API 05-013-05014

STATE OF COLORADO
OIL & GAS
CONSERVATION COMMISSION

DEPARTMENT OF NATURAL RESOURCES
Bill Ritter, Jr., Governor
1120 Lincoln St., Suite 801
Denver, CO 80203
Phone: (303) 894-2100
FAX: (303) 894-2109
www.cogcc.state.co.us

01998643

August 26, 2008

Mr. Brian Goodheim
Spring Valley Water Association
3870 Spring Valley Road
Boulder, CO 80304

RE: Response to Concerns Regarding Possible Water Well Impact from the Maxwell #5
(API# 05-013-05014)
Section 13 – Township 1 North – Range 71 West
Boulder County, Colorado

Dear Mr. Goodheim:

In response to your request, the Colorado Oil and Gas Conservation Commission (COGCC) conducted an investigation to establish if the Spring Valley Water Association water supply well was impacted by thermogenic methane originating from the nearby Maxwell #5 gas well. This letter summarizes the results of laboratory analysis of water samples from your well and interpretation of these results.

WATER SAMPLING

On July 22, 2008, a COGCC contractor, Bryan Grigsby (S.S. Papadopulos and Associates) collected water samples from the Spring Valley Water Association water supply wells indicated by Brian Goodheim (primary well permit number 1996023-AB and a second well tentatively identified as permit #14238-F). The water samples were analyzed by TestAmerica Laboratories, Inc. A copy of the letter report and field sampling forms are included as Attachment 1. Copies of the laboratory analytical reports are included as Attachment 2.

Methane

Methane gas alone is physiologically inert and non-toxic to humans. Normal breath exhalation contains 1 to 99 parts per million of methane (parts per million [ppm] is the same units as milligrams per liter [mg/L]). The presence of methane in drinking water does not present a known health hazard to humans or other animals via ingestion; however, methane in domestic water supplies can be associated with undesirable and potentially serious side effects. The following discussion is provided as background information.

Methane gas dissolved in water "exsolves" when exposed to the atmosphere and dissipates rapidly because it is lighter than air. This is often responsible for the "fizzing" observed in water

wells that contain methane gas. If the methane occurs at a high enough concentration and if it is allowed to accumulate in a confined space, such as a well pit, crawl space, closet, etc., an explosion hazard can be established. In addition, if methane concentrations in well water are high, bubbles of free gas form within the water and cause the well pump to cavitate and no longer bring water to the surface.

Methane gas is common in water wells in Colorado. It occurs naturally and the source of the methane is commonly from one or more of the sources listed below.

1. Methane is commonly found as a gas in coal or black shale seams in the subsurface.

2. Methane is often found as a byproduct of the decay of organic matter and the presence of bacteria in water wells can provide the conditions favorable for the production of methane either from the activity or decay of bacteria.

As the result of extensive testing for methane gas in water wells throughout Colorado, concentrations of methane gas below 1 mg/L are considered harmless, with concern for possible hazards from the methane increasing at concentrations in well water at or exceeding 7 mg/L.

Methane Analytical Results

Laboratory analysis for methane indicated that the concentration of dissolved methane in the water wells was below the analytical detection limit of 0.005 mg/L.

Inorganic Analytical Results

The Water Quality Control Commission (WQCC) of the Colorado Department of Public Health and Environment (CDPHE) has established drinking water standards for the protection of human health. The analytical results from the water samples from the wells have been compared to applicable ground water and/or drinking water standards and are summarized below. Please keep in mind that these water standards were established for public drinking water supplies. People often use and consume ground water from private wells that can exceed these standards.

- Total Dissolved Solids (TDS): CDPHE has established a TDS standard for human drinking water of 500 milligrams per liter (mg/L). The standard is called the secondary maximum contaminant level (SMCL) and is based on the aesthetic quality of the water (such as taste and odor) and is intended as a guideline for public water supply systems and is not an enforceable standard. Although CDPHE does not have an agricultural standard for TDS, other agencies recommend concentrations below 2,000 mg/L for irrigation, and below 5,000 mg/L for most livestock watering. TDS concentrations are related to the presence of naturally occurring elements and chemical compounds such as chloride, sodium, potassium, calcium, magnesium, and sulfate.

