



September 26, 2008

Certified Mail Return Receipt Requested # 7007 1490 0001 8186 0989

Mr. and Mrs. Tracy and Amy Dahl  
PO Box 160  
Weston, CO 81091

RE: Complaint 200190666  
Water Well Analysis  
Well Permit 242925  
SWSE 2 33S, 68W Las Animas County, Colorado

Dear Tracy and Amy:

In response to your concerns regarding possible impacts to water quality from coal bed methane (CBM) operations in the area near your home, the Colorado Oil and Gas Conservation Commission (COGCC) conducted a field visit to your property on June 10, 2008. Water samples were collected for general organic and inorganic water quality testing as well as for analysis of dissolved methane. 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**

I visited your property on June 10, 2008 and you and I walked to your domestic water well so that I could determine if methane was venting from your water well. I determined that there was no methane venting from the casing of your water well before or during the sampling. We started water flowing from your outdoor hydrant at approximately 1-1.5 gallons per minute at 11:42. We collected samples from your well using the hydrant installed near the well casing after pumping the well for 38 minutes. The water temperature had been stable at 60°F for thirty minutes at the time of sampling. The samples were shipped to TestAmerica Laboratories in Arvade, CO and received on June 11, 2008.

### **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. Table 1 also includes results from testing you had conducted in 2004 on water from your well and from COGCC sampling and analyses in February 2008. Shortly before the June sampling event, completion operations were conducted by Pioneer Natural Resources at the Wood 2-43V coal bed methane (CBM) well. The Wood 2-43V is located approximately 1150 feet east of your domestic water well.

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

Antimony was not detected in the sample collected from your water well.

- **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 sample 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 detected in the sample collected from your water well at a concentration of 0.046mg/l which is below the CDPHE human health standard.

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

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

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

Nickel was not detected in the sample 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 sample 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 sample 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 sample 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 sample 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 sample collected from your water well at a concentration of 0.65mg/l which is below the CDPHE human health standard.

- **Nitrate (NO<sub>3</sub>):** 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 sample collected from your water well.

- **Nitrite (NO<sub>2</sub>):** 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 sample collected from your water well.

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

Copper was not detected in the sample collected from your water well.

- **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 5.1mg/l which is 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 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 not detected in the sample collected from your water well.

- **Sulfate (SO<sub>4</sub>):** 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 55mg/l which is below 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 value of 8.7 which is outside 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 sample collected from your well at a concentration of 320mg/l which is below 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 not detected in the water sample collected from your well.

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 sample from your well at a concentration of 120mg/l which is above the recommended level.

- **Boron (B):**

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

- **Calcium (Ca):**

The calcium concentration in the sample collected from your well was 2.3mg/l.

- **Magnesium (Mg):**

Magnesium was not detected in the sample collected from your water well.

- **Potassium (K):**

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

- **Molybdenum (Mo):**

Molybdenum was not detected in the sample collected from your water well.

- **Bicarbonate (HCO<sub>3</sub>):**

Bicarbonate alkalinity was measured in the sample collected from your well at a concentration of 200mg/l.

- **Bromide (Br):**

Bromide was not detected in the sample collected from your water well.

### **METHANE GAS ANALYSIS**

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

### **VOLATILE ORGANIC COMPOUND ANALYSIS**

A target list of sixty-six volatile organic compounds (VOC) was utilized during analysis of water from your well. One of the 66 target compounds (chloroform) was detected in water samples from your well. Chloroform can form by reaction of chlorine (commonly used as a disinfectant in water wells) with naturally occurring organic matter. Three volatile tentatively identified compounds were detected in the water samples from your well. One TIC is a siloxane and is also present in the method blank analyzed with the sample from your well. The siloxane is a commonly observed artifact of the analytical process. One volatile TIC was identified as tetrahydrofuran based mainly on retention time. The third TIC was not identified by the lab but has the characteristics of a long chain hydrocarbon.

### **SEMI-VOLATILE ORGANIC COMPOUND ANALYSIS**

A target list of sixty-three semi-volatile organic compounds (SVOC) was utilized during analysis of water from your well. None of the 63 target compounds were detected in water samples from your well. Two semi-volatile tentatively identified compounds were detected in the water samples from your well. Both of those were also present in the method blank prepared and analyzed with the water sample from your well. As both semi-volatile TIC's present in the sample from your domestic well were also present in the method blank, it is likely that both are artifacts of the analytical process.

## **CONCLUSIONS**

The inorganic chemistry of water from your well is not similar to coal bed methane (CBM) produced water and does not appear to have been impacted by CBM operations in the vicinity of your home. CBM produced water is typically much higher in sodium content than your well water is. CBM produced water typically has much greater levels of total dissolved solids than water from your well. The major ion chemistry of water in your well (sodium, potassium, magnesium, calcium, chloride, sulfate, bicarbonate) has remained relatively constant over that time. The limits of laboratory precision and accuracy typical of analyses for these ions are in the range of  $\pm 10\%$ .

Table 1 shows a comparison of results from a baseline sample collected from your well in 2004 by a private consultant to the results from February and July 2008. The overall chemistry of the water from your well has not changed during the four years for which data is available. The water is predominantly of a sodium-bicarbonate character. TDS is a good indicator of overall inorganic water quality and it has remained stable over the last four years as seen in Table 1.

