

**Notice:** This form and any information attached to it are "Public Records" as defined in NC General Statute 132-1. As such, these documents are available for inspection and examination by any person upon request (NC General Statute 132-6).

- Instructions:**
- Prepare one form for each individually monitored unit.
  - Please type or print legibly.
  - Attach a notification table with values that attain or exceed NC 2L groundwater standards or NC 2B surface water standards. The notification must include a preliminary analysis of the cause and significance of each value. (e.g. naturally occurring, off-site source, pre-existing condition, etc.).
  - Attach a notification table of any groundwater or surface water values that equal or exceed the reporting limits.
  - Attach a notification table of any methane gas values that attain or exceed explosive gas levels. This includes any structures on or nearby the facility (NCAC 13B .1629 (4)(a)(i)).
  - Send the original signed and sealed form, any tables, and Electronic Data Deliverable to: Compliance Unit, NCDENR-DWM, Solid Waste Section, 1646 Mail Service Center, Raleigh, NC 27699-1646.

**Solid Waste Monitoring Data Submittal Information**

Name of entity submitting data (laboratory, consultant, facility owner):  
 SHIELD ENGINEERING, INC.

Contact for questions about data formatting. Include data preparer's name, telephone number and E-mail address:  
 Name: J. David Wallace, P.E. Phone: (704)-971-4149  
 E-mail: dwallace@shieldengineering.com

| Facility name:             | Facility Address:   | Facility Permit # | NC Landfill Rule: (.0500 or .1600) | Actual sampling dates (e.g., October 20-24, 2006) |
|----------------------------|---|-------------------|------------------------------------|---|
| CITY OF ALBEMARLE LANDFILL | 40592-B STONY GAP ROAD<br>ALBEMARLE NORTH CAROLINA, 28001 | 84-01             | .1600                              | May 18, 2016                                      |

**Environmental Status: (Check all that apply)**

Initial/Background Monitoring 
  Detection Monitoring 
  Assessment Monitoring 
  Corrective Action

**Type of data submitted: (Check all that apply)**

Groundwater monitoring data from monitoring wells 
  Methane gas monitoring data  
 Groundwater monitoring data from private water supply wells 
  Corrective action data (specify) \_\_\_\_\_  
 Leachate monitoring data 
  Other(specify) \_\_\_\_\_  
 Surface water monitoring data

**Notification attached?**

No. No groundwater or surface water standards were exceeded.  
 Yes, a notification of values exceeding a groundwater or surface water standard is attached. It includes a list of groundwater and surface water monitoring points, dates, analytical values, NC 2L groundwater standard, NC 2B surface water standard or NC Solid Waste GWPS and preliminary analysis of the cause and significance of any concentration.  
 Yes, a notification of values exceeding an explosive methane gas limit is attached. It includes the methane monitoring points, dates, sample values and explosive methane gas limits.

**Certification**

To the best of my knowledge, the information reported and statements made on this data submittal and attachments are true and correct. Furthermore, I have attached complete notification of any sampling values meeting or exceeding groundwater standards or explosive gas levels, and a preliminary analysis of the cause and significance of concentrations exceeding groundwater standards. I am aware that there are significant penalties for making any false statement, representation, or certification including the possibility of a fine and imprisonment.

J. David Wallace, P.E. SENIOR ENGINEER (704)-971-4149

Facility Representative Name (Print) Title (Area Code) Telephone Number  
 Signature Date Affix NC Licensed/ Professional Geologist Seal

4301 TAGGART CREEK ROAD, CHARLOTTE, NC 28208  
 Facility Representative Address  
 F-0856  
 NC PE Firm License Number (if applicable effective May 1, 2009)



