



Project Memorandum

To:	Mr. John Noto	Company:	Colorado Oil and Gas Conservation Commission
From:	Cory Chance	Company:	URS Corporation
CC:	David White, Scott Pope, Bob Williamson, Kevin Lively	Company:	Colorado Interstate Gas
Date:	August 14, 2014		
Subject:	Fort Morgan Second Quarter 2014 Groundwater Monitoring Event - Remediation Site #3792		

This memorandum summarizes the groundwater monitoring field activities and analytical results for the Second Quarter 2014 monitoring event which extends the long-term monitoring (LTM) program at the Colorado Interstate Gas (CIG) Fort Morgan Compressor Station (Site). The LTM consists of quarterly groundwater monitoring to monitor the extent of dissolved methane concentrations in groundwater resulting from an accidental release of natural gas in October 2006.

This memorandum includes a brief summary of the field activities, and includes the following attachments:

- Table 1 – Summary of Field Parameters and Dissolved Gas Results – June 2014
- Table 2 – Summary of Dissolved Methane Results for LTM Locations
- Table 3 – Summary of Deep Monitoring Well Field Parameters and Dissolved Gas Results
- Figure 1 – Groundwater Monitoring Sample Locations
- Figure 2 – Shallow Groundwater Potentiometric Surface June 2014
- Figure 3 – Dissolved Methane in Shallow Groundwater June 2014
- Figure 4 – Dissolved Methane Time Series Graphs

Summary of Field Activities

The Second Quarter 2014 monitoring event was conducted from June 16 to June 18, 2014. The monitoring network (Figure 1) includes 21 piezometers, 2 active domestic wells (H101 and H98), 3 inactive domestic wells (H100, H64/65, and H66), 4 monitoring wells (MW-01, CPT-46SR, CPT-58SR, CPT-62SR), and 2 deep monitoring wells (DMW-1 and DMW-2). URS collected domestic well samples on June 16, 2014, deep well samples on June 16 and 18, 2014, and piezometer and monitoring well samples on June 17 and 18, 2014.

Prior to sample collection at the piezometers and the monitoring wells, URS measured the natural gas content in the headspace of the riser pipe using a QRAE Multi-Gas Monitor (QRAE). Once the headspace screening was completed, URS measured the static groundwater level and total well depth at each monitoring location, using an electronic water level indicator.

While attempting to remove the cap from site CPT-57R, the PVC piezometer came apart at a joint approximately 12 inches below the top of completion. The sand fill in the protective casing fell into the piezometer, filling it to approximately 18 feet below completion. The historic water level at this site is approximately 20 feet below completion. The sample team

attempted to blow out the sand using the available equipment on site, but was unsuccessful. The sample team was not able to collect a sample from this location for this event. The piezometer at this location will need to be repaired or replaced before a sample can be collected for future events.

Based on the February 13, 2014 approval by the Colorado Oil and Gas Commission (COGCC), piezometers CPT-09S, CPT-17S, CPT-26S, CPT-44S, and CPT-50S are sampled annually during the First Quarter Monitoring Event and were not sampled during this sample event.

The size of the Second Quarter 2014 dissolved methane plume is similar to the dissolved methane plumes observed during the First Quarter 2014 monitoring event. The Second Quarter 2014 event was the second consecutive event that dissolved methane was not detected above the COGCC 2.0 milligrams per liter (mg/L) action level in the Southwest portion of the project area, which includes piezometers CPT-09S, CPT-11S, and CPT-15S (Figure 3). Dissolved methane concentrations adjacent to and east of the Site continue to exceed the 2 mg/L action level in the groundwater (Figure 3).

Future Work

The next groundwater monitoring event is scheduled for September 2014.

If you have any questions or comments regarding this memorandum, please feel free to contact me at 719.268.7417.

Sincerely,
URS Corporation

A handwritten signature in cursive script that reads "Cory Chance".

Cory Chance
Project Manager

Table 1

Summary of Field Parameter and Dissolved Gas Results - June 2014

	Location Sample Date	CPT-09S 06/17/2014	CPT-11S 06/17/2014	CPT-11S FD 06/17/2014	CPT-15S 06/17/2014	CPT-17S 06/17/2014	CPT-26S 06/17/2014	CPT-34S 06/17/2014	CPT-35D 06/17/2014	CPT-35S 06/17/2014	CPT-36S 06/18/2014	CPT-41D 06/18/2014	CPT-41S 06/18/2014	CPT-43S 06/17/2014
Head Space Field Parameter	Units													
Carbon Monoxide	ppm	<1	<1	NA	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Combustible Gas	Percent LEL	<1	<1	NA	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
H2S	ppm	<1	<1	NA	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Oxygen	Percent	20.9	20.9	NA	20.9	20.9	20.9	20.5	20.4	19.1	20.9	18.3	17.1	20.9
Groundwater Field Parameter	Units													
Conductivity	uS/cm	NS	629	NA	882	NS	NS	NS	2166	1897	2388	2230	3186	2949
Dissolved Oxygen	mg/L	NS	5.23	NA	3.98	NS	NS	NS	3.93	4.19	5.51	4.83	5.01	2.98
ORP	mV	NS	-69.8	NA	-67.8	NS	NS	NS	-46.2	-25.3	189.6	-58.3	-86.3	20
pH	pH Units	NS	7.42	NA	7.59	NS	NS	NS	7.03	6.99	7.03	7.21	6.97	7.25
Temperature	degrees Celsius	NS	18.19	NA	19.17	NS	NS	NS	15.8	16.16	15.47	15.19	16.02	22.42
Dissolved Gases	Units													
Ethane	mg/L	NS	0.00017	0.00013	0.068	NS	NS	NS	0.00015	0.000015 J	0.000053	0.0001	0.00011	0.0018
Ethene	mg/L	NS	0.000083 J	0.00028 J	0.000043 J	NS	NS	NS	0.000098 J	0.000057 J	0.0000075 J	0.0001 J	0.000021 J	0.000045 J
iso-Butane	mg/L	NS	<0.00005	<0.00005	<0.00005	NS	NS	NS	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Methane	mg/L	NS	1.4	1.5	1.1	NS	NS	NS	0.01	0.0065	0.0016	0.062	0.044	0.024
n-Butane	mg/L	NS	<0.00005	<0.00005	<0.00005	NS	NS	NS	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Propane	mg/L	NS	0.00003 J	0.000027 J	0.000086	NS	NS	NS	<0.00005	<0.00005	<0.00005	0.000017 J	<0.00005	0.000011 J
Propene	mg/L	NS	<0.00005	<0.00005	<0.00005	NS	NS	NS	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005

Notes:

Less than (<) symbol indicates the concentration listed is below the reporting limit for the specific sample, analytical method, and analyte.

Bold values highlight detections.

"J" flag indicates an estimated value.

FD = sample was a field duplicate, analyzed for dissolved gases only.

H₂S = hydrogen sulfide

ORP = oxidation-reduction potential

NA = Not Applicable

NS = Not Sampled

ppm = parts per million

LEL = lower explosive limit

uS/cm = microSiemens per centimeter

mg/L = milligrams per liter

mV = millivolt

Table 1

Summary of Field Parameter and Dissolved Gas Results - June 2014

	Location Sample Date	CPT-44S 06/17/2014	CPT-46D 06/17/2014	CPT-46SR 06/17/2014	CPT-46SR FD 06/17/2014	CPT-50S 06/17/2014	CPT-53S 06/17/2014	CPT-54S 06/17/2014	CPT-58SR 06/16/2014	CPT-62SR 06/17/2014	CPT-63S 06/16/2014	CPT-85S 06/17/2014	CPT-92S 06/16/2014	CPT-93S 06/16/2014
Head Space Field Parameter	Units													
Carbon Monoxide	ppm	<1	<1	<1	NA	<1	<1	<1	<1	<1	<1	<1	<1	<1
Combustible Gas	Percent LEL	<1	<1	<1	NA	<1	<1	<1	<1	<1	<1	<1	<1	<1
H2S	ppm	<1	<1	<1	NA	<1	<1	<1	<1	<1	<1	<1	<1	<1
Oxygen	Percent	20.9	20.9	20.9	NA	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.5	20.9
Groundwater Field Parameter	Units													
Conductivity	uS/cm	NS	2237	3650	NA	NS	2786	3768	2126	3951	3043	3583	3082	4078
Dissolved Oxygen	mg/L	NS	3.61	2.01	NA	NS	3.61	2.21	2.65	5.97	2.47	2.52	3.82	3.45
ORP	mV	NS	40.4	39.7	NA	NS	-93.5	-123.6	28.6	21.2	22.7	15.1	-149.9	5.9
pH	pH Units	NS	7.22	7.16	NA	NS	6.91	7.11	7.35	7.15	7.2	7.06	7.15	7.12
Temperature	degrees Celsius	NS	15.25	26.74	NA	NS	23.12	21.09	24.4	20.32	21.89	22.97	17.6	15.97
Dissolved Gases	Units													
Ethane	mg/L	NS	0.00024	0.0000024 J	0.0000066 J	NS	0.0018	0.012	0.000043	0.00066	0.00031	0.000081	0.0014	0.000018 J
Ethene	mg/L	NS	0.000034 J	0.0000042 J	0.0000088 J	NS	0.00026 J	0.000065 J	0.00019 J	0.000048 J	0.000042 J	0.000019 J	0.0018 J	0.000038 J
iso-Butane	mg/L	NS	<0.00005	<0.00005	<0.00005	NS	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Methane	mg/L	NS	0.3	4.8	5.7	NS	9.3	11	0.0022	0.074	0.021	0.39	0.24	0.0013
n-Butane	mg/L	NS	<0.00005	<0.00005	<0.00005	NS	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Propane	mg/L	NS	0.00017	0.000012 J	0.000015 J	NS	0.000061	0.000043 J	<0.00005	<0.00005	<0.00005	0.0000081 J	0.00018	<0.00005
Propene	mg/L	NS	0.000012 J	<0.00005	0.000018 J	NS	<0.00005	0.000018 J	0.000022 J	<0.00005	<0.00005	<0.00005	0.00003 J	<0.00005

