STATE OF COLORADO
OIL & GAS
CONSERVATION COMMISSION

March 12, 2012

Certified Mail Return Receipt Requested # 7011 0470 0003 6447 5551

Kazuko Nosaka
17500 County Road 38.2
Weston, CO 81091

RE: Complaint 200339396
Continued Baseline Sampling
Well Permit 126701-A, Receipt 0440536
NWSW 23, 32S 68W Las Animas County, Colorado

Dear Kazuko:

In response to your concerns regarding possible impacts to water quality from nearby coal bed methane (CBM) operations, I conducted a field visit to your water well on February 14, 2012 to collect water quality samples on behalf of the COGCC. Water samples were collected for general inorganic water quality testing as well as for analysis of dissolved methane, volatile organic compounds and semi-volatile organic compounds. A sample was also collected for analysis of gas composition and isotopic ratio determination. A summary of the results of the February 14, 2012 sampling event and the chemical analyses is presented below. The analytical results are also compared to published water quality standards.

FIELD TESTING

I visited your home in the Cimarron Ranches subdivision in western Las Animas county on February 14, 2012 to collect water samples from the domestic well at your home. You assisted me in starting the pump and in collecting samples as water flowed directly into your cistern from the pump. The well was started at 14:11 and was pumped at a rate of approximately 10 gallons per minute for 6 minutes before samples were collected.

The samples from your well for general inorganic, organic analyses and dissolved methane analyses were shipped to ALS Laboratory Group in Fort Collins, CO and received on February 16, 2012. The sample for gas composition and isotopic analysis was received by Isotech Laboratories, Inc. in Champaign, IL on February 16, 2012. These samples were stored and shipped on ice with custody seals and by overnight service.

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 Water Supply - Human Health standards" (Table 1) and Domestic Water Supply - Drinking Water standards" (Table 2) within their Regulation 41 "The Basic Standards for Groundwater" (5CCR 1002-41). The COGCC is an implementing agency of the groundwater standards for impacts associated with oil and gas exploration and production activities. Analytical data for the recently collected samples from your 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" are analogous to but not the

same as standards established for **municipal or public** drinking water supplies and oftentimes people use and consume ground water from private wells that exceed these standards. The groundwater standards are different in concept than the rules and standards adopted for public supply systems but many of the threshold concentrations are identical. A paper copy of the reports from ALS Laboratory Group is included as Attachment 2. A paper copy of the report provided by Isotech Laboratories in included as Attachment 3. The results of three previous sampling events at your well are included in Table 2 which is included as Attachment 4.

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

  Antimony was detected in the sample from your well at a concentration of 0.00063mg/l, which is below the CDPHE human health standard (2012).

- **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 from your well (2012).

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

  Barium was detected in the sample from your well at a concentration of 0.041mg/l, which is below the CDPHE human health standard (2012).

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

  Beryllium was not detected in the samples collected from your well (2012).

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

  Cadmium was not detected in the samples collected from your well (2012).

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

  Chromium was not detected in the samples collected from your well (2012).

- **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 samples from your well (2012).

- **Molybdenum (Mo):** The CDPHE human health standard for lead is 0.035 mg/l. Molybdenum occurs naturally in the earth's crust and is usually found in very low concentrations in groundwater.

  Molybdenum was detected in the sample from your well at a concentration of 0.0019mg/l, which is below the CDPHE human health standard (2012).

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

  Nickel was not detected in the samples collected from your well (2012).

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

  Selenium was not detected in the samples collected from your well (2012).

- **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 well (2012).

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

  Thallium was not detected in the samples from your well (2012).

- **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 detected in the sample from your well at a concentration of 0.00011mg/l, which is below the CDPHE human health standard (2012).

- **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 from your well at a concentration of 1.5mg/l, which is below the CDPHE human health standard (2012).

- **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 not detected in the samples from your well (2012).

- **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 well (2012).

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

  Copper was not detected in the samples from your well (2012).

- **Chloride (Cl):** The CDPHE domestic supply 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 from your well at a concentration of 11mg/l, which is below the CDPHE domestic supply drinking water standard (2012).

- **Iron (Fe):** The CDPHE domestic supply 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 well (2012).

- **Manganese (Mn):** The CDPHE domestic supply 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 samples collected from your well (2012).

- **Sulfate (SO_4):** The CDPHE sulfate domestic supply drinking water 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 from your well at a concentration of 120mg/l, which is below the CDPHE domestic supply drinking water standard (2012).

- **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 samples from your well at 8.23 which is within the CDPHE drinking water and agricultural standards (2012).

- **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 concentration measured in samples from your water well was 380mg/l which is below the CDPHE drinking water standard (2012).

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

  Zinc was not detected in the samples from your well (2012).

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 120mg/l (2012). The sodium concentration is above the recommended level.

