STATE OF COLORADO
OIL & GAS
CONSERVATION COMMISSION

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

November 3, 2009

Ms. Laura Sossaman
PO Box 547
Bayfield, CO 81122

RE: Water Well Complaint #200216578
Water Well Permit #170121

Dear Ms Sossaman:

Enclosed please find the results of the August 12, 2009 groundwater sampling of your water well, located on your property at 404 Silver Hills Road in La Plata County, Colorado. In your original complaint you stated there was a rotten egg odor in your water and you were concerned that area oil & gas activities may have caused an impact. The following letter and documentation provides the results of the Colorado Oil & Gas Conservation Commission's (COGCC) investigation into this matter.

On Wednesday, August 12, 2009 COGCC contractor, Four Corners Geoscience (FCG), came to your property to perform groundwater sampling from your water well. FCG collected water samples from the faucet on the front of the house to analyze for methane and hydrogen sulfide gases, field chemistries, basic chemistries, coliform bacteria, and iron-reducing and sulfur-reducing bacteria (BART's). Methane and hydrogen sulfide gas and BART's analyses were conducted by FCG in their Bayfield laboratory and the coliform analysis was conducted by San Juan Basin Health in Durango. All other samples were submitted to Green Analytical Laboratories (GAL) in Durango for analyses.

No hydrogen sulfide gases or coliform bacteria were detected in your well water; however methane was detected at 5.53 mg/L. As a result an additional sample was collected and sent for isotopic analysis which allows for evaluation of the source of methane. Results of the isotopic analysis indicate the gas is biogenic in origin and is likely being sourced by carbon dioxide (CO_2) reduction in the subsurface. The attached plot of four separate gas analyses from your well along with typical gas reservoir isotopic ratios demonstrates this difference. Both sulfur- and iron-reducing bacteria were identified in your well water at very aggressive levels which is probably what is creating the odors in your well water. I have attached a brochure from the Colorado Department of Public Health & Environment (CDPHE) on how to deal with iron and sulfur bacteria problems in your well water.

Chemical data indicate that your water is a sodium-bicarbonate type which is very typical for shallow groundwater in this area. The Total Dissolved Solids (TDS) of your water is low at 440 mg/L and all of your tested 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 criteria. The fluoride concentration at 5.5 mg/L exceeds the drinking water criteria of 4.0 mg/L, which is not uncommon in your area. However consumption of water containing greater than 2.0 mg/L fluoride is not recommended for children with developing teeth as it can cause pitting or staining of the permanent teeth. Table 2 provides a comparison of these criteria and your water well analyses.

Table 2 – Analytical results

Constituent	Result (mg/L)	Regulatory Standard (mg/L)
Methane	5.53	2.0*
Hydrogen sulfide	<0.1	NA
Alkalinity, Total	208	NA
Alkalinity, Bicarbonate	208	NA
Alkalinity, Carbonate	<10	NA
Alkalinity, Hydroxide	<10	NA
Calcium	6.5	NA
Chloride	119	250[2]
Conductivity (µS/cm)	853	NA
Fluoride	5.5	4.0[1]/2.0[2]
Iron	<0.05	0.3[2]
Magnesium	<0.5	NA
Manganese	0.0131	0.05[2]
Nitrate/Nitrite as N	<0.02	10[1]
pH (s.u.)	8.15	6.5-8.5 s.u.
Potassium	<0.5	NA
Selenium	0.003	0.05
Sodium	180	NA
Sulfate	30	250[2]
Total Dissolved Solids (TDS)	440	500[2]
Hardness	16	Soft
Bacteria, Total Coliform	Absent	NA
Bacteria, E. coli	Absent	NA
Bacteria, sulfur-reducing (SRB)	Very aggressive	NA
Bacteria, iron-reducing (IRB)	Very aggressive	NA

[1]Primary Standard
[2]Secondary Standard
*COGCC Standard; above 2 mg/L isotopic testing is conducted
NA = not available
s.u. = standard units
µS/cm = micro Siemens per centimeter
mg/L = milligrams per liter

National Primary Drinking Water Regulations are legally enforceable standards that apply to public water systems only however, they are used as a guideline for private wells. The Secondary Standards are non-enforceable guidelines regulating contaminants that may cause cosmetic or aesthetic effects in drinking water.

