STATE OF COLORADO
OIL & GAS
CONSERVATION COMMISSION

August 31, 2009

Certified Mail Return Receipt Requested # 7008 3230 0003 3235 3622

Mr. Jerry Angely
PO Box 1080
Walsenburg, CO 81089

RE: Complaint 200205808
Continued Monitoring – Groundwater Chemistry
NENW 10 29S, 67W Huerfano County, Colorado

Dear Jerry:

The COGCC collected water samples from your domestic well as part of continued monitoring of methane gas venting from your water well and elevated dissolved methane in the water produced from your well. Water samples were collected for general organic and inorganic water quality testing as well as for analysis of dissolved methane and volatile organic compounds. A summary of the results of the chemical analyses is presented below. The analytical results are also compared to published water quality standards and to results of prior testing of water from your well.

FIELD TESTING

Christa Whitmore of Whetstone Associates and Peter Gintautas of the COGCC visited your property on March 9, 2009. You turned on power to the pump from circuit breakers in your home. We started water flowing from an outdoor spigot at 09:20 at approximately 4.1 gallons per minute. Samples were collected at 09:54 after water temperature, conductivity and pH had been stable for more than fifteen minutes. A second set of samples was collected after the pump had been active for 69 minutes at 10:29. Later in the day, water samples were collected from three recovery wells operated by Petroglyph.

The table below includes the field sampling measurements as well as periodic measurements of depth to water before and during the sampling. The samples for general chemical analyses, dissolved methane and volatile organic compounds were then shipped to ALS Paragon in Fort Collins, CO and received on March 10, 2009. The samples from the three recovery wells were shipped to Isotech Laboratories in Champaign, IL and received on March 10, 2009.

Date	Time	pH (s.u.)	E.C. (µS/cm)	Temperature (°C)	Disolved Oxygen (%)	Disolved Oxygen (mg/L)	Depth to Water (ft btoc)	Comments
3/9/09	9:20	---	---	---	---	---	527.70	
3/9/09	9:25	---	---	---	---	---	---	Pump on
3/9/09	9:30	7.54	1890	15.4	4.0%	0.39	---	
3/9/09	9:35	7.82	2230	17.8	0.9%	0.08	---	
3/9/09	9:43	7.78	1808	17.9	0.5%	0.04	---	
3/9/09	9:48	7.76	1808	17.9	0.4%	0.04	---	
3/9/09	9:50	---	---	---		---	622.3	
3/9/09	9:52	7.75	1815	17.8	0.4%	0.04	---	
3/9/09	9:54	---	---	---	---	---	---	Collect Sample
3/9/09	10:02	7.74	1807	18.1	1.0%	0.10	---	
3/9/09	10:07	7.82	1816	18.1	0.8%	0.08	---	
3/9/09	10:14	7.85	1811	18.1	0.8%	0.07	---	
3/9/09	10:19	7.86	1805	18.2	0.8%	0.08	---	
3/9/09	10:24	7.84	1803	18.3	0.8%	0.08	---	
3/9/09	10:29	---	---	---	---	---	682.82	Pump stopped, collect samples for anions and metals

COMPARISON OF INORGANIC ANALYTICAL RESULTS TO CDPHE INORGANIC STANDARDS

The Water Quality Control Commission (WQCC) of the Colorado Department of Public Health and Environment (CDPHE) has established "Domestic Use-Quality" human health standards and drinking water standards. Analytical data for the samples from your water well was compared to these standards. This information is summarized in Table 1 which is located in Attachment 1 and discussed in narrative form below. Please keep in mind that these "Domestic Use-Quality Standards" were established for **municipal public** drinking water supplies and often people use and consume ground water from private wells that exceed these standards. The analytical reports from ALS Paragon are included as Attachment 2.

- **Antimony (Sb):** The CDPHE human health standard for antimony is 0.006mg/l. Antimony is a contaminate metal.

  Antimony was detected in the second sample collected from your water well at a concentration of 0.00091mg/l which is below the CDPHE human health standard.

- **Arsenic (As):** The CDPHE human health standard for arsenic is 0.05 mg/l. Arsenic is a highly poisonous metal.

  Arsenic was not detected in the samples collected from your water well.

- **Barium (Ba):** The CDPHE human health standard for barium is 2.0 mg/l. Barium is a contaminate metal.