  The concentration of TDS measured in water from the wells was 430 mg/L, which is below the CDPHE established guideline for TDS (SMCL).

- Sodium (Na): Although CDPHE does not have a standard for sodium, people on salt restricted diets should be aware of the sodium concentration in the water they drink. Drinking water with a concentration of sodium 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 ground water in many areas at concentrations that exceed the recommended level.

  Sodium was detected in the water samples from the wells at a concentration of 20 mg/L.

- Chloride (Cl): The CDPHE chloride standard (SMCL) for drinking water is 250 mg/L. Chloride concentrations in excess of 250 mg/L usually produce a noticeable taste in drinking water.

  Chloride was detected in the water from the wells at a concentration of 50 mg/L, which is below the CDPHE (SMCL) water standard.

- Sulfate (SO_4): The CDPHE sulfate standard for drinking water is 250 mg/L (SMCL). 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 occurs naturally in the ground water in many areas in Colorado at concentrations that exceed the drinking water standard.

  Sulfate was detected in the water from the wells at a concentration of 67 mg/L, which is below the CDPHE (SMCL) water standard.

- Total Nitrate (NO_3) + Nitrite (NO_2) as Nitrogen (N): The CDPHE total nitrate (NO_3) + nitrite (NO_2) as nitrogen (N) standard for human drinking water is 10 mg/L. Nitrate and nitrite are common contaminants in ground water from agricultural sources, such as fertilizer and animal, including human, wastes. They are known to cause infant cyanosis or "blue baby disease" in humans and, at concentrations greater than 100 mg/L as nitrogen, may be dangerous to livestock. High concentrations of nitrate and nitrite in ground water are known to occur in agricultural areas in Colorado.

  Total nitrate/nitrite, as nitrogen was detected in the water from the wells at a concentration of 1.0 mg/L, which is below the CDPHE established standard for nitrate/nitrite as N.

- Iron (Fe): The CDPHE standard for iron in human drinking water is 0.3 mg/L (SMCL). Small amounts of iron are common in ground water. Iron may produce 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 detected in the water from the wells at a concentration of 0.24 mg/L, which is below the CDPHE established standard.

- Selenium (Se): The CDPHE selenium standard for human drinking water is 0.05 mg/L. Excessive selenium (concentrations greater than 0.05 mg/L) can cause loss of hair and/or fingernails as well as adverse effects on the central nervous system. Selenium occurs naturally in the ground water in many areas of Colorado at concentrations that exceed the drinking water standard.

  Selenium was not detected in the water from the wells above the analytical detection limit of 0.005 mg/L.

- Fluoride (F): CDPHE has established a fluoride standard for human drinking water of 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.

  Flouride was not detected in the water from the wells above the analytical detection limit of 0.5 mg/L.

- Calcium (Ca), Magnesium (Mg), Manganese (Mn), Potassium (K), Bicarbonate (HCO_3), Carbonate (CO_3), Lead (Pb), Barium (Ba), Bromide (Br), Cadmium (Cd), Chromium (Cr) and pH were also tested for in water from both wells. Primary standards have been established for lead, barium, cadmium, and chromium. No primary standards exist for the remainder of these parameters and a secondary standard (S) has only been established for manganese and pH. These results are summarized in the following table. Please note that primary standard (P) is the CDPHE Human Health Standard and the secondary standard (S) is the CDPHE secondary maximum contaminant level (SMCL).

Spring Valley Water Association (SVWA) Wells, July, 2008

METAL/INORGANIC	SVWA Well (Permit #XXX) July, 2008	CDPHE Water Quality Standard (P – Primary S-Secondary)
Calcium (Ca)	85	NS
Magnesium (Mg)	31	NS
Manganese (Mn)	0.068	0.05 (S)
Bicarbonate (HCO_3)	230	NS
Carbonate (CO_3)	<5	NS
Lead (Pb)	0.0024	0.05 (P)
Barium (Ba)	0.110	2.0 (P)
Bromide (Br)	<0.2	NS
Cadmium (Ca)	<0.001	0.005 (P)
Chromium (Cr)	0.003	0.1 (P)
Potassium (K)	<3.0	NS
pH	7.3	6.5-8.5 (S)

NS – no standard
ND – not detected in the sample
CDPHE – Colorado Department of Public Health and Environment

CONCLUSION

Analysis of water samples from the wells indicated that no constituents exceed any primary CDPHE Human Health Standard and that only Manganese exceeded any CDPHE secondary standard.