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Table 1

Summary of Field Parameter and Dissolved Gas Results - June 2014

	Location Sample Date	H100 06/16/2014	H101 06/16/2014	H59W 06/16/2014	H64/65 06/16/2014	H66 06/16/2014	H66 FD 06/16/2014	H98 06/16/2014	MW01 06/17/2014
Head Space Field Parameter	Units								
Carbon Monoxide	ppm	<1	<1	<1	<1	<1	NA	<1	<1
Combustible Gas	Percent LEL	<1	<1	<1	<1	<1	NA	<1	<1
H2S	ppm	<1	<1	<1	<1	<1	NA	<1	<1
Oxygen	Percent	20.9	20.9	20.9	20.9	20.9	NA	20.9	20.9
Groundwater Field Parameter	Units								
Conductivity	uS/cm	3723	3090	3569	3370	3184	NA	2779	4085
Dissolved Oxygen	mg/L	3.41	3.02	6.31	4.72	6.01	NA	5.03	4.73
ORP	mV	-33.1	70.2	83.9	23.3	-59.3	NA	70.2	-85.4
pH	pH Units	7.31	7.03	6.94	7.05	7.23	NA	7.17	6.9
Temperature	degrees Celsius	14.8	14.03	14.51	14.86	15.59	NA	14.29	14.56
Dissolved Gases	Units								
Ethane	mg/L	<0.000025	0.00002 J	0.0000025 J	0.000045	0.000032	0.000068	0.0000041 J	0.48
Ethene	mg/L	<0.000025	0.0000037 J	0.0000085 J	0.000033 J	0.000024 J	0.00012 J	0.0000032 J	0.000018 J
iso-Butane	mg/L	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Methane	mg/L	0.2	0.00021	0.00015	0.3	0.078	0.085	0.00016	7.8
n-Butane	mg/L	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Propane	mg/L	<0.00005	<0.00005	<0.00005	<0.00005	0.000011 J	0.000013 J	<0.00005	0.000037 J
Propene	mg/L	<0.00005	<0.00005	<0.00005	<0.00005	0.000029 J	0.000027 J	<0.00005	0.000041 J

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Table 2
Summary of Dissolved Methane Results for LTM Locations

Location	2007		2008		2009		2010		2011				2012				2013				2014	
	Max	Min	Max	Min	Max	Min	Max	Min	LTM Q1	LTM Q2	LTM Q3	LTM Q4	LTM Q1	LTM Q2	LTM Q3	LTM Q4	LTM Q1	LTM Q2	LTM Q3	LTM Q4	LTM Q1	LTM Q2
	Mar	Jun	Sep	Dec	Mar	Jun	Sep	Dec	Mar	Jun	Sep	Dec	Mar	Jun	Sep	Dec	Mar	Jun	Sep	Dec	Mar	Jun
CPT-09S	23	0.24	5.3	3.5	5.6	1.1	3	0.91	0.84	1.5	0.89	1.6	0.63	0.64	0.56	0.45	0.67	NS	NS	NS	0.46	NS
CPT-11S	13	0.55	11	6	11	6.3	6.9	4.6	5.5	4.5	5.3	3.6	4.3	4.2	2.4	2.7	2.9	2.7	2	2.2	1.6	1.5
CPT-15S	0.0025	0.00084	0.12	0.00092	4.6	2.6	3.2	0.12	0.27	0.33	0.72	1.3	0.000081	1.9	2.5	2.3	3.8	2.8	2	1.8	1.9	1.1
CPT-17S	0.005	0.00054	0.0016	0.00073	0.029	0.0019	0.0013	0.00071	0.0026	NS	0.0013	0.00023	0.0026	0.00008	0.0001	0.0027	0.00012	NS	NS	NS	0.15	NS
CPT-26S	0.0054	0.00051	0.0048	0.00067	0.2	0.0016	0.17	0.00062	0.0011	0.00046	0.002	0.00036	0.00039	0.00013	0.000084	0.00042	0.00038	NS	NS	NS	0.0058	NS
CPT-34S	0.0052	0.0011	0.0032	0.00016	0.014	0.0012	0.0063	0.0016	0.0017	0.0017	NS	0.00034	0.001	0.00022	0.00019	0.0031	0.00024	NS	NS	NS	NS	NS
CPT-35D	2.5	1	6.7	1.8	10	2.7	4.8	0.67	0.33	0.0063	0.004	0.025	0.38	0.12	0.027	0.24	0.14	0.22	0.13	0.12	0.021	0.01
CPT-35S	0.32	0.0045	0.9	0.21	0.46	0.11	0.065	0.008	0.0045	0.013	0.0074	0.0087	0.013	0.0072	0.0062	0.0072	0.0062	0.0072	0.0065	0.0051	0.04	0.0065
CPT-36S	14	7	14	6.6	15	2	3.3	0.46	1.6	0.037	0.003	0.058	0.3	0.081	0.0041	0.0049	0.00053	0.0083	0.0048	0.077	0.0042	0.0016
CPT-41D	15	0.31	35	4.9	25	5.4	28	17	13	18	12	9.8	4.7	1.2	1.7	0.3	0.1	0.23	0.053	0.24	0.38	0.062
CPT-41S	0.25	0.011	5.4	0.083	31	11	22	5.5	18	15	9.8	1.7	8.2	7.7	2.4	0.72	7.8	0.44	0.62	0.18	2.9	0.044
CPT-43S	14	9.5	15	10	30	12	21	5.7	2.6	0.00026	0.53	0.68	0.14	0.16	0.41	1.1	0.14	0.088	0.034	0.0004	0.0017	0.024
CPT-44S	12	8.4	14	0.39	1.1	0.12	0.053	0.00044	0.0031	0.02	0.01	0.0012	0.015	0.0016	0.0054	0.0043	0.0023	NS	NS	NS	0.028	NS
CPT-46D	29	15	19	6.6	28	7.6	8.1	1	2.6	2.7	2.2	2.2	2.1	0.33	0.34	0.32	0.33	0.36	0.83	0.25	0.13	0.3
CPT-46S	19	5.4	17	8.2	28	9.3	24	18	25	18	16	17	12	12	3.4	12	NS	NS	NS	NS	NS	NS
CPT-46SR	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	8.1	7.6	5.7
CPT-50S	0.0036	0.0011	0.002	0.00026	0.0034	0.0003	0.00077	0.00017	0.00023	0.0004	0.00028	0.0012	0.00035	0.00079	0.00014	0.00046	0.000071	0.0013	0.0013	0.0022	0.017	NS
CPT-53S	11	8	12	3.8	6.5	3.8	3.7	1.9	2.7	3.6	2	6.1	6.8	5.5	0.36	7.1	7.9	6.8	7.2	3.8	8.8	9.3
CPT-54S	14	5.5	12	4	20	7.6	11	9	9.7	0.96	11	5.7	8	17	1	16	19	16	14	13	13	11
CPT-57R	20	13	18	7.4	8.4	6.1	5.2	2.3	2.6	2.1	0.18	0.82	2.4	1.5	1.4	1.6	1.7	1.6	1.4	0.69	1.4	NS
CPT-58S	24	0.006	16	7.3	11	7.8	13	7.6	7.8	10	11	10	13	3.8	1.6	1.2	2.7	2.1	0.54	NS	NS	NS
CPT-58SR	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.0077	0.012	0.0022
CPT-62S	0.13	0.0016	11	0.33	27	7.1	24	15	19	16	14	7.3	6.7	5.3	7.8	6	4.5	3.2	1.6	NS	NS	NS
CPT-62SR	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.0087	0.12	0.074
CPT-63S	0.0054	0.00069	0.0024	0.00079	4.6	0.0021	0.35	0.049	0.067	0.4	0.79	5.6	5.8	7	0.9	0.18	0.26	0.6	0.007	0.0054	0.036	0.021
CPT-85S	5	0.17	2.2	0.00077	0.86	0.09	0.89	0.11	1.4	1.3	0.00082	0.86	1.8	1.2	0.12	0.91	0.63	0.64	0.44	0.26	0.49	0.39
CPT-92S	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.44	0.67	0.0033	0.031	0.019	0.04	0.019	0.28	0.5	0.16	0.24
CPT-93S	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.03	0.00052	0.23	0.23	0.0058	0.12	0.0049	0.035	0.043	0.029	0.0013
H100	30	10	30	21	19	12	14	12	12	5.9	2.8	8.5	5.2	1.7	4.5	7.6	7.8	1.2	7	4	2	0.2
H101	0.25	0.0025	0.004	0.004	0.0015	0.00042	0.00019	0.00013	0.000078	0.0001	0.00011	0.0011	0.00025	0.0024	0.0004	0.00086	0.00017	0.0039	0.00024	0.00014	0.000061	0.00021
H59W	0.00058	0.00013	NS	NS	NS	NS	0.0019	0.000084	NS	0.00011	0.00045	NS	NS	0.0001	0.00008	NS	NS	0.0014	0.0002	NS	NS	0.00015
H64/65	0.0028	0.000019	0.26	0.00022	2.1	0.096	6.1	1.7	5.2	3.9	2.5	3.1	5.4	2.6	3.5	2.1	1.7	1.2	2.4	0.59	0.15	0.3
H66	0.017	0.00002	8.1	0.0045	9.9	6.6	18	12	15	13	14	14	14	8.2	5.7	5.4	1.4	3.3	1.6	0.88	0.69	0.085
H98	0.021	0.0001	0.6	0.072	0.36	0.046	0.074	0.015	0.031	0.012	0.0018	0.0025	0.012	0.0012	0.0016	0.0034	0.00013	0.0029	0.0018	0.00011	0.000036	0.00016
L59	0.046	0.00035	0.0016	0.0016	NS	NS	0.00012	0.00004	0.000081	0.00014	0.00019	0.00094	0.00012	0.00021	0.000061	NS	0.000053	0.00022	0.00014	0.000032	NS	NS
MW01	NS	NS	20	17	28	21	26	15	8.6	7.5	2	2.2	3.6	10	20	19	12	18	17	15	8.4	7.8

Notes:
* - Historical data are minimum and maximum of pre-LTM events sampled between March and November 2007
Less than (<) symbol indicates result was not detected at the associated detection limit.
Units are milligrams per liter (mg/L)
COGCC = Colorado Oil and Gas Conservation Commission
LTM = long-term monitoring
NS = Not sampled

Bold value	Highest detected value at each sample location
<i>Italic value</i>	Lowest detected value at each sample location
Value	> 2.0 mg/l (COGCC Dissolved Methane Action Level)
Value	> 0.0067 mg/L and < = 2.0 mg/l
Value	< = 0.0067 mg/L (Background dissolved methane concentration determined during Phase I Investigation)

Table 3
Summary of Deep Monitoring Well Field Parameter and Dissolved Gas Results