  Barium was not detected in the samples collected from your water well.

- **Beryllium (Be):** The CDPHE human health standard for beryllium is 0.004mg/l. Beryllium is a contaminate metal.

  Beryllium was not detected in the samples collected from your water well.

- **Cadmium (Cd):** The CDPHE human health standard for cadmium is 0.005 mg/l. Cadmium is a contaminate metal.

  Cadmium was not detected in the samples collected from your water well.

- **Chromium (Cr):** The CDPHE human health standard for chromium is 0.1 mg/l. Chromium is a contaminate metal.

  Chromium was not detected in the samples collected from your water well.

- **Lead (Pb):** The CDPHE human health standard for lead is 0.05 mg/l. Prolonged exposure to this metal can result in serious health effects.

  Lead was detected in the second sample collected from your water well at a concentration of 0.00053mg/l which is below the CDPHE human health standard.

- **Molybdenum (Mo):** The CDPHE human health standard for molybdenum in groundwater is 0.035mg/l.

  Molybdenum was detected in the samples collected from your water well at a concentration of 0.0022mg/l and 0.0035 which are below the CDPHE human health standard.

- **Nickel (Ni):** The CDPHE human health standard for nickel is 0.1mg/l. Nickel is a contaminate metal.

  Nickel was not detected in the samples collected from your water well.

- **Selenium (Se):** The CDPHE human health standard for selenium is 0.05 mg/l. Selenium is a contaminate metal.

  Selenium was not detected in the samples collected from your water well.

- **Silver (Ag):** The CDPHE human health standard for silver is 0.05 mg/l. Excess amounts of silver may cause a permanent gray discoloration of the skin.

  Silver was not detected in the samples collected from your water well.

- **Thallium (Tl):** The CDPHE human health standard for thallium is 0.002 mg/l. Thallium is a contaminate metal.

  Thallium was not detected in the samples collected from your water well.

- **Uranium (U):** The CDPHE human health standard for thallium is 0.03 mg/l. Uranium can be present due to erosion of natural deposits of this element.

  Uranium was not detected in the samples collected from your water well.

- **Fluoride (F)**: The CDPHE human health standard for fluoride 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 occurs naturally in the ground water in many areas in Colorado at concentrations that exceed the drinking water standard.

Fluoride was detected in the samples collected from your water well at concentrationa of 3.4mg/l which is below the CDPHE human health standard and 6mg/l which is above the CDPHE human health standard.

- **Nitrate (NO_3):** The CDPHE human health standard for nitrate is 10.0 mg/l. Nitrate can cause cyanosis in infants; a household water supply should not contain nitrate concentration in excess of 10 mg/l.

  Nitrate was not detected in the samples collected from your water well.

- **Nitrite (NO_2):** The CDPHE human health standard for nitrite is 1.0 mg/l. Nitrite concentrations exceeding 1.0 mg/l should not be used for feeding infants.

  Nitrite was not detected in the samples collected from your water well.

  Copper (Cu): The CDPHE secondary drinking water standard for copper is 1 mg/l.

  Copper was detected in the second sample collected from your water well at a concentration of 0.014mg/l which is below the CDPHE human health standard.

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

  Chloride was detected in the sample collected from your water well at concentration of 50mg/l and 37mg/l which are below the CDPHE drinking water standard.

- **Iron (Fe):** The CDPHE secondary drinking water standard for iron is 0.3mg/l. Small amounts of iron are common in ground water. Iron produces 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 not detected in the samples collected from your water well.

- **Manganese (Mn):** The CDPHE secondary drinking water standard for manganese is 0.05mg/l. Manganese produces a brownish color in laundered clothing, may stain fixtures and affect the taste of coffee or tea.

  Manganese was detected in the samples collected from your water well at a concentration of 0.19mg/l and 0.16mg/l which are above the CDPHE human health standard.

- **Sulfate (SO_4):** The CDPHE sulfate secondary standard for human drinking water is 250mg/l. 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 was detected in the samples collected from your water well at a concentration of 930mg/l and 470mg/l which are above the CDPHE drinking water standard.