- **Boron (B):**

  Boron was not detected in the samples collected from your well (2012).

- **Calcium (Ca):**

  Calcium was detected in the water sample from your well (2012) at a concentration of 21mg/l.

- **Magnesium (Mg):**

  Magnesium was not detected in the water sample from your well (2012).

- **Potassium (K):**

  Potassium was detected in the water sample from your well at a concentration of 1.3mg/l (2012).

- **Strontium (Sr):**

  Strontium was detected in the water sample from your well at a concentration of 0.37mg/l (2012). The U.S. EPA has not established drinking water standards for strontium. However this federal agency has issued a health advisory level of 4mg/l for lifetime consumption of water by an individual. The Sr concentration in your well water is less the advisory level if you were to consume this water for your entire life.

- **Bicarbonate (HCO_3):**

  Bicarbonate alkalinity was detected in the water sample from your well at a concentration of 170mg/l (2012).

- **Bromide (Br):**

  Bromide was not detected in the water sample from your well (2012).

METHANE GAS ANALYSIS

Methane was not detected in the samples collected from your well (2012).

VOLATILE ORGANIC COMPOUND ANALYSIS

A target list of sixty-nine volatile organic compounds (VOC) was utilized during analysis of water from your well. None of the 69 target compounds was detected above the lab's established reporting limit in water samples from your well.

SEMI-VOLATILE ORGANIC COMPOUND ANALYSIS

A target list of 73 semi-volatile organic compounds (SVOC) was utilized during analysis of water from your well. None of the 73 target compounds were detected in water samples from your well (2012).

DISCUSSION

A summary of available analytical results from water samples collected from the Nosaka domestic water well is presented in Table 2. TDS is a good indicator of overall inorganic water quality and the concentration of dissolved solids your well water is below the drinking water standards established by the Water Quality Control Commission of the Colorado Department of Public Health and the Environment in each of the four sampling and analysis events since 2008. The concentration of total dissolved solids has remained constant within typical laboratory analytical precision and accuracy limits (±10%).

Stiff diagrams are a means of examining major ion composition of waters. Major cations are plotted to the left of the diagram and major anions are plotted to the right of the diagram. Concentrations are plotted in terms of milliequivalents per liter. The plot below illustrates insignificant changes in major ion chemistry of water from the Nosaka well since first sampled.

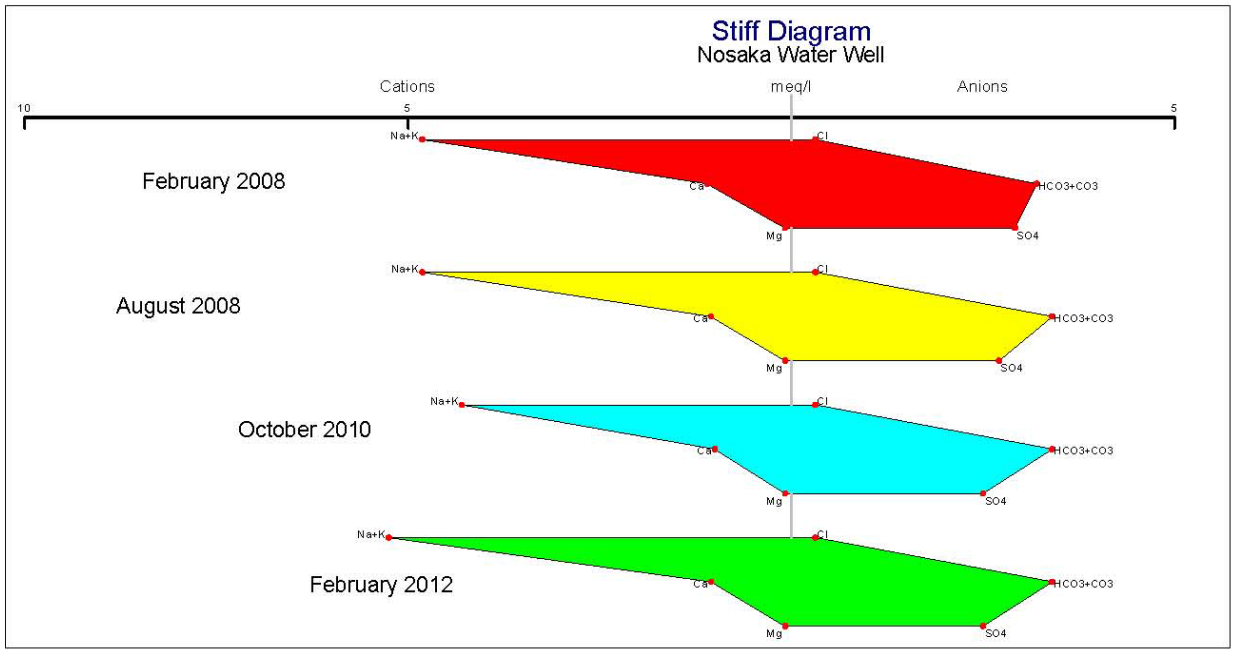

Figure 1. Stiff Diagram

CONCLUSIONS

The water from your well is predominantly of a sodium-bicarbonate (with lesser calcium and sulfate) character. TDS is a good indicator of overall inorganic water quality and the concentration of dissolved solids your well water was below the drinking water standards established by the Water Quality Control Commission of the Colorado Department of Public Health and the Environment. None of the tested parameters exceed the CDPHE WQCC groundwater standards.

