Final Report for Oil and Gas Research Council Grant

GO13-A:

Identification of a Shallow Gas Source System

in Southeastern Steele County, North Dakota.

Submitted by:

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Project Summary

The purpose of this Research Project G013-A, was twofold. Proposed activities included expanding upon gas detection reconnaissance field work previously completed by the NDGS in Southeastern Steele County, and to collect a gas and water sample for analysis from a shallow NDSWC (North Dakota State Water Commission) observation well.

Field activities and data collection were conducted in September of 2007. Unfortunately, data collected during this phase of the project returned results that were consistently lower than expected. Lower than anticipated FID responses were measured in the focus well, as well as other, older observation wells in the area. Because of the lower results obtained during the 2007 field activities, wells were capped, and shut-in, to be resampled in the spring of 2008.

Field activities in May of 2008 again resulted in FID responses lower than those recorded in 2006. It was concluded that because of low gas background any attempts to collect a gas sample and incubate methanogens from water samples would most likely not be successful. Based on the unfavorable results of two seasons of data collection, it was decided to discontinue the project.

Total project expenditures were $12,033.47, with a Oil and Gas Research contribution of $5,000.00.

Project Activity Discussion

The purpose of Oil and Gas Research Council Grant GO13-A: Identification of a Shallow Gas Source System in Southeastern Steele County, North Dakota was twofold: to expanded upon gas detection reconnaissance field work previously completed by the NDGS in Southeastern Steele County, and to collect a gas and water sample for analysis from a shallow NDWC (North Dakota Water Commission) observation well.

The focus of the project is an NDWC observation well located in S4 T145N R56W, that when tested in September, 2006, had a methane gas response of 89.2 ppm C1, just above the groundwater-atmospheric interface (NDGS GI 30, 2006). Importantly, the NDWC observation well was located near a (Tables 1 & 2) privately owned rural water well with a historical show of gas.

In September, 2007, 21 wells were visited (Tables 1 & 2). These wells included the focus well, a privately owned well, 13 NDWC observation wells nearby, and 6 NDWC observation wells in Stutsman County. The privately owned well had anecdotal evidence of the presence of methane.

Unfortunately, data collected during this phase of the project was disappointing. Lower than anticipated FID response was measured in the focus well, as well as other, older observation wells in the area (Table 1: Comparison of 2006, 2007, & 2008 water well and FID data). It was also noted that water levels between field screening events have shown a net increase between 2006 and 2007. The net water level increase may have been due to recent precipitation that potentially resulted in lowering the presence of methanogens due to a temporary oxygenation of the system. In addition, it was discovered that in recently completed NDSWC wells, the joints in the PVC pipe string were cemented with the petroleum base cement, contaminating the system for at least the season.

The poorer than expected results in the focus well resulted in the following decisions. It was decided to cap the wellhead of the focus well for 12 hours, with a plastic membrane, and test the FID response well again in the morning. The FID response 12 hours later was measured at 3.2 ppm. This response is interpreted to show that some methanogens were present, and the system was active. It was also decided that it would be imprudent to collect water samples for the incubation at this time. It was felt that water samples should be collected at a time when more gas was in the system to improve the probability of successfully incubating methanogens.

Based on the results of the 12 hour shut-in test of the focus well, and because of the lower results obtained during the 2006 and 2007 measurements, NDWC wells were capped, and shut-in for the winter in order to determine if a significant concentration increase would occur. It was decided to measure the water levels and FID response of the shut-in wells in the spring of 2008.

Field activities in May of 2008 again resulted in FID responses lower than those recorded in 2006. It was concluded that because of low gas background any attempts to collect a gas sample and incubate methanogens from water samples would not be successful.

Based on results of two seasons of data collection it was decided to discontinue the project under the current scope of work. Goals of the research project were not attainable based on recorded field conditions.

Budget

Total project expenditures were $12,033.47, with a Oil and Gas Research contribution of $5,000.00 (Appendix 1).