- **pH:** pH is the measure of the hydrogen ion concentration in water. The pH of water in its natural state is generally from 5.5 to 9.0. The CDPHE standard for domestic and agricultural water is a range of 6.5 to 8.5. Seven (7) represents neutrality, while values less than 7 indicate increasing acidity and values greater than 7 indicate increasing alkalinity.

  pH was measured in the water sample from your well with a values of 7.75 and 7.81which are within the CDPHE drinking water and agricultural standards.

- **Total Dissolved Solids (TDS):** CDPHE's TDS standard for human drinking water is 500 milligrams per liter (mg/l). Although CDPHE does not have an agricultural standard for TDS, other agencies recommend concentrations below 1500 mg/l for irrigation, and below 5,000 mg/l for most livestock watering. TDS occurs naturally in the ground water in many areas of Colorado at concentrations that exceed the drinking water standard.

  TDS was measured in the water samples collected from your well at a concentration of 1500mg/l and 900mg/l which are above the drinking water standard.

- **Zinc (Zn):** CDPHE's Zn standard for human drinking water is 5 milligrams per liter (mg/l) and the agricultural standard is 2mg/l.

  Zinc was detected in the second sample collected from your water well at a concentration of 0.28mg/l which is below the CDPHE human health standard.

The following parameters were also measured as part of the laboratory analysis although there are no CDPHE standards.

- **Sodium (Na):** People on salt restricted diets should be aware of the sodium concentration in the water they drink. A concentration of 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 of Colorado at concentrations that exceed this health advisory level.

  Sodium was detected in the water samples from your well at a concentration of 280mg/l and 190mg/l which are above the recommended level.

- **Boron (B):**

  Boron was not detected in either sample collected from your water well.

- **Calcium (Ca):**

  The calcium concentration in the samples collected from your well was 190mg/l and 110mg/l.

- **Magnesium (Mg):**

  The magnesium concentration in the samples collected from your water well was 2.6mg/l and 1.3mg/l.

- **Potassium (K):**

  The potassium concentration in the samples collected from your well was 2.0mg/l and 1.3mg/l

.

- **Bicarbonate (HCO_3):**

  Bicarbonate alkalinity was measured in the samples collected from your well at a concentration of 62mg/l and 140mg/l.

- **Bromide (Br):**

  The bromide concentration in the first sample collected from your well was 0.66mg/l.

METHANE GAS ANALYSIS

Methane was detected in the sample collected from your well at a concentration of 23mg/l. The concentration of methane in the water produced from the well is above the threshold level of 1.1mg/l that could allow methane to accumulate in confined unventilated spaces and potentially be explosive. All samples from your well that I have a record of indicate the concentration of dissolved methane in water produced by your domestic well exceeds the 1.1mg/l threshold discussed above. The February 2008 sample shows effects of the chlorination of the well by Weber Water in the preceding months. The table below lists dates of sampling with associated reported concentrations of dissolved methane in water from your well. You have a vented outdoor cistern that serves as a passive treatment system to reduce methane dissolved in water pumped from your domestic well and then on to your home. I understand that you are not using water from the well in your house and that you are still relying on water deliveries arranged by Petroglyph for water used in your home. I would recommend that you continue to utilize water deliveries due to the high concentration of methane present in water produced by your well.

Date Sampled	12/17/2007	02/27/2008	3/26/2008	12/8/2008	03/09/2009
methane (mg/l)	23.2	0.11	15	100	23

The relatively low concentration reported for the sample collected in February 2008 is thought to be artificially low due to a disinfection process carried out by Weber Water on your well after installation of a sounding tube between the December 2007 and February 2008 sampling events. The well was re-sampled in March 2008 after purging the well several times to remove the hypochlorite disinfectant that was left in the well per the well driller's and pump installer's rules.

VOLATILE ORGANIC COMPOUND ANALYSES

The laboratory analyzed the samples collected in March, 2009 for the presence of 70 volatile organic compounds. None of the 70 target compounds was detected in the sample.

CONCLUSIONS

Table 1 in Attachment 1 compares the results of the most recent sampling and analysis event to the groundwater standards promulgated by the Water Quality Control Commission of the Colorado Department of Public Health and the Environment. All parameters tested are below the groundwater standards with the exception of TDS, sulfate and manganese. The Colorado Water Quality Control Commission has not promulgated any regulatory concentrations for sodium, calcium or dissolved methane in groundwater or drinking water.

