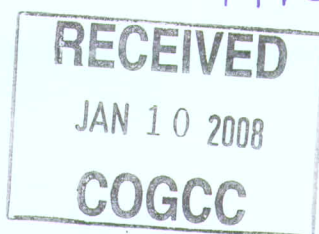




COMPLIANCE / ENGINEERING / REMEDIATION



01632317



#1976

LT Environmental Inc.

4600 West 60th Avenue

Arvada, Colorado 80003

T 303.433.9788 / F 303.433.1432

January 4, 2008

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

RE: Additional ERF Gas Seep Investigation Report  
Abandoned Production Wells - Orphan A, Orphan B, and Ellis #2 (API# 05-083-06597,  
API# 05-083-06598, and API#05-083-06035)  
Montezuma County, Colorado

Dear Mr. Lindblom:

LT Environmental, Inc. (LTE) has been retained by the Colorado Oil and Gas Conservation Commission (COGCC) to conduct additional gas seep investigation activities in the vicinity of the Orphan A, Orphan B, and Ellis #2 abandoned production wells in Montezuma County, Colorado (Figure 1), collectively referred to as the Ellis #2. LTE understands that this work is being conducted in response to methane gas seepage identified during the Environmental Response Fund (ERF) well investigation performed in April 2007. The following is a summary of the additional assessment activities conducted at the site.

## PURPOSE

The purposes of this investigation are to confirm the presence of methane seepage east of the Ellis #2, delineate the lateral extent of methane seepage at the ground surface, and assess the threat of methane seepage to impact nearby structures and water wells.

## BACKGROUND

The ERF program has funded the plugging and abandonment (P&A) of over 200 orphan oil and gas production wells in Colorado. Only limited documentation regarding the completion and/or the P&A of these wells is available. In 2005, methane seepage from the Bryce 1-X orphan well in Bondad, Colorado created increased awareness of the potential hazardous conditions associated with the integrity of the P&A of orphan wells.

In April 2007, LTE was retained by the COGCC to conduct gas seep surveys at 30 orphan wells in the southwest region of Colorado. Results of the initial ERF well investigations in April 2007 were submitted to the COGCC in a report dated June 2007. The initial investigation indicated the presence of methane seepage east of the Ellis #2. The well abandonment markers were not present during the initial ERF well investigation and as a result, LTE conducted the investigation in the vicinity of the GPS coordinates supplied by the COGCC.



## **RESULTS**

### **Landowner Identification**

LTE used information provided on the Montezuma County Assessor's website to determine the landowner of the nearest residence and water well to the orphan well. An access request letter with a return card was sent to the landowner. LTE was denied access to conduct an interior/exterior house and water well survey by the landowner nearest to the Ellis #2.

### **Soil Gas Survey**

LTE conducted a soil gas survey approximately 195 feet east of the Ellis #2 on November 12, 2007. LTE was denied access to the nearest house and water well, however, during the initial ERF survey, a soil gas survey was conducted on the property for the Ellis/Robb #5 abandoned production well (Figure 2). A soil gas probe was also advanced next to the property's water well. Methane was not detected on the property or near the water well at that time.

Prior to initiating the field work, LTE contacted the Utility Notification Center of Colorado (UNCC) to identify any buried facilities in the survey area. The soil gas probes were advanced to approximately 3 feet below ground surface (bgs) using a slide hammer to bore a 0.5-inch diameter hole into the surface soil. Polyethylene tubing (0.25-inch diameter), with the bottom 6 inches perforated, was inserted into each borehole to collect subsurface gas measurements. After subsurface concentration measurements were collected, the polyethylene tubing was removed from the ground and the borehole was backfilled with native soil. The four gases measured in each soil gas probed included oxygen, methane, carbon monoxide, and hydrogen sulfide.

Each soil gas probe location and pertinent site features were recorded using a Trimble GeoXT<sup>®</sup> GPS, which measures and records geographic position in accordance with COGCC Rule 215. At each soil gas probe, LTE recorded the geographic position by logging a minimum of 20 GPS positions. The GPS data were downloaded and differentially corrected using publicly available base station data to achieve sub-meter accuracy.

A total of 20 soil gas probes were within a 50-foot radius advanced east of the Ellis #2 (Photo 1). Three of the 20 soil gas probes advanced east of the Ellis #2 detected methane at concentrations of 2,000 parts per million (ppm), 70,000 ppm, and 100,000 ppm. The methane seepage was detected in soil gas probes located adjacent to a holding pond in a marshy area.

