Fluoride	U	0 20									

Sample ID MBLK	SampType MBLK	TestCode F_W	Run ID F_080603A	Prep Date 6/3/2008	Units mg/L
	Batch ID R39565	TestNo SM 4500-F C	FileID 79	Analysis Date 6/3/2008	SeqNo 694237

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Fluoride	U	0 20									

Sample ID LCS	SampType LCS	TestCode F_W	Run ID F_080603A	Prep Date 6/3/2008	Units mg/L
	Batch ID R39565	TestNo SM 4500-F C	FileID 2	Analysis Date 6/3/2008	SeqNo 694213

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Fluoride	10 03	0 20	10	0	100	95	105	0	0		

Sample ID LCS	SampType LCS	TestCode F_W	Run ID F_080603A	Prep Date 6/3/2008	Units mg/L
	Batch ID R39565	TestNo SM 4500-F C	FileID 80	Analysis Date 6/3/2008	SeqNo 694238

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Fluoride	9 96	0 20	10	0	99 6	95	105	0	0		

Qualifiers

U - Not detected at or above the Reporting Limit
J - Analyte detected below quantitation limits
S - Spike Recovery outside acceptance limits
E - Extrapolated value, value exceeds calibration range
R - RPD outside acceptance limits
B - Analyte detected in the associated Method Blank
H - Prep or analytical holding time exceeded
X - See case narrative

Work Order. 08-3556
Client Project ID Markham WW

ANALYTICAL QC SUMMARY REPORT

TestCode: PH_DW

Sample ID	LCS-R39379	SampType	LCS	TestCode	PH_DW	Run ID	PH_080523B	Prep Date	5/23/2008	Units	pH Units
		Batch ID	R39379	TestNo	E150 1	FileID		Analysis Date	5/23/2008	SeqNo	690973

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
pH	7 96	1 00	8	0	99 5	99 3	100 7	0	0		

Qualifiers

U - Not detected at or above the Reporting Limit
J - Analyte detected below quantitation limits
S - Spike Recovery outside acceptance limits
E - Extrapolated value, value exceeds calibration range
R - RPD outside acceptance limits
B - Analyte detected in the associated Method Blank
H - Prep or analytical holding time exceeded
X - See case narrative

Work Order: 08-3556
Client Project ID: Markham WW

ANALYTICAL QC SUMMARY REPORT

TestCode: TDS_W

Sample ID	MBLK 05/27/08	SampType	MBLK	TestCode	TDS_W	Run ID	ANALYTICAL BALANCE_080527B	Prep Date	5/27/2008	Units	mg/L
		Batch ID	R39444	TestNo	SM 2540C	FileID	1	Analysis Date	5/27/2008	SeqNo	691978

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Dissolved Solids	U	10 0									

Sample ID	LCS	SampType	LCS	TestCode	TDS_W	Run ID	ANALYTICAL BALANCE_080527B	Prep Date	5/27/2008	Units	mg/L
		Batch ID	R39444	TestNo	SM 2540C	FileID	2	Analysis Date	5/27/2008	SeqNo	691979

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Dissolved Solids	397	10 0	400	0	99 2	90	110	0	0		

Qualifiers

U - Not detected at or above the Reporting Limit
J - Analyte detected below quantitation limits
S - Spike Recovery outside acceptance limits
E - Extrapolated value, value exceeds calibration range
R - RPD outside acceptance limits
B - Analyte detected in the associated Method Blank
H - Prep or analytical holding time exceeded
X - See case narrative

Evergreen Analytical, Inc

Date: *27-May-08*

Work Order 08-3556

Client Project ID: Markham WW

ANALYTICAL QC SUMMARY REPORT

BatchID: GAS052708

Sample ID	GB052708	SampType	MBLK	TestCode	MEEP_W	Run ID	FID4_080527A	Prep Date	5/27/08	Units	mg/L
		Batch ID	GAS052708	TestNo	RSKSOP175	FileID	GAS0527004	Analysis Date	5/27/08	SeqNo	691591