Conclusions

The variations of measurable methane in shallow groundwater observed during the project may indicate a highly dynamic system associated with shallow methane generation. The dynamic nature of the shallow methane occurrences found in the Dakota's, is demonstrated by multiple measurements in project scale work. Concentrations may be interpreted to show annual and monthly variation, and may respond to a number of factors including temperature, barametric pressure, and precipitation. These variations may in part represent constraints on the field measurement techniques. But, they probably also reflect the dynamic, open or unconfined nature of the late-generation biogenic gas systems that are believed to be forming methane in the shallow and ultra-shallow subsurface environments. Perhaps variations as those noted in the Steele County project are amplified because of relatively low total organic content (TOC) in the host system. Unfortunately only very sparse TOC data from Cretaceous systems has been collected in the State.

It is strongly recommended by the Investigators that the North Dakota Oil and Gas Research Council continue to support research proposals concerned with investigating Cretaceous shallow biogenic gas systems. In the current exploration environment, basic research into these gas systems needs to take place to stimulate Industry to explore for shallow biogenic gas in the State.

Table 1
Shallow Gas FID Field Screening Summary - Steele County

Well Location	2006 FID Response (ppm)	2007 FID Response (ppm)	2008 FID Response (ppm)	Screened Interval (ft)	Total Well Depth (ft)
14505413DDD3	146.3	1.9, 3.2*	0.0	75-80	100
14505604DDD	89.2	5.4	12.6	50-60	60
14505422AAA2	2.0	0.0	0.0	74-79	106
14505501DDD2	0.0	0.0	0.0	36-41	50
14505408BBB	0.0	0.0	0.0	55-60	160
14505417DDD	0.0	0.0	0.0	93-98	280
14505409CCC2	0.0	0.0	0.0	45-50	58
14505415CCC2	0.0	0.0	0.0	78-83	100
14505413AAA2	0.0	0.0	0.0	27-32	40
14505410DDD2	0.0	NV	NV	15-20	23
14605709BAA	NV	NF	NF	0-80	80
14505513AAA2	NV	NV	NV	46-51	58
14505405BBB2	NV	NV	NV	35-40	60
14505432AAA	NV	NV	NV	68-73	147
14505427AAA	NV	NV	NV	87-91	200
14505426AAA3	NV	NV	NV	58-63	80
14505414DDD2	NV	0.0	NV	55-60	80
14505413BBB	NV	0.0	NV	75-80	280
14505436CCC	NV	0.0	NV	78-83	280
14505425CCC2	NV	0.0	NV	75-80	100
14605534DDD	NF	NV	NV	48-51	120
Burchill Private Well	NV	0.0	NV	30-50	50

* 3.2 ppm result recorded on 9/6/07 after 12 hour shut-in period.
NF = Well not found at prescribed location. Presumed abandoned or destroyed.
NV = Well location not visited during this investigation.
2008 response measured after approx. 6 month shut-in period

Table 2
Shallow Gas FID Field Screening Summary Stutsman County

Well Location	2006 FID Response (ppm)	2007 FID Response (ppm)	2008 FID Response (ppm)	Screened Interval (ft)	Total Well Depth (ft)
14006227CCC1	48.5	0.8	0.0	258-264	280
14006229CCC3	30.6	0.0	0.0	45-50	55
13706229CDD	182.0	2.0	0.0	157-163	260
13706230BBB1	0.0	0.6	0.0	217-220	247
13706230BBB2	65.1	155.4	0.4	134-140	NA
13806231CCC1	44.3	53.3	58.9	121-126	143

2008 response measured after approx. 6 month shut-in period

APPENDEX 1: BUDGET EXPENDITURES

	Proposed Budget	2007 Expenditures	2008 Expenditures
FID Equipment Rental		$300.00	$100.00
Miscellaneous Field Costs	$250.00		
Laboratory Cost			
culture 2 water samples*	$2,800.00		
Consultant Fees & Expenses			
Labor @ $125/hr (4 weeks)	$20,000.00	$6,500.00	$1,500.00
travel/lodging/perdiem	$1,575.00	$1,388.00	$199.47
NDGS Fees & Expenses			
Labor/travel/lodging/perdiem	$2,000.00	$1,297.00	$1,149.00
Final report editing and publishing as NDGS Geological Investigation	$1,600.00		
Subtotal	$30,225.00	$9,185.00	$2,848.47
TOTAL EXPEDITURES	**$12,033.47**		
TOTAL OGRC FUNDS RECEIVED	**$5,000.00**		