STATE OF COLORADO
OIL & GAS
CONSERVATION COMMISSION

Document #1733458

DEPARTMENT OF NATURAL RESOURCES
Bill Ritter, Governor
P.O. Box 2651
Durango, CO 81302
Phone: (970) 259-1619
FAX: (970) 259-9128
www.colorado.gov/cogcc

September 23, 2010

Joe & Julie Cundiff
1465 CR 513
Ignacio, CO 81137

RE: Complaint #200265927
Water Well Permit #220143
SWSE Sec 16 T34N R8W
La Plata County, Colorado

Dear Mr. & Mrs. Cundiff:

Enclosed please find a copy of the results of the August 16, 2010 sampling of your domestic water well, located on your property at 1465 CR 513 in La Plata County, Colorado. Your water well was first sampled by BP on August 14, 2008 prior to the installation of the adjacent Jones GU 34-16 #3 gas well in December 2008. At that time a low concentration of 0.002 mg/l methane was present and no hydrogen sulfide was detected in your water. Follow up sampling on May 12, 2010 indicated that 2.8 mg/l methane and 0.3 mg/l hydrogen sulfide was present in your water and you are concerned that your well has been impacted by area oil & gas activities. Four Corners Geoscience (FCG), representing the COGCC, collected samples for methane, hydrogen sulfide, field chemistries, bacteriology and COGCC Infill Order 112-156/157 parameters. This letter presents the results of the COGCC sampling.

Water Well Information

Records for water well permit #220143 indicate that your well was installed in November 1999 to a depth of 180 feet below ground surface (bgs). The driller's log notes soil and clay from 0-6 ft bgs and shale from 6-180 ft bgs. Water was identified at 70 ft bgs and 100 ft bgs. Screen was set from 60-80 ft bgs and 100-160 ft bgs to intercept these water horizons. Pea gravel (3/8") was installed from 20-180 ft bgs as a filter pack with 3 bags of cement placed from 0-20 ft bgs as a surface seal. This is a shallow seal so your wellhead should be protected to ensure surface materials cannot reach the groundwater. The best way to achieve this is to keep positive drainage away from the wellhead and do not store materials near it.

Sampling Summary and Results

FCG staff collected water samples from a faucet located in the shed near your driveway. They noted the water to be clear with no odor. There was no tint in the water and no sediment was observed. Samples were sent to FCG laboratory for methane analysis, San Juan Basin Health for total and fecal coliform analysis and Green Analytical Laboratories (GAL) for all other parameters. Results are discussed below and presented in Table 1 and Attachments.

In general, your well water is good and all of your tested chemical parameters, except fluoride, fall within the Colorado Department of Public Health and Environment (CDPHE) and Environmental Protection Agency's (EPA) primary and secondary drinking water standards. Methane is present at 1.02 mg/l which is down from the high of 2.8 mg/l identified in May 2010, but still warrants watching. Primary Drinking Water Standards are legally enforceable standards that apply to public water systems only, but are used as a guideline for private water wells. The Secondary Standards are non-enforceable guidelines regulating contaminants that may cause cosmetic or aesthetic effects in drinking water.

Calcium (Ca): There are no drinking water standards for calcium.

The calcium concentration in the sample collected from your well was 6.9 mg/l.

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 a concentration of 57 mg/L which is below the secondary drinking water standard.

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 groundwater in many areas in Colorado at concentrations that exceed the drinking water standard.

Fluoride was detected in the sample collected from your water well at a concentration of **4.5 mg/l** which is **above** the CDPHE human health standard. It is recommended that you do not drink this water without treatment due to fluorosis risks; however it is safe for bathing and other household uses.

Iron (Fe): The CDPHE secondary drinking water standard for iron is 0.3mg/l. Small amounts of iron are common in groundwater. 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 sample collected from your water well.

Magnesium (Mg): There are no drinking water standards for magnesium.

Magnesium was not detected in the sample 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 sample collected from your water well at a concentration of 0.0217 mg/l.

Nitrate (NO3) and Nitrite (NO2): 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. 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.

Nitrate/Nitrite as N was not detected in the sample collected from your water well.

Potassium (K): There are no drinking water standards for potassium.

Potassium was not detected in the sample collected from your well.

Selenium (Se): The CDPHE human health standard for selenium is 0.05 mg/l. Selenium is a contaminate metal which is commonly sourced from organic shales. The Oxford area of Colorado has been documented to contain high levels of selenium in the near surface soils.

Selenium was detected in the sample collected from your water well at a concentration of 0.001 mg/l which is below the CDPHE human health standard.

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 groundwater in many areas of Colorado at concentrations that exceed this health advisory level.

Sodium was detected in the water sample from your well at a concentration of **199 mg/l** which is **above** the recommended level for people on salt restricted diets.