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Methane	U	0 00080									

Sample ID	LCS052708	SampType	LCS	TestCode	MEEP_W	Run ID	FID4_080527A	Prep Date	5/27/08	Units	mg/L
		Batch ID	GAS052708	TestNo	RSKSOP175	FileID	GAS0527005	Analysis Date	5/27/08	SeqNo	691592

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Methane	0 5741	0 0080	0 5094	0	113	70	130	0	0		

Sample ID	LCSD052708	SampType	LCSD	TestCode	MEEP_W	Run ID	FID4_080527A	Prep Date	5/27/08	Units	mg/L
		Batch ID	GAS052708	TestNo	RSKSOP175	FileID	GAS0527006	Analysis Date	5/27/08	SeqNo	691593

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Methane	0 5743	0 0080	0 5094	0	113	70	130	0 5741	0 0412	30	

Sample ID	08-3442-01DMS	SampType	MS	TestCode	MEEP_W	Run ID	FID4_080527A	Prep Date	5/27/08	Units	mg/L
		Batch ID	GAS052708	TestNo	RSKSOP175	FileID	GAS0527012	Analysis Date	5/27/08	SeqNo	691587

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Methane	0 5452	0 0080	0 5094	0	107	70	130	0	0		

Sample ID	08-3442-01DMSD	SampType	MSD	TestCode	MEEP_W	Run ID	FID4_080527A	Prep Date	5/27/08	Units	mg/L
		Batch ID	GAS052708	TestNo	RSKSOP175	FileID	GAS0527013	Analysis Date	5/27/08	SeqNo	691588

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Methane	0 5402	0 0080	0 5094	0	106	70	130	0 5452	0 916	30	

Qualifiers

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X - See case narrative

ATTACHMENT B

Fac ID 705495

EMPACT ANALYTICAL SYSTEMS, INC

365 S MAIN STREET
BRIGHTON, CO 80601
(303) 637-0150

NATURAL GAS WITH AIR ADJUSTED

PROJECT NO	**200805110**	ANALYSIS NO	**01**
COMPANY NAME	**COLORADO OIL & GAS**	ANALYSIS DATE	MAY 29, 2008
CUSTOMER ID #		SAMPLE DATE	MAY 23, 2008
PRODUCER		CANISTER #	1L GLASS
LOCATION			
NAME/DESCRIP	MARKHAM WW @ 10 00		
DEPTH (FT)			
FIELD DATA			
SAMPLED BY	J AXELSON		
SAMPLE PRES		SAMPLE TEMP	
INJECTED VOLUME	92 4%		
COMMENTS	SPOT		

****SAMPLE CONTAINED AIR, AND, NORMALIZE MOLE PERCENTS WERE ADJUSTED**

COMPONENTS	NORM MOLE%	**AIR ADJUSTED MOLE%**
HELIUM	0 01	**0.06**
HYDROGEN	0 02	**0.12**
OXYGEN/ARGON	18 37	**0.00**
NITROGEN	74 72	**57.14**
CO2	0 21	**1.12**
METHANE	6 61	**41.19**
ETHANE	0 06	**0.37**
PROPANE	0 00	**0.00**
ISOBUTANE	0 00	**0.00**
N-BUTANE	0 00	**0.00**
ISOPENTANE	0 00	**0 00**
N-PENTANE	0 00	**0.00**
HEXANES+	0 00	**0.00**
TOTAL	100 00	**100.00**
BTU @ 60 DEG F		
GROSS DRY BTU	68 1	**424 3**
GROSS WET BTU	66 9	**416.9**
Z FACTOR	0 9996	**0 9991**
RELATIVE DENSITY (AIR=1 @14 696 PSIA	0 9661	**0.8023**

NOTE REFERENCE GPA 2261, 2145, & 2172 CURRENT PUBLICATIONS

EMPACT

EMPACT Analytical Systems Inc
365 South Main Street
Brighton, CO 80601
303-637-0150