Table 2 in Attachment 4 compares general analytical results from samples collected since 2007 from your domestic water well. The analytical results shown in Table 2 indicate there have been significant changes in

overall water chemistry since the December 2007 sampling event. The concentrations of sulfate, calcium and sodium in water produced by your well have increased significantly between December 2007 and December 2008. These changes were still evident in the samples collected in March, 2009. The second set of samples collected after more than 1 hour of pumping showed less increase in the parameters listed above. The pH has decreased by one unit. TDS has increased by a factor of 4. No other water well sampled in the area around your home has shown similar changes. That includes the wells installed by Petroglyph as part of the MIMMP pump, treat and re-inject system.

Significant changes in groundwater chemistry in a well can occur from changes in the source of the water. Testing of wells near yours has not shown any similar groundwater to that presently found in your well. The lack of any other well with similar chemistry to water from your well indicates to me the changes are part of processes that at present are unique to your well and I think the oxidation of hydrogen sulfide in your well to sulfate and hydrogen ion is a likely cause of the observed changes. The mechanism suggested may be reinforced by the lack of use of the well. The lower TDS from the second sample collected in March, 2009 may be indicative that the changes are localized in and around the well bore.

The isotopic composition of methane in groundwater from your well is thermogenic as shown in Attachment 5. The plot also includes analytical data from CBM wells and other water wells near your home. The isotopic composition of the methane venting from wells near your water well is similar to the isotopic composition of methane from your well. The isotopic ratios of deuterium and ^{13}C are similar to the ratios in methane from samples of Vermejo Formation gas.

If you have any questions or would like to discuss these matters further, please contact me at 719-846-3091 or by email at peter.gintautas@state.co.us . We appreciate your continued cooperation with the staff of the COGCC in granting continued access to sample and investigate the occurrence of methane in the Poison Canyon aquifer.

Sincerely,
Colorado Oil and Gas Conservation Commission

Peter Gintautas

Digitally signed by Peter Gintautas
DN: cn=Peter Gintautas, o=Colorado Oil and Gas Conservation Commision, ou, email=peter.gintautas@state.co.us, c=US
Date: 2009.08.31 11:37:12 -06'00'

Peter Gintautas
Environmental Protection Specialist

Attachments:
Attachment 1 - Table 1 - Analytical Summary
Attachment 2 - ALS Paragon Reports
Attachment 3 - Isotech Laboratories Reports
Attachment 4 - Table 2 - Summary of 2007-2008 Analytical Results
Attachment 5 - Plot of Isotopic Composition of Methane

cc: David Neslin, COGCC Director w/o attachments
Debbie Baldwin, COGCC Environmental Protection Manager w/o attachments
Tom Melland, Petroglyph w/o attachments

TABLE 1
ANALYTICAL SUMMARY
Complaint 200205808
Angely Water Well

Parameter	Water Sample			CDPHE Standards		
	Sample Date	Sample Date				
	03/09/2009	03/09/2009				
	9:56 AM	10:30 AM				
	Result	Result	Unit	Domestic	Agriculture	Unit
Antimony	ND(<0.0003)	0.00091	mg/l	0.006	NS	mg/l
Arsenic	ND	ND	mg/l	0.01	0.1	mg/l
Barium	ND	ND	mg/l	2.0	NS	mg/l
Berylium	ND	ND	mg/l	0.004	0.1	mg/l
Boron	ND	ND	mg/l	NS	0.75	mg/l
Cadmium	ND	ND	mg/l	0.005	0.01	mg/l
Calcium	190	110	mg/l	NS	NS	
Chromium	ND	ND	mg/l	0.1	0.1	mg/l
Cobalt	ND	ND	mg/l	NS	0.05	mg/l
Copper	ND(<0.01)	0.014	mg/l	1	0.2	mg/l
Iron	ND	ND	mg/l	0.3	5	mg/l
Lead	ND(<0.0005)	0.00053	mg/l	0.05	0.1	mg/l
Lithium	0.026	0.017	mg/l	NS	NS	
Magnesium	2.6	1.3	mg/l	NS	NS	
Manganese	0.19	0.16	mg/l	0.05	0.2	mg/l
Molybdenum	0.0022	0.0035	mg/l	0.035	NS	mg/l
Nickel	ND	ND	mg/l	0.1	0.2	mg/l
Potassium	2	1.3	mg/l	NS	NS	
Selenium	ND	ND	mg/l	0.05	0.02	mg/l
Silver	ND	ND	mg/l	0.05	NS	mg/l
Sodium	280	190	mg/l	NS	NS	
Strontium	3.9	2	mg/l	NS	NS	
Thallium	ND	ND	mg/l	0.002	NS	mg/l
Uranium	ND	ND	mg/l	0.03	NS	mg/l
Zinc	ND(<0.02)	0.28	mg/l	5	2	mg/l
Chloride	50	37	mg/l	250	NS	mg/l
Nitrite	ND	ND	mg/l	1.0	10	mg/l
Nitrate	ND	ND	mg/l	10.0	100	mg/l
Total Nitrite/Nitrate	ND	ND	mg/l	10.0	100	mg/l
Fluoride	3.4	6	mg/l	4.0	NS	mg/l
Total Dissolved Solids	1500	900	mg/l	400	*1500	mg/l
pH	7.75	7.81	No units	6.5 - 8.5	6.5 - 8.5	No units
Sulfate	930	470	mg/l	250	NS	mg/l
Bromide	0.66	ND(<0.4)	mg/l	NS	NS	
Total Alkalinity	62	140	mg/l	NS	NS	
Bicarbonate	62	140	mg/l	NS	NS	
Carbonate	ND	ND	mg/l	NS	NS	
Conductivity	2000	1365	umhos/cm	NS	NS	
methane	23	NA	mg/l	NS	NS	
Total Organic Carbon	1.6	NA	mg/l	NS	NS	