Sulfate (SO4): 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 sample collected from your water well at a concentration of 59 mg/l which is below the CDPHE 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 value of 8.37 which is high, but within the CDPHE drinking water and agricultural standard.

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 1,500 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 detected in the water sample collected from your well at a concentration of 500 mg/l which is just at the drinking water standard.

Hardness: Hardness is the soap-consuming capacity of water; that is, the more soap required to produce lather, the harder the water. Hardness is reported as calcium carbonate in milligrams per liter (mg/l).

Hardness was reported in the water sample collected from your well at 17 mg/l which is classified as soft water.

Methane Gas Analysis: The concentration of methane in the water that could theoretically allow methane to accumulate in confined, unventilated spaces and potentially be explosive is 1.1-2.0 mg/l.

Methane gas **was detected** in the sample collected from your well at a concentration of **1.02 mg/l**. A follow up sample collected on September 20, 2010 contained 1.17 mg/l methane. Care should be taken to ensure that the water remains ventilated to avoid the potential for buildup of gas should methane concentrations increase. COGCC has placed your well on a monthly methane monitoring schedule until this investigation is complete.

Hydrogen Sulfide Gas Analysis: Sulfur-reducing bacteria, which use sulfur as an energy source, are the primary producers of large quantities of hydrogen sulfide. These bacteria chemically change natural sulfates in water to hydrogen sulfide. Sulfur-reducing bacteria live in oxygen-deficient environments such as deep wells, plumbing systems, water softeners and water heaters. These bacteria usually flourish on the hot water side of a water distribution system.

Hydrogen sulfide gas also occurs naturally in some groundwater. It is formed from decomposing underground deposits of organic matter such as decaying plant material. Hydrogen sulfide often is present in wells drilled in shale or sandstone, or near coal or peat deposits or oil fields.

Hydrogen sulfide gas was not detected in the sample collected from your well.

Isotopic/Compositional Gas Analysis: A water sample was collected from your well to be tested for stable isotopes of methane ($\delta^{13}C$ and δD) which can help identify the source of methane when present. The isotopic signature of methane collected from your well water indicates it is of **thermogenic** origin rather than biogenic (microbial). The COGCC is continuing to collect data from area wells to further evaluate potential sources of the gas and will report back to you once this analysis is complete.

Bacterial Analysis: The COGCC collected samples to analyze for the presence of iron, sulfur and coliform bacteria in your water well. Samples from your water well were tested for the presence of iron-related (IRB), and sulfate reducing (SRB) bacteria using Biological Activity Reaction Test (BART) kits. In addition to detecting the presence of bacteria the BART Kits allow for an estimation of the size of the population and/or the rate at which they can metabolize and/or grow through an observable change or reaction. This reaction rate is referred to as the "aggressivity" of the bacterial population. The aggressivity levels of the bacteria are described as: Not Detected; Background; Moderately Aggressive; Very Aggressive; or Extremely Aggressive Levels.

Iron-Related Bacteria (IRB): Although not harmful, iron-related bacteria 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 appears to be a sheen on standing water. Signs that may indicate an iron bacteria problem include "yellowish, red or orange colored water, rusty deposits in toilet tanks and strange smells resembling fuel oil, cucumbers or sewage. Sometimes the odor will only be apparent in the morning or after other extended periods of non-use" (CDPHE, Laboratory Services Division).

IRB bacteria were present in the water sample collected at this well at **Very Aggressive** levels.

Sulfate Reducing Bacteria (SRB): Sulfate reducing bacteria 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, initiates corrosion on metal surfaces and reacts with dissolved metals such as iron to generate black sulfide deposits.

SRB bacteria were present in the water sample collected at this well at background levels. Slime bacteria were also present.

Coliform Bacteria: Coliforms are bacteria that are always present in the digestive tracts of animals, including humans, and are found in their wastes. They are also found in plant and soil material. Total coliform counts give a general indication of the sanitary condition of a water supply. When coliforms have been detected, repairs or modifications of the water system may be required.

Total coliform bacteria and E. coli were not present in the water sample collected at this well.

The BART and coliform tests indicated the presence of SRB and IRB in your well system. Once bacterial colonies are established they are difficult to eliminate; therefore, you may need to establish a schedule for periodic disinfection of your well system to help control the bacteria present in it. Odor and taste problems with water wells are frequently caused by the presence of bacteria in the system. Please consult "How Well Do You Know Your Water Well?" for additional information on well and water system treatment.

Pamphlets published by the CDPHE and other agencies that provide more information concerning water well iron bacteria and shock chlorination treatment of bacteria are included in the Attachments. Additional information and assistance can be provided through the State of Colorado Health Department. Contact information for the agency is provided below.