CHAIN OF CUSTODY RECORD

CO NAME Colo Oil & Gas Cons. Com	CONTACT NAME John Axelson	TELE NO 303-637-7178	LAB PROJECT NO
Sampler (PRINT NAME) John Axelson	Signature	FAX NO 7179	
PROJECT INFO / NO Markham WW			

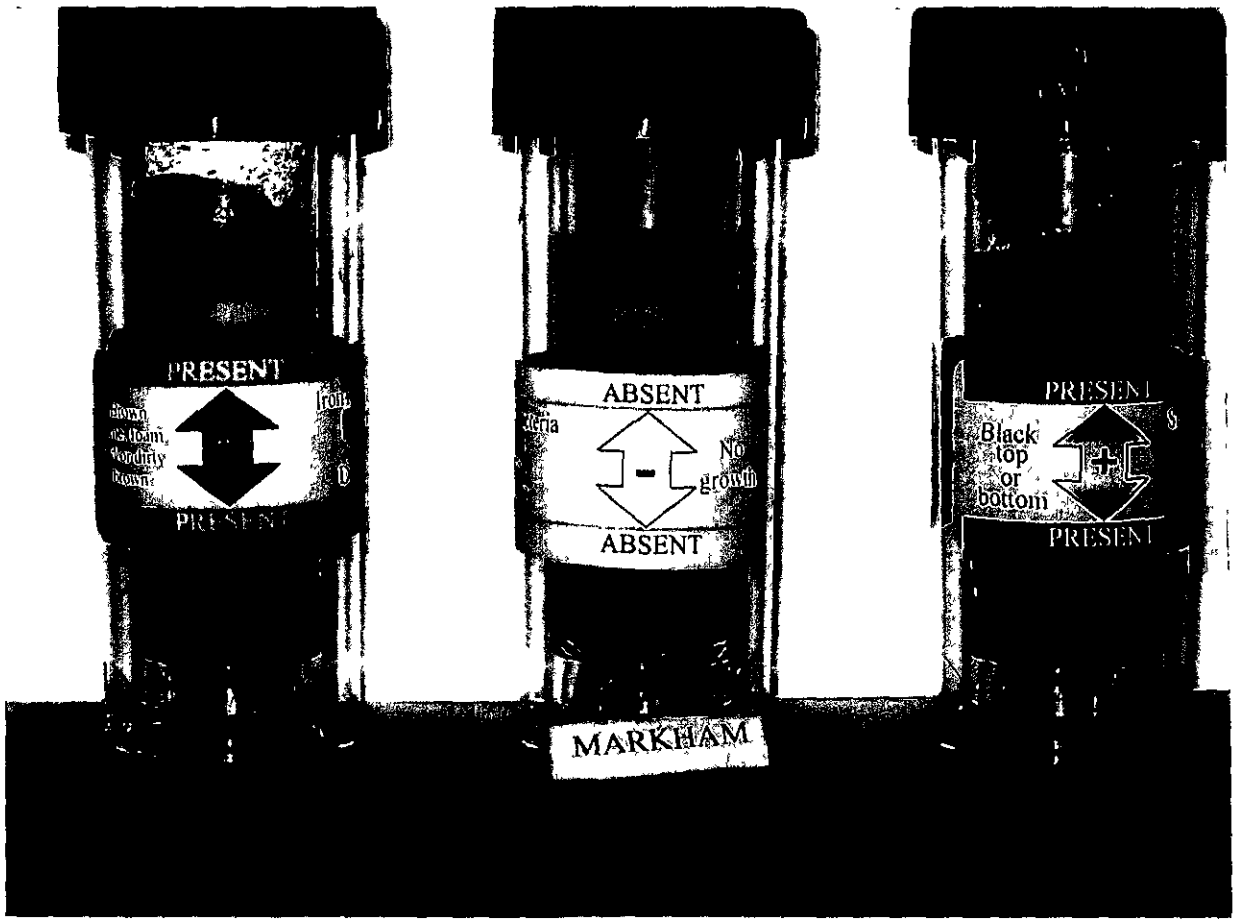
SAMPLE ID	SAMPLE DESCRIPTION	Comp	Grab	Date	Time	SAMPLE MATRIX	Container	No of Containers	ANALYSIS / METHOD	REMARKS
	Markham WW		✓	5/23/08	10:00	GW		1	Gas Comp	Correct for air

