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
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www.colorado.gov/cogcc

April 22, 2010

Victor Androvich
24639 WCR 6
Hudson, Colorado 80462

RE: Water Quality Analytical Results for Your Water Well (Permit # 251002)
Section 19 – Township 1 North – Range 64 West
Weld County, Colorado; Complaint No. 200236627

Dear Mr. Androvich:

On March 5, 2010 Terracon Consultants (Terracon), under direction of the Colorado Oil & Gas Conservation Commission (COGCC), sampled your water well and submitted these samples for laboratory analysis. The purpose of this water sampling was to determine if natural gas drilling and production activities in your area might have impacted your well water. The water samples collected by the Terracon was submitted to Test America Laboratories (TA) in Arvada, Colorado, for analysis of inorganic chemical constituents, organic compounds associated with petroleum hydrocarbons, methane gas, and pH. A copy of the TA analytical report is enclosed. Additionally a sample of gas from your water well was collected for compositional and stable isotope analysis and submitted to Isotech Laboratories, In. (Isotech) in Champaign, Illinois. A copy of the Isotech report is also enclosed.

Your water well has been previously sampled by the COGCC in November 2006. Where possible the most recent analytical sample results (2010) are compared to the 2006 sample 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 your well 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 **municipal public** drinking water supplies (wells providing 15 or more households) and not private water wells. Often people use and consume ground water from private wells that can exceed these standards.

COMPARISON OF INORGANIC ANALYTICAL RESULTS TO 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.

TDS was detected in the water sample from your well at concentration of 860 mg/l, which is above the CDPHE SMCL, less than the recommended maximum concentration for irrigation, and less than the recommended maximum concentration for most livestock watering. The sample from 2006 had a concentration of 821 mg/l.

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

  Sodium was detected in the water sample from your well at a concentration of 380 mg/l, which is greater than the recommended level for people of salt restricted diets. The sample from 2006 had a concentration of 269 mg/l.

- Fluoride (F): CDPHE has established a fluoride (F) standard for human drinking water 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 was detected in the water sample from your water well at a concentration of 3.7 mg/l, which is less than the maximum human health drinking water standard. The sample from 2006 had a concentration of 3.5 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 sample from your well at a concentration of 120 mg/l, which is less than the CDPHE SMCL. The sample from 2006 had a concentration of 107 mg/l.

- 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 not detected in the water sample from your well for this sampling or the 2006 sampling.

- Total Nitrate (NO_3) + Nitrite (NO_2) as Nitrogen (N): The CDPHE total nitrate (NO_3) + nitrite (NO_2) as nitrogen (N) for 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 (N), 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 N was not detected in the water sample from your well. In 2006 nitrite was detected in your water well at a concentration of 0.01 mg/l, which is below the drinking water standard.

- Iron (Fe): The CDPHE standard for human drinking water for iron 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 sample from your well at a concentration of 0.17 mg/l, which is below the SMCL drinking standard. The sample from 2006 had a concentration of 0.132 mg/l.

- Selenium (Se): The CDPHE selenium standard for human drinking water is 0.05 mg/l and the agricultural standard is 0.02 mg/l. Excessive selenium (Se) (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 (Se) 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 sample from your water well for this sampling or the 2006 sampling.

- Calcium (Ca), Potassium (K), and Magnesium (Mg) were also tested for in your water. There are no standards from CDPHE for these parameters. In addition, the COGCC also collected samples for metals and the Table 1 presents the analytical laboratory results. 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).

Table 1
ANDROVICH WATER WELL

METAL/INORGANIC	03/05/2010 Sample Concentration (in Milligrams per liter [mg/l])	11/15/2006 Sample Concentration (in Milligrams per liter [mg/l])	CDPHE Water Quality Standard (P – Primary S-Secondary) (in Milligrams per liter [mg/l])
Arsenic (As)	**ND**	**ND**	**0.05 (P)**
Barium (Ba)	**NA**	**0.046**	**2.0 (P)**
Calcium (Ca)	**1.9**	**1.57**	**NS**
Cadmium (Cd)	**ND**	**ND**	**0.005 (P)**
Chromium (Cr)	**ND**	**ND**	**0.1 (P)**
Potassium (K)	**ND**	**1.38**	**NS**
Manganese (Mn)	**ND**	**0.0133**	**0.05 (S)**
Magnesium (Mg)	**0.56**	**0.477**	**NS**
Lead (Pb)	**ND**	**0.011**	**0.05 (P)**
pH	**8.69 (pH units)**	**8.5 (pH units)**	**6.5 – 8.5 (pH units)**

NS – no standard
ND – not detected in the sample
NA - not analyzed

ORGANIC COMPOUNDS ASSOCIATED WITH PETROLEUM HYDROCARBONS

- Benzene: CDPHE's basic ground water standard for benzene is 5 micrograms per liter (µg/l). **Benzene was not detected in the sample from your water well for this sampling or the 2006 sampling.**

- Toluene: CDPHE's basic ground water standard for toluene is 1,000 µg/l. **Toluene was not detected in the sample from your water well for this sampling or the 2006 sampling.**

- Ethylbenzene: CDPHE's basic ground water standard for ethylbenzene is 680 µg/l. **Ethylbenzene was not detected in the sample from your water well for this sampling or the 2006 sampling.**

- Total Xylenes (sum of m,p, and o-xylene): CDPHE's basic ground water standard for total xylenes is 10,000 µg/l. **Total xylenes were not detected in the sample from your water well for this sampling or the 2006 sampling.**

METHANE GAS CONCENTRATION

- **Methane was detected in the sample from your water well at a concentration of 27 mg/l. The 2006 sampling had a concentration of 15.4 mg/l.**

Methane gas alone is physiologically inert and non-toxic to humans. Normal breath exhalation contains 1 to 99 ppm of methane (parts per million [ppm] is the same units as 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. 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 may 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, then pockets 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 commonly 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 concentration levels in well water at 7 mg/l and higher. You should be aware that the methane gas in your water well is at a high enough concentration that precautions should be taken to adequately vent your water system to avoid potential gas accumulations. I have included some additional information on mitigation of methane from home water wells that may be of interest.

GAS COMPOSITION AND STABLE ISOTOPE RESULTS

The gas produced from the oil/gas wells around your home is "thermogenic" methane. Thermogenic methane gas is formed by the thermal breakdown of organic material in rocks resulting from high temperatures created by deep burial. Biogenic methane gas occurs in most near-surface environments and is a principal product of the decomposition of buried organic material. In Weld County the Laramie/Fox Hills aquifer, in which your water well is completed, contain naturally occurring biogenic methane gas.