Colorado Department of Public Health and Environment
Colorado Drinking Water Program
4300 Cherry Creek Drive South
Denver, CO 80246-1530
Phone: 303-692-3500
Fax: 303-782-0390

COGCC staff is continuing to evaluate potential sources of the methane in your well water and have placed your well on a monthly methane sampling program until the investigation is complete. You should be able to use the water safely in your home as long as you maintain ventilation as the concentration of methane is at the lower limit of explosive concerns. However you do not want to drink the water without treatment due to the high fluoride concentration and people with sodium-restricted diets (high blood pressure) should avoid drinking the water due to its high sodium content. Both high fluoride and sodium are common in the shales in our area and are not sourced by oil and gas activities.

Additionally you should seek treatment for the IRB and SRB bacteria that are present in the well as they can negatively impact the long-term performance and yield of your well as well. Please feel free to give me a call or email me at karen.spray@state.co.us if you want to discuss these results further. I will stay in contact with you as the investigation proceeds and additional information becomes available.

Sincerely,
Colorado Oil & Gas Conservation Commission Staff

Karen L. Spray
Digitally signed by Karen L. Spray
DN: cn=Karen L. Spray, o, ou, email=karen.spray@state.co.us, c=US
Date: 2010.09.23 14:21:56 -06'00'

Karen L. Spray, PG
SW Environmental Protection Specialist

Attachments: DWR Well Completion Report, Permit #220143
FCG Field Report
GAL Analytical Report
San Juan Basin Health Bacterial Report
FCG BARTs Report
Isotech Report
FCG Field Report – Monthly Methane 9/20/2010
CDPHE – Shock Chlorination Brochure
CDPHE – Iron & Sulphur Bacteria Brochure

Cc: File #200265927

TABLE 1
ANALYTICAL SUMMARY
Complaint 200265927
Cundiff Water Well

Parameter	Water Sample		CDPHE Standards		
	Sample Date				
	August 16, 2010				
	Result	Unit	Domestic	Agriculture	Units
Alkalinity, Total	318	mg/l	NS	NS	
Alkalinity, Bicarbonate	310	mg/l	NS	NS	
Alkalinity, Carbonate	<10	mg/l	NS	NS	
Alkalinity, Hydroxide	<10	mg/l	NS	NS	
Calcium	6.9	mg/l	NS	NS	
Chloride	57	mg/l	250	NS	mg/l
Conductivity	895	umhos/cm	NS	NS	
Fluoride	**4.5**	mg/l	4.0	NS	mg/l
Iron	<0.05	mg/l	0.3	5	mg/l
Magnesium	<0.5	mg/l	NS	NS	
Manganese	0.0217	mg/l	0.05	0.2	mg/l
Nitrate/Nitrite as N	<0.02	mg/l	10.0	100	mg/l
pH	8.37	S.U.	6.5-8.5	6.5-8.5	S.U.
Potassium	<0.5	mg/l	NS	NS	
Selenium	0.001	mg/l	0.05	0.02	mg/l
Sodium	199	mg/l	NS	NS	
Sulfate	59	mg/l	250	NS	
TDS	500	mg/l	500	*1500	mg/l
Hardness	17	mg/l	NS	NS	
Other Parameters					
Methane	**1.02**	mg/l	NS	NS	
Hydrogen sulfide	<0.1	mg/l	NS	NS	
Total Coliform	Absent		zero	NS	
E. Coli	Absent		zero	NS	
Sulfate reducing bacteria	Present Slime		NS	NS	
Iron reducing bacteria	Very Aggressive		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.
Human health standard.
Secondary standard.

FORM NO. GWS-31 01/93

WELL CONSTRUCTION AND TEST REPORT
STATE OF COLORADO, OFFICE OF THE STATE ENGINEER

For Office Use only
RECEIVED
APR 26 2000
WATER RESOURCES STATE ENGINEER COLO.

1. WELL PERMIT NUMBER 220143

2. OWNER NAME(S) Kent & Pam Jones
Mailing Address P.O. Box 4313
City, St. Zip Durango, Co. 81302
Phone (970) 382-0589

3. WELL LOCATION AS DRILLED: SW 1/4 SE 1/4, Sec. 16 Twp. 34 N, Range 8 W
DISTANCES FROM SEC. LINES:
1250 ft. from S (north or south) Sec. line. and 2600 ft. from E (east or west) Sec. line. OR
SUBDIVISION: Project 400 LOT ___ BLOCK ___ FILING(UNIT) ___
STREET ADDRESS AT WELL LOCATION:

4. GROUND SURFACE ELEVATION ___ ft. DRILLING METHOD air rotary
DATE COMPLETED 11-13-99 TOTAL DEPTH 180 ft. DEPTH COMPLETED 180 ft.