### **Gas Sampling**

LTE collected a subsurface gas sample in the area of the highest methane concentration to determine the origin of the gas (biogenic or thermogenic). The sample was collected using a hand pump to transfer gas from the subsurface soils exhibiting methane seeps into a mylar





sample bag. All gas samples were packaged per the Federal Department of Transportation (DOT) regulations with a completed chain-of-custody (COC) form and submitted to Isotech Laboratories, Inc. (Isotech) in Champaign, Illinois. Gas samples were submitted for the following parameters:

- **Fixed Gas Chromatography:** Hydrogen (H<sub>2</sub>), Argon (Ar), Nitrogen (N<sub>2</sub>), Oxygen (O<sub>2</sub>), Carbon Dioxide (CO<sub>2</sub>), and Hydrogen Sulfide (H<sub>2</sub>S);
- **Hydrocarbon Gas Chromatography:** Methane, Ethane, Propane, i-Butane, n-Butane, i-Pentane, and Hexane+; and
- **Stable Isotopic Analysis:** Carbon and Hydrogen isotopes of Methane, Carbon isotopes of CO<sub>2</sub>, and Carbon isotopes of Ethane and Propane.

Results of the laboratory analysis indicated that methane was detected in the Ellis #2 sample at a concentration of 0.0875 percent (%). Due to an insufficient concentration of methane detected by the laboratory, the isotopic analysis of the gas sample described above could not be conducted. Since the methane seepage is located in a marshy area adjacent to a holding pond, the origin of the methane appears to be biogenic, but cannot be confirmed at this time. Thermogenic gas is defined as gas derived from heat and pressure exerted on organic matter as opposed to biogenic gas which is derived from biological activity. The laboratory analytical report is included in Attachment 1.

## CONCLUSIONS

Methane seepage has been confirmed east of the Ellis #2. Methane was detected adjacent to a holding pond, which would appear to indicate the methane seepage is generated biogenically.

Based on the initial ERF investigation in April 2007, methane was not detected at the nearest water well or in the vicinity of the nearest residence.

LTE appreciates the opportunity to provide environmental services to the COGCC. If you have any questions, please contact me at (303) 433-9788.

Sincerely,

LT ENVIRONMENTAL, INC.