Laboratory results of the gas sample collected from your water well show that methane (73.25 percent) was detected along with nitrogen (21.84 percent), oxygen (4.02 percent), argon (0.426 percent), and carbon dioxide (0.4 percent) and trace amounts of ethane, propane, butane, and hexanes. The nitrogen, oxygen, argon, and carbon dioxide are components of air and the presence of methane with ethane and the trace amounts of propane, etc. are typical of the naturally occurring biogenic gas in the Laramie/Fox Hills aquifer.

Isotopic Analysis of Methane

- The deuterium/hydrogen isotope ratio for the methane in the water sample from your water well is –268 parts per mil (‰). The 2006 sample result was -267.8 ‰.
- The carbon-13/carbon-12 isotope ratio for the methane in the water sample from your water well is -70.70 ‰. The 2006 sample result was -71.57 ‰.

Isotopic Cross-Plot

I have included a cross-plot of the stable methane isotopes for your water well samples (both the 2006 and the 2010) to help discuss the sample results for your well. On the cross-plot you will notice the area near the top right corner as defined a "Thermogenic Gas". This is the area of the cross-plot that the natural gas produced by the gas wells in the Denver Basin plot. Your well plots in the area to the left defined as "Sub-surface/ Near Surface Microbial Gas" which is methane gas of a biogenic origin.

CONCLUSION

Because your water exceeded the CDPHE drinking water (SMCL) standard for total dissolved solids (TDS), and the health advisory for sodium (Na), and because you or your livestock and/or pets drink your water, you may wish to discuss the possible health effects of continued consumption with your physician and/or veterinarian. There are no indications of any oil & gas related impacts to your water well. Comparison of the sample results from 2006 and 2010 shows that the general water quality of your water well has remained relatively consistent.

The methane gas in your water well is from natural biological activity (biogenic gas) and not related to any oil & gas activity. The concentration of the methane in your water well, as noted earlier, is at a concentration that may pose an explosion hazard if water is brought directly into your home or other confined space. You may want to consider installation of a vented outdoor cistern as a form of passive treatment to lessen the chances of buildup of methane in your house. I have included some information on mitigation of nuisance methane gas in water wells.

If you have any questions or would like to discuss these matters further, please contact me at the COGCC in Denver via e-mail (robert.chesson@state.co.us) or by phone at 303-894-2100, extension 5112.

Respectfully,

Digitally signed by Robert Chesson
DN: cn=Robert Chesson, o, ou=COGCC, email=robert.chesson@state.co.us, c=US
Date: 2010.04.22 10:56:10 -06'00'

Robert H. Chesson, C.P.G., P.G.
Environmental Protection Specialist
cc: Debbie Baldwin, COGCC Steve Lindblom, COGCC David Neslin, COGCC
Jim Precup, COGCC

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

Job Number: 280-1099-1

Job Description: 24639 WCR6 Hudson, CO 80462

For:
Colorado Oil&Gas Conservation Commision
1120 Lincoln St.
Suite 801
Denver, CO 80203

Attention: Bob Chesson

Lori Parsons

Approved for release.
Lori A Parsons
Project Manager I
3/24/2010 11:01 AM

Lori A Parsons
Project Manager I
lori.parsons@testamericainc.com
03/24/2010

The test results in this report relate only to the samples in this report and meet all requirements of NELAC, with any exceptions noted. Pursuant to NELAP, this report shall not be reproduced except in full, without the written approval of the laboratory. All questions regarding this report should be directed to the TestAmerica Denver Project Manager.

The Lab Certification ID# is E87667.

Reporting limits are adjusted for sample size used, dilutions and moisture content if applicable.

Table of Contents

CASE NARRATIVE

Client: Colorado Oil&Gas Conservation Commision

Project: 24639 WCR6 Hudson, CO 80462

Report Number: 280-1099-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

RECEIPT

The samples were received on 03/05/2010; the samples arrived in good condition, properly preserved and on ice. The temperature of the coolers at receipt was 3.5 degrees C.

The laboratory received three Trip Blank VOA vials that were not listed on the Chain-of-Custody. The laboratory proceeded to analyze the Trip Blank sample by 8021B for BTEX+Mtbe and the client was notified on March 5, 2010.

VOLATILE ORGANIC COMPOUNDS (GC)

Samples ANDROVICH (280-1099-1) and TRIP BLANK (280-1099-2) were analyzed for volatile organic compounds (GC) in accordance with EPA SW-846 Method 8021B. The samples were analyzed on 03/09/2010.

No difficulties were encountered during the VOC analyses.

All quality control parameters were within the acceptance limits.

DISSOLVED GASES

Sample ANDROVICH (280-1099-1) was analyzed for dissolved gases in accordance with RSK_175. The sample was analyzed on 03/11/2010.

Sample ANDROVICH (280-1099-1)[100X] required dilution prior to analysis. The reporting limits have been adjusted accordingly.

The method required MS/MSD could not be performed for analytical batch 7167, due to insufficient sample volume. Method precision and accuracy have been verified by the acceptable LCS/LCSD analysis data.

No difficulties were encountered during the dissolved gases analysis.

All quality control parameters were within the acceptance limits.

DISSOLVED METALS

Sample ANDROVICH (280-1099-1) was analyzed for dissolved metals in accordance with EPA SW-846 Method 6010B. The samples were prepared on 03/10/2010 and analyzed on 03/11/2010 and 03/13/2010.

The MS/MSD was performed on sample ANDROVICH (280-1099-1) and was qualified with a '4' for sodium. The analyte present in the original sample was four times greater than the matrix spike concentration; therefore, control limits are no applicable.

No other difficulties were encountered during the dissolved metals analysis.

All other quality control parameters were within the acceptance limits.

ANIONS

Sample ANDROVICH (280-1099-1) was analyzed for anions in accordance with EPA Method 300.0. The samples were analyzed on 03/05/2010.

Sample ANDROVICH (280-1099-1)[5X] required dilution prior to analysis for Chloride. The reporting limit has been adjusted accordingly.

No difficulties were encountered during the anions analysis.

All quality control parameters were within the acceptance limits.

NITRATE-NITRITE AS NITROGEN
Sample ANDROVICH (280-1099-1) was analyzed for nitrate-nitrite as nitrogen in accordance with EPA Method 353.2. The samples were analyzed on 03/13/2010.

No difficulties were encountered during the nitrate-nitrite analysis.