Notes

CDPHE	Colorado Department of Public Health and the Environment.
Domestic	Water Quality Control Commission 5 CCR 1002-41, Regulation No. 41 - The Basic Standards For Groundwater.
Agriculture	* Standards for agriculture complied from CDPHE and other of sources.
mg/l	milligrams per liter (ppm or parts per million).
µmhos/cm	micromhos per centimeter
NA	Not analyzed.
ND	Not detected.
NS	No Standard.
******	Health Advisory.
	Human health standard.
	Secondary standard.

ISOTECH
ISOTECH LABORATORIES INC

ANALYSIS REPORT

Lab #:	157998	Job #:	11117
Sample Name/Number:	PEI Recovery 4		
Company:	Colorado Oil & Gas Conservation		
Date Sampled:	3/09/2009		
Container:	Dissolved Gas Bottle		
Field/Site Name:	Complaint 200205808		
Location:	Huerfano County, CO		
Formation/Depth:			
Sampling Point:			
Date Received:	3/10/2009	Date Reported:	4/20/2009

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	0.32	0.22			
Oxygen	3.01				
Nitrogen	18.49	8.49			
Carbon Dioxide	nd	nd			
Methane	78.14	91.24	-50.62	-228.8	
Ethane	0.044	0.051			
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: 793

Specific gravity, calculated: 0.650

Remarks:

Analysis is of gas extracted from water by headspace equilibration. Analysis has been corrected for helium added to create headspace. Helium dilution factor = 0.67

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

ANALYSIS REPORT

Lab #:	157999	Job #:	11117
Sample Name/Number:	PEI Recovery 3		
Company:	Colorado Oil & Gas Conservation		
Date Sampled:	3/09/2009		
Container:	Dissolved Gas Bottle		
Field/Site Name:	Complaint 200205808		
Location:	Huerfano County, CO		
Formation/Depth:			
Sampling Point:			
Date Received:	3/10/2009	Date Reported:	4/20/2009

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	0.43	0.43			
Oxygen	0.030				
Nitrogen	22.36	22.28			
Carbon Dioxide	nd	nd			
Methane	77.15	77.26	-46.28	-212.9	
Ethane	0.027	0.027			
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: 782
Specific gravity, calculated: 0.650

Remarks:

Analysis is of gas extracted from water by headspace equilibration. Analysis has been corrected for helium added to create headspace. Helium dilution factor = 0.59

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

ANALYSIS REPORT

Lab #:	158000	Job #:	11117
Sample Name/Number:	PEI Recovery 1		
Company:	Colorado Oil & Gas Conservation		
Date Sampled:	3/09/2009		
Container:	Dissolved Gas Bottle		
Field/Site Name:	Complaint 200205808		
Location:	Huerfano County, CO		
Formation/Depth:			
Sampling Point:			
Date Received:	3/10/2009	Date Reported:	4/20/2009