	Location	DMW-1										DMW-2									
	Sample Date	6/18/2014	3/18/2014	11/21/2013	9/25/2013	6/19/2013	3/12/2013	2012 Max	2012 Min	2011 Max	2011 Min	6/16/2014	3/17/2014	11/19/2013	9/24/2013	6/17/2013	3/11/2013	2012 Max	2012 Min	2011 Max	2011 Min
Head Space Field Parameter	Units																				
Carbon Monoxide	ppm	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	8	8	<1	1	<1
Combustible Gas	Percent LEL	100	100	<1	25	<1	100	7	<1	<1	<1	10	100	100	11	38	100	100	<1	35	<1
H2S	ppm	<1	<1	NS	<1	<1	<1	<1	<1	<1	<1	<1	<1	NS	<1	<1	<1	<1	<1	<1	<1
Oxygen	Percent	7.4	18.6	20.9	20.9	20.9	6.2	20.9	20.9	20.9	20.9	20.9	18.4	19.6	20.9	20.3	19.8	20.9	18.5	20.9	20.7
Groundwater Field Parameter	Units																				
Conductivity	uS/cm	3057	3028	3152	3208	3144	3052	3275	2723	3321	9	3309	2413	2502	3457	3026	3363	3302	2853	2712	127
Dissolved Oxygen	mg/L	2.07	1.97	1.76	1.58	0.12	0.26	5.87	0.52	3.16	2.44	4.25	2.19	2.2	2.54	1.62	1.27	27	0.99	42.4	2.8
ORP	mV	-130.3	-111.5	77.6	-65.7	-169.1	-275.6	-22.9	-167.4	141	-223.3	-97.1	-23.2	29.2	-63.3	-155.2	-153.8	6.2	-178.8	-42.7	-47.8
pH	pH Units	7.63	8.07	8.23	7.81	8.38	8.27	8.25	7.39	9.42	5.86	7.97	7.99	8.11	8.08	8.1	8.11	8.33	7.71	8.69	8.09
Temperature	degrees Celsius	22.15	7.18	10.36	20.84	17.55	7.36	21.93	9.05	14.9	10.48	14.42	9.42	12.12	14.12	13.31	11.83	14.8	12.99	18.2	14.26
Dissolved Gases	Units																				
Ethane	mg/L	0.077	0.06	0.071	0.065	0.064	0.079	0.088 J	0.076	0.082	0.071	0.11	0.12	0.086	0.14	0.19	0.31	0.62	0.26	0.27	0.12
Ethene	mg/L	0.0011 J	0.0013	0.0014	0.0012	0.00069	0.0018	0.0021	0.0013	0.0018	0.0017	0.00037 J	0.00066	0.00053	0.00071	0.00056	0.00046	0.00087	0.00058	0.0006	0.00047
iso-Butane	mg/L	0.000044 J	0.000042 J	0.000077	0.000044 J	0.000061	0.000064	0.0001	0.000046 J	0.000087	<0.00005	0.00078	0.0011	0.00027	0.00056	0.0011	0.0027	0.0073	0.0025	0.0037	0.0005
Methane	mg/L	39	29	31	29	25	32	36 J	32	39	34	43	46	31	44	38	42	48	34 J	46	40
n-Butane	mg/L	0.000021 J	0.0000098 J	0.000007 J	0.000094	<0.00005	<0.00005	0.000028 J	<0.00005	0.000062	<0.00005	0.00064	0.00089	0.00023	0.00062	0.0012	0.0031	0.0065	0.0018	0.0046	0.00062
Propane	mg/L	0.00028	0.00018	0.00017	0.00022	0.00018	0.00027	0.00037	0.00028	0.00048	0.00036	0.0063	0.0086	0.0032	0.0065	0.014	0.039	0.1	0.033	0.048	0.0065
Propene	mg/L	0.00054	0.00055	0.00055	0.00048	0.0005	0.00055	0.00059	0.00054	0.00074	0.00055	0.00052	0.00059 J	0.00047	0.00063	0.0006	0.00062 J	0.00068	0.00054	0.00065	0.00059

Notes:

The February 20, 2011 groundwater samples at DMW-1 and DMW-2 were collected using a bailer; all subsequent groundwater samples at these wells were collected using passive diffusion bags, which were deployed at a depth of approximately 350 feet below ground surface.

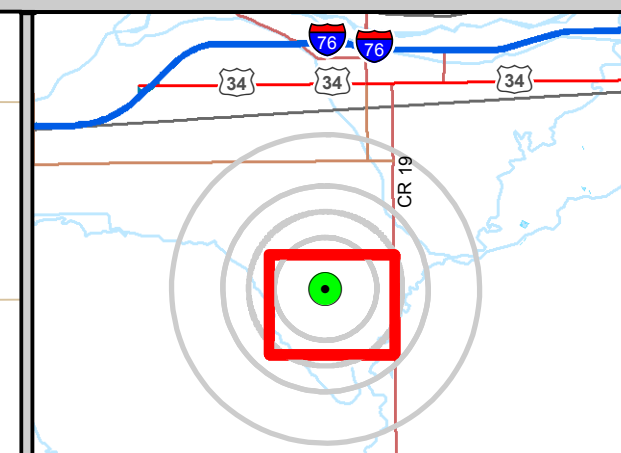
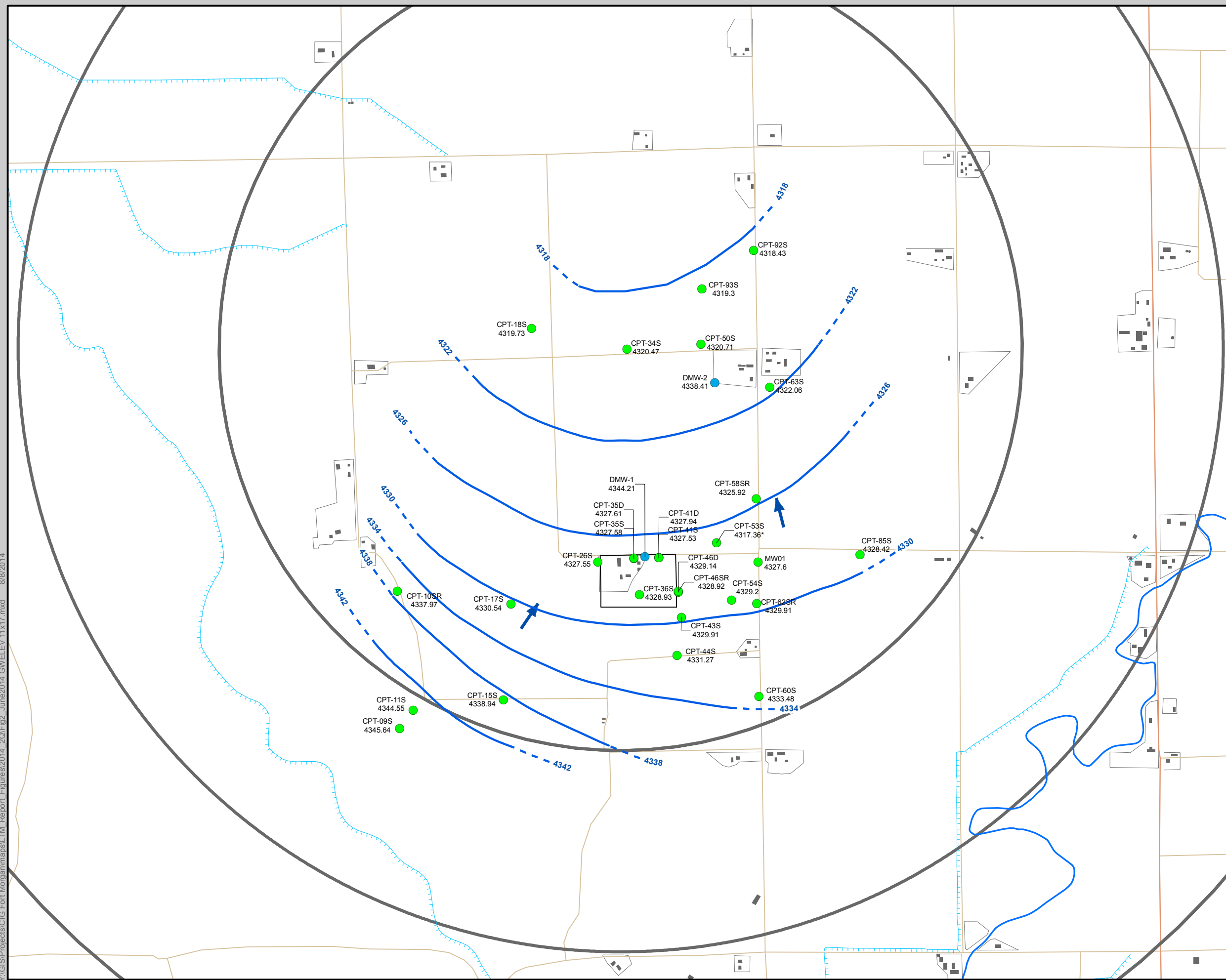
Less than (<) symbol indicates the concentration listed is below the reporting limit for the specific sample, analytical method, and analyte.
"J" flag indicates an estimated value.