All quality control parameters were within the acceptance limits.

ALKALINITY
Sample ANDROVICH (280-1099-1) was analyzed for Alkalinity in accordance with SM 2320B. The samples were analyzed on 03/09/2010.

No difficulties were encountered during the alkalinity analysis.

All quality control parameters were within the acceptance limits.

TOTAL DISSOLVED SOLIDS
Sample ANDROVICH (280-1099-1) was analyzed for total dissolved solids in accordance with SM 2540C. The samples were analyzed on 03/10/2010.

No difficulties were encountered during the TDS analysis.

All quality control parameters were within the acceptance limits.

CATION ANION BALANCE
Sample ANDROVICH (280-1099-1) was analyzed for Cation Anion Balance in accordance with Cation Anion Balance. The samples were analyzed on 03/19/2010.

No difficulties were encountered during the Cation Anion Balance analysis.

All quality control parameters were within the acceptance limits.

SPECIFIC CONDUCTIVITY
Sample ANDROVICH (280-1099-1) was analyzed for specific conductivity in accordance with SM 2510B. The samples were analyzed on 03/09/2010.

No difficulties were encountered during the specific conductivity analysis.

All quality control parameters were within the acceptance limits.

CORROSIVITY (PH)
Sample ANDROVICH (280-1099-1) was analyzed for corrosivity (pH) in accordance with SM 4500 H+. The samples were analyzed on 03/06/2010.

No difficulties were encountered during the pH analysis.

All other quality control parameters were within the acceptance limits.

GC VOA MANUAL INTEGRATION SUMMARY

Lab Name: TestAmerica Denver Job No.: 280-1099-1

SDG No.:

Instrument ID: GCV_H Analysis Batch Number: 5213

Lab Sample ID: IC 280-5213/1 Client Sample ID:

Date Analyzed: 02/23/10 10:43 Lab File ID: 111B0501.D GC Column: RTX 502.2 ID: 0.53(mm)

COMPOUND NAME	RETENTION TIME	MANUAL INTEGRATION		
		REASON	ANALYST	DATE
Chlorobenzene	11.65	Split Peak	target	02/24/10 07:17
Ethylbenzene	11.75	Split Peak	target	02/24/10 07:17

GC VOA MANUAL INTEGRATION SUMMARY

Lab Name: TestAmerica Denver Job No.: 280-1099-1

SDG No.:

Instrument ID: GCV_H Analysis Batch Number: 7007

Lab Sample ID: CCVIS 280-7007/1 Client Sample ID:

Date Analyzed: 03/09/10 09:59 Lab File ID: 110B0201.D GC Column: RTX 502.2 ID: 0.53(mm)

COMPOUND NAME	RETENTION TIME	MANUAL INTEGRATION		
		REASON	ANALYST	DATE
Methyl tert-butyl ether	4.00	Baseline Event	reamb	03/09/10 10:37

SAMPLE SUMMARY

Client: Colorado Oil&Gas Conservation Commision

Job Number: 280-1099-1

Lab Sample ID	Client Sample ID	Client Matrix	Date/Time Sampled	Date/Time Received
280-1099-1	ANDROVICH	Water	03/05/2010 1045	03/05/2010 1203
280-1099-2TB	TRIP BLANK	Water	03/05/2010 0000	03/05/2010 1203

EXECUTIVE SUMMARY - Detections

Client: Colorado Oil&Gas Conservation Commision Job Number: 280-1099-1

Lab Sample ID / Analyte	Client Sample ID	Result / Qualifier		Reporting Limit	Units	Method
280-1099-1	**ANDROVICH**					
Dissolved Methane		27000		500	ug/L	RSK-175
Bromide		1.2		0.20	mg/L	300.0
Chloride		120		15	mg/L	300.0
Fluoride		3.7		0.50	mg/L	300.0
Total Anions		16			meq/L	SM 1030F
Total Cations		17			meq/L	SM 1030F
Percent Difference		2.8			%	SM 1030F
Anion/Cation Balance		2.8			%	SM 1030F
Total Alkalinity		610		5.0	mg/L	SM 2320B
Bicarbonate Alkalinity as CaCO3		550		5.0	mg/L	SM 2320B
Carbonate Alkalinity as CaCO3		60		5.0	mg/L	SM 2320B
Specific Conductance		1500		2.0	umhos/cm	SM 2510B
Total Dissolved Solids		860		10	mg/L	SM 2540C
pH adj. to 25 deg C		8.69	HF	0.100	SU	SM 4500 H+ B
Dissolved						
Calcium		1900		200	ug/L	6010B
Iron		170		100	ug/L	6010B
Magnesium		560		200	ug/L	6010B
Sodium		380000		1000	ug/L	6010B

METHOD SUMMARY

Client: Colorado Oil&Gas Conservation Commision Job Number: 280-1099-1

Description	Lab Location	Method	Preparation Method
Matrix: Water			
Aromatic and Halogenated VOCs by Gas Chromatography using PID or ELCD	TAL DEN	SW846 8021B	
Purge and Trap	TAL DEN		SW846 5030B
Dissolved Gases (GC)	TAL DEN	RSK RSK-175	
Metals (ICP)	TAL DEN	SW846 6010B	
Sample Filtration	TAL DEN		FILTRATION
Preparation, Total Recoverable or Dissolved Metals	TAL DEN		SW846 3005A
Anions, Ion Chromatography	TAL DEN	MCAWW 300.0	
Nitrogen, Nitrate-Nitrite	TAL DEN	MCAWW 353.2	
Cation Anion Balance	TAL DEN	SM SM 1030F	
Alkalinity	TAL DEN	SM SM 2320B	
Conductivity, Specific Conductance	TAL DEN	SM SM 2510B	
Solids, Total Dissolved (TDS)	TAL DEN	SM SM 2540C	
pH	TAL DEN	SM SM 4500 H+ B	

Lab References:

TAL DEN = TestAmerica Denver

Method References:

MCAWW = "Methods For Chemical Analysis Of Water And Wastes", EPA-600/4-79-020, March 1983 And Subsequent Revisions.