Antimony, arsenic, barium and lead have been detected in water from your well during one or more tests, including the 2004 sampling and analysis. The concentrations of these elements have always been below the concentrations present in the groundwater standards of the Colorado Water Quality Control Commission. All of these elements may leach from rocks in contact with water in the aquifer your well taps. Barium is sometimes used as an additive to muds in drilling wells. Muds are not used frequently in drilling CBM wells. Most CBM wells in the Raton Basin are drilled using air, mist or foams and not drilling mud. You suggested to me that antimony might be an indicator element of drilling and operations impacts on water wells. The COGCC water quality database contains more than 120 water analyses for antimony in CBM produced water and antimony was not detected in any of the produced water tested. The water quality data for the 2008 sampling and analysis does not show any impacts from nearby CBM drilling and production activities.

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](mailto:peter.gintautas@state.co.us).

Sincerely,  
Colorado Oil and Gas Conservation Commission

Peter Gintautas  
Environmental Protection Specialist

Attachments: Attachment 1 - Table 1 - Analytical Summary  
Attachment 2 - TestAmerica Laboratories Analytical Report

cc: David Neslin, Acting COGCC Director w/o attachments  
Debbie Baldwin, COGCC Environmental Protection Manager w/o attachments  
Margaret Ash, COGCC Environmental Protection Specialist w/o attachments

**TABLE 1**  
**ANALYTICAL SUMMARY**  
**Complaint 200190666**  
**Dahl Water Well**

Parameter	Water Well Sample				CDPHE Standards		
	Sample Date	Sample Date	Sample Date				
	15-Oct-04	06-Feb-08	10-Jun-08				
	Result	Result	Result	Unit	Domestic	Agriculture	Units
Antimony	0.0002	0.0011	ND(<0.002)	mg/l	0.006	NS	mg/l
Boron	0.01	ND (<0.1)	ND(<0.1)	mg/l	NS	0.75	mg/l
Copper	ND	ND	ND	mg/l	1	0.2	mg/l
Arsenic	0.0014	0.0031	ND(<0.005)	mg/l	0.01	0.1	mg/l
Barium	0.044	ND (<0.1)	0.046	mg/l	2.0	NS	mg/l
Beryllium	ND	ND	ND	mg/l	0.004	0.1	mg/l
Cadmium	ND	ND	ND	mg/l	0.005	0.01	mg/l
Calcium	2.6	2.5	2.3	mg/l	NS	NS	
Chromium	ND	ND	ND	mg/l	0.1	0.1	mg/l
Iron	0.03	ND (<0.1)	ND(<0.1)	mg/l	0.3	5	mg/l
Lead	0.0004	0.0007	ND(<0.001)	mg/l	0.05	0.1	mg/l
Lithium	NA	ND	ND	mg/l	NS	NS	
Magnesium	ND	ND	ND	mg/l	NS	NS	
Manganese	ND	ND	ND	mg/l	0.05	0.2	mg/l
Molybdenum	ND (<0.001)	0.0015	ND(<0.002)	mg/l	0.035	NS	mg/l
Nickel	ND	ND	ND	mg/l	0.1	0.2	mg/l
Potassium	0.6	ND(<1)	ND(<3)	mg/l	NS	NS	
Selenium	ND	ND	ND	mg/l	0.05	0.02	mg/l
Silver	ND	ND	ND	mg/l	0.05	NS	mg/l
Sodium	114	110	120	mg/l	NS	NS	
Strontium	NA	0.076	0.07	mg/l	NS	NS	
Thallium	ND	ND	ND	mg/l	0.002	NS	mg/l
Uranium	0.00016	0.0002	ND(<0.001)	mg/l	0.03	NS	mg/l
Zinc	ND	ND	ND	mg/l	5	2	mg/l
Chloride	5	5.1	5.1	mg/l	250	NS	mg/l
Nitrite	ND	ND	ND	mg/l	1.0	10	mg/l
Nitrate	0.19	ND (<0.2)	ND(<0.5)	mg/l	10.0	100	mg/l
Total Nitrite/Nitrate	0.19	ND (<0.2)	ND(<0.5)	mg/l	10.0	100	mg/l
Fluoride	0.5	0.48	0.65	mg/l	4.0	NS	mg/l
Total Dissolved Solids	320	310	320	mg/l	400	*1500	mg/l
pH	8.1	8.61	8.7	No units	6.5 - 8.5	6.5 - 8.5	No units
Sulfate	60	54	55	mg/l	250	NS	mg/l
Bromide	NA	ND	ND	mg/l	NS	NS	
Total Alkalinity	206	200	200	mg/l	NS	NS	
Bicarbonate	191	190	200	mg/l	NS	NS	
Carbonate	15	ND	ND	mg/l	NS	NS	
Conductivity	499	503	520	umhos/cm	NS	NS	
methane	NA	0.0025	ND(<0.005)	mg/l	NS	NS	
Total Organic Carbon	NA	ND	ND	mg/l	NS	NS	
chloroform	NA	0.0028	0.0021	mg/l	0.0035	NS	mg/l

**Notes**

**CDPHE**

**Domestic**

**Agriculture**

**mg/l**

**umhos/cm**

**NA**

**ND**

**NS**

**\*\***

Colorado Department of Public Health and the Environment.

Water Quality Control Commission 5 CCR 1002-41, Regulation No. 41 - The Basic Standards For Groundwater.

\* Standards for agriculture complied from CDPHE and other of sources.

milligrams per liter (ppm or parts per million).

micromhos per centimeter

Not analyzed.

Not detected.

No Standard.

Health Advisory.

Human health standard.

Secondary standard.