COMMENTS

Relinquished by (Signature)	Received by (Signature)	Time 1025	Date 5/23/08
Relinquished by (Signature)	Received by (Signature)	Time	Date
Laboratory	Received for Laboratory by	Time	Date
Method of Shipment	Dispatched by (Signature)	Time	Date

ATTACHMENT C

ATTACHMENT C - BIOLOGICAL ACTIVITY REACTION TEST RESULTS
MARKHAM WATER WELL



Results after 8 Days:

Red Capped Vial – Test for Iron Related Bacteria – Present
Green Capped Vial – Test for Slime Forming Bacteria – Absent
Black Capped Vial – Test for Sulfate Reducing Bacteria - Present

ATTACHMENT D

STATE OF COLORADO
OIL & GAS
CONSERVATION COMMISSION

DEPARTMENT OF NATURAL RESOURCES
Bill Ritter, Jr., Governor
1120 Lincoln St. Suite 801
Denver, CO 80203
Phone: (303) 894-2100
FAX: (303) 894-2109
www.colorado.gov/cogcc

August 7, 2009

Mr. and Mrs. Ellsworth
20991 Weld Count Road 20
Fort Lupton, CO 80621

RE: Ellsworth Water Well Investigation (WW Permit No. 201558)
SESE Section 16 – Township 2 North - Range 65 West
COGCC Complaint Investigation No. 200196553
Weld County, Colorado

Dear Mr. and Mrs. Ellsworth:

This letter summarizes the process, results, and conclusions of the Colorado Oil and Gas Conservation Commission (COGCC) staff investigation into the occurrence of hydrocarbon gases in your water well under COGCC Complaint Investigation No. 200196553.

The Division of Water Resources (DWR) permit number for your water well is No. 201558 and according to the DWR water well record it was drilled in October 1998 to a total depth of 695 feet below the ground surface (fbgs) and completed as a Laramie-Fox Hills Aquifer water well. The well is screened from 475 to 685 fbgs. The well was drilled under a permit issued to Ronald Lakey of Longmont, Colorado. In 2001, the Dickhausens of Thornton, Colorado submitted to DWR a Pump Installation and Test Report for this water well. The test report shows the installation of a submersible water pump with an intake at a depth of 500 fbgs and a pumping rate of 15 gallon per minute.

On or around September 18, 2008, Mrs. Ellsworth contacted COGCC staff for assistance in investigating the occurrence of methane gas in your water well. You indicated that you had recently purchased the property and water well at 20991 WCR 2, and that when the water well was pumped you noticed significant bubbling in the water and when the water treatment system was "back-washed" into the septic tank the septic pump shut off automatically. On your behalf, a third party contractor had collected and analyzed samples of the gas collected from the house kitchen sink and determined that the gas was methane. Because there are active oil and gas production wells and facilities in the area in which you live, you were concerned that the methane gas in your water well might be related to a release from one of these facilities/wells.

On August 10, 2008, you had also collected samples from the water well and submitted these samples to Weld County Department of Public Health and Environment (WCDPHE) for analysis. Methane was not one of the constituents analyzed by the WCDPHE. You have provided the COGCC staff with the analytical results from that sampling.