RSK = Sample Prep And Calculations For Dissolved Gas Analysis In Water Samples Using A GC Headspace Equilibration Technique, RSKSOP-175, Rev. 0, 8/11/94, USEPA Research Lab

SM = "Standard Methods For The Examination Of Water And Wastewater",

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

METHOD / ANALYST SUMMARY

Client: Colorado Oil&Gas Conservation Commision

Job Number: 280-1099-1

Method	Analyst	Analyst ID
SW846 8021B	Ream, Brian E	BER
RSK RSK-175	Ream, Brian E	BER
SW846 6010B	Harre, John K	JKH
SW846 6010B	Trudell, Lynn-Anne	LT
MCAWW 300.0	Kudla, Ewa	EK
MCAWW 353.2	Golden, Reva	RG
SM SM 1030F	Sullivan, Roxanne	RS
SM SM 2320B	Derosia, Marcia R	MRD
SM SM 2510B	Peterson, Braden H	BHP
SM SM 2540C	Domnick, Brandon J	BJD
SM SM 4500 H+ B	Jarusewic, Lara E	LEJ

Client: Colorado Oil&Gas Conservation Commision

Job Number: 280-1099-1

Client Sample ID: **ANDROVICH**

Lab Sample ID: 280-1099-1
Client Matrix: Water

Date Sampled: 03/05/2010 1045
Date Received: 03/05/2010 1203

8021B Aromatic and Halogenated VOCs by Gas Chromatography using PID or ELCD

Method:	8021B	Analysis Batch: 280-7007	Instrument ID: GCV_H
Preparation:	5030B		Initial Weight/Volume: 5 mL
Dilution:	1.0		Final Weight/Volume: 5 mL
Date Analyzed:	03/09/2010 1525		Injection Volume: 5 mL
Date Prepared:	03/09/2010 1525		Result Type: PRIMARY

Analyte	Result (ug/L)	Qualifier	RL
Benzene	ND		0.50
Ethylbenzene	ND		0.50
Methyl tert-butyl ether	ND		5.0
Toluene	ND		0.50
m-Xylene & p-Xylene	ND		0.50
o-Xylene	ND		0.50

Surrogate	%Rec	Qualifier	Acceptance Limits
a,a,a-Trifluorotoluene	97		85 - 115

Client: Colorado Oil&Gas Conservation Commision

Job Number: 280-1099-1

Client Sample ID: **TRIP BLANK**

Lab Sample ID: 280-1099-2TB
Client Matrix: Water

Date Sampled: 03/05/2010 0000
Date Received: 03/05/2010 1203

8021B Aromatic and Halogenated VOCs by Gas Chromatography using PID or ELCD

Method:	8021B	Analysis Batch: 280-7007	Instrument ID: GCV_H
Preparation:	5030B		Initial Weight/Volume: 5 mL
Dilution:	1.0		Final Weight/Volume: 5 mL
Date Analyzed:	03/09/2010 1556		Injection Volume: 5 mL
Date Prepared:	03/09/2010 1556		Result Type: PRIMARY

Analyte	Result (ug/L)	Qualifier	RL
Benzene	ND		0.50
Ethylbenzene	ND		0.50
Methyl tert-butyl ether	ND		5.0
Toluene	ND		0.50
m-Xylene & p-Xylene	ND		0.50
o-Xylene	ND		0.50

Surrogate	%Rec	Qualifier	Acceptance Limits
a,a,a-Trifluorotoluene	97		85 - 115

Client: Colorado Oil&Gas Conservation Commision

Job Number: 280-1099-1

Client Sample ID: **ANDROVICH**

Lab Sample ID: 280-1099-1
Client Matrix: Water

Date Sampled: 03/05/2010 1045
Date Received: 03/05/2010 1203

RSK-175 Dissolved Gases (GC)

Method:	RSK-175	Analysis Batch: 280-7167		Instrument ID:	GCV_J
Preparation:	N/A			Initial Weight/Volume:	
Dilution:	100			Final Weight/Volume:	18 mL
Date Analyzed:	03/11/2010 1653			Injection Volume:	
Date Prepared:				Result Type:	PRIMARY

Analyte	Result (ug/L)	Qualifier	RL
Dissolved Methane	27000		500

Client: Colorado Oil&Gas Conservation Commision

Job Number: 280-1099-1

Client Sample ID: **ANDROVICH**

Lab Sample ID: 280-1099-1
Client Matrix: Water

Date Sampled: 03/05/2010 1045
Date Received: 03/05/2010 1203

6010B Metals (ICP)-Dissolved

Method:	6010B	Analysis Batch: 280-7116		Instrument ID:	MT_025
Preparation:	3005A	Prep Batch: 280-6690		Lab File ID:	N/A
Dilution:	1.0			Initial Weight/Volume:	50 mL
Date Analyzed:	03/11/2010 1754			Final Weight/Volume:	50 mL
Date Prepared:	03/10/2010 0730				

Analyte	Result (ug/L)	Qualifier	RL
Arsenic	ND		15
Cadmium	ND		5.0
Calcium	1900		200
Chromium	ND		10
Iron	170		100
Lead	ND		9.0
Potassium	ND		3000
Selenium	ND		15
Sodium	380000		1000

Method:	6010B	Analysis Batch: 280-7274		Instrument ID:	MT_025
Preparation:	3005A	Prep Batch: 280-6690		Lab File ID:	N/A
Dilution:	1.0			Initial Weight/Volume:	50 mL
Date Analyzed:	03/13/2010 0217			Final Weight/Volume:	50 mL
Date Prepared:	03/10/2010 0730				

Analyte	Result (ug/L)	Qualifier	RL
Magnesium	560		200
Manganese	ND		10

General Chemistry

Client Sample ID: **ANDROVICH**

Lab Sample ID: 280-1099-1 Date Sampled: 03/05/2010 1045
Client Matrix: Water Date Received: 03/05/2010 1203

Analyte	Result	Qual	Units	RL	Dil	Method
Bromide	1.2		mg/L	0.20	1.0	300.0
Analysis Batch: 280-6439	Date Analyzed: 03/05/2010 1806					
Chloride	120		mg/L	15	5.0	300.0
Analysis Batch: 280-6439	Date Analyzed: 03/05/2010 1830					
Fluoride	3.7		mg/L	0.50	1.0	300.0
Analysis Batch: 280-6439	Date Analyzed: 03/05/2010 1806					
Sulfate	ND		mg/L	5.0	1.0	300.0
Analysis Batch: 280-6439	Date Analyzed: 03/05/2010 1806					
Nitrate Nitrite as N	ND		mg/L	0.10	1.0	353.2
Analysis Batch: 280-7446	Date Analyzed: 03/13/2010 1410					
Total Alkalinity	610		mg/L	5.0	1.0	SM 2320B
Analysis Batch: 280-6819	Date Analyzed: 03/09/2010 2007					
Bicarbonate Alkalinity as CaCO3	550		mg/L	5.0	1.0	SM 2320B
Analysis Batch: 280-6819	Date Analyzed: 03/09/2010 2007					
Carbonate Alkalinity as CaCO3	60		mg/L	5.0	1.0	SM 2320B
Analysis Batch: 280-6819	Date Analyzed: 03/09/2010 2007					
Total Dissolved Solids	860		mg/L	10	1.0	SM 2540C
Analysis Batch: 280-6776	Date Analyzed: 03/10/2010 0754					