In summary, the methane detected in your well water appears to be biogenic in origin and does not match the isotopic signature of natural gas reservoirs in the area. The basic chemistry of your well water is very good and meets all tested CDPHE and EPA primary and secondary drinking water criteria except for fluoride, which is often naturally high in your area. Based on these data it does not appear that your well is being impacted by vicinity natural gas wells. The rotten egg smell in your water is likely sourced by the presence of very aggressive sulfur- and iron-reducing bacteria in your water which can be treated by chlorination, as outlined in the attached CDPHE brochure.

COGCC staff appreciates your cooperation in this investigation. Please feel free to contact me at 970-259-1619 if you have any questions.

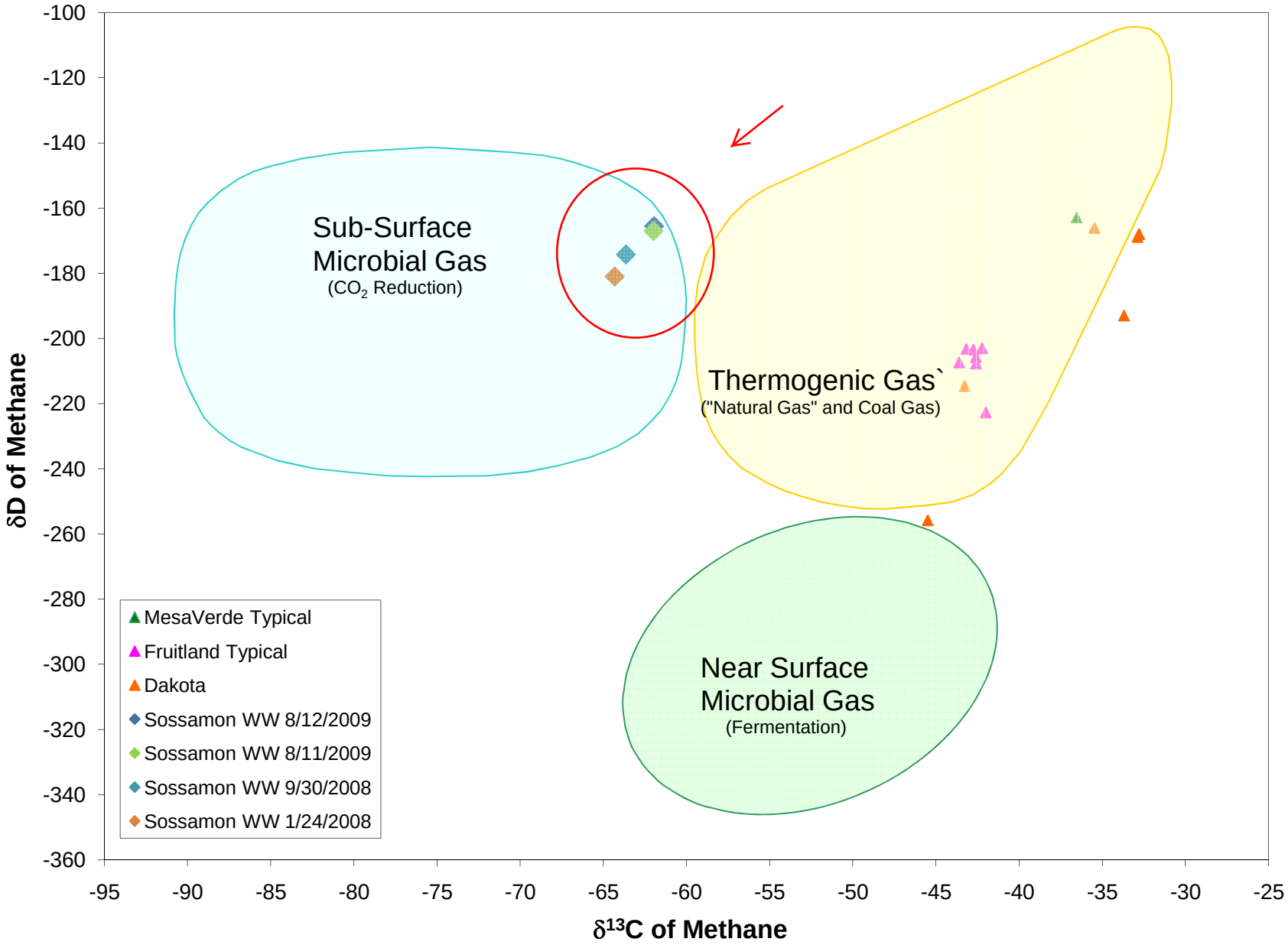
Sincerely,
Colorado Oil & Gas Conservation Commission Staff

Karen L. Spray, PG
SW Environmental Protection Specialist

Enc.