In response to your complaint, on September 22, 2008, COGCC staff collected samples from your water well for analysis of general water quality parameters, organic compounds associated with oil and gas production, gas composition and stable isotopes of methane and deuterium, and for nuisance bacteria. Upon receipt of the analytical results the COGCC staff sent you a summary letter on October 27, 2008, presenting and discussing the results from the COGCC sampling. In addition, the COGCC letter compared the results with those from the WCDPHE analyses. The methane gas present in the September 22, 2009, COGCC sample was identified as being a mixture of thermogenic and biogenic gas and the heavier hydrocarbon gases were thermogenic. The thermogenic gases are likely related to oil and gas operations.

As a result of the determination that the gas in your water well was in part thermogenic, the COGCC staff began an investigation of the producing oil and gas wells in the vicinity of your water well for evidence of a release of production gas into the Laramie-Fox Hills Aquifer. The operators of these wells are Noble Energy (Noble) and Kerr McGee/Anadarko (KMG). COGCC staff contacted Noble and KMG to inform them that a water well impacted by thermogenic gas had been discovered and that the COGCC would be investigating the source of the gas.

From the date of your original contact with the COGCC, the staff has devoted significant resources to try to determine the source of the thermogenic hydrocarbon gases in your water well. Six staff members have been involved to varying degrees in this effort. As is the COGCC's standard procedure, you have been kept informed about all phases of the investigation. When available, analytical results and a discussion of the COGCC's interpretation of the results have been sent to you. The COGCC staff has answered numerous inquiries from you totaling approximately 40 separate email and telephone communications. In addition, staff has prepared approximately 20 written communications for you explaining the steps being taken in our investigation. The following is a summary of our investigation activities and conclusions.

ENGNEERING AND WATER WELL INVESTIGATION

Engineering Investigation – Oil and Gas Wells

Concurrent with evaluation of your water well sample results, the COGCC Engineering staff initiated review of drilling, well construction, and well completion records for the 37 oil and gas wells within a one-mile radius of your water well. The review included checking the surface casing depth, checking whether the Laramie-Fox Hills Aquifer was protected by the well construction, and checking whether there were anomalies in gas production that might indicate gas leakage from the well.

Based on COGCC staff experience investigating impacts to ground water, we focused the field testing of oil and gas wells to those within ½ mile of your water well. This is because, except in very rare instances, oil and gas wells that have impacted water wells are located less than 1,000 feet from the impacted water well, so our process of field testing oil and gas wells located up to ½ mile or 2,640 feet from an impacted water well extends by more than 2½ times this distance. In addition, thermogenic gas or a mixture of thermogenic and biogenic gas was not detected in

any other water wells so we conclude that the impact to the Laramie-Fox Hills Aquifer that is affecting your well is localized.

There are nine oil and gas wells within ½ mile of your water well. On October 15, 2008, COGCC staff witnessed measurement of bradenhead pressures on these nine wells. The bradenhead valve is connected to the open space between the production casing and the surface casing and opening the valve to measure pressure and check for gas and fluids is a technique used to help determine whether there is a casing or wellhead leak. Bradenhead pressures were not measured and fluids were not present in any of the nine wells tested.

On January 8, 2009, Noble performed a mechanical integrity test (MIT) on the Powers 21-22 well which had been selected by the COGCC staff for further investigation based on some earlier well casing/well cementing issues. The MIT involves pressuring-up the production casing of an oil and gas well and observing any pressure loss which would indicate a possible production casing leak. This well passed the MIT. In March 2009, the remaining wells within the ½ mile radius were MITed. All these wells passed the MITs.

The results of the bradenhead pressure measurements and MITs indicate that the oil and gas wells within ½ mile of your water well are operating properly and not leaking gas, but do not negate the possibility of a prior leak that was subsequently remediated.