Analyte	Result	Qual	Units	Dil	Method
Total Anions	16		meq/L	1.0	SM 1030F
Analysis Batch: 280-7935	Date Analyzed: 03/19/2010 1114				
Total Cations	17		meq/L	1.0	SM 1030F
Analysis Batch: 280-7935	Date Analyzed: 03/19/2010 1114				
Percent Difference	2.8		%	1.0	SM 1030F
Analysis Batch: 280-7935	Date Analyzed: 03/19/2010 1114				
Anion/Cation Balance	2.8		%	1.0	SM 1030F
Analysis Batch: 280-7935	Date Analyzed: 03/19/2010 1114				

Analyte	Result	Qual	Units	RL	Dil	Method
Specific Conductance	1500		umhos/cm	2.0	1.0	SM 2510B
Analysis Batch: 280-6636	Date Analyzed: 03/09/2010 1200					
pH adj. to 25 deg C	8.69	HF	SU	0.100	1.0	SM 4500 H+ B
Analysis Batch: 280-6384	Date Analyzed: 03/06/2010 1045					

DATA REPORTING QUALIFIERS

Client: Colorado Oil&Gas Conservation Commision Job Number: 280-1099-1

Lab Section	Qualifier	Description
Metals		
	4	MS, MSD: The analyte present in the original sample is 4 times greater than the matrix spike concentration; therefore, control limits are not applicable.
General Chemistry		
	HF	Field parameter with a holding time of 15 minutes

ISOTECH
ISOTECH LABORATORIES INC

ANALYSIS REPORT

Lab #: 181088 Job #: 12640
Sample Name: Androvich Well Co. Lab#:
Company: Colorado Oil & Gas Conservation
Date Sampled: 3/05/2010
Container: Dissolved Gas Bottle
Field/Site Name:
Location:
Formation/Depth:
Sampling Point:
Date Received: 3/10/2010 Date Reported: 4/14/2010

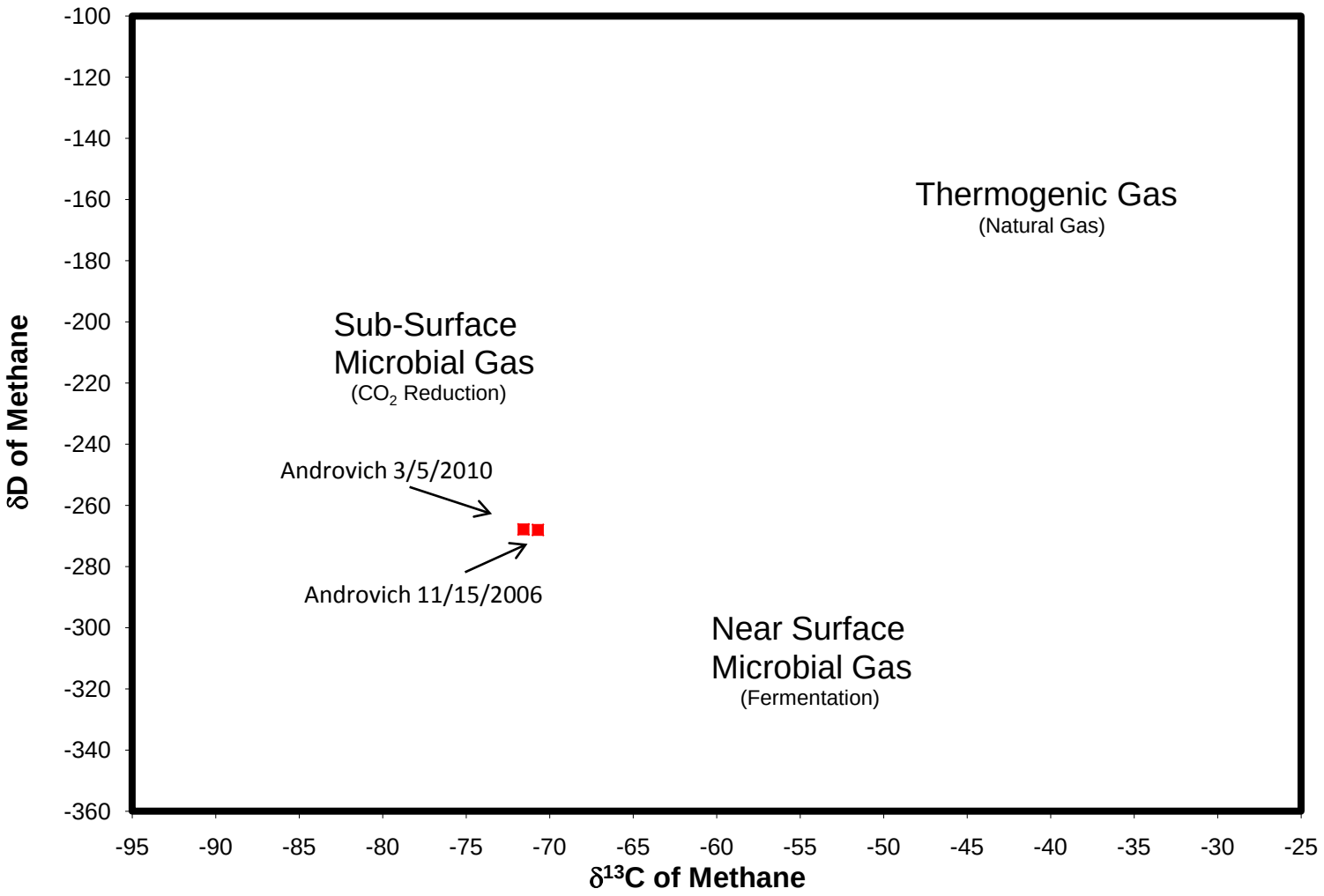
Component	Chemical mol. %	Delta 13C per mil	Delta D per mil	Delta 15N per mil
Carbon Monoxide	nd			
Hydrogen Sulfide	nd			
Helium	nd			
Hydrogen	nd			
Argon	0.426			
Oxygen	4.02			
Nitrogen	21.84			
Carbon Dioxide	0.40			
Methane	73.25	-70.70	-268.0	
Ethane	0.0596			
Ethylene	nd			
Propane	0.0014			
Iso-butane	0.0002			
N-butane	0.0002			
Iso-pentane	nd			
N-pentane	nd			
Hexanes +	0.0002			