5. GEOLOGIC LOG:

Depth	Description of Material (Type, Size, Color, Water Location)
0 - 6'	Soil & Clay
6' - 180'	Shale
	H2O @ 70 + 100'

6. HOLE DIAM. (in.)

	From (ft)	To (ft)
7 7/8"	0	20
7"	20'	180

7. PLAIN CASING

OD (in)	Kind	Wall Size	From(ft)	To(ft)
5 9/16"	Steel	3/8"	0	20
5"	PVC	Sch 40	20	60
			80	100
			160	180

PERF. CASING: Screen Slot Size: .010

5"	PVC	Sch 40	60	80
"	"	"	100	160

8. FILTER PACK:
Material Pea gravel
Size 3/8"
Interval 20' - 180

9. PACKER PLACEMENT:
Type N/A
Depth ___

10. GROUTING RECORD:

Material	Amount	Density	Interval	Placement
Portland	3 bags	15	0-20'	hand

REMARKS:

11. DISINFECTION: Type HTH Amt. Used 6 ozs

12. WELL TEST DATA: ☐ Check box if Test Data is submitted on Form No. GWS 39 Supplemental Well Test.
TESTING METHOD air lift
Static Level 40 ft. Date/Time measured 11-13-99, Production Rate 3 gpm.
Pumping level unknown ft. Date/Time measured ___, Test length (hrs.) 1
Remarks

13. I have read the statements made herein and know the contents thereof, and that they are true to my knowledge. [Pursuant to Section 24-4-104 (13)(a) C.R.S., the making of false statements herein constitutes perjury in the second degree and is punishable as a class 1 misdemeanor.]

CONTRACTOR Beeman Bros Drilling Phone (970) 259-1195 Lic. No. 871
Mailing Address P.O. Box 5180 Dgo, Co 81302

Name/Title (Please type or print)	Signature	Date
J. L. Beeman	J. L. Beeman	11-13-99

Four Corners Geoscience
P.O. Box 4224
Durango,CO 81302
Water Well Test Field Report

Client
Colorado Oil and Gas Conservation Commisssion
Karen Spray

8/16/2010
DATE

1829
IID(COGCC)

081610-L1
FCG #

Joe Cundiff & Julie COGCC Test
NAME

1465 CR 513 Ignacio, CO 81137
AddressWaterWell

1465 CR 513 Ignacio, CO 81137
MAILINGADD

Water Well Location Per DOWR Permit

SWSE	16	34	8	1250S2600E
QTRQTR	**SECTION**	**TWP North**	**RGE West**	**FTG**

220143	180	40	3	111
WaterWellPermit#	**Depth FT**	**Water Level FT**	**Yield(Permit)gpm**	**GallonsPumped**

Garmin GPS 12 Decimal Degrees-NAD Conus 27

-107.72166
LongDecDegrees

37.18727
LatDecDegrees

Field Chemistries

8.46	870	544	14.8
PH_FIELD	**ElectricConductivity**	**TDS_CALC**	**WATERTEMP_**

Water samples collected and delivered to analytical lab for COGCC parameters

Methane Result (mg/L)Dissolved

1.02
CH4_MG_L

Detection Limit 0.0005 mg/L

State of Colorado-ColiAlert test for presence or absence of Coliform Bacteria

Absent
SanJuanBasin HlthSOCBacteria

HACH(TM)HydrogenSulfide Test

<0.1
H_2_S_MG_L

Detection Limit 0.1 mg/L

Onsite with Karen Spray COGCC met Julie-interview for concerns.FCGEO sample collection-from faucet-pressure tank in shed.Water clear,no odor,no tint,bubbles from end hose & on sides of bucket,no sediment.Isotope & BARTs.111 gallons pumped

COMMENTS

Green Analytical Laboratories, Inc.
75 Suttle Street
Durango, CO 81303

GAL I.D.: **1008-128-01**

COGCC
PO Box 2651
Durango, CO 81302
Attention: Karen Spray

Date Received: 08/16/10
Date Reported: 09/01/10
QC Batches:

PROJECT NAME: Jones GU 34-16 #3
PROJECT NUMBER: FCG081610-L1
SAMPLE I.D.: Joe & Julie Cundiff

Sample Date: 08/16/10
Sample Matrix: Water

Laboratory Report

RESULTS

PARAMETER	METHOD	REPORT LIMIT	RESULT	DIL	UNITS	Maximum Contamination Level
Alkalinity, Total	2320B	10	318	1	mg/L	
Alkalinity, Bicarbonate	2320B	10	310	1	mg/L	
Alkalinity, Carbonate	2320B	10	<10	1	mg/L	
Alkalinity, Hydroxide	2320B	10	<10	1	mg/L	
Calcium	200.7	0.5	6.9	1	mg/L	
Chloride	4500CL	10	57	1	mg/L	
Conductivity	2510B	1.0	895	1	uS/cm	
Fluoride	4500F C	0.2	4.5	1	mg/L	4.0
Iron	200.7	0.05	<0.05	1	mg/L	
Magnesium	200.7	0.5	<0.5	1	mg/L	
Manganese	200.8	0.0005	0.0217	1	mg/L	
Nitrate/Nitrite as N	353.3	0.02	<0.02	1	mg/L	
pH	150.1	NA	8.37	NA	SU	
Potassium	200.7	0.5	<0.5	1	mg/L	
Selenium	200.8	0.001	0.001	1	mg/L	0.05
Sodium	200.7	0.5	199	1	mg/L	
Sulfate	4500SO4	10	59	1	mg/L	
TDS	2540C	10	500	1	mg/L	
Hardness	Calc	10	17	1	mg/L	
CAB	Calc		3.32		%	