Former Powers No. 1 well

Staff review of COGCC well files showed that an old well, the Powers No. 1 (API 05-123-05076), had been drilled sometime around 1946 in Section 22, Township 2 North, Range 65 West, which is southeast of your property. However, the COGCC records regarding the Powers No. 1 did not specify the exact well location or include information about the depth, casing, or how the well was abandoned. Because of the limited amount of information in the COGCC records and because this old well had the potential to be a source or conduit for ground water contamination, the COGCC conducted a search for additional information about this well. Records concerning the Powers No. 1 well were found at the Denver Earth Resources Library, which provided a specific location and information about both well casing and depth. According to the records, the Powers No. 1 well was spud on April 18, 1946 by J. Clayton and drilled to a total depth of 1,005 fbgs with well casing set to a depth of 335 fbgs. Other than some information about the rocks encountered during the drilling of the well (i.e., lithologic information), no additional information was found.

Between May 26, 2009, and June 16, 2009, the COGCC reentered the old well bore, sampled the well for gas and general water quality, and abandoned the well by cementing the borehole from total depth to the surface. Results of a sample collected on May 27, 2009, show that the former Powers No. 1 did not have gas in it and there were no unusual water quality results observed. A second sample collected on June 11, 2009, was analyzed for gas composition and stable isotopes of carbon and hydrogen. A small amount of biogenic methane gas, similar to the biogenic gas that occurs frequently in the Laramie-Fox Hills aquifer, was detected.

As a result of the reentry and sampling, the COGCC staff determined that the Powers No. 1 well is not the source of the thermogenic gas observed in your water well. The COGCC spent approximately $107,000 on reentering and properly plugging this well.

Water Well Investigation

On February 20, 2009, COGCC staff collected a second sample of gas from your water well and on March 11, 2009, a second water sample was collected. The analytical results for these two samples are similar to the results for the water and gas samples collected by staff on September 22, 2008.

Between October 22, 2008, and April 7, 2009, COGCC staff collected production gas samples from the nine oil and gas wells within ½ mile of your water well for gas composition and stable isotope analysis. As part of the COGCC staff evaluation of the theromgenic gas in your water well, the analytical results of these production gas samples were compared to the analytical results for the gas from your water well. Unfortunately, after a thorough review of all of the analytical results the COGCC staff is unable to identify any of the oil and gas wells within ½ mile of your water well as the source of the thermogenic hydrocarbon gases (methane, ethane, propane, iso- and n-butanes, iso- and n-pentanes, and hexanes) present in your well.

Throughout large areas of Weld County the Laramie-Fox Hills Aquifer, in which your water well is completed, has naturally occurring bacterially produced methane (biogenic methane). The source of this natural methane is likely from coals present in the aquifer. Isotopically and compositionally, this biogenic gas has a distinctive signature that is different from the composition of the thermogenic gas and the stable isotopes of the methane produced from the oil and gas wells in your area. Generally, these differences make identifying the presence of thermogenic gas in a water well versus naturally occurring biogenic gas relatively straight forward. However, when the gas in a water well is a mixture of biogenic and thermogenic gas the isotopic signature of the gas is not as definitive a tool for determining the source. When this occurs, the evaluation of the other hydrocarbon gases, propane, iso- and n-butanes, iso- and n-pentanes, and hexanes (C3 through C6), which are present in the production gas, is very important and often helps in identifying a possible source. The biogenic gas in the Laramie-Fox Hills Aquifer does not contain C3 through C6 gases and, when present in a Laramie-Fox Hills Aquifer water well, it is evidence of an impact from thermogenic gas (as was noted in the October 2008 evaluation of your water well).

Comparison of the C3 through C6 compounds from an impacted water well to those in the gas produced from oil and gas wells in the area is a tool used by the COGCC staff to identify a possible source. The COGCC staff looked at both the isotopes of methane and the occurrences of the other hydrocarbon gases in the samples collected both from your water well and the oil and gas wells. The methane gas in your water well is a mixture of both naturally occurring biogenic gas and thermogenic gas which, as discussed earlier, makes the identification of a specific source difficult. Based on isotopic evaluation of the methane in your water well and the samples from the production wells, the COGCC staff are unable to identify a particular oil and gas well as the source of thermogenic gas in your water well. Our evaluation of the C3 through

C6 compounds from the production well samples and your water well also failed to positively identify a particular oil and gas well as the source.