The Colorado Oil & Gas Conservation Commission has participated in the publication of a general information pamphlet on water supply wells which includes a simple well disinfection procedure to help control nuisance bacteria, should they ever become an issue. This brochure is available on the COGCC website (www.cogcc.state.co.us) on the Library Page under the heading Water Well Related Reports and Papers.

If you have any questions or would like to discuss these matters further, please contact me at the COGCC in Denver via e-mail (steven.lindblom@state.co.us) or by phone at 303-894-2100, extension 114.

Respectfully,

Steven R. Lindblom, P.G.
Environmental Protection Specialist

Enclosures

cc: Diana Burn – COGCC w/o enclosures
David Dillon – COGCC w/o enclosures

ATTACHMENT 1

S. S. PAPADOPULOS & ASSOCIATES, INC.
ENVIRONMENTAL & WATER-RESOURCE CONSULTANTS

S. S. PAPADOPULOS
S. P. LARSON
C. B. ANDREWS
D. L. HATHAWAY

August 25, 2008 *via electronic mail*

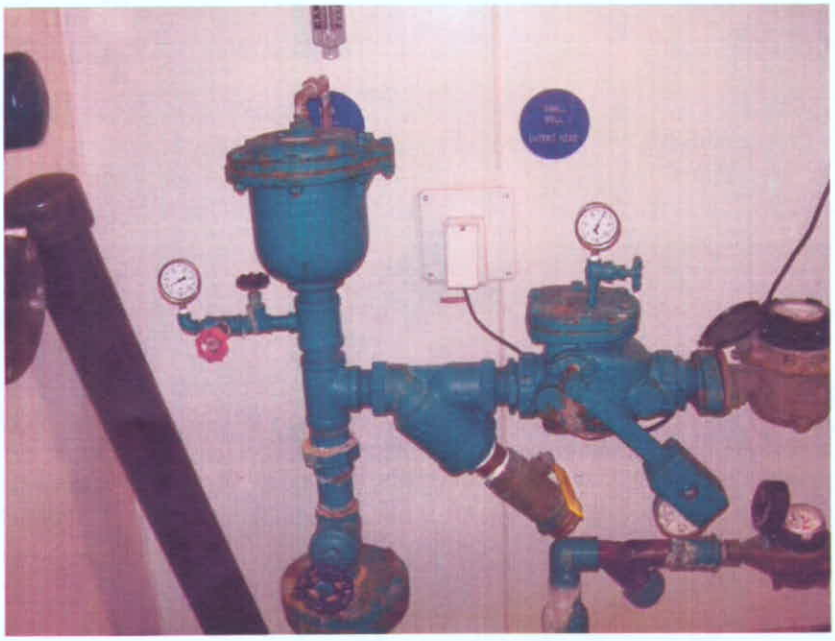
Steven Lindblom
Colorado Oil and Gas Conservation Commission
1120 Lincoln Street. Suite 801
Denver, CO 80203

Subject: Spring Valley Municipal Water Authority Well Sampling, Boulder, Colorado

Dear Steve:

Pursuant to your request, S. S. Papadopulos & Associates, Inc. (SSPA) collected a groundwater sample from the Spring Valley Municipal Water Authority (SVMWA) water supply system on July 22, 2008. Prior to sampling it was believed that the SVMWA was served by one well; however, upon arrival at the site, it was discovered that two wells were present, the Large Well and the Small Well. Following a brief discussion with Brian Goodheim, SVMWA representative, SSPA isolated flow from and sampled the Large Well.

The piping and treatment setup for the SVMWA water supply system is shown in the photos below.



Large Well discharge line enters from floor on the left; Small Well enters from floor on right.