Total BTU/cu.ft. dry @ 60deg F & 14.7psia, calculated: 743
Specific gravity, calculated: 0.674

Remarks: Analysis is of gas extracted from water by headspace equilibration. Analysis has been corrected for helium added to create headspace. Helium dilution factor = 0.58
*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%

Typical Compositional Ranges of Methane - Androvich Water Well



AGRI-FACTS
Practical Information for Alberta's Agriculture Industry

June 2006 Agdex 716 (D63)

Methane Gas in Well Water

Methane is a colourless, odourless gas and is lighter than air. Methane is not considered toxic, but it is an asphyxiant at a concentration of over 50 per cent in air. Methane is extremely flammable and can be easily ignited by heat, sparks or flames. Methane is explosive at volumes of 5 per cent to 15 per cent (50,000 ppm to 150,000 ppm) in air. Although methane will rise, it can displace oxygen in confined spaces such as cisterns, pumphouses or well pits.

Common terms

Gas concentrations are commonly referred to in percentage of air by volume (%) or parts per million (ppm). The following examples indicate how to convert between ppm and per cent. The lower explosive limit (LEL) is the minimum amount of a gas in the air that can cause an explosion. This limit is 5 per cent for methane.

1. convert ppm to %
   5 ppm ÷ 10,000 = 0.0005%
2. convert % to ppm
   78% x 10,000 = 780,000 ppm

A gas concentration of **10 per cent or more of the Lower Explosive Limit in a confined space** is considered to be a safety hazard. For methane, this limit works out to over 5,000 ppm.

Methane in well water

Gases (not dissolved in water) can migrate into wells that are not properly cased. Gas can also be naturally present in the water in an aquifer. For example, the Ardley coal zone is present in the Scollard Formation, which is the major aquifer in central Alberta. A water well completed in the Scollard Formation can yield gas if the gas-bearing zone is not cased and sealed off. Well drillers are required to report and seal off gas that could be dangerous to the drilling operation or operation of the well.

Methane can also migrate from coal seams into sandstone aquifers. If methane is present in an aquifer, it will likely exist as a dissolved gas in the water. When the well is pumped, the water level is drawn down. The drawdown will lower the pressure in the well and allow more gas to be released from the water. Methane will readily move from the water phase to the gas phase when water pressure is reduced to atmospheric pressure at the ground surface.

Methane can displace oxygen in confined spaces such as cisterns, pumphouses or well pits

Detecting methane in wells and air

Handheld gas detectors can be rented from a number of environmental equipment suppliers for approximately $60 per day. There are many types of equipment, so it is important to discuss what equipment will be useful to test for methane. The supplier should calibrate the equipment, so that you can take accurate measurements, and should also provide an operation manual. Some suppliers will provide training on equipment use.

Field monitoring equipment is only useful for air measurements above ground. These results will not be as accurate as a laboratory test but may tell you whether or not a laboratory test is necessary and will provide an immediate indication of methane levels.

A water sample or a gas sample can be collected and analyzed for methane content. Testing for methane dissolved in well water must be performed carefully because methane will move into the gas phase easily. A laboratory should be consulted regarding appropriate sample collection procedures and sample containers.

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Most laboratories will analyze water or gas for methane content. The laboratory results will indicate the ppm or per cent concentration of methane present.

Removing methane from well water

Methane will escape from the water when the pressure is released or when the water is heated. Depending on the amount of methane and pressure, some gas will often separate from the water in a pressure tank or a hot water heater. It is not uncommon to have this gas "spurt" out of household water taps. Gas will also build up in the tank and escape into water lines.

A galvanized pressure tank with an automatic air vent will allow gases to escape from the tank to the outside air. If large volumes of gas are present in the well, a vented pressure tank may not be sufficient to disperse the gas. In this case, a cistern with a spray unit and vent can be installed before the pressure tank. The spray unit helps separate dissolved gases from water, so they can be vented outside. Figure 1 and 2 illustrate both the pressure tank and aeration options.

Some wells have enough dissolved gas in them to cause gas locking of the pump. For more information, see the factsheet *Dissolved Gases in Well Water*, Agdex 716 (D18), on the Alberta Agriculture, Food and Rural Development website (http://www1.agric.gov.ab.ca).

Protecting your water wells

It is important to monitor your water wells on a regular basis, especially before seismic and oil/gas drilling activities start. Have both a routine analysis and a microbiological analysis performed. The non-pumping water level should also be monitored on a regular basis.

A professional should be contracted if a test for methane in water is required and to test well production. Well production tests do not need to test how hard the well can be pumped but should be pumped at a sustainable rate using a test procedure that can be duplicated at a later date.