We have three previous sampling and analysis event from your domestic well to compare to the results of the February 2012 sampling and analysis. A summary of the four sets of analytical results in included in Table 2. The major ion chemistry of your water is similar to when first sampled in 2008.

At this time the water quality data for the 2012 sampling and analysis does not show any impacts from CBM drilling and production activities in your area. 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 .

Sincerely,
Colorado Oil and Gas Conservation Commission

Peter Gintautas

Digitally signed by Peter Gintautas
DN: cn=Peter Gintautas, o=COGCC, ou=Environmental Protection Specialist, email=peter.gintautas@state.co.us, c=US
Date: 2012.03.12 11:22:57 -06'00'

Peter Gintautas, Ph.D.
Environmental Protection Specialist

Attachments:
Attachment 1 - Table 1 - Analytical Summary
Attachment 2 - ALS Laboratory Group Analytical Reports
Attachment 3 - Isotech Laboratories Analytical Report
Attachment 4 - Table 2 – Analytical Summary 2008-2012 sampling events

cc: Thom Kerr, acting COGCC Director w/o attachments
Karen Spray, acting COGCC Environmental Protection Manager w/o attachments
Steve Lindblom, COGCC Environmental Protection Supervisor w/o attachments

TABLE 1
ANALYTICAL SUMMARY
Complaint 200339399
Nosaka Water Well
February 2012 Sampling

Parameter	Sample Date		CDPHE Groundwater Standards		
	14-Feb-12				
	Result	Unit	Domestic	Agriculture	Unit
Antimony	0.00063	mg/l	0.006	NS	mg/l
Arsenic	ND	mg/l	0.01	0.1	mg/l
Barium	0.041	mg/l	2.0	NS	mg/l
Berylium	ND	mg/l	0.004	0.1	mg/l
Boron	ND	mg/l	NS	0.75	mg/l
Cadmium	ND	mg/l	0.005	0.01	mg/l
Calcium	21	mg/l	NS	NS	
Chromium	ND	mg/l	0.1	0.1	mg/l
Cobalt	ND	mg/l	NS	0.05	mg/l
Copper	ND	mg/l	1	0.2	mg/l
Iron	ND	mg/l	0.3	5	mg/l
Lead	ND	mg/l	0.05	0.1	mg/l
Lithium	0.023	mg/l	NS	NS	
Magnesium	ND	mg/l	NS	NS	
Manganese	ND	mg/l	0.05	0.2	mg/l
Molybdenum	0.0019	mg/l	0.035	NS	mg/l
Nickel	ND	mg/l	0.1	0.2	mg/l
Potassium	1.3	mg/l	NS	NS	
Selenium	ND	mg/l	0.05	0.02	mg/l
Silicon	3.7	mg/l	NS	NS	
Silver	ND	mg/l	0.05	NS	mg/l
Sodium	120	mg/l	NS	NS	
Strontium	0.37	mg/l	NS	NS	
Thallium	ND	mg/l	0.002	NS	mg/l
Uranium	0.00011	mg/l	0.03	NS	mg/l
Zinc	ND	mg/l	5	2	mg/l
Chloride	11	mg/l	250	NS	mg/l
Nitrite	ND	mg/l	1.0	10	mg/l
Nitrate	ND	mg/l	10.0	100	mg/l
Total Nitrite/Nitrate	ND	mg/l	10.0	100	mg/l
Fluoride	1.5	mg/l	4.0	NS	mg/l
Total Dissolved Solids	380	mg/l	400	*1500	mg/l
pH	8.23	No units	6.5 - 8.5	6.5 - 8.5	No units
Sulfate	120	mg/l	250	NS	mg/l
Bromide	ND	mg/l	NS	NS	
Total Alkalinity	170	mg/l	NS	NS	
Bicarbonate	170	mg/l	NS	NS	
Carbonate	ND	mg/l	NS	NS	
Conductivity	623	umhos/cm	NS	NS	
TOC	1.6	mg/l	NS	NS	
methane	ND	mg/l	NS	NS	
SAR	6.2	No units	NS	NS	
Phosphate	ND	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 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.
	Domestic Water Supply - Human Health Standard (Table 1).
	Domestic Water Supply - Drinking Water Standard (Table 2).