H₂S = hydrogen sulfide
ORP = oxidation-reduction potential
NA = Not Applicable

Value	> 2.0 mg/L (COGCC Dissolved Methane Action Level)
Value	> 0.0067 mg/L and <= 2.0 mg/L
Value	<= 0.0067 mg/L (Background dissolved methane concentration determined during Phase I Investigation)

ppm = parts per million
LEL = lower explosive limit
uS/cm = microSiemens per centimeter
mg/L = milligrams per liter
mV = millivolt

Y:\GIS\Projects\CIG Fort Morgan\maps\TM_Report_Figures\2014_2Q\Fig2_June2014_GWELEV 11x17.mxd 8/8/2014



Legend

- Monitor Well with Groundwater Elevation Alluvial Aquifer
- Monitor Well with Groundwater Elevation Pierre Shale (for comparison only, not used for piezometric surface)
- Potentiometric Surface Contour (dashed where inferred)
- ➔ Groundwater Flow Direction
- Hydrologic Features (National Hydrography Dataset)
 - Canal or Ditch
 - Stream or River
- 1 and 1.5 mile radii from Gas Storage Well #26



0 1,000 2,000 Feet

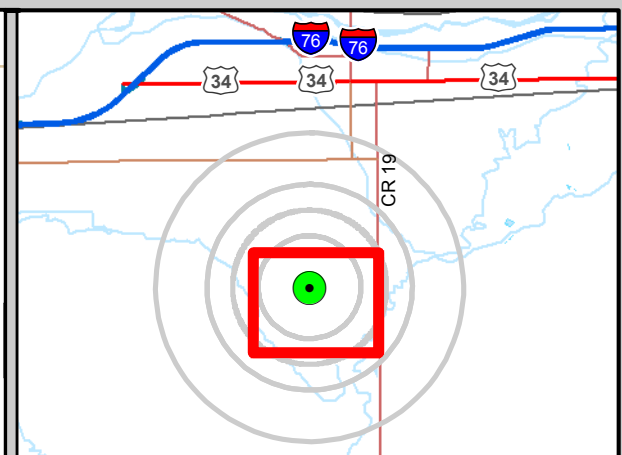
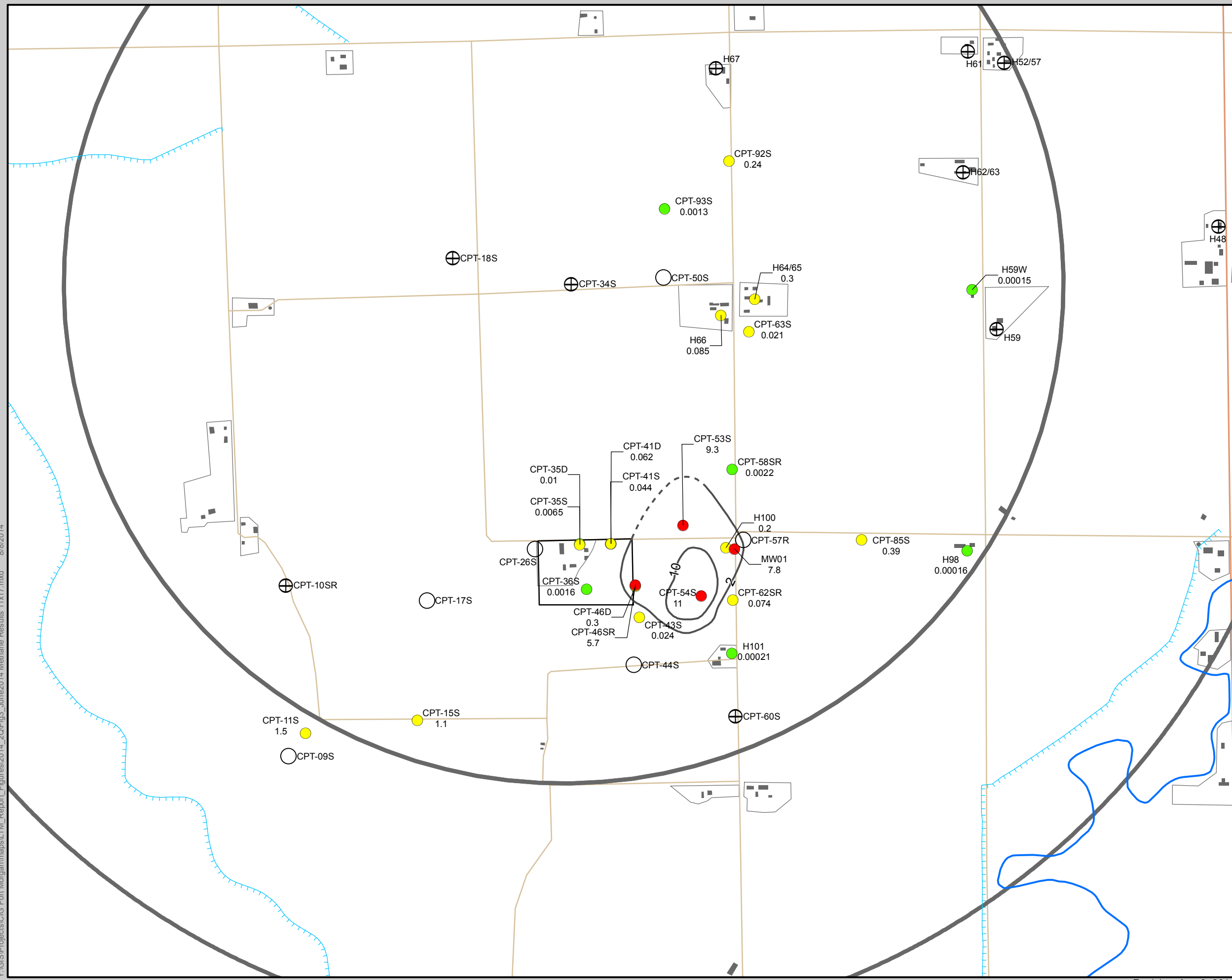
Note:
The contour interval is 4 feet.
* CPT-53S was not used for contouring

Figure 2
Shallow Groundwater
Potentiometric Surface
June 2014

CIG Fort Morgan
Gas Storage Field

URS

Y:\GIS\Projects\CIG Fort Morgan\maps\LTM_Report_Figures\2014_20\Fig3_June2014_Methane Results 11x17.mxd 8/8/2014



Legend

Dissolved Methane in Groundwater

- Green circle: ≤ 0.0067 mg/L (Background UTL)
- Yellow circle: > 0.0067 mg/L and ≤ 2.0 mg/L
- Red circle: > 2.0 mg/L

Methane Isoconcentration Contour, June 2014 (mg/L), dashed where inferred

Shallow Groundwater Sample Location or Residential Well Completed in Alluvial Aquifer - Not Sampled

Historical Sampling Location

Hydrologic Features (National Hydrography Dataset)

- Canal or Ditch
- Stream or River

1 and 1.5 mile radii from Gas Storage Well #26

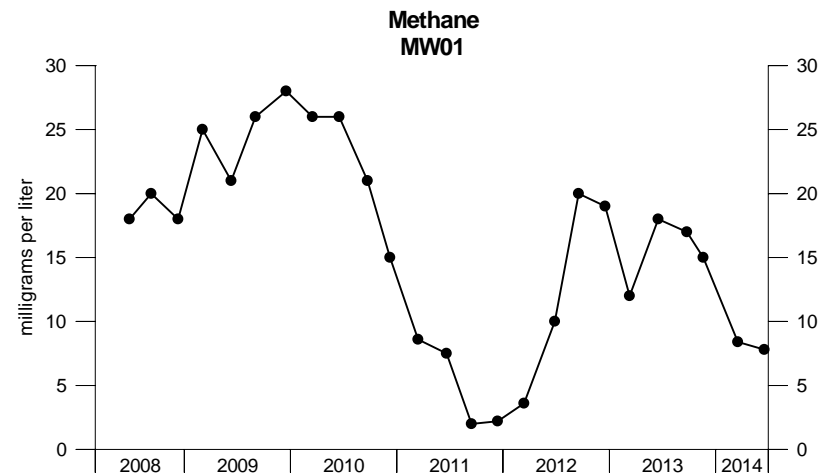
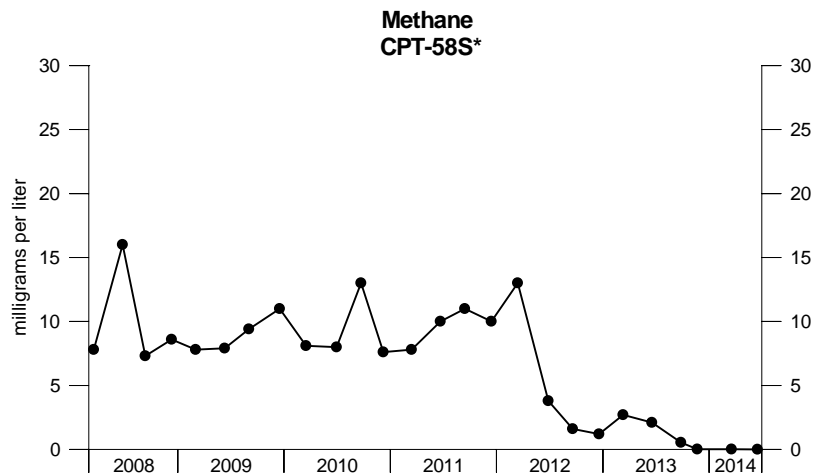
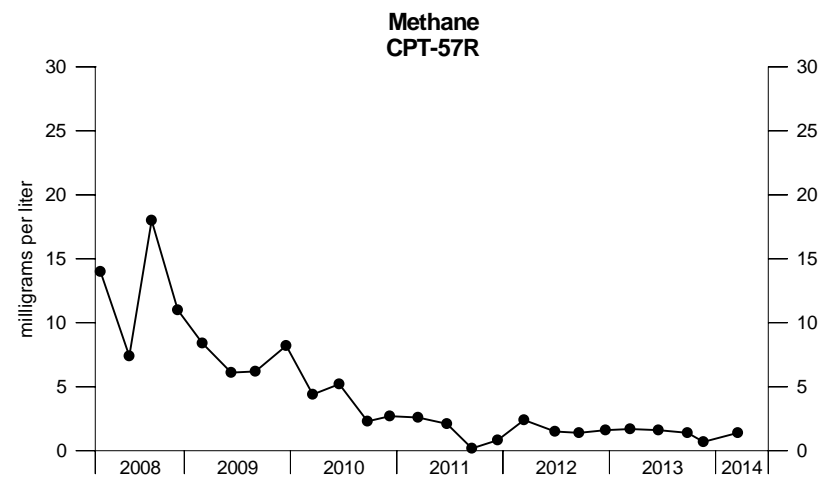
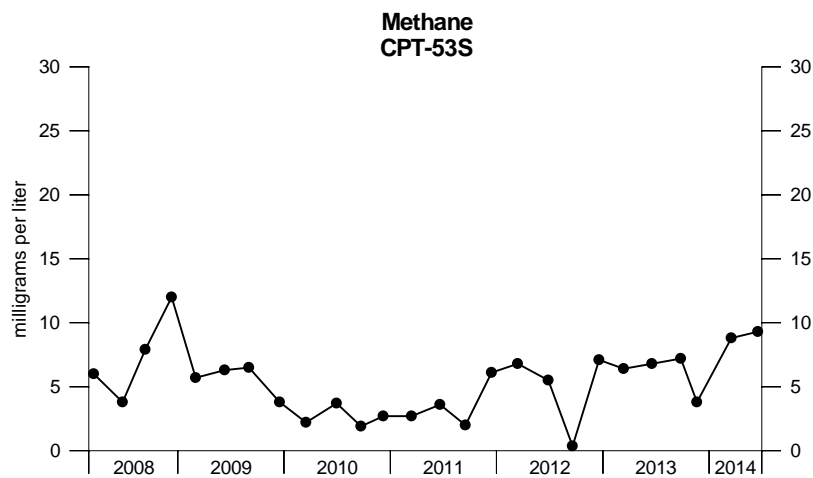
0 1,000 2,000 Feet

Note:
At nested well locations, the higher of the two concentrations was used for contouring.