Debbie Zufelt, Laboratory Manager

San Juan Basin Health Department
Water Bacteriology Result

Coli Alert Test for Presence or Absence
Coliform Bacteria in Water Wells and other Water Sources

A coli-form bacteria sample was collected at the time of your water well test by Four Corners Geoscience, Inc.
This sample was delivered to San Juan Basin Health Department laboratory located in Durango,Colorado.
Please see copy of the original report below.

Please call San Juan Basin Health at 970-247-5702 for more information if you have questions.

You may, also, refer to your water well booklet Page 19 for more information. Please contact a water treatment specialist in your area for further instructions regarding water well disinfection.

Colorado Department of Public Health and Environment

San Juan Basin Health Department/Laboratory
281 Sawyer Drive
P.O. Box 140
Durango, CO 81302

WATER BACTERIOLOGY

TO BE BILLED pd
Fee Stamp
FCG# 08161O-L1

SAMPLE INFORMATION: ☐ COMMUNITY ☐ NON-COMMUNITY ☒ PRIVATE

PWS ID ☐ ROUTINE ☒ RAW ☐ REPEAT FOR THE MONTH OF
☐ SPECIAL PURPOSE ☐ FINISHED

CUNDIFF
NAME OF SYSTEM

MG/L
CHLORINE RESIDUAL

ADDRESS CITY COUNTY

DATE TIME BY
COLLECTED 8/16/10 1418 ☐ AM ☑ PM LF
RECEIVED / / ☐ AM ☐ PM

RESULTS: [redacted]

TOTAL COLIFORM ☐ PRESENT ☒ ABSENT
E. COLI ☐ PRESENT ☒ ABSENT
MOST PROBABLE NO. COLIFORM/1000ML

AUG 16'10 16:04 2488

ORDERED BY: (SAMPLE MAY NOT BE TESTED IF ALL INFORMATION IS NOT PROVIDED)

LAB PROCEDURE
STD. MTH
20th ED
9223C

( ) PHONE
Four Corners Geo
NAME
PO Box 4224
ADDRESS
Durango, CO 81302
CITY / STATE / ZIP

☐ Colilert-18 ☐ Colilert-24 ☐ Colisure-24 48

ANALYST

☐ TEST ORDERED ☒ STD BACT. ☐ OTHER

GCC

Four Corners Geoscience
BART (Bacterial Test Results)

1829
IID(COGCC)

NAME
Joe & Julie Cundiff

FCG #
081610-L1

DATE
8/16/2010

Water Well Location

QTRQTR SWSE Section 16 TWP(North) 34 RGE(West) 8

Methane Result(mg/L)

1.02
CH4_MG_L

pending
ISOTOPE

SRB

SRB- present at Day 16 Background level -Bacteria present with combination of Aerobic and anaerobic bacteria.SRB and slime present at Day 7 No black till Day 16.

BART Hach Company
BART TYPE: SRB-BART
Batch # 0792-M,S Lot 0792-S
Expiration Date Sept 2012

IRB

IRB- present Very aggressive at Day 3.Anaerobic bacteria present.

BART Hach Company
BART TYPE:IRB-BART
Batch #: 0491-G Lot #:0491-G
Expiration Date Sept 2012

GasWell
Jones GU 34-16 #3

ISOTECH
ISOTECH LABORATORIES INC

ANALYSIS REPORT

Lab #: 193391 Job #: 13595

Sample Name: Joe & Julie Cundiff Water Well Co. Lab#: FCG# 081610-L1

Company: Colorado Oil & Gas Conservation

Date Sampled: 8/16/2010

Container: Dissolved Gas Bottle

Field/Site Name: Jones GU 34-16 #3

Location: Sec 16 T34N R8W

Formation/Depth:

Sampling Point:

Date Received: 8/18/2010 Date Reported: 9/16/2010

Component	Chemical mol. %	$\delta^{13}C$ ‰	δD ‰	$\delta^{15}N$ ‰
Carbon Monoxide	0.008			
Hydrogen Sulfide	nd			
Helium	nd			
Hydrogen	nd			
Argon	1.47			
Oxygen	2.68			
Nitrogen	86.06			
Carbon Dioxide	0.49			
Methane	9.09	-42.55	-202.9	
Ethane	0.192			
Ethylene	nd			
Propane	nd			
Iso-butane	nd			
N-butane	nd			
Iso-pentane	nd			
N-pentane	nd			
Hexanes +	0.0093			

Total BTU/cu.ft. dry @ 60deg F & 14.7psia, calculated: 96

Specific gravity, calculated: 0.942

Remarks: Analysis is of gas extracted from water by headspace equilibration. Analysis has been corrected for helium added to create headspace. Helium dilution factor = 0.72
*Addition of helium negates the ability to detect native helium or hydrogen.