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	1.18	1.24			
Oxygen	4.10				
Nitrogen	72.38	70.99			
Carbon Dioxide	0.04	0.05			
Methane	22.29	27.71	-45.12	-195.6	
Ethane	0.010	0.012			
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: 226

Specific gravity, calculated: 0.886

Remarks:

Analysis is of gas extracted from water by headspace equilibration. Analysis has been corrected for helium added to create headspace. Helium dilution factor = 0.69

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

ANALYSIS REPORT

Water Analysis

Lab Number: 157998 Job Number: 11117

Submitter Sample Name: PEI Recovery 4

Submitter Sample ID:

Submitter Job #:

Company: Colorado Oil & Gas Conservation

Field or Site: Complaint 200205808

Location: Huerfano County, CO

Depth/Formation:

Container Type: Dissolved Gas Bottle

Sample Collected: 3/09/2009 Results Reported: 4/20/2009

Delta D of water	-96.5 per mil relative to VSMOW
Delta O-18 of water	-12.15 per mil relative to VSMOW
Tritium content of water	na
Delta C-13 of DIC	-24.26 per mil relative to VPDB
Carbon-14 content of DIC	na
Delta N-15 of nitrate	na
Delta O-18 of nitrate	na
Delta S-34 of sulfate	na
Delta O-18 of sulfate	na

Remarks: Analysis is of gas extracted from water by headspace equilibration. Analysis has been corrected for helium added to create headspace. Helium dilution factor = 0.67

ISOTECH
ISOTECH LABORATORIES INC

ANALYSIS REPORT

Water Analysis

Lab Number: 157999 Job Number: 11117

Submitter Sample Name: PEI Recovery 3

Submitter Sample ID:

Submitter Job #:

Company: Colorado Oil & Gas Conservation

Field or Site: Complaint 200205808

Location: Huerfano County, CO

Depth/Formation:

Container Type: Dissolved Gas Bottle

Sample Collected: 3/09/2009 Results Reported: 4/20/2009

Delta D of water	-99.6 per mil relative to VSMOW
Delta O-18 of water	-12.81 per mil relative to VSMOW
Tritium content of water	na
Delta C-13 of DIC	-36.10 per mil relative to VPDB
Carbon-14 content of DIC	na
Delta N-15 of nitrate	na
Delta O-18 of nitrate	na
Delta S-34 of sulfate	na
Delta O-18 of sulfate	na

Remarks: Analysis is of gas extracted from water by headspace equilibration. Analysis has been corrected for helium added to create headspace. Helium dilution factor = 0.59

ISOTECH
ISOTECH LABORATORIES INC

ANALYSIS REPORT

Water Analysis

Lab Number: 158000 Job Number: 11117

Submitter Sample Name: PEI Recovery 1

Submitter Sample ID:

Submitter Job #:

Company: Colorado Oil & Gas Conservation

Field or Site: Complaint 200205808

Location: Huerfano County, CO

Depth/Formation:

Container Type: Dissolved Gas Bottle

Sample Collected: 3/09/2009 Results Reported: 4/20/2009

Delta D of water	-99.2 per mil relative to VSMOW
Delta O-18 of water	-12.66 per mil relative to VSMOW
Tritium content of water	na
Delta C-13 of DIC	-24.87 per mil relative to VPDB
Carbon-14 content of DIC	na
Delta N-15 of nitrate	na
Delta O-18 of nitrate	na
Delta S-34 of sulfate	na
Delta O-18 of sulfate	na