Figure 3
Dissolved Methane in
Shallow Groundwater
June 2014

CIG Fort Morgan
Gas Storage Field





EXPLANATION

- - Measured Value
- - Undetected (Displayed at RL)
- * - Includes CPT-58S and CPT-58SR

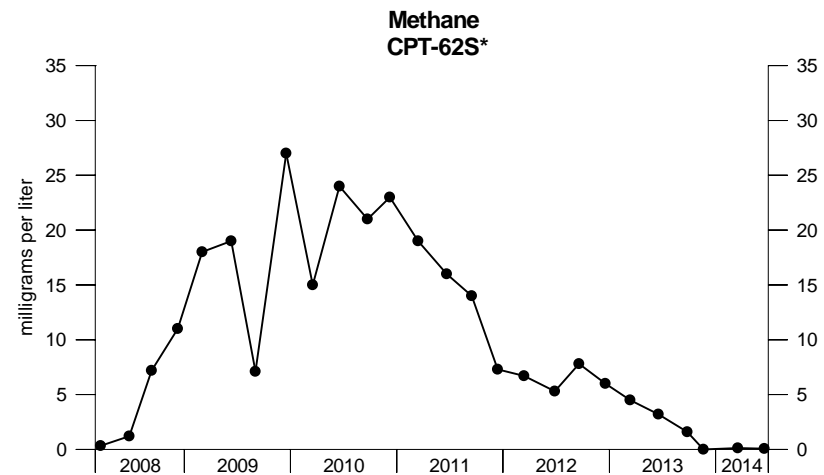
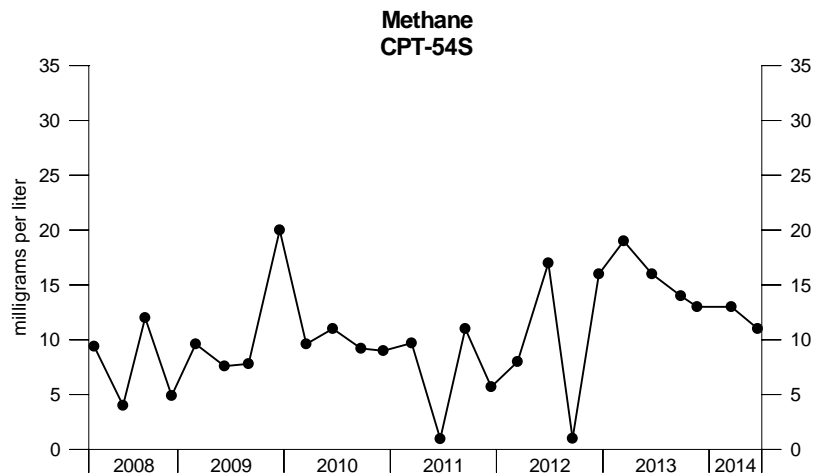
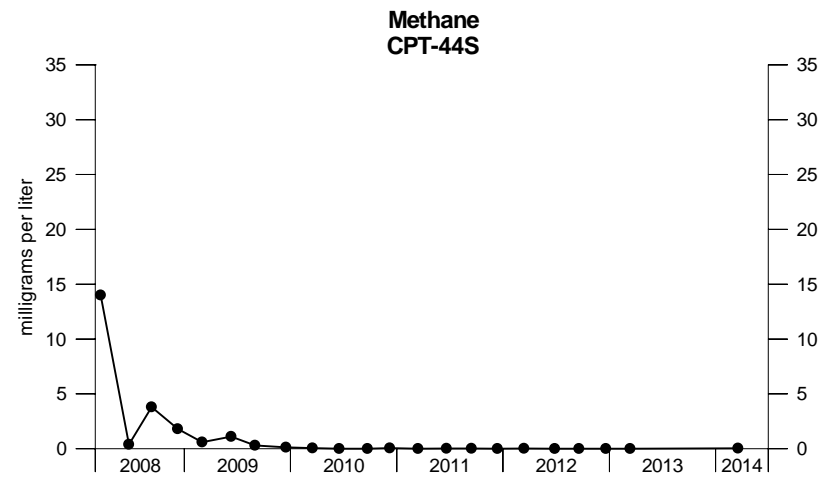
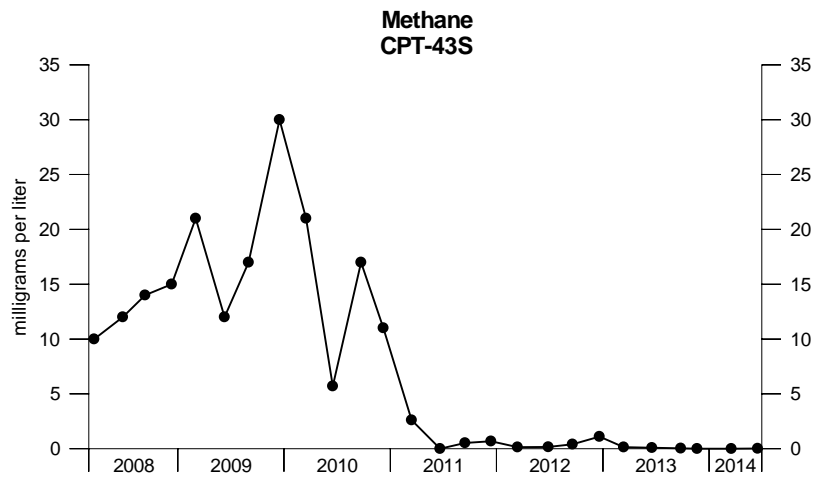
URS

Project Name: CIG Fort Morgan LTM

Job No: 22243892

Date: August 2014

**Figure 4 - Dissolve Methane
Time-Series Graphs
Main Plume - North
CIG Fort Morgan LTM
Fort Morgan, Colorado**



EXPLANATION

- - Measured Value
- - Undetected (Displayed at RL)
- * - Includes CPT-62S and CPT-62SR

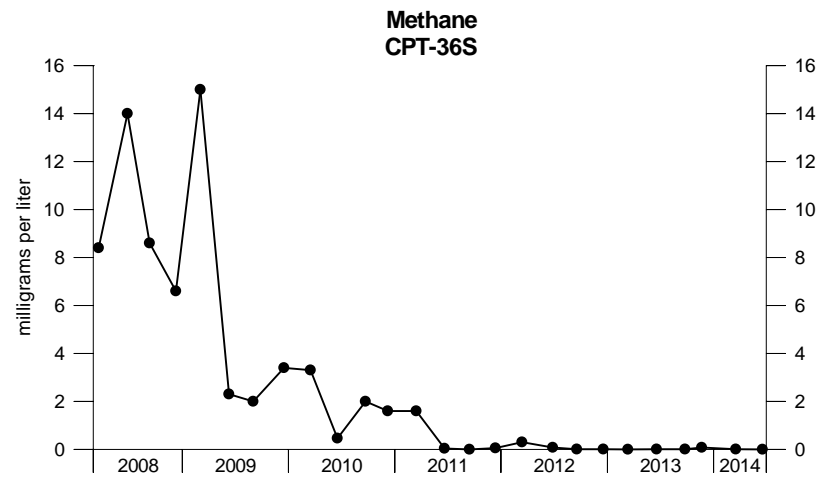
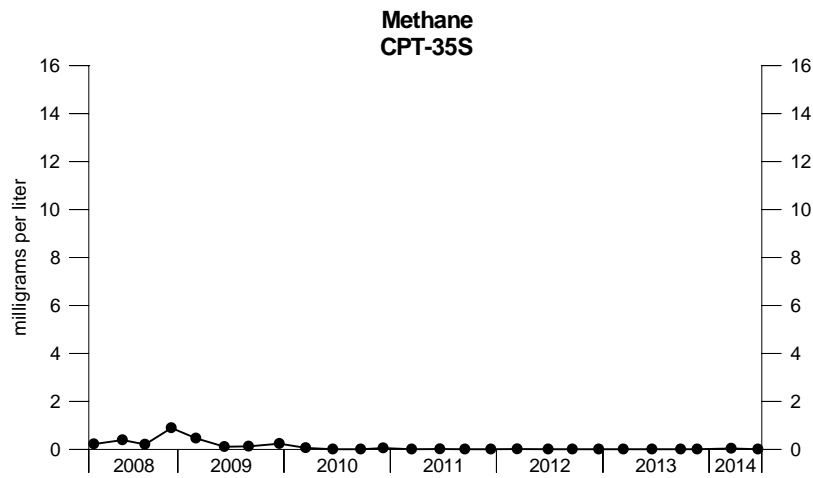
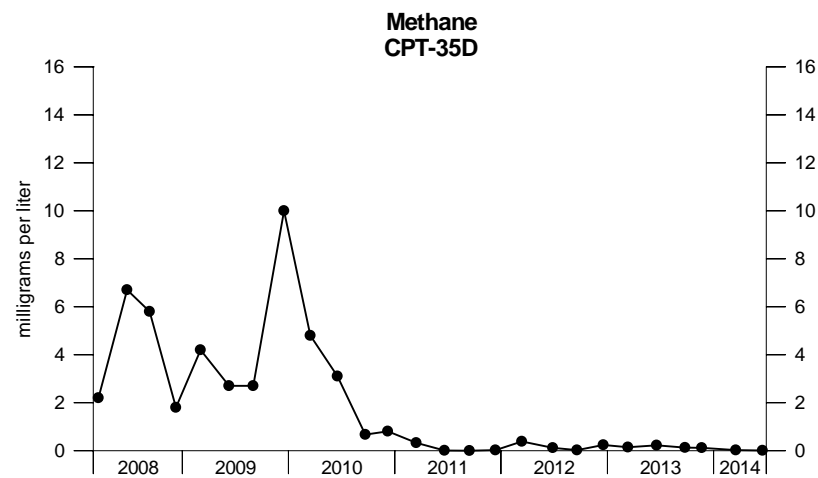
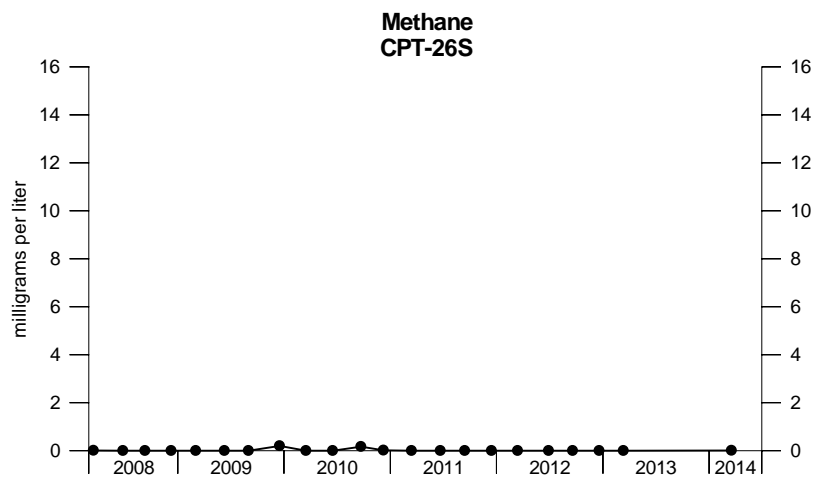
URS