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%. Mol. % is approximately equal to vol. %.

Four Corners Geoscience
P.O. Box 4224
Durango,CO 81302
Water Well Test Field Report

Client
Colorado Oil and Gas
Conservation Commisssion
Karen Spray

IID(COGCC) 1829 **FCG #** 092010-L1 9/20/2010 **DATE**

NAME Joe & Julie Cundiff Follow Up 1465 CR 513 Ignacio, CO 81137 **AddressWaterWell**

MAILINGADD 1465 CR 513 Ignacio, CO 81137 **TELEPHONE_** 970-799-2216

Water Well Permit # and Information-Colorado DOWR **WaterWellPermit#** 220143

QTRQTR SWSE **SECTION** 16 **TWP North** 34 **RGE West** 8 **FTG** 1250S2600E

Depth FT 180 **Water Level FT** 40 **Yield(gpm)** 3 **GallonsPumped** 115

Latitude LongitudeDecimal Degrees NAD 83 **LatDecDegrees** 37.18727 **LongDecDegrees** -107.72166

Field Chemistries

PH_FIELD 8.39 **ElecConductivity(us)** 890 **TDS_CALC** 556 **WaterTp(Celsius)_** 14

No water samples collected and delivered to Green Analytical Lab.No samples collected for BART -IRB and SRB.

Methane Result (mg/L)Dissolved **CH4_MG_L** 1.17 *Detection Limit 0.0005 mg/L*

State of Colorado-ColiAlert test-presence or absence of Coliform Bacteria No Test **SanJuanBasin HlthSOCBacteria**

HACH(TM)HydrogenSulfide Test **H_2_S_MG_L** <0.1 *Detection Limit 0.1 mg/L*

COMMENTS
Monthly follow up for methane.Sample from faucet in well house.Water clear,no odor,no tint,bubbles in solution,no sediment.Field chemistries,observations,sample collection for methane only.

CAUTION

- During the seven- to 13-hour procedure, purchase water for drinking, cooking and laundry. Do not use well water for drinking or cooking while chlorine level is exceptionally strong.
- All concentrated chlorine solutions are corrosive and care should be taken to avoid splashing them onto skin or into eyes. Skin areas or eyes contacted by the disinfection solution should be flushed immediately with clean water.
- Never mix chlorine solutions with compounds containing acids or ammonia to improve their cleaning ability because toxic gases will form.

Glossary

Contaminant: Any physical, chemical, biological, or radiological substance or matter that has an adverse effect on air, water, or soil.

Disinfection: Killing a larger portion of the harmful and objectionable bacteria in water.

Groundwater: Water that fills wells from aquifers (natural reservoirs below the earth's surface).

Resample: Any water sample taken after the initial sampling of a well.

Sample: Water that is analyzed by a laboratory for the presence of drinking water contaminants.

Shock chlorination: Adding chlorine to water for the purpose of disinfection or other biological or chemical results.

Well: An artificial excavation constructed for the purpose of exploring for or producing ground water.

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Chemistry Laboratory – (303) 692-3048
Microbiology Laboratory – (303) 692-3490
Bottle Order Line (menu driven) –
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Colorado Department of Public Health and Environment
Laboratory Services Division
8100 Lowry Boulevard
Denver, CO 80230

COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT

LABORATORY SERVICES DIVISION

Shock Chlorination of Wells and Water Systems

CHEMISTRY LABORATORY
(303) 692-3048
MICROBIOLOGY LABORATORY
(303) 692-3490

Determining Amount of Chlorination for Your Well

Table I

Casing Diameter (Inches)	Gallons of Water in 1 Foot of Casing	Casing Diameter (Inches)	Gallons of Water in 1 Foot of Casing
2	0.16	18	13.21
4	0.65	24	23.50
5	1.02	30	36.72
6	1.47	36	52.87
8	2.61	42	71.97
10	4.08	48	94.00
12	5.88		

Table II

Gallons of Water in Well	Laundry Bleach	Chlorinated Lime	High Test Hypochlorite
5	5.5 oz.	1.2 oz.	.5 oz.
50	56 oz.	12 oz.	4 oz.
100	112 oz.	24 oz.	8 oz.
150	168 oz.	36 oz.	12 oz.
200	224 oz.	48 oz.	16 oz.
300	336 oz.	72 oz.	24 oz.
Each addtional 100 gallons add:	112 oz.	24 oz	8 oz.