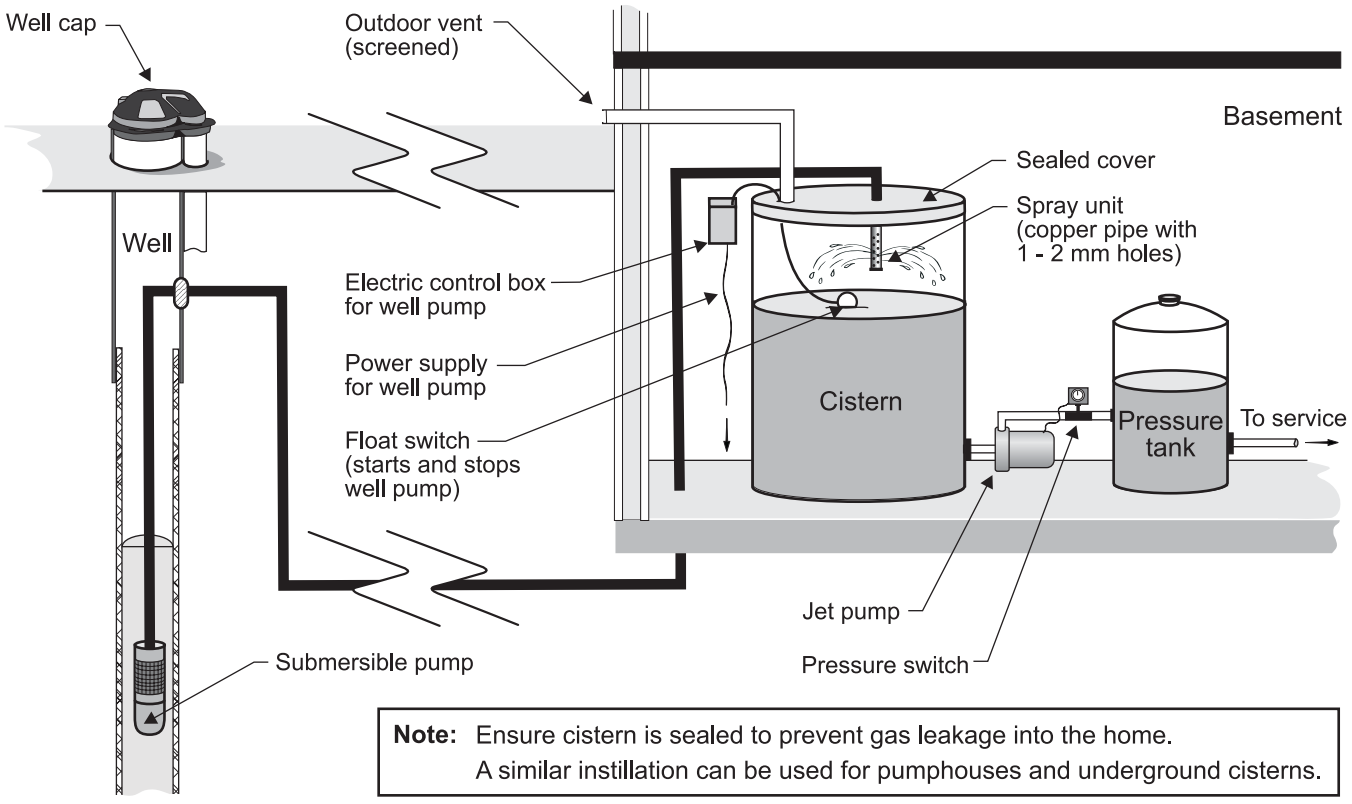
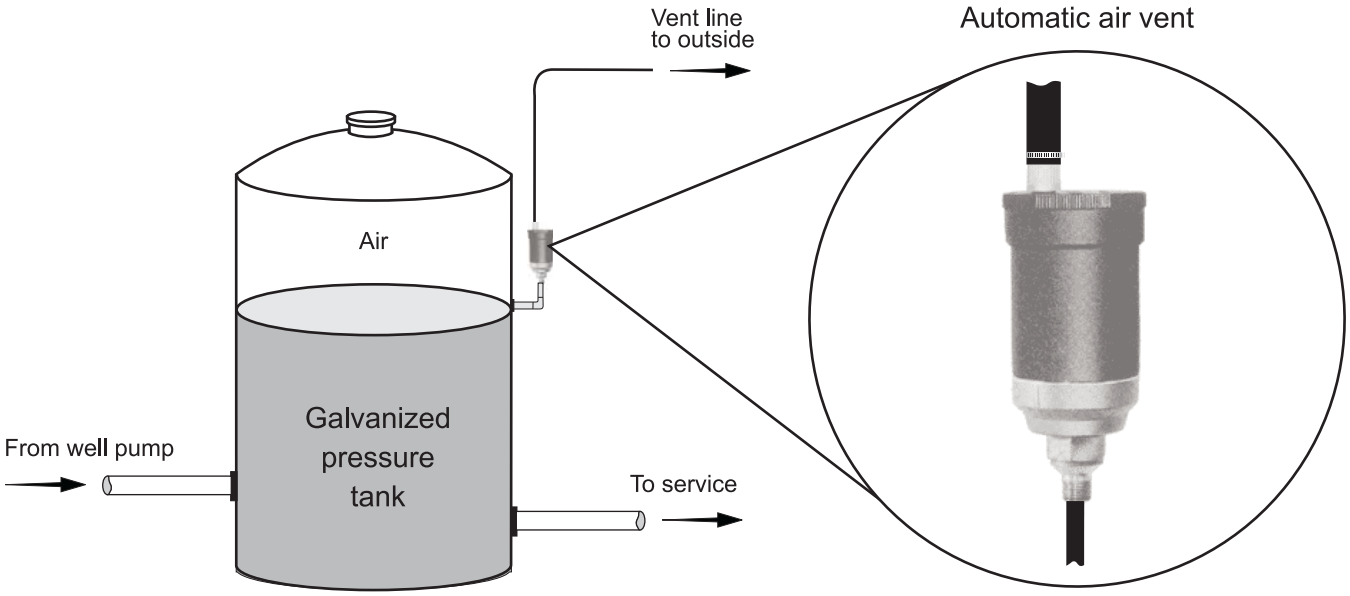


Figure 1. Aeration and ventilation system



Note: Use a galvanized pressure tank without a diaphragm so that the excess gas can be vented from the tank. The figure shows a Braukmann EA122A automatic air vent however other similar vents can also be used.

Figure 2. Galvanized pressure tank

Coal bed methane (CBM) requirements

In April 2006, Alberta Environment released the document *Standard for Baseline Water-Well Testing for Coalbed Methane/Natural Gas in Coal Operations*. This document states that CBM developers must test water wells within a minimum 600 metre radius of a CBM well that is completed above the base of groundwater protection.

The base of groundwater protection is the depth above which potable water can be found and varies throughout the province. Potable water is considered to have less than 4,000 mg/L of total dissolved solids (TDS). If no water wells are located within a 600 metre radius, testing must be performed on water wells within an 800 metre radius.

The testing that must be performed includes water well capacity, routine potability, bacteriological, and presence and analysis of gas.

References

For more information, see the following publications:

Methane Safety, Agdex 729-2, http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex9038

Alberta Environment's *Standard for Baseline Water-Well Testing for Coalbed Methane/Natural Gas in Coal Operations*, April 2006 http://www.waterforlife.gov.ab.ca/coal/docs/CBM_Standard.pdf

Alberta Agriculture, Food and Rural Development *Dissolved Gases in Well Water*, Agdex 716 (D18), http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex637?opendocument

Coal Bed Methane (CBM) Wells and Water Well Protection http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/eng9758

More information

For further information, contact any of the Agricultural Water Specialists with Alberta Agriculture, Food and Rural Development at the following locations:

Red Deer (403) 340-5324
Edmonton (780) 427-2963

Prepared by:

Rachelle Ormond – Agricultural Water Engineer
Technical Services Division

06/06/1M

Fact Sheet

Commonwealth of Pennsylvania • Department of Environmental Protection

Methane Gas and Your Water Well

Residents of the coal producing regions of Pennsylvania need to be aware of the potential dangers from the accumulation of coal bed methane, or natural gas, in their water wells.