Project Name: CIG Fort Morgan LTM

Job No: 22243892

Date: August 2014

**Figure 4 - Dissolve Methane
Time-Series Graphs
Main Plume - South
CIG Fort Morgan LTM
Fort Morgan, Colorado**



EXPLANATION

- - Measured Value
- - Undetected (Displayed at RL)

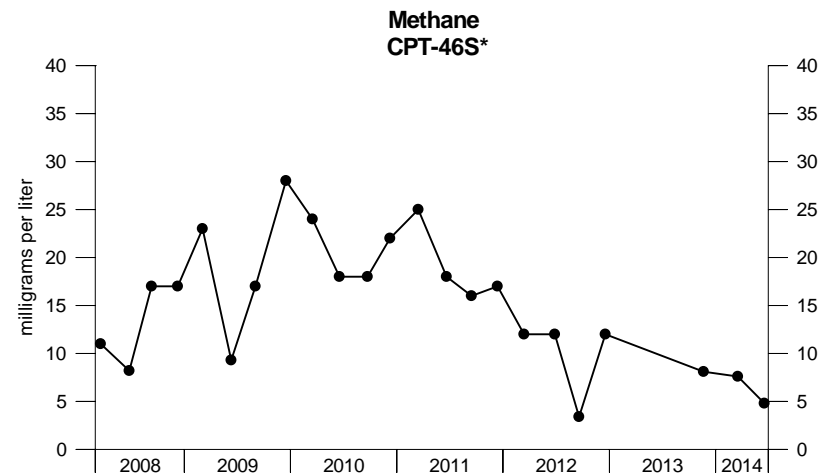
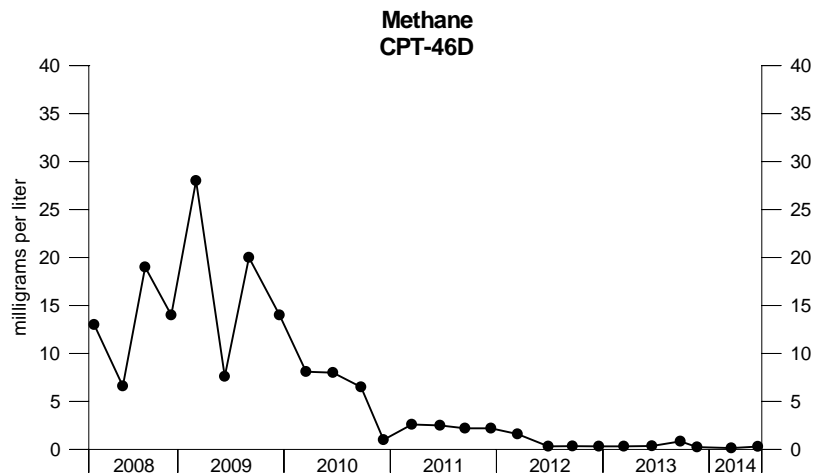
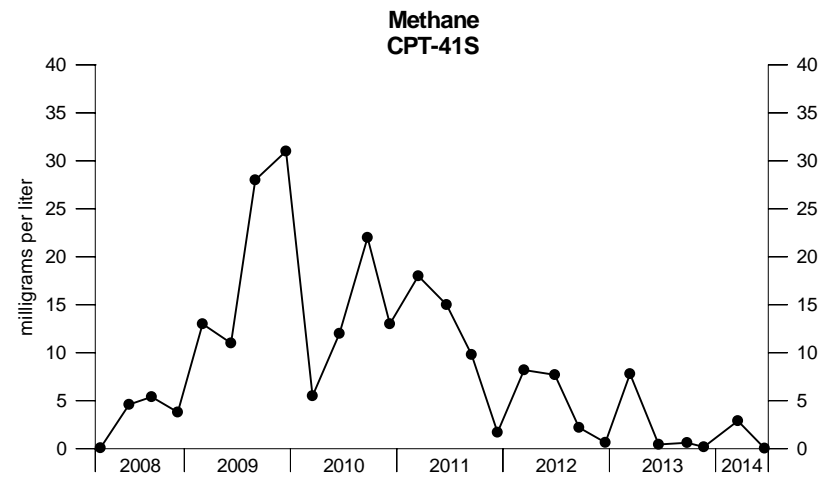
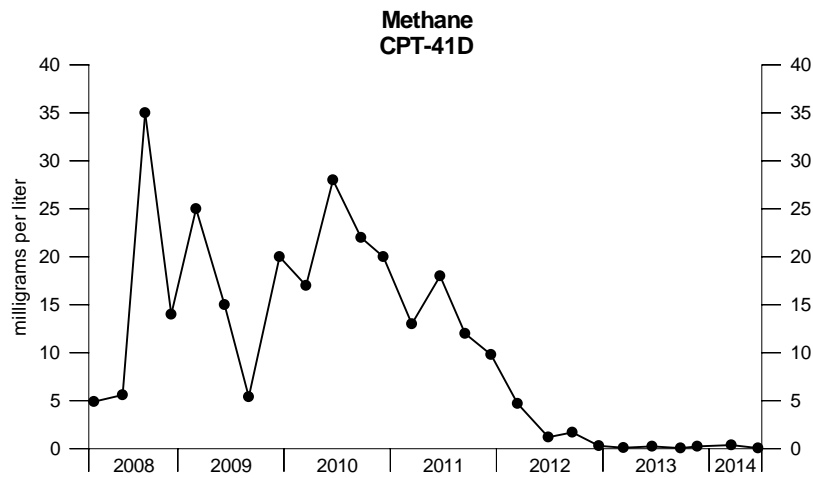
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Project Name: CIG Fort Morgan LTM

Job No: 22243892

Date: August 2014

**Figure 4 - Dissolve Methane
Time-Series Graphs
Compressor Station Area
CIG Fort Morgan LTM
Fort Morgan, Colorado**



EXPLANATION

- - Measured Value
- - Undetected (Displayed at RL)
- * - Includes CPT-46S and CPT46SR

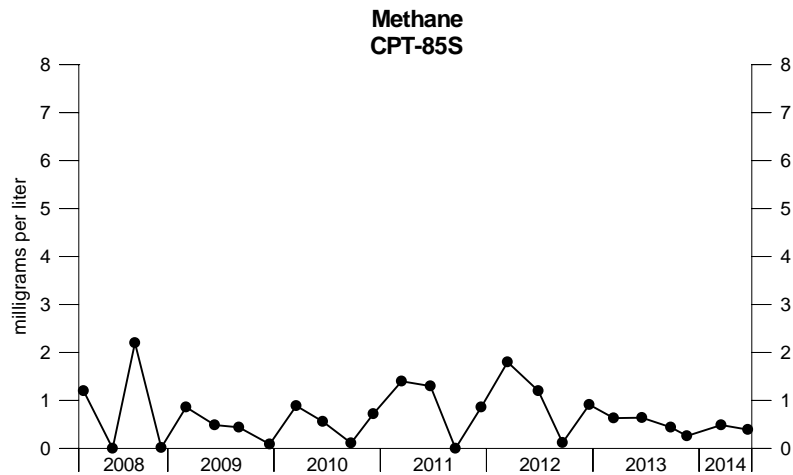
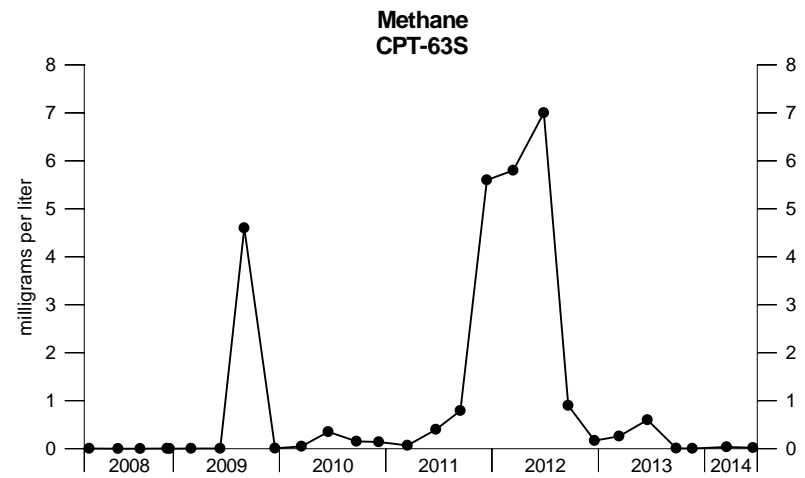
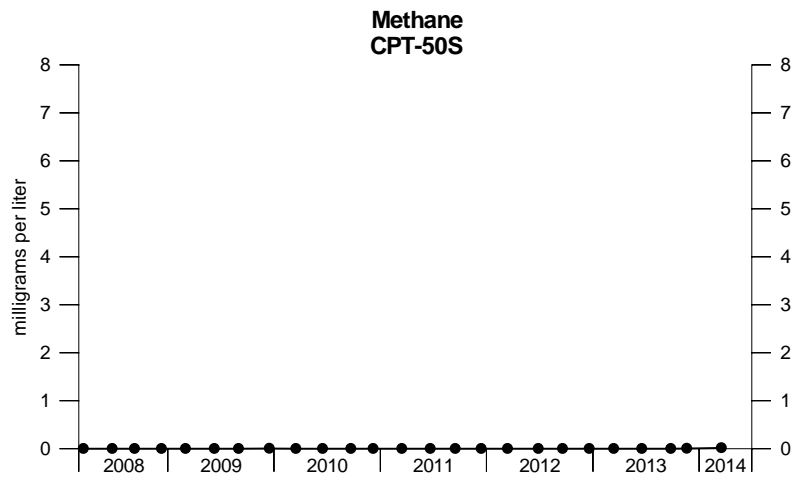
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Project Name: CIG Fort Morgan LTM