3100 ARAPAHOE AVENUE, SUITE 203, BOULDER, COLORADO 80303 • TEL: (303) 939-8880 FAX: (303) 939-8877
http://www.sspa.com • e-mail: boulder@sspa.com

The faucet on the right (with the blue handle), just above the large gate valve, was used for sampling. This tap is located after water from the Large and Small Wells combines and after both the Aqua Mag sodium phosphate solution feed line (clear poly line in upper left portion of the photo) and the chlorine feed line (small blue ball valve in upper right portion of the photo) connect to the water supply line.

For sampling, the Small Well was turned off and the Large Well was operated in manual mode. The chlorine feed line was closed; however, the Aqua Mag feed remained on. The pumping rate for the Large Well was 50 gpm.

A YSI 556 multi-parameter water quality meter with a flow-through cell was used to collect the field parameters temperature, pH, specific conductance, and dissolved oxygen while the well was being purged. The field parameters were measured on approximately 4 minute intervals until 1,000 gallons had been purged from the well. Results of the field parameter measurements are shown on the field sampling form included as an attachment to this letter.

The water sample for the Large Well was collected from a low flow bypass line off of the tap. Samples were analyzed for general chemistry parameters, total metals, and dissolved methane

using bottles supplied by Test America Laboratories. The samples were placed in a cooler on ice immediately after sampling was completed. The sealed cooler was delivered to Test America Laboratories in Arvada, Colorado, via courier using appropriate custody protocols on the same day that sampling was completed. Laboratory reports were sent directly to Colorado Oil and Gas Conservation Commission personnel.

Well permit numbers were not obtained for either the Large Well or the Small Well; however, SVMWA maintains a project notebook at the sample site (building located southwest of the residence at the west end of Cactus Court) and this information is probably available in the notebook.

Please feel free to contact me if you have questions or comments.

Sincerely,

S. S. PAPADOPULOS & ASSOCIATES, INC.

Bryan Grigsby
Senior Hydrogeologist

attachment

S.S. PAPADOPULOS & ASOCIATES, INC.
Environmental & Water-Resource Consultants

Well No.: SPRING VALLEY MUTUAL WATER ASSN - LARGE WELL
Sample No.: SVMWA-LARGE-080722

GROUND-WATER FIELD SAMPLING FORM

Project Name: ERF - Hanover #5 Project Number: 1103-3 Date: 7/22/08

Sampling Team: GALASBY, TORVSIAK Weather: CLEAR, NLCM 20s

Well Data

Total Well Depth (ft.): 665 - Cap to 67 Date Measured: NA Time: _____

Depth to Water (ft.): NA Well Diameter (in.): 6" / 5"

Feet of Water: NA Screened Interval (ft.): Open Hole Below 67'

Purging Data

1 well volume (gal.): _____

3 well volumes (gal.): _____

Method of Purging:
bailed _____
pumped X In well Submersible

Instruments used to measure field parameters:
YSI 556 w/ Flow Through Cell

Time	Gals. Purged	Well Vols.	pH	Temp. (C)	Conductivity (µmho/cm)	DO	Appearance
1107	0	NA					START PUMP (50 GPM)*
1110	~150		6.94	14.11	0.731 mS/cm	63.7	70
1114			6.82	14.22	0.722	63.6	→ 5.82 mg/L
1118			6.89	14.56	.703	7.17	mg/L
1123			6.90	14.84	.700	3.75	mg/L
1127	~1000 gal		6.93	15.24	.688	2.36	—
1130	SAMPLE						

Sampling Data

Duplicate Collected? N Dup. Sample No.: —

Sampling Date: 7/22/08

Sampling Time: 1130

Sample Depth (ft.): —

Sample Collection Method: GRAB

Color: CLEAR

Turbidity: NONE

Odor: NONE

Number & type of bottles	Preservation	Analysis	Laboratory
3 x 40ml Glass VOA	—	DIOX, CH4	Test America (Denver, STL)
1 x 500ml Poly	HNO_3	Total Metals	"
1 x 1L Poly	—	Gen Chem	"

Sample Shipping Method: Bonded Power Courier

NOTES: *Shut off chlorine feed pump
*Did Not shut off Aqua Feed Pump. ($Na_x H_y P_z O_a$) "Linear Phosphate"

ATTACHMENT 2

SEE PROJECT 1973 FOR
ANALYTICAL DATA SHEETS