STATE OF COLORADO
OIL & GAS
CONSERVATION COMMISSION

September 23, 2008

Certified Mail Return Receipt Requested # 7007 1490 0001 8185 5022

Ms. Kazuko Nosaka
17500 County Road 38.2
Weston, CO 81091-9733

RE: Complaint 200194002
Water Well Analysis
Well Permit 126701-A
NWSW 23 32S, 68W Las Animas County, Colorado

Dear Ms. Nosaka:

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 August 20, 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 and bacterial 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 August 20, 2008. We started water flowing into your cistern at approximately 6 gallons per minute at 12:45. The water was clear and I did not detect any odors associated with the water during pumping. We collected samples from your well using the hydrant installed near your well after pumping the well for 9 minutes. The samples were shipped to Paragon Analytics in Fort Collins, CO and received on August 21, 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. The analytical reports from the laboratory are included as Attachment 2.

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

  Antimony was detected in the sample collected from your water well at a concentration of 0.00031mg/l which is below the CDPHE drinking water standard

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

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

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

  Beryllium was not detected in the 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 detected in the sample collected from your water well at a concentration of 0.0001mg/l which is below the CDPHE human health 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 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 1.4mg/l which is below the CDPHE human health standard.

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

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

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

  Nitrite was not detected in the 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 11mg/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_4):** The CDPHE sulfate secondary standard for human drinking water is 250mg/l. Although CDPHE does not have an agricultural standard for sulfate, other agencies recommend a concentration below 1,500 mg/l for livestock watering. Waters containing high concentrations of sulfate, typically caused by the leaching of natural deposits of magnesium sulfate (Epsom salts) or sodium sulfate (Glauber's salt), may be undesirable because of their laxative effects.

  Sulfate was detected in the sample collected from your water well at a concentration of 130mg/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 8.28 which is within the CDPHE drinking water and agricultural standards.

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

  TDS was measured in the water sample collected from your well at a concentration of 380mg/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 sample collected from your water 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 110mg/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 21mg/l.

- **Magnesium (Mg):**

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

- **Potassium (K):**

  The potassium concentration in the sample collected from your well was 1.1mg/l.

- **Molybdenum (Mo):**

  The molybdenum concentration in the sample collected from your well was 0.0018mg/l.

- **Bicarbonate (HCO_3):**

  Bicarbonate alkalinity was measured in the sample collected from your well at a concentration of 170mg/l.

- **Bromide (Br):**

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

METHANE GAS ANALYSIS

Methane was detected in the sample collected from your well at a concentration of 0.0031mg/l. That low concentration is not considered to present a possible explosion risk.

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 that your well water is. CBM produced water typically has much greater levels of total dissolved solids than water from your well. The chemistry of water in your well in August 2008 was very similar to the chemistry of the water from your well when sampled and analyzed in February 2008 (Table 2 in Attachment 3). You had submitted a water sample for analysis in late July 2008 and provided me with those results. As we talked about at your home, I suspect that there may be an error in that data or that some of the results are inaccurate. Water is assumed to be electrically neutral which means the amount of positively charged ions (cations) in the water is balanced by the amount of negatively charged ions (anions). Paragon Analytics calculated charge balance for the samples that were submitted to them and the results for the August 2008 sampling show a relative percent difference (RPD) between the reported results of 8.71%. I calculated the RPD from the data you provided me (July 2008 sampling) and the RPD is over 120% (Table 3 in Attachment 4). That indicates there is an analytical error or a reporting error in the results you provided me and not that there was a sudden change in the water chemistry.

Table 4 below compares analytical results from your well to data from two CBM wells and to data from a water well (TP Water Well) located near your home. The locations of the wells are shown in Attachment 5. The results for your well and for the TP well are both from samples collected this summer.

The water from your well is predominantly of a sodium-sulfate-bicarbonate character. Some of the produced CBM waters are more of a sodium-chloride character as in the Melanie 44-23. Waters produced from CBM wells in the Raton Basin are generally of a sodium-bicarbonate character as in the Cactus Flower 13-24. The chemistry of water in the domestic well located southwest of you is very similar to the chemistry of water produced from your well. Both your well and the TP water well are completed in the Poison Canyon Formation. The coals of the Raton Formation are at least 1300 feet deep in the area around your house. The construction record for your water well shows your well to be 117 feet deep. Most of the CBM wells near you are completed in the Vermejo Formataion coals that lie below your well by about 2000 feet.

Table 4. Comparison of Major Ion Chemistry

Analyte	**units**	**NosakaWater Well**	**TP Water Well**	**Melanie 44-23**	**Cactus Flower 13-24**
TDS	mg/l	380	340	1800	1300
Na	mg/l	110	94	NA	NA
Ca	mg/l	21	14	NA	NA
Mg	mg/l	<1	<1	NA	NA
Cl	mg/l	11	10	935	226
HCO_3	mg/l	170	170	381	786
SO_4	mg/l	130	88	<5	<5
pH	s.u.	8.28	8.33	7.7	8.2
SAR	ratio	6.2	6.6	NA	NA

NA = not analyzed

Table 1 shows a comparison of results from the sample collected from your well in August of 2008 to groundwater standards established by the Water Quality Control Commission. None of the analytes exceed the groundwater standards. The water quality data for the August 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 .