Cc: File #200216578

Compositional Ranges of Methanes -
Sossamon Well Investigation



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

Client
Colorado Oil and Gas
Conservation Commisssion
Karen Spray

8/12/2009
DATE

670
IID(COGCC)

081209-J2
FCG #

Laura Sossomon Concern
NAME

404 Silver Hills Rd. Ignacio, CO 81137
AddressWaterWell

P O Box 547 Bayfield, CO 81122
MAILINGADD

970-884-8055
TELEPHONE_

Water Well Location Per DOWR Permit

QTRQTR	SECTION	TWP North	RGE West	FTG
SWNE	12	34	8	2400N1800E

WaterWellPermit#	Depth FT	Water Level FT	Yield(Permit)gpm	GallonsPumped
170121	200	30	3.57	66.5

Garmin GPS 12 Decimal Degrees-NAD Conus 27

-107.66329
LongDecDegrees

37.20557
LatDecDegrees

Field Chemistries

PH_FIELD	ElectricConductivity	TDS_CALC	WATERTEMP_
8.15	860	538	18.6

Water samples collected and delivered to analytical lab for COGCC parameters

Methane Result (mg/L)Dissolved

5.53
CH4_MG_L

Detection Limit 0.0005 mg/LUSGS/BLM Method

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

Present
SanJuanBasin HlthSOCBacteria

HACH(TM)HydrogenSulfide Test

<0.1
H_2_S_MG_L

Detection Limit 0.1 mg/L

Laura requested water test due to"rotten egg"odor.Well located 700ft.east of house.Sample from faucet on front of house.Water clear,sl.musty odor to no distinct odor,no tint,occasional small bubbles,no sediment.Well chlorinated 3mos.ago.Isotope & BARTs.

COMMENTS

Green Analytical Laboratories
75 Suttle Street
Durango, CO 81303

GAL I.D.: **908-085-02**
Date Received: 08/12/09
Date Reported: 08/20/09
QC Batches:

COGCC
PO Box 2651
Durango CO 81302
Attention: Karen Spray / Debbie Baldwin

PROJECT NAME: Sossamon Water Well
PROJECT NUMBER: FCG 081209-J2
SAMPLE I.D.: Laura Sossamon

Sample Date: 08/12/09
Sample Matrix: Water

Laboratory Report

RESULTS

PARAMETER	METHOD	REPORT LIMIT	RESULT	DIL	UNITS	Maximum Contamination Level
Alkalinity, Total	2320B	10	208	1	mg/L	
Alkalinity, Bicarbonate	2320B	10	208	1	mg/L	
Alkalinity, Carbonate	2320B	10	<10	1	mg/L	
Alkalinity, Hydroxide	2320B	10	<10	1	mg/L	
Calcium	200.7	0.5	6.5	1	mg/L	
Chloride	4500CL	10	119	1	mg/L	
Conductivity	2510B	1.0	853	1	uS/cm	
Fluoride	4500F C	0.2	5.5	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	0.0131	1	mg/L	
Nitrate/Nitrite as N	353.3	0.02	<0.02	1	mg/L	
pH	150.1	NA	8.15	NA	SU	
Potassium	200.7	0.5	<0.5	1	mg/L	
Selenium	200.8	0.001	0.003	1	mg/L	0.05
Sodium	200.7	0.5	180	1	mg/L	
Sulfate	4500SO4	10	30	1	mg/L	
TDS	2540C	10	440	1	mg/L	
Hardness	Calc	10	16	1	mg/L	
CAB	Calc		3.22		%	

Debbie Zufelt, Laboratory Manager

Four Corners Geoscience
BART (Bacterial Test Results)

670
IID(COGCC)

NAME
Laura Sossomon Concern

FCG #
081209-J2

DATE
8/12/2009

Water Well Location

QTRQTR SWNE Section 12 TWP(North) 34 RGE(West) 8

Methane Result(mg/L) 5.53 (CH4_MG_L) Pending (ISOTOPE)

SRB

Sulfate reducing bacteria present very aggressive at 2 days.Combination of aerobic and anaerobic bacteria.