Job No: 22243892

Date: August 2014

**Figure 4 - Dissolve Methane
Time-Series Graphs
Compressor Station Area
CIG Fort Morgan LTM
Fort Morgan, Colorado**



EXPLANATION

- - Measured Value
- - Undetected (Displayed at RL)

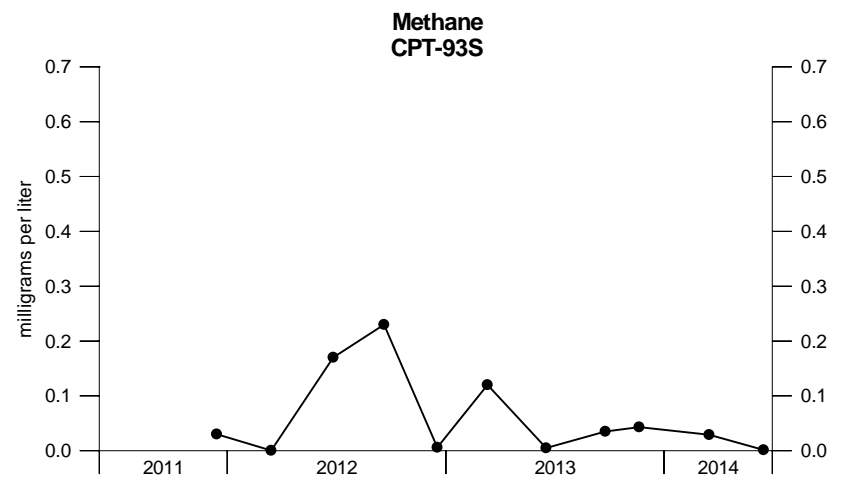
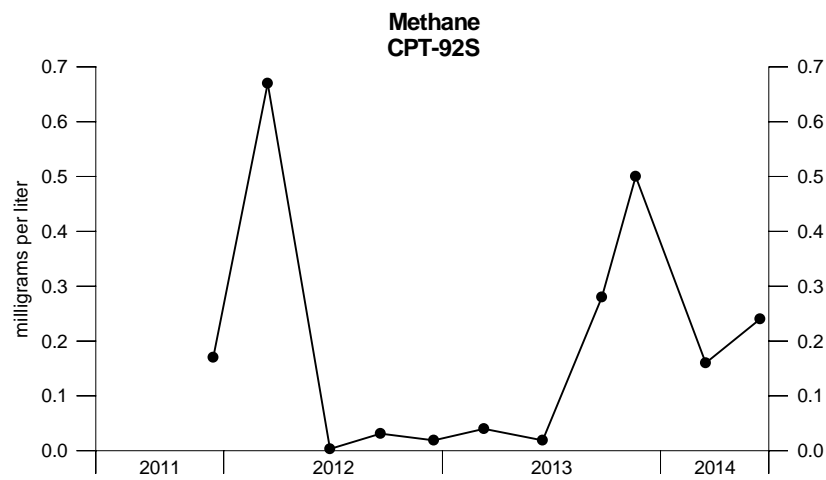
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Project Name: CIG Fort Morgan LTM

Job No: 22243892

Date: August 2014

**Figure 4 - Dissolve Methane
Time-Series Graphs
North and East of Main Plume
CIG Fort Morgan LTM
Fort Morgan, Colorado**



EXPLANATION

- - Measured Value
- - Undetected (Displayed at RL)

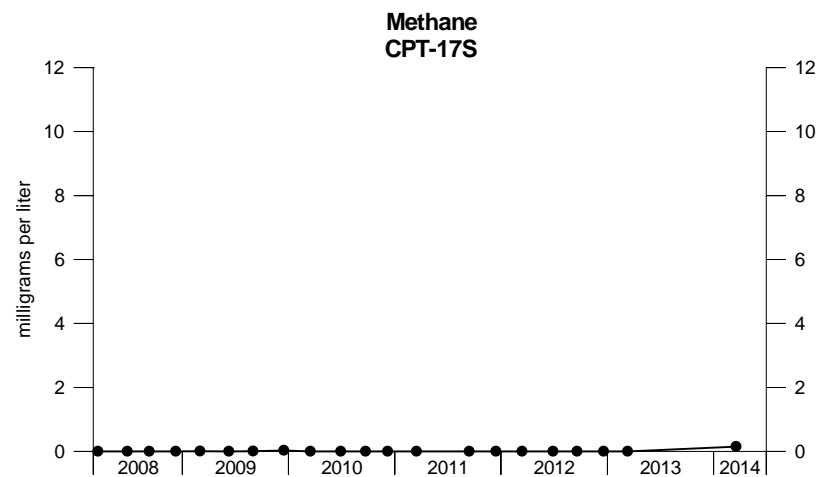
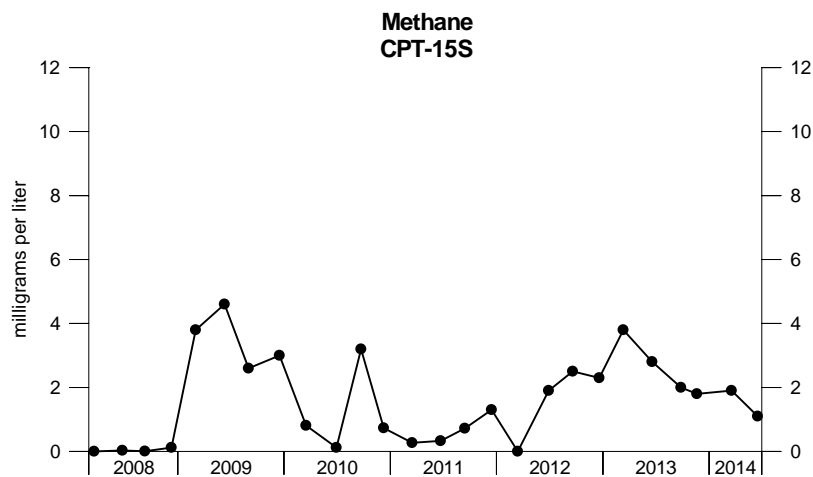
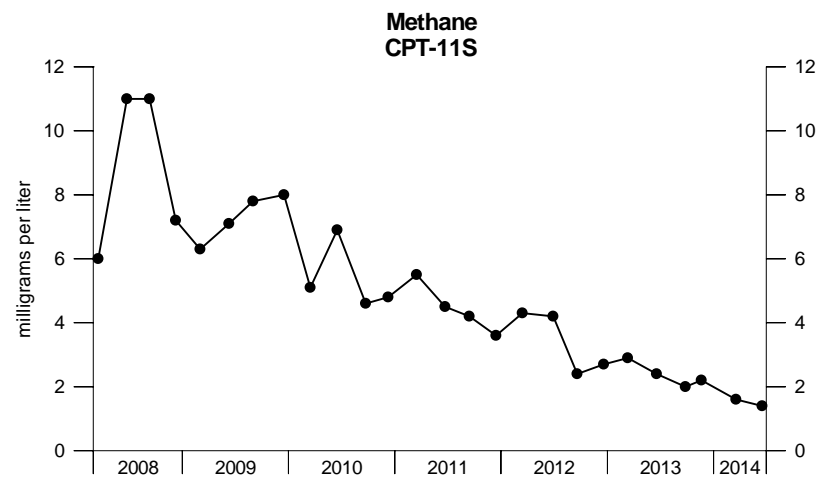
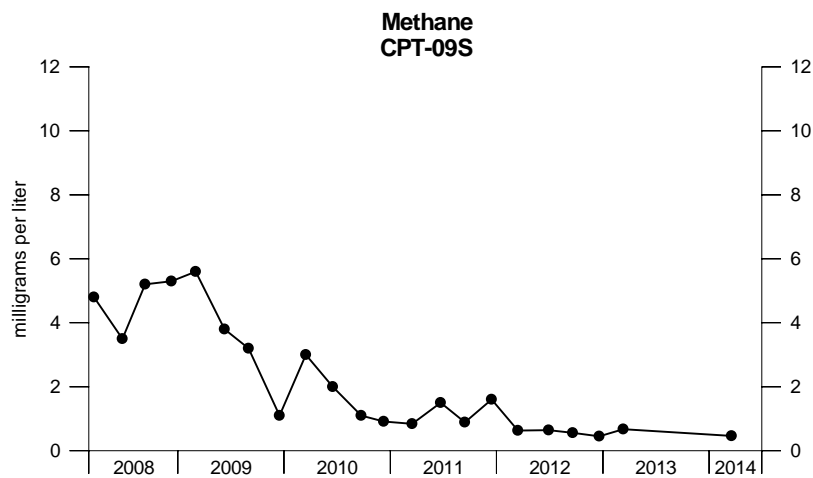
URS

Project Name: CIG Fort Morgan LTM

Job No: 22243892

Date: August 2014

**Figure 4 - Dissolve Methane
Time-Series Graphs
North of Main Plume
CIG Fort Morgan LTM
Fort Morgan, Colorado**



EXPLANATION

- - Measured Value
- - Undetected (Displayed at RL)