Sincerely,
Colorado Oil and Gas Conservation Commission

Peter Gintautas
Environmental Protection Specialist

Attachments:
Attachment 1 - Table 1 - Analytical Summary
Attachment 2 - Paragon Analytics Reports
Attachment 3 - Table 2 – Comparison of February and August 2008 Results
Attachment 4 - Table 3 – Anion Cation Balance (Olsen Data July 2008)
Attachment 5 - Locations of CBM and Water Wells in Table 4

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

TABLE 1
ANALYTICAL SUMMARY
Complaint 200194002
Nosaka Water Well

Parameter	Water Well Sample		CDPHE Standards		
	Sample Date				
	20-Aug-08				
	Result	Unit	Domestic	Agriculture	Units
Antimony	0.00031	mg/l	0.006	NS	mg/l
Boron	ND	mg/l	NS	0.75	mg/l
Copper	ND	mg/l	1	0.2	mg/l
Arsenic	ND	mg/l	0.01	0.1	mg/l
Barium	ND	mg/l	2.0	NS	mg/l
Berylium	ND	mg/l	0.004	0.1	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
Iron	ND	mg/l	0.3	5	mg/l
Lead	ND	mg/l	0.05	0.1	mg/l
Lithium	0.027	mg/l	NS	NS	
Magnesium	ND	mg/l	NS	NS	
Manganese	ND	mg/l	0.05	0.2	mg/l
Molybdenum	0.0018	mg/l	0.035	NS	mg/l
Nickel	ND	mg/l	0.1	0.2	mg/l
Potassium	1.1	mg/l	NS	NS	
Selenium	ND	mg/l	0.05	0.02	mg/l
Silver	ND	mg/l	0.05	NS	mg/l
Sodium	110	mg/l	NS	NS	
Strontium	0.4	mg/l	NS	NS	
Thallium	ND	mg/l	0.002	NS	mg/l
Uranium	0.0001	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	1.4	mg/l	4.0	NS	mg/l
Total Dissolved Solids	380	mg/l	400	*1500	mg/l
pH	8.28	No units	6.5 - 8.5	6.5 - 8.5	No units
Sulfate	130	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	606	umhos/cm	NS	NS	
methane	0.0031	mg/l	NS	NS	

Notes

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

TABLE 2
COMPARISON OF ANALYTICAL RESULTS
Complaint 200194002
Nosaka Water Well

Parameter	Water Well Samples			CDPHE Standards		
	Sample Date	Sample Date				
	13-Feb-08	20-Aug-08				
	Result	Result	Unit	Domestic	Agriculture	Units
Antimony	ND(<0.003)	0.00031	mg/l	0.006	NS	mg/l
Boron	ND	ND	mg/l	NS	0.75	mg/l
Copper	ND	ND	mg/l	1	0.2	mg/l
Arsenic	ND	ND	mg/l	0.01	0.1	mg/l
Barium	ND	ND	mg/l	2.0	NS	mg/l
Berylium	ND	ND	mg/l	0.004	0.1	mg/l
Cadmium	ND	ND	mg/l	0.005	0.01	mg/l
Calcium	22	21	mg/l	NS	NS	
Chromium	ND	ND	mg/l	0.1	0.1	mg/l
Iron	ND	ND	mg/l	0.3	5	mg/l
Lead	ND	ND	mg/l	0.05	0.1	mg/l
Lithium	0.029	0.027	mg/l	NS	NS	
Magnesium	ND	ND	mg/l	NS	NS	
Manganese	ND	ND	mg/l	0.05	0.2	mg/l
Molybdenum	0.002	0.0018	mg/l	0.035	NS	mg/l
Nickel	ND	ND	mg/l	0.1	0.2	mg/l
Potassium	1.2	1.1	mg/l	NS	NS	
Selenium	ND	ND	mg/l	0.05	0.02	mg/l
Silver	ND	ND	mg/l	0.05	NS	mg/l
Sodium	110	110	mg/l	NS	NS	
Strontium	0.4	0.4	mg/l	NS	NS	
Thallium	ND	ND	mg/l	0.002	NS	mg/l
Uranium	0.00017	0.0001	mg/l	0.03	NS	mg/l
Zinc	ND	ND	mg/l	5	2	mg/l
Chloride	11	11	mg/l	250	NS	mg/l
Nitrite	ND	ND	mg/l	1.0	10	mg/l
Nitrate	ND	ND	mg/l	10.0	100	mg/l
Total Nitrite/Nitrate	ND	ND	mg/l	10.0	100	mg/l
Fluoride	1.4	1.4	mg/l	4.0	NS	mg/l
Total Dissolved Solids	380	380	mg/l	400	*1500	mg/l
pH	8.4	8.28	No units	6.5 - 8.5	6.5 - 8.5	No units
Sulfate	140	130	mg/l	250	NS	mg/l
Bromide	ND	ND	mg/l	NS	NS	
Total Alkalinity	160	170	mg/l	NS	NS	
Bicarbonate	160	170	mg/l	NS	NS	
Carbonate	ND	ND	mg/l	NS	NS	
Conductivity	747	606	umhos/cm	NS	NS	
methane	NA	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 of sources.
mg/l	milligrams per liter (ppm or parts per million).
µmhos/cm	micromhos per centimeter
NA	Not analyzed.
ND	Not detected.
NS	No Standard.
****	Health Advisory.
	Human health standard.
	Secondardy standard.

TABLE 3
Anion Cation Balance
Complaint 200194002
Nosaka Water Well

July 26, 2008 Sampling

		mg/l	meq/l	
Anions				
Total Alkalinity as $CaCO_3$		908	18.16	
Cl		12	0.342857	
SO_4	NA		0	
S (Total)		34.5	2.151879	
F	NA		0	
			20.65	**Sum**
Cations				
Na		94	4.08877	
Ca		19	0.948104	
Mg		1	0.082288	
K	<1		0	
			5.12	**Sum**
Relative % Difference (RPD)			**121**	**%**

Nosaka Water Well Location