BART Hach Company
BART TYPE: SRB-BART
Batch # 0793-M,N,O Lot 0793-O
Expiration Date Jan 2013

IRB

Iron related bacteria present very aggressive at day 3 with possible enteric bacteria.

BART Hach Company
BART TYPE:IRB-BART
Batch #: 0492-R; Lot #:0492-R
Expiration Date Feb 2013

GasWell
NearestSchirard 3-12UXTO

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~~ Sample FCGH 08/20-52

SAMPLE INFORMATION: ☐ COMMUNITY ☐ NON-COMMUNITY ☒ PRIVATE

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

LAURA SOSSAMON — CHLORINE RESIDUAL ____ MG/L
NAME OF SYSTEM

404 Silver Hills Rd — Ignacio — 81137
ADDRESS / CITY / COUNTY

	DATE	TIME	BY
COLLECTED	8/12/09	☐ AM ☒ PM	JC
RECEIVED	___/___/___	☐ AM ☐ PM	

RESULTS: [redacted]

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

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

LAB PROCEDURE
STD. MTH
20th ED
9223C
LCLC

( ) PHONE
Four Corners Geo — NAME
P.O Box 4224 — ADDRESS
Durango, CO 81302 — CITY / STATE / ZIP

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

☐ TEST ORDERED ☒ STD BACT. ☐ OTHER ____

ANALYST ✓

ISOTECH
ISOTECH LABORATORIES INC

ANALYSIS REPORT

Lab #: 169073 Job #: 11838
Sample Name: Laura Sossamon Water Well, FCG#081209-J2 Co. Lab#:
Company: Colorado Oil & Gas Conservation
Date Sampled: 8/12/2009
Container: Dissolved Gas Bottle
Field/Site Name:
Location:
Formation/Depth:
Sampling Point:
Date Received: 8/14/2009 Date Reported: 9/11/2009

Component	Chemical mol. %	Delta 13C per mil	Delta D per mil	Delta 15N per mil
Carbon Monoxide	nd			
Hydrogen Sulfide	nd			
Helium	nd			
Hydrogen	nd			
Argon	na			
Oxygen + Argon	4.84			
Nitrogen	51.89			
Carbon Dioxide	0.74			
Methane	42.51	-61.95	-165.5	
Ethane	0.0165			
Ethylene	nd			
Propane	nd			
Iso-butane	nd			
N-butane	nd			
Iso-pentane	nd			
N-pentane	nd			
Hexanes +	nd			

Total BTU/cu.ft. dry @ 60deg F & 14.7psia, calculated: 431
Specific gravity, calculated: 0.802

Remarks: Analysis is of gas extracted from water by headspace equilibration. Analysis has been corrected for helium added to create headspace. Helium dilution factor = 0.76
*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. %. Chemical analysis based on standards accurate to within 2%

Isotech Gas Data

Job 11838

Isotech Lab No.	Sample Name	GC date	He %	H_2 %	O_2 + Ar %	CO_2 %	N_2 %	CO %	C_1 %	C_2 %	C_2H_4 %	C_3 %	iC_4 %	nC_4 %	iC_5 %	nC_5 %	C_6+ %	MS date	$\delta^{13}C_1$ ‰	δDC_1 ‰	Specific Gravity	BTU	Helium dilution factor *
169073	Laura Sossamon Water Well, FCG#081209-J2	9/03/2009			4.84	0.74	51.89	0	42.51	0.0165	0	0	0	0	0	0	0	9/04/2009	-61.95	-165.5	0.802	431	0.76

Chemical analysis based on standards accurate to within 2%

* Analysis is of gas extracted from water by headspace equilibration. Analysis has been corrected for helium added to create headspace.

**Addition of helium negates the ability to detect native helium or hydrogen.

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.

Laboratory Services Division – (303) 692-3090
Fax: (303) 344-9989
http://www.cdphe.state.co.us/lr
Chemistry Laboratory – (303) 692-3048
Microbiology Laboratory – (303) 692-3490
Bottle Order Line (menu driven) –
(303) 692-3074

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

Iron and Sulfur Bacteria in Water Supplies

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

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.

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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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.