Bacterial contamination of well water can come from many sources. The most common include repairing the pump or casing without follow-up chlorination, surface water entering pump or casing, poor construction of the well, or leaks in the well or well casing.

Shock chlorination of the well may eliminate the bacterial contamination, but well rehabilitation may be necessary if contamination continues to occur (as in a rusted or leaking casing).

To determine the amount of chlorine needed to shock chlorinate your well, first determine the approximate volume of water contained in your well. Determine the volume of water in your well by multiplying the depth of your well times the amount of water in one foot of casing (Table I).

Well Depth x Gallons of Water in 1 Foot of Casing (see Table I) = Volume of Water in Well

Once you have determined the volume of water in your well, refer to Table II to determine the amount of chlorine compound required to shock chlorinate your well.

Forms of Chlorine Used in Shock Chlorination

Format	Chemical Mixture
Liquid	Laundry Bleach (Sodium Hypochlorite, 5.25%)
Powder or Tablet Form	Chlorinated Lime (Chloride of Lime, 25-30%)
Powder or Tablet Form	High-Test Hypochlorate (Calcium Hypochlorite, 65-75 %)

Treatment of Casing and Drop Pipe

During the shock chlorination process it is necessary to thoroughly wet down the inside of the well casing and drop pipe. This can be accomplished by one of the three methods mentioned below:

- If liquid bleach is used, mix the recommended amount (Table II) to at least 10 gallons of water. Pour down the inside of the casing, thoroughly wetting down everything inside the casing.
- If powdered or tablet chlorine is used, dissolve the recommended amount (Table II) in a small quantity of water, then add the clear solution to a larger quantity of water (at least 20 gallons). Pour this solution into the casing, thoroughly wetting down everything inside the casing.
- If a hose will extend from a nearby hydrant or faucet to the well casing, pour the recommended amounts of chlorine (Table II) into the casing and wash down the inside of the casing with the hose. Make sure the chlorine solution in the well is coming through the hose during the wash-down procedure. Pumping the solution into the casing will help to mix the chlorine solution with the standing water in the well.

Once the chlorine is thoroughly mixed with the water in the well casing, allow it to stand for about six to12 hours. At the end of the six- to12-hour period, all faucets should be allowed to run until a strong odor of chlorine is observed at each faucet, then turn off the faucets and allow the water to stand in the pipes for one hour.

Flushing the System

Begin flushing the system by running all outside faucets until you no longer smell chlorine. Run this water into the street or onto an area where there is no lawn or flowers, such as a rocked area. You may severely damage lawns, landscape plantings, flowers or septic tanks with heavily chlorinated water.

Once you have removed most of the chorine at the outside faucets, go into the house and run all inside faucets. If you have a septic tank or leaching field, you may want to dechlorinate the water at the drain by using approximately two (2) ounces of sodium bisulfite for every gallon run. Sodium bisulfite can be purchased at hardware stores.

Hot water heaters should be drained after a well is treated with chlorine. If possible, run a hose from the water heater outside to an area that does not contain lawn or other sensitive plants.

CAUTION
- Do not flush more than 100 gallons of chlorinated water from the system into the septic system.
- Avoid draining heavily chlorinated water to lawns and do not allow puddles to form.
- Do not chlorinate carbon or charcoal filters because this will deplete their capacity.

Raising the water heater temperature will temporarily solve the odor problem, but sulfur-reducing bacteria will quickly reinvade unless more permanent measures are taken.

Removing the sacrificial anode will eliminate the problem, but it can also shorten the water heater's lifespan significantly and may void the warranty. Replacing the magnesium rod with one made of zinc won't totally eliminate sulfur-reducing bacteria, but it will greatly reduce the number of bacteria. Consult with a plumber before attempting to modify your water heater.

Point-of-Use Treatment (Carbon Filters)

Some point-of-entry (POE) and point-of-use (POU) systems can inhibit reproduction of bacteria and reduce associated odors and tastes. To determine the best system, you can use the NSF International online product database of drinking water treatment units. Visit the NSF International website at www.nsf.org or call 1-800-673-6275.

Follow-up Procedures

Shock chlorination or the other methods discussed should solve the immediate problems associated with iron or sulfur bacteria, but they may not be long-term solutions. Iron and sulfur bacteria tend to build up again a few months after treatment. Bacteria problems are much easier to control after the initial contamination has been treated. However, to keep down bacterial regrowth, well owners can periodically disinfect their wells by shock chlorinating with a weaker chlorine solution, or by installing a chlorination unit that will constantly chlorinate the water. A licensed well contractor can advise you on which option is best for you.