ISOTECH
ISOTECH LABORATORIES INC

ANALYSIS REPORT

Lab #:	236706	Job #:	17492
Sample Name/Number:	705325 Nosaka WW		
Company:	Colorado Oil & Gas Conservation		
Date Sampled:	2/14/2012		
Container:	Dissolved Gas Bottle		
Field/Site Name:	Complaint 200339399		
Location:			
Formation/Depth:			
Sampling Point:			
Date Received:	2/16/2012	Date Reported:	3/12/2012

Component	Chemical mol. %	$\delta^{13}C$ ‰	δD ‰	$\delta^{18}O$ ‰
Carbon Monoxide	nd			
Hydrogen Sulfide	na			
Helium	na			
Hydrogen	nd			
Argon	1.52			
Oxygen	13.31			
Nitrogen	84.65			
Carbon Dioxide	0.52			
Methane	0.0019			
Ethane	nd			
Ethylene	nd			
Propane	nd			
Propylene	nd			
Iso-butane	nd			
N-butane	nd			
Iso-pentane	nd			
N-pentane	nd			
Hexanes +	nd			
Water			-81.4	-10.92
Dissolved Inorganic Carbon		-15.0		

Total BTU/cu.ft. dry @ 60deg F & 14.7psia, calculated: 0 Specific gravity, calculated: 0.995

Remarks:
Analysis is of gas extracted from water by headspace equilibration. Analysis has been corrected for helium added to create headspace. Helium dilution factor = 0.74
*Addition of helium negates the ability to detect native helium and may negate the ability to detect hydrogen.

nd = not detected. na = not analyzed. Isotopic composition of hydrogen is relative to VSMOW. Isotopic composition of carbon is relative to VPDB. Isotopic composition of oxygen is relative to VSMOW, except for carbon dioxide which is relative to VPDB. Calculations for BTU and specific gravity per ASTM D3588. Chemical compositions are normalized to 100%. Mol. % is approximately equal to vol. %.

TABLE 2
COMPARISON OF ANALYTICAL RESULTS (2008-2012)
Complaint 200339399
Nosaka Water Well

Parameter	Water Well Samples				
	Sample Date	Sample Date	Sample Date	Sample Date	
	13-Feb-08	20-Aug-08	27-Oct-10	14-Feb-12	
	Result	Result	Result	Result	Unit
Antimony	ND(<0.0003)	0.00031	ND(<0.0003)	0.00063	mg/l
Boron	ND	ND	ND	ND	mg/l
Copper	ND	ND	ND	ND	mg/l
Arsenic	ND	ND	ND	ND	mg/l
Barium	ND(<0.1)	ND(<0.1)	0.029	0.041	mg/l
Berylium	ND	ND	ND	ND	mg/l
Cadmium	ND	ND	ND	ND	mg/l
Calcium	22	21	20	21	mg/l
Chromium	ND	ND	ND	ND	mg/l
Iron	ND	ND	ND	ND	mg/l
Lead	ND	ND	ND	ND	mg/l
Lithium	0.029	0.027	0.021	0.023	mg/l
Magnesium	ND	ND	ND	ND	mg/l
Manganese	ND	ND	ND	ND	mg/l
Molybdenum	0.002	0.0018	0.0017	0.0019	mg/l
Nickel	ND	ND	ND	ND	mg/l
Potassium	1.2	1.1	1.4	1.3	mg/l
Selenium	ND	ND	ND	ND	mg/l
Silver	ND	ND	ND	ND	mg/l
Sodium	110	110	98	120	mg/l
Strontium	0.4	0.4	0.37	0.37	mg/l
Thallium	ND	ND	ND	ND	mg/l
Uranium	0.00017	0.0001	0.00011	0.00011	mg/l
Zinc	ND(<0.02)	ND(<0.02)	0.021	ND(<0.02)	mg/l
Chloride	11	11	11	11	mg/l
Nitrite	ND	ND	ND	ND	mg/l
Nitrate	ND	ND	ND	ND	mg/l
Total Nitrite/Nitrate	ND	ND	ND	ND	mg/l
Fluoride	1.4	1.4	1.4	1.5	mg/l
Total Dissolved Solids	380	380	380	380	mg/l
pH	8.4	8.28	8.29	8.23	No units
Sulfate	140	130	120	120	mg/l
Bromide	ND	ND	ND	ND	mg/l
Total Alkalinity	160	170	170	170	mg/l
Bicarbonate	160	170	170	170	mg/l
Carbonate	ND	ND	ND	ND	mg/l
Conductivity	747	606	618	623	umhos/cm
methane	NA	ND	ND	ND	mg/l