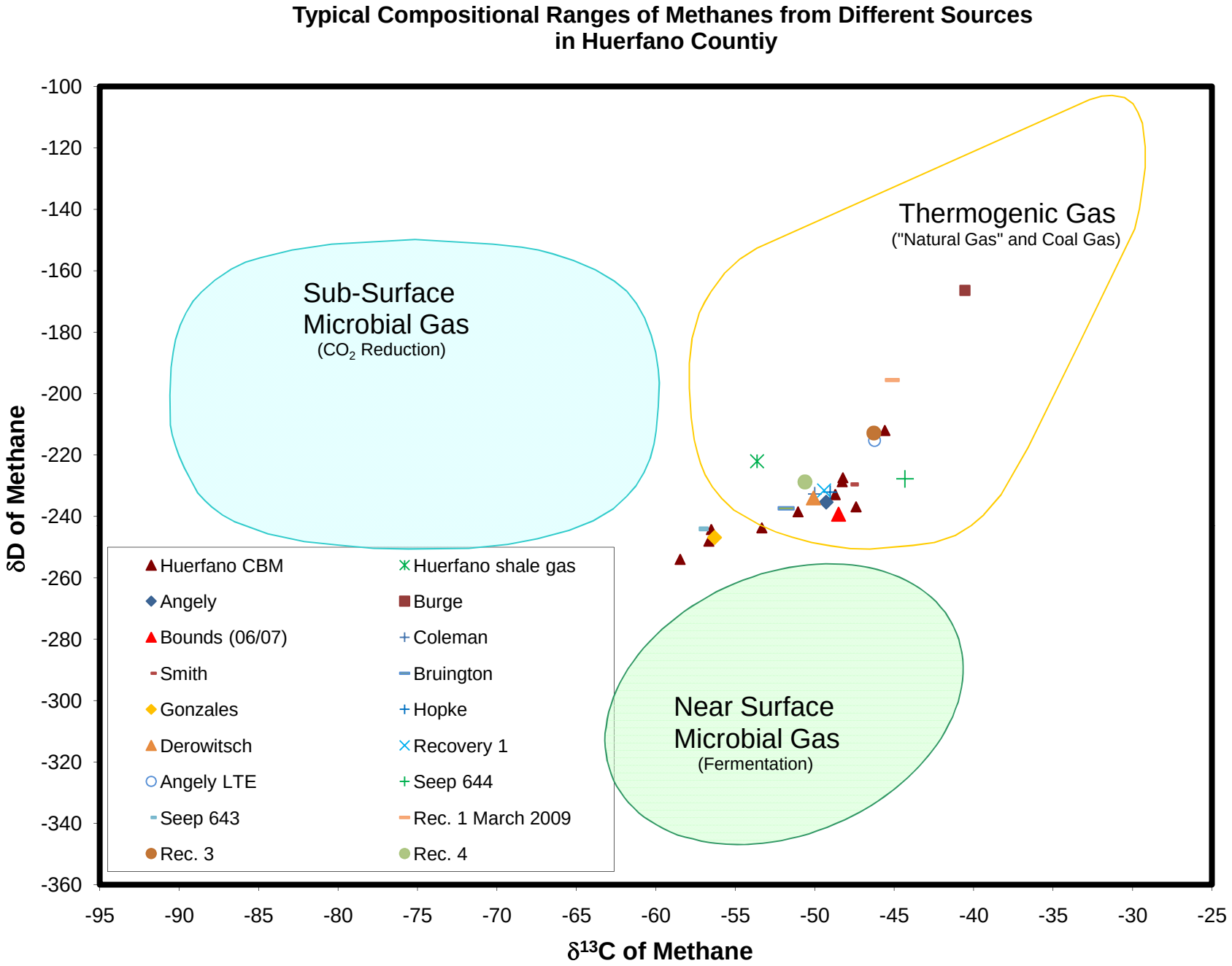
Remarks: Analysis is of gas extracted from water by headspace equilibration. Analysis has been corrected for helium added to create headspace. Helium dilution factor = 0.69