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LABORATORY SERVICES DIVISION

Iron and Sulfur Bacteria in Water Supplies

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Bacterial contamination of a water supply doesn't always indicate the existence of a health hazard. Some types of bacterial contamination are more annoying than harmful. The normal bacteria test performed on drinking water is specific for coliform and E. coli. A sample may test negative for coliform but still contain other nuisance bacteria. Two of the most common bacterial contaminants are iron and sulfur bacteria. They are not particularly harmful, but they can be incredibly annoying.

Iron Bacteria

Iron bacteria are generally more common than sulfur bacteria because iron is abundant in ground water. Iron bacteria are oxidizing agents and combine iron or manganese dissolved in ground water with oxygen. A side effect of the process is a foul-smelling brown slime that can cause unpleasant odors, corrode plumbing equipment and fixtures, and clog well screens and pipes. If conditions are right, the bacteria can grow at amazing rates, rendering an entire well system useless in just a few months.

Signs that may indicate an iron bacteria problem include yellow-, red- or orange-colored water; rusty slime deposits in toilet tanks; and strange smells resembling fuel oil, cucumbers, or sewage. Sometimes the odor will only be apparent in the morning or after other extended periods of non-use.

Sulfur Bacteria

There are two categories of sulfur bacteria; sulfur oxidizers and sulfur reducers. Sulfur-reducing bacteria are the more common. Sulfur-oxidizing bacteria produce effects similar to those of iron bacteria. They convert sulfide into sulfate, producing a dark slime that can clog plumbing. Sulfur-reducing bacteria live in oxygen-deficient environments. They break down sulfur compounds, producing hydrogen sulfide gas in the process. The distinctive "rotten egg" odor of hydrogen sulfide gas is the most obvious sign of a sulfur bacteria problem. Hydrogen sulfide gas is foul smelling and highly corrosive. As with odors caused by iron bacteria, the sulfur smell may only be noticeable when the water hasn't been run for several hours.

If the odor is only present when hot water is run, sulfur-reducing bacteria could be building up in the water heater. Blackening of water or dark slime coating the inside of the toilet tank may also indicate a sulfur bacteria problem.

Iron bacteria and sulfur bacteria contaminations are often difficult to tell apart because the symptoms are so similar. To complicate matters, sulfur-reducing bacteria often live in complex symbiotic relationships with iron bacteria, so both types may be present. Fortunately, both types of bacteria can be treated using the same methods.

Prevention

The best treatment for both iron and sulfur bacteria is prevention. Unsanitary well drilling can often introduce bacteria into a previously clean water supply. Therefore, anything that will be going into the ground during the drilling process needs to be disinfected. Tools, pumps, pipes, gravel pack material, and even water used during drilling should be treated with a 200-milligrams-per-liter chlorine solution. When the well is completed, it should be shock chlorinated. Well owners should be alert for any signs of iron or sulfur bacteria contamination.

Shock Chlorination

Shock chlorination involves adding chlorine to water to disinfect the water or to obtain other biological or chemical results. Chlorine is a common disinfectant used in water systems, and is highly toxic to coliform and similar types of bacteria. Iron and sulfur bacteria are more resistant to chlorine's effects because iron and sulfur bacteria occur in thick layers and are protected by the slime they secrete. A standard chlorine treatment may kill off bacterial cells in the surface layer but leave the rest untouched. In the case of iron bacteria, iron dissolved in the water may absorb disinfectant before it reaches the bacteria.

For all of these reasons, iron and sulfur bacteria may be able to survive a chlorine treatment that would kill other types of bacteria. For information on shock chlorinating iron- or sulfur-bacteria contaminated wells, contact the Laboratory Services Division at 303-692-3048 and request the "Shock Chlorination of Wells and Water Systems" fact sheet.

Acid Treatment

For severe cases, treatment with a strong acid and salt solution following thorough shock chlorination may be required. The acid solution (commercial hydrochloric acid, commonly known as muriatic acid) may be able to penetrate thick incrustations of bacteria that the chlorine solution was unable to kill. This procedure should only be performed by a licensed well contractor.

Water Heater Treatment

As noted earlier, sulfur-reducing bacteria can often contaminate water heaters, creating a foul smell when hot water is turned on. A water heater provides a good environment for sulfur-reducing bacteria because it contains a "sacrificial anode." This anode is a magnesium rod that helps protect the water heater by corroding instead of the tank lining. Electrons released from the anode as it corrodes nourish sulfur-reducing bacteria.

Water heaters infested with sulfur-reducing bacteria can be treated. Sulfur-reducing bacteria die at temperatures of 140 degrees Fahrenheit or above, which is roughly equivalent to the "medium" setting on most home water heaters. Setting the water heater on "high" will raise the water temperature to approximately 160 degrees Fahrenheit and kill any sulfur-reducing bacteria in the tank. (Do this only if the water tank has a pressure relief valve and everyone in the house is warned, to prevent scalding.) After about eight hours, the tank can be drained and the temperature setting returned to normal.