**REPORT OF GAS MONITORING  
SECOND QUARTER 2016  
CITY OF ALBEMARLE LANDFILL  
STANLY COUNTY, NORTH CAROLINA**

**Prepared for:**  
CITY OF ALBEMARLE  
Albemarle, North Carolina

**By:**  
Shield Engineering  
4301 Taggart Creek Road  
Charlotte, North Carolina

**Shield Project 1110192**

**June 9, 2016**



June 9, 2016

Mr. Ervin Lane  
Solid Waste Section  
Division of Waste Management  
NCDENR  
1646 Mail Service Center  
Raleigh, North Carolina 27699-1646

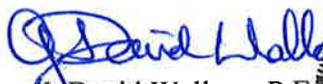
**Subject: Report of Gas Monitoring – Second Quarter 2016**  
**City of Albemarle Landfill**  
**DSWM Permit No. 84-01**  
**Shield Project 1110192**

Dear Mr. Lane:

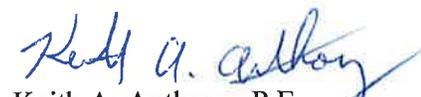
On behalf of City of Albemarle (Albemarle), Shield Engineering, Inc. (Shield) is pleased to submit this Report of Gas Monitoring for the Second Quarter of 2016 for the subject site. This report includes the results of the Second Quarter 2016 gas monitoring of permanent probes. The activities were performed in accordance with the *Landfill Gas Monitoring Guidance* dated November 2010.

If you have any questions or comments, please contact us at (704) 394-6913.

Sincerely,  
**SHIELD ENGINEERING, INC.**

  
J. David Wallace, P.E.  
Senior Engineer



  
Keith A. Anthony, P.E.  
Principal Engineer

JDW/KAA:

cc: Ms. Nina Underwood, Director of Public Works (City of Albemarle)



## 1.0 INTRODUCTION

### 1.1 Background

The City of Albemarle Landfill (DSWM [Division of Solid Waste Management] Permit #84-01) is located on Stony Gap Road (SR 1720), in Stanly County, North Carolina (see Figure 1). Prior to operating as a C&D Landfill, the site formerly operated as an unlined Municipal Solid Waste Landfill (MSWLF) that consisted of two units. The first unit (Unit #1) was closed prior to October 1991 with a 24-inch thick final soil cover. The second unit (Unit #2) was closed with an 18-inch thick cohesive soil cap with a permeability of  $10^{-5}$  centimeters per second (cm/sec) and an 18-inch thick soil erosive layer prior to June 1999 in accordance with the *Transition Plan*. The C&D Landfill is constructed and operating on top of the Unit #1 MSWLF.

Adjacent to the C&D Landfill, across the unnamed tributary of Jacob's Creek, on the same contiguous property is the active Subtitle D lined MSWLF. The lined MSWLF is comprised of two contiguous phases (Phase 1 and 2) which are combined and treated as a single unit for continuity of the reporting to the SWS. This active MSWLF also operates under DSWM Permit #84-01 and is also reported herein.

### 1.2 Gas Monitoring Program

The Gas Monitoring Program for the active C&D Landfill on top of the former MSWLF has included the monitoring of the permanent gas monitoring probes located around the site (MP-1 through MP-13; excluding MP-6, MP-8), and both the maintenance and recycling shops.

A series of gas monitoring probes have also been installed around the Subtitle D lined MSWLF (MP-14, and MP-18 through MP-30) to monitor for explosive gases as required by Title 15A North Carolina Administrative Code Subchapter 13B Section .1626(4)(a)(ii) and .1626(4)(b) [15A NCAC 13B.1626(4)(a)(ii) and .1626(4)(b)].

The locations of the gas monitoring probes are shown on the attached Figure 1. Together these two groups of gas monitoring probes and the two shops comprise the current gas monitoring for the City of Albemarle Landfill.

### **1.3 Gas Data Collection and Presentation**

The percentage of methane gas in air data and hydrogen sulfide gas concentrations within the gas monitoring probes were measured on May 18, 2016 using a LANDTEC GEM-5000™ gas monitor. These data were entered onto the SWS forms from the LANDTEC GEM-5000™ gas monitor and the original copy of these forms is retained as part of the landfill operating record (see Appendix A).