High concentrations of methane in water wells, well enclosures and other confined spaces can cause an explosion.

What Is Methane?

Methane is a naturally occurring gas found underground. It is present in both shallow and deep rocks, and is frequently associated with coal beds. Underground coal mining can release methane to nearby areas.

Because most mining takes place at relatively shallow depths, the methane may migrate into groundwater. This gas may eventually find its way into wells that use the groundwater.

Many mines have systems to divert or remove methane from the underground workings. Methane vented to the atmosphere is harmless. However, these systems do not collect all the methane released by mining, and it may still escape to water wells. In addition, methane may continue to escape after the mine is closed. It can also be released from old, abandoned deep mines.

Because methane is colorless and odorless, it may accumulate undetected in well bores and well enclosures that are not properly vented. Methane may also move into basements of homes and other structures through plumbing and electrical connections. These conditions can lead to an explosion.

What Can You Do?

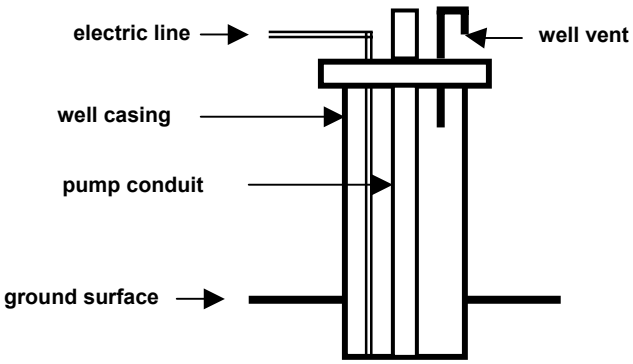
Fortunately, methane will not accumulate in the well bore if the well is properly vented to the air. Venting is an inexpensive and effective way to prevent methane accumulation in wells, well enclosures and other confined spaces, such as basements. Proper venting eliminates the potential for methane to seep into homes from water wells.

Recommended Venting Procedures

Well vents provide an exit for methane trapped in well bores or well enclosures. Proper design is extremely important.

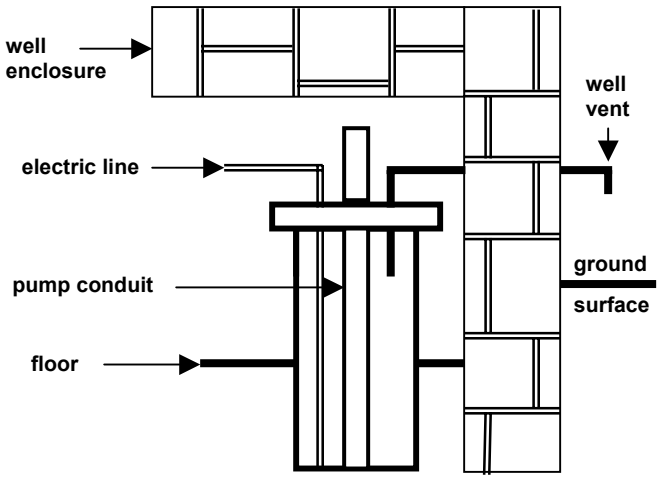
The vent should extend above any possible flood level or potential ignition sources and should have watertight connections to prevent surface water from entering. The end of the vent pipe should have a down-turned "gooseneck" and be capped with corrosion-resistant screening. If the vent is not turned down and screened, it can become a potential entry point for rainwater and small animals.

The diagram below is a simplified example of a vent pipe on a water well that contains a submersible pump.



Enclosed Wells

When the top of the well is buried in a covered pit or enclosed in a basement, the vent pipe must vent gas to the outside air, as shown in the diagram below. The vent pipe should be turned down and screened, and terminate at least 18 inches above ground level.



In cases where the well is located in an enclosure, it should have a tight-fitting well cap, and all openings through the cap should be properly sealed to prevent methane from escaping into the well enclosure.

Play It Safe

When a well is no longer in service, the plumbing connections should be disconnected to prevent methane from entering the home or building.

NOTE: Your well may differ considerably from the wells depicted in the diagrams. Also, well venting requirements may vary from place to place due to differences in local plumbing codes. Therefore, well owners are encouraged to contact a professional water well specialist or a local building code enforcement officer to determine the proper venting procedures required under the local plumbing code.

For more information on methane and water wells, please contact the DEP Mining Office in your area.

Pottsville District Mining Office
5 West Laurel Blvd.
Pottsville, PA 17901-2454
Telephone: 570-621-3118
Counties Served: Adams, Berks, Bucks, Carbon, Chester, Columbia, Cumberland, Dauphin, Delaware, Franklin, Juniata, Lackawanna, Lancaster, Lebanon, Lehigh, Luzerne, Mifflin, Monroe, Montgomery, Montour, Northampton, Northumberland, Perry, Pike, Philadelphia, Schuylkill, Snyder, Susquehanna, Union, Wayne, Wyoming and York

Moshannon District Mining Office
186 Enterprise Drive
Philipsburg, PA 16866
Telephone: 814-342-8200
Counties Served: Bradford, Cameron, Centre, Clearfield, Clinton, Lycoming, Potter, Sullivan and Tioga

Knox District Mining Office
White Memorial Building
P.O. Box 669
Knox, PA 16232-0669
Telephone: 814-797-1191
Counties Served: Butler, Clarion, Crawford, Elk, Erie, Forest, Jefferson, Lawrence, McKean, Mercer, Venango and Warren

Cambria District Mining Office
286 Industrial Park Road
Ebensburg, PA 15931-4119
Telephone: 814-472-1900
Counties Served: Bedford, Blair, Cambria, Fulton, Huntingdon, Indiana and Somerset

Greensburg District Mining Office
Armbrust Building
RR 2, Box 603C
Greensburg, PA 15601-0982
Telephone: 724-925-5500
Counties Served: Allegheny, Armstrong, Beaver, Fayette, Greene, Washington and Westmoreland

California District Mining Office
25 Technology Drive
California Technology Park
Coal Center, PA 15423
Telephone: 724-769-1100
Counties Served: All counties with underground bituminous mining and subsidence

For more information, please visit the PA PowerPort at www.state.pa.us, Keyword: "DEP Mining Offices."

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Department of Environmental Protection
Kathleen A. McGinty, Secretary
5600-FS-DEP2690 Rev. 1/2004

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