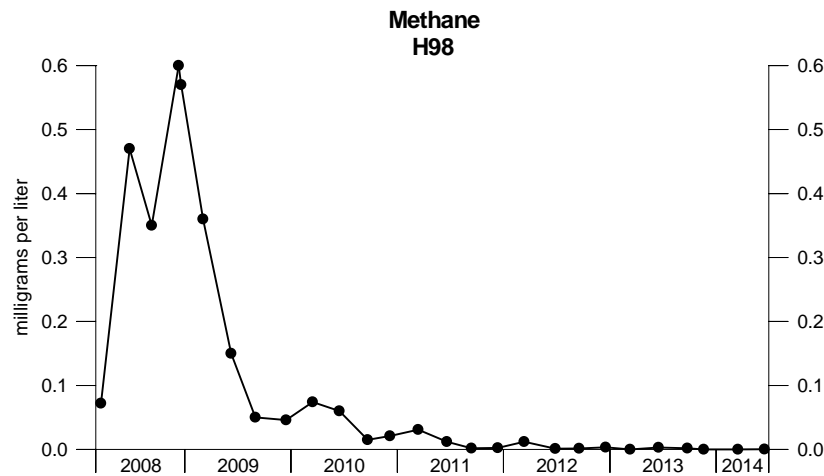
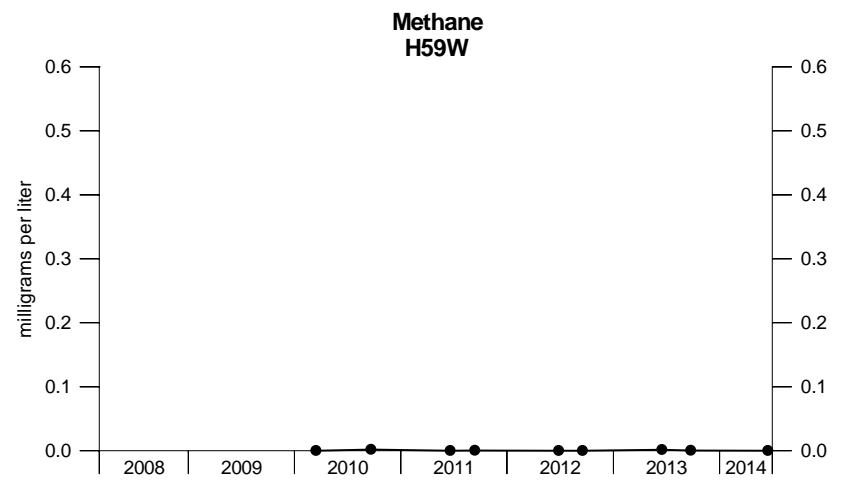
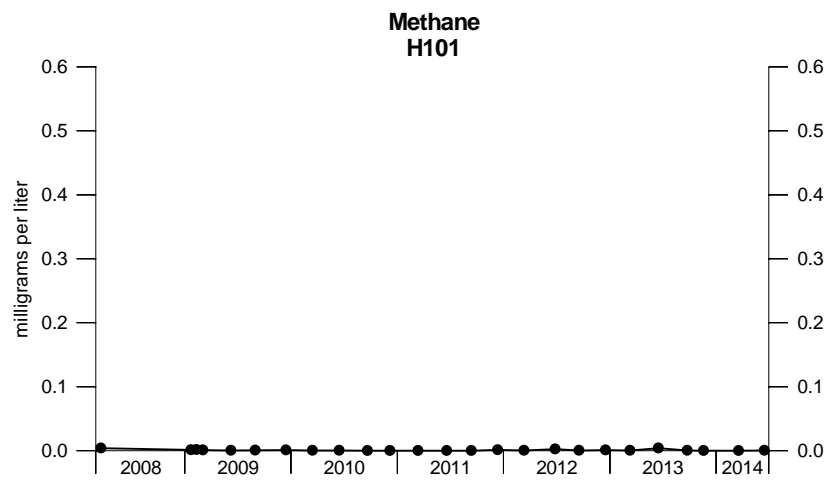
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Project Name: CIG Fort Morgan LTM

Job No: 22243892

Date: August 2014

**Figure 4 - Dissolve Methane
Time-Series Graphs
South West Plume
CIG Fort Morgan LTM
Fort Morgan, Colorado**



EXPLANATION

- - Measured Value
- - Undetected (Displayed at RL)

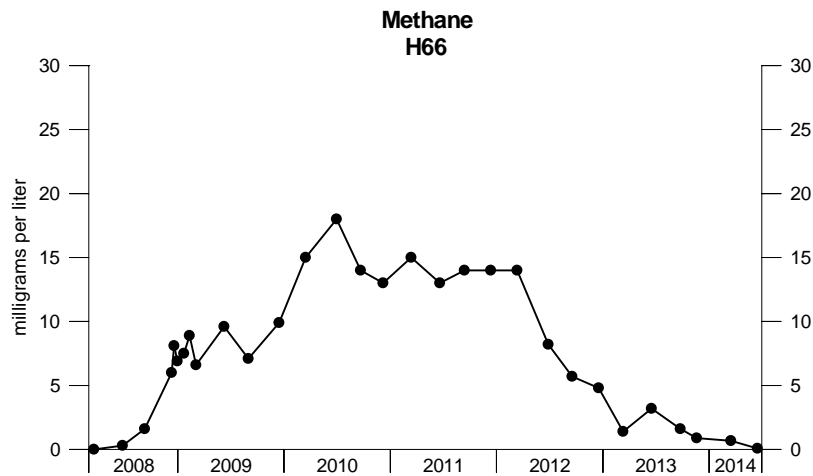
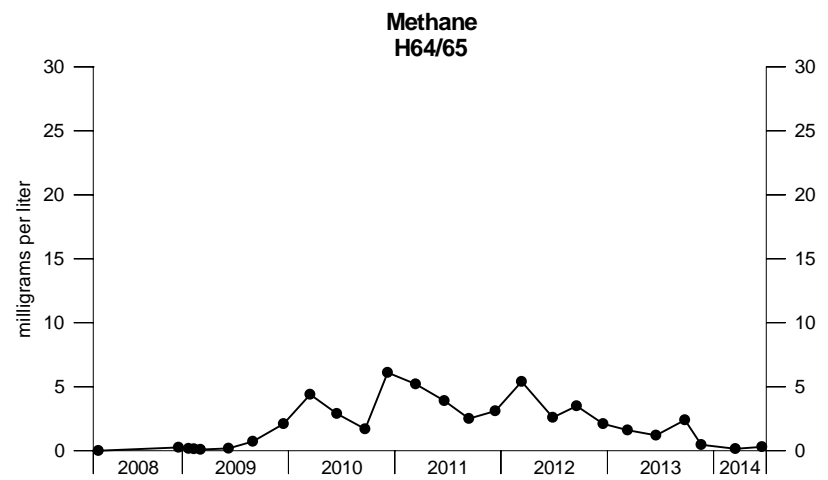
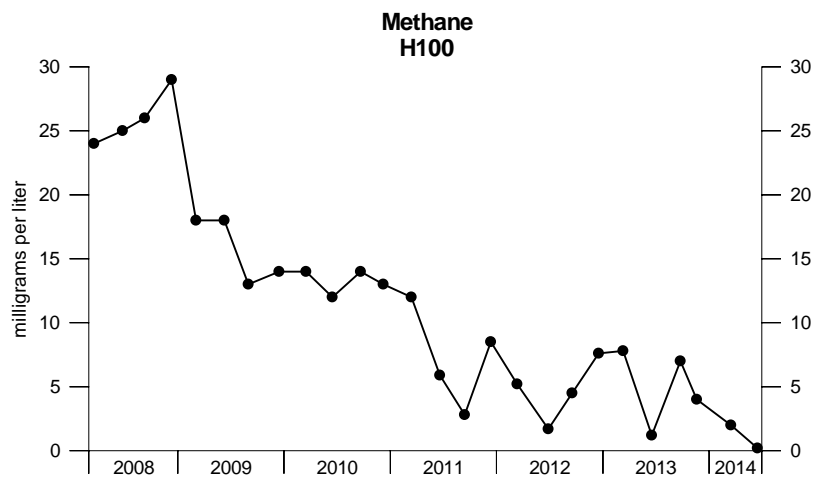
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Project Name: CIG Fort Morgan LTM

Job No: 22243892

Date: August 2014

**Figure 4 - Dissolve Methane
Time-Series Graphs
Residential Wells
CIG Fort Morgan LTM
Fort Morgan, Colorado**



EXPLANATION

- - Measured Value
- - Undetected (Displayed at RL)

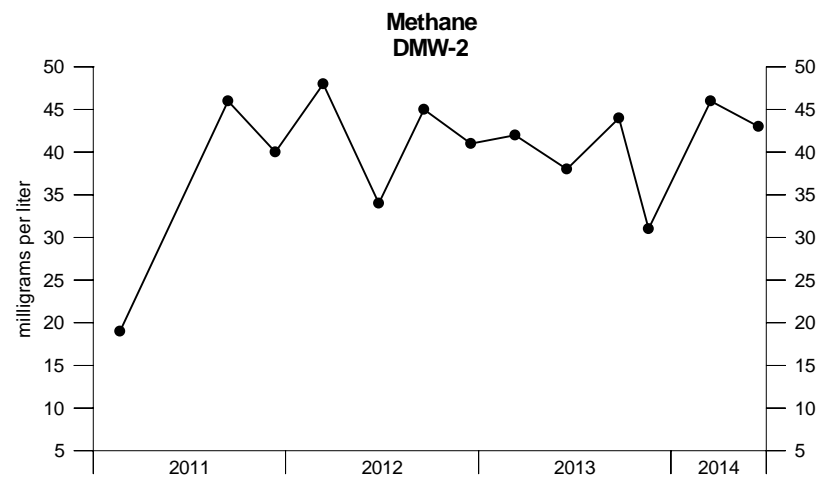
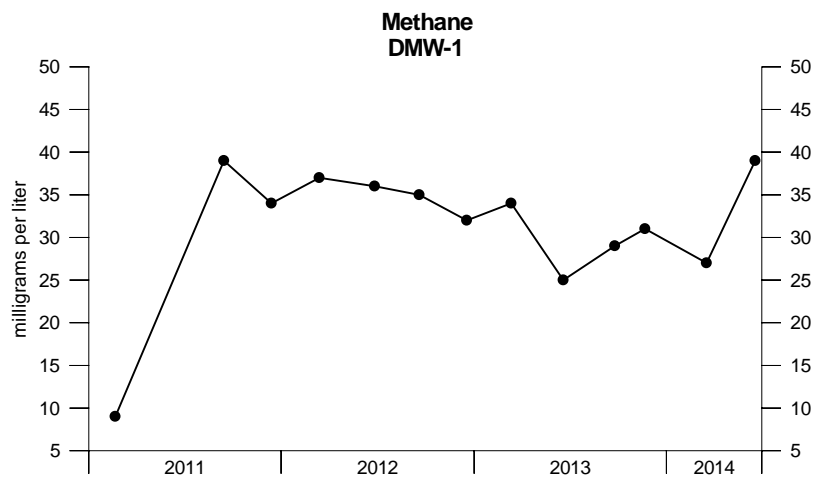
URS

Project Name: CIG Fort Morgan LTM

Job No: 22243892

Date: August 2014

**Figure 4 - Dissolve Methane
Time-Series Graphs
Residential Well
CIG Fort Morgan LTM
Fort Morgan, Colorado**



EXPLANATION

- - Measured Value
- - Undetected (Displayed at RL)

URS

Project Name: CIG Fort Morgan LTM

Job No: 22243892

Date: August 2014

**Figure 4 - Dissolve Methane
Time-Series Graphs
Deep Wells in Pierre Shale
CIG Fort Morgan LTM
Fort Morgan, Colorado**