TABLE 2
ANALYTICAL SUMMARY 2007 to 2009
Complaint 200205808
Angely Water Well

Parameter	Water Sample					CDPHE Standards		
	Sample Date	Sample Date	Sample Date	Sample Date				
	17-Dec-07	08-Dec-08	03/09/2009	03/09/2009				
			9:56 AM	10:30 AM				
	Result	Result	Result	Result	Unit	Domestic	Agriculture	Unit
Antimony	0.00031	0.00045	ND(<0.0003)	0.00091	mg/l	0.006	NS	mg/l
Arsenic	ND	ND	ND	ND	mg/l	0.01	0.1	mg/l
Barium	ND	ND	ND	ND	mg/l	2.0	NS	mg/l
Berylium	ND	ND	ND	ND	mg/l	0.004	0.1	mg/l
Boron	ND(<0.1)	0.45	ND	ND	mg/l	NS	0.75	mg/l
Cadmium	ND	ND	ND	ND	mg/l	0.005	0.01	mg/l
Calcium	4	190	190	110	mg/l	NS	NS	
Chromium	ND	ND	ND	ND	mg/l	0.1	0.1	mg/l
Cobalt	NA	ND	ND	ND	mg/l	NS	0.05	mg/l
Copper	ND	ND	ND(<0.01)	0.014	mg/l	1	0.2	mg/l
Iron	ND	ND	ND	ND	mg/l	0.3	5	mg/l
Lead	ND	ND	ND(<0.0005)	0.00053	mg/l	0.05	0.1	mg/l
Lithium	NA	0.029	0.026	0.017	mg/l	NS	NS	
Magnesium	ND (<1)	2.5	2.6	1.3	mg/l	NS	NS	
Manganese	ND(<0.01)	0.19	0.19	0.16	mg/l	0.05	0.2	mg/l
Molybdenum	0.0038	0.002	0.0022	0.0035	mg/l	0.035	NS	mg/l
Nickel	ND	ND	ND	ND	mg/l	0.1	0.2	mg/l
Potassium	ND(<1)	2.2	2	1.3	mg/l	NS	NS	
Selenium	ND	ND	ND	ND	mg/l	0.05	0.02	mg/l
Silver	ND	ND	ND	ND	mg/l	0.05	NS	mg/l
Sodium	95	260	280	190	mg/l	NS	NS	
Strontium	0.12	3.8	3.9	2	mg/l	NS	NS	
Thallium	ND	ND	ND	ND	mg/l	0.002	NS	mg/l
Uranium	NA	ND	ND	ND	mg/l	0.03	NS	mg/l
Zinc	ND	ND	ND(<0.02)	0.28	mg/l	5	2	mg/l
Chloride	21	61	50	37	mg/l	250	NS	mg/l
Nitrite	ND	ND	ND	ND	mg/l	1.0	10	mg/l
Nitrate	ND	ND	ND	ND	mg/l	10.0	100	mg/l
Total Nitrite/Nitrate	ND	ND	ND	ND	mg/l	10.0	100	mg/l
Fluoride	9.8	3.2	3.4	6	mg/l	4.0	NS	mg/l
Total Dissolved Solids	300	1600	1500	900	mg/l	400	*1500	mg/l
pH	8.76	7.67	7.75	7.81	No units	6.5 - 8.5	6.5 - 8.5	No units
Sulfate	94	1000	930	470	mg/l	250	NS	mg/l
Bromide	ND (<0.2)	0.74	0.66	ND(<0.4)	mg/l	NS	NS	
Total Alkalinity	110	57	62	140	mg/l	NS	NS	
Bicarbonate	89	57	62	140	mg/l	NS	NS	
Carbonate	17	ND	ND	ND	mg/l	NS	NS	
Conductivity	507	2040	2000	1365	umhos/cm	NS	NS	
methane	23.2	100	23	NA	mg/l	NS	NS	
Total Organic Carbon	NA	1.6	1.6	NA	mg/l	NS	NS	

Notes

CDPHE	Colorado Department of Public Health and the Environment.
Domestic	Water Quality Control Commission 5 CCR 1002-41, Regulation No. 41 - The Basic Standards For Groundwater.
Agriculture	* Standards for agriculture complied from CDPHE and other of sources.
mg/l	milligrams per liter (ppm or parts per million).
µmhos/cm	micromhos per centimeter
NA	Not analyzed.
ND	Not detected.
NS	No Standard.
******	Health Advisory.
	Human health standard.
	Secondary standard.


Typical Compositional Ranges of Methanes from Different Sources in Huerfano Countiy
δD of Methane
δ13C of Methane
-100
-120
-140
-160
-180
-200
-220
-240
-260
-280
-300
-320
-340
-360
-95
-90
-85
-80
-75
-70
-65
-60
-55
-50
-45
-40
-35
-30
-25
Thermogenic Gas
("Natural Gas" and Coal Gas)
Sub-Surface Microbial Gas
(CO2 Reduction)
Near Surface Microbial Gas
(Fermentation)
Huerfano CBM
Huerfano shale gas
Angely
Burge
Bounds (06/07)
Coleman
Smith
Bruington
Gonzales
Hopke
Derowitsch
Recovery 1
Angely LTE
Seep 644
Seep 643
Rec. 1 March 2009
Rec. 3
Rec. 4