Daniel R. Moir, G.I.T.  
Staff Geologist

Kyle G. Siesser  
Project Geologist

PHOTO



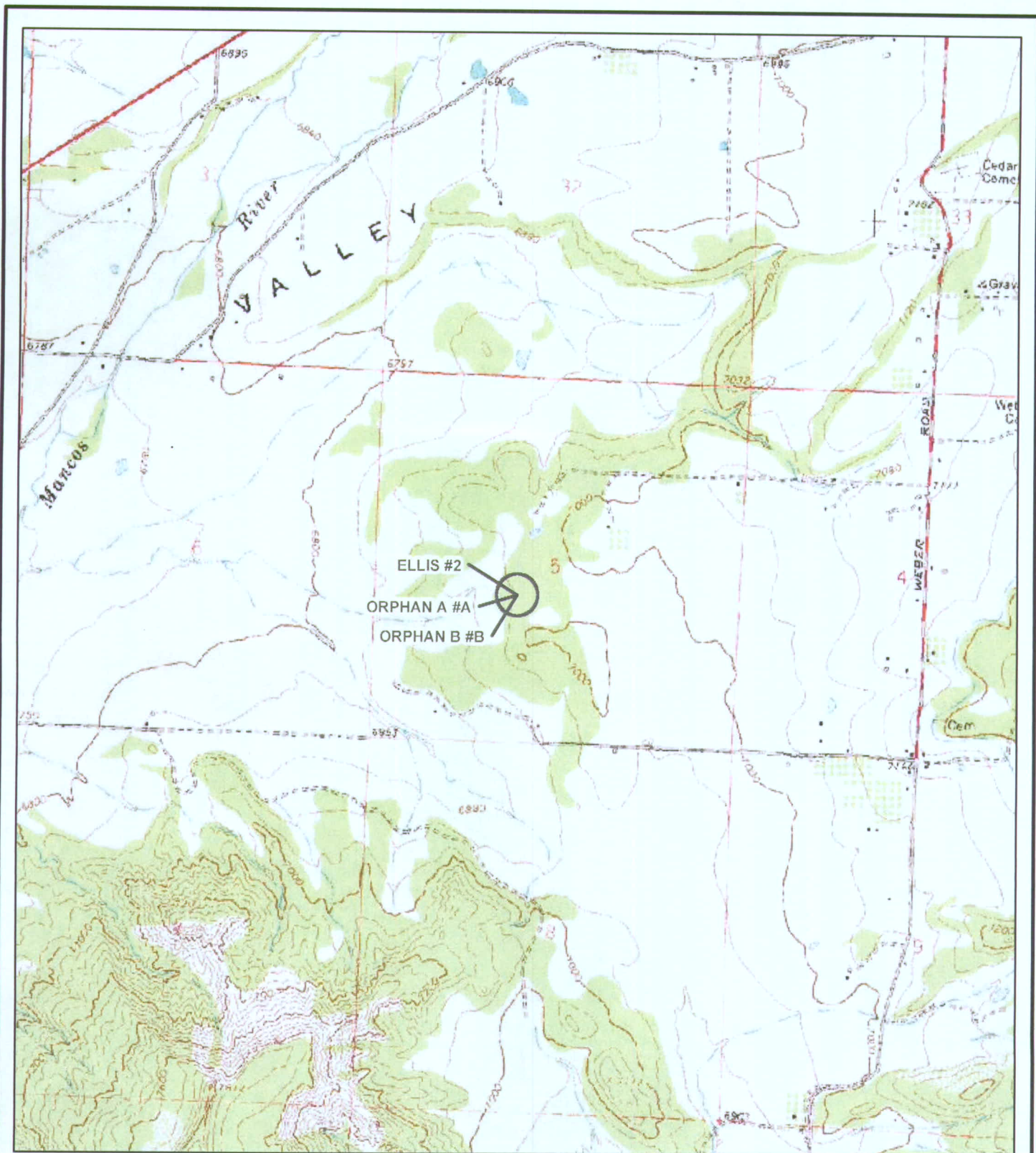


Photo 1: Methane seep area in center of photograph, east of holding pond (right), view south.

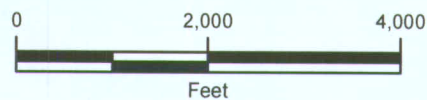
## FIGURES







Map Source:  
USDA, Natural Resources Conservation Service  
National Cartography & Geospatial Center, 1999-Present



#### LEGEND

○ SITE LOCATION

FIGURE 1  
SITE LOCATION MAP  
ELLIS #2/ORPHAN A #A/ORPHAN B #B  
API #05-083-06035/05-083-06597/05-083-06598  
MONTEZUMA COUNTY, COLORADO  
COLORADO OIL AND GAS CONSERVATION COMMISSION







Map Source: USDA, National Agriculture Imagery Program Mosaic, 2006

## LEGEND

### SUBSURFACE METHANE MEASUREMENTS

- |                   |                              |
|-------------------|------------------------------|
| ○ 0 ppm           | ✚ GAS SAMPLE LOCATION        |
| ● 1 ppm - 500 ppm | ⊕ PLUGGED AND ABANDONED WELL |
| ● 501 ppm - 5%    | ⊖ DRY AND ABANDONED WELL     |
| ● 6% - 15%        |                              |
| ● 16% - 25%       |                              |
| ● 26% - 50%       |                              |
| ● 51% - 75%       |                              |
| ● 76% - 100%      |                              |

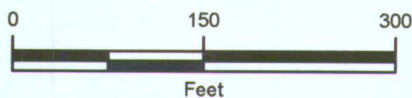


FIGURE 2  
SITE MAP

ELLIS #2/ORPHAN A #A/ORPHAN B #B/ORPHAN C #C  
API #05-083-06035/05-083-06597/05-083-06598/05-083-06599  
MONTEZUMA COUNTY, COLORADO  
COLORADO OIL AND GAS CONSERVATION COMMISSION



GAS SAMPLE COLLECTED ON 11/12/07  
SOIL GAS SURVEY PERFORMED ON 11/12/07



**ATTACHMENT 1**  
**ANALYTICAL LABORATORY REPORT**





# ISOTECH®

Web Page [www.isotechlabs.com](http://www.isotechlabs.com) Email [mail@isotechlabs.com](mailto:mail@isotechlabs.com)

Isotech Laboratories, Inc. 1308 Parkland Court, Champaign IL 61821-1826 Telephone (217) 398-3490 Fax (217) 398-3493

Lab #: 127709 Job #: 9104  
Sample Name/Number: Ellis #2  
Company: LT Environmental  
Date Sampled: 11/12/2007  
Container: Cali-5-Bond Bag  
Field/Site Name: OGCC0705.02  
Location: SW Colorado  
Formation/Depth:  
Sampling Point:  
Date Received: 11/21/2007 Date Reported: 12/19/2007

Component	Chemical		Delta 13C per mil	Delta D per mil	Delta 15N per mil
	Chemical mol. %	Air Free vol. %			
Carbon Monoxide -----	nd	nd			
Hydrogen Sulfide -----	nd	nd			
Helium -----	nd	nd			
Hydrogen -----	nd	nd			
Argon -----	0.92	0.42			
Oxygen -----	20.36				
Nitrogen -----	78.50	91.87			
Carbon Dioxide -----	0.13	4.60			
Methane -----	0.088	3.11			
Ethane -----	nd	nd			
Ethylene -----	nd	nd			
Propane -----	nd	nd			
Iso-butane -----	nd	nd			
N-butane -----	nd	nd			
Iso-pentane -----	nd	nd			
N-pentane -----	nd	nd			
Hexanes + -----	nd	nd			

Total BTU/cu.ft. dry @ 60deg F & 14.7psia, calculated: 1

Specific gravity, calculated: 0.999

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 percent. Mol. % is approximately equal to vol. %