Methane is explosive at concentrations ranging from 5 percent (%) of methane gas (lower explosive limit – LEL) to 15 % of methane gas (upper explosive limit – UEL) by volume in air. Hydrogen sulfide is explosive at concentrations ranging from 4.3 percent (%) of hydrogen sulfide gas (LEL) to 46% of hydrogen sulfide gas (UEL) by volume in air. SWS management guidelines state that explosive gases should not exceed either the LEL (5 % of methane gas in air and 4.3% of hydrogen sulfide in air) at property boundaries or 25 % of the LEL (1.25 % of methane gas in air and 1.08% of hydrogen sulfide in air) in facility structures [15A NCAC 13B.1626(4)(a)].

The gas measurement procedures used for monitoring for explosive gases at this Site follow both the manufacturer's specifications for the gas monitor and those procedures outlined in *Landfill Gas Monitoring Guidance* dated November 2010.

The gas results are summarized in Table 1. The instrument calibration records and the Landfill Gas Monitoring Data Forms as required by *Landfill Gas Monitoring Guidance* are included in Appendix A.

## 2.0 GAS DATA

### 2.1 Gas Data Results Summary

#### 2.1.1 Active C&D and Closed MSWLF

Methane was undetected in ten of the eleven gas probes around the active C&D Landfill and closed MSWLF. Hydrogen sulfide was undetected in all of these eleven gas probes. Neither of the two shops exhibited the presence of methane or hydrogen sulfide. Methane concentration was found to be above zero for Gas Probe MP-12 (42.9%) along the southwest perimeter of the active C&D Landfill and closed MSWLF. The regulatory limit at the compliance boundary or property boundary is 5% of methane in air. However, the purchase of the adjacent property located west from this methane probe, has moved the property boundary about 900 feet further southwest from MP-12. Additionally, Gas Probe MP-13 which is located southeast from Gas Probe MP-12 and is closer to the property boundary, exhibited no methane gas. Also, in the case of Gas Probe MP-12 the surface water along a drainage feature located within the adjacent property southwest of this gas probe prevents the migration of gas to the property boundary to the southwest.

The following briefly describes the historical trend to date for Gas Probe MP-12:

- MP-12: Methane had been previously detected for the period from July 2007 through January 2009, during which it ranged from 2 to 9% of methane gas in air. Methane has been undetected since April 2009 through to the Fourth Quarter of 2012. To date methane has been detected above the LEL since the First Quarter of 2013.

No hydrogen sulfide was detected in the monitored gas probes at this site during this quarter.

#### 2.1.2 Subtitle D lined MSWLF

Methane was undetected for all of the gas probes around the active Subtitle D lined MSWLF (see Table 1).

No hydrogen sulfide was detected in the monitored gas probes at this site during this quarter.

## **2.2 Comments**

Based on results of recent methane monitoring data for both sites, methane gas concentrations at the gas monitoring probes closest to the property boundary are below regulatory limits for the Second Quarter of 2016. Additionally, in the case of Gas Probe MP-12 the surface water along a drainage feature southwest of this gas probe prevents the migration of gas to the property boundary to the southwest.

TABLE 1  
 METHANE MONITORING DATA  
 CITY OF ALBEMARLE LANDFILL  
 STANLY COUNTY, NORTH CAROLINA

| Methane Monitoring Probe Identification | Date of Readings: May 18, 2016 |                        |
|---|--------------------------------|------------------------|
|   | Methane in Air (%)             | H <sub>2</sub> S (ppm) |
| <b>ACTIVE C&amp;D AND CLOSED MSWLF</b>  |                                |                        |
| MP-1                                    | ND                             | 0                      |
| MP-2                                    | ND                             | 0                      |
| MP-