Other Water Well Sampling

As part of the investigation into the occurrence of methane gas in your water well and to determine whether other water wells had been impacted, 26 water wells were sampled. This sampling and analysis was conducted by the COGCC, Noble, and KMG. Thermogenic gas was not detected in any of these other water wells. Because the results of this sampling and analysis have been discussed in earlier communication and correspondence with you, they will not be discussed in this letter. The COGCC spent approximately $30,000 collecting and analyzing samples from water wells and oil and gas wells.

You have expressed concern that some of the samples collected from water wells were collected at a time when nearby oil and gas wells had been "killed." You have further stated that the "killing" of these wells rendered the analytical results invalid because it had effectively cut off gas that was leaking out of a well or wells. However, it is COGCC's experience that if an oil and gas well has leaked and impacted ground water the effects of that leak can be detected long after the leak has been repaired or the well has been plugged and abandoned; therefore, we believe that if another water well had been impacted by gas leaking from an oil and gas well the thermogenic gas that would have been entrained in the ground water would still be present and would have been detected in the water sample. That being said, if any of your neighbors still believe that their water well contains thermogenic gas or has been impacted by gas leaking from an oil and gas well they should contact us and we will collect additional samples from their water well for laboratory analysis.

Mitigation of the Gas in Your Water Well

On March 21, 2009, Noble voluntarily began providing you with temporary substitute water for domestic use at your home. By letter dated June 17, 2009, you and Noble jointly advised me that you had recently agreed upon certain measures to further mitigate the natural gas detected in your water well. That letter states that Noble will install a filtration system to remove the gas from your water well and make such well safe for your use. The letter also states that you and Noble have further agreed to cooperate and work diligently to resolve any remaining issues between you. It is our understanding that the filtration system is designed to mitigate the methane and other gases entrained in your water and eliminate possible fire or explosion hazards and is now operating.

CONCLUSION

The method used by the COGCC staff to investigate and address the impact to your water well has been thorough and appropriate. The COGCC staff's conclusion, supported by all the investigation records, is that your water well contains a mixture of both biogenic and thermogenic gas and that the thermogenic gas appears to be from oil and gas activity; however, the COGCC staff has been unable to identify any current activity or existing well as the source of the impact. As previously discussed, all current oil and gas wells within ½ mile of your water well are operating properly and not leaking gas, but this does not negate the possibility of a prior leak that was subsequently remediated. Based on our experience investigating other groundwater impacts, as well as our review of oil and gas well records and water well samples, we do not believe that the gas in your water well is attributable to an oil and gas well located more than ½ mile away.

Because no responsible party for the water well impact can be identified, the staff will not be issuing a notice of violation (NOAV) or pursuing enforcement against any oil and gas operator as a result of the investigation of Complaint No. 200196553. Because Noble voluntarily has constructed a water treatment system to mitigate the gas in your well water and because all oil and gas wells within ½ mile of your water well are operating properly, the COGCC staff considers the situation mitigated and COGCC complaint No. 200196553 closed. Nonetheless, if you wish, the COGCC staff will continue to collect samples from your water well for gas composition and stable isotope analysis on an annual basis. In the event that such analysis or any other future information allows us to identify the party responsible for the thermogenic gas in your water well, then we may issue an NOAV or pursue enforcement at that time.

Under COGCC Rule 522, you as the complainant, have the right to file an application for a hearing with the Commission regarding this complaint if you are not satisfied with this resolution. If you wish to apply for a hearing, please contact Rob Willis, COGCC Hearings Officer at 303-894-2100 ext. 5125.

If you have any questions or would like to discuss these matters further, please contact me at 303-894-2100 ext. 5122, or Debbie Baldwin, COGCC Environmental Manager at ext. 5111, or Dave Dillon, COGCC Engineering Manager at ext. 5104.

Respectfully,

David S. Neslin

David Neslin
Director
Colorado Oil & Gas Conservation Commission

cc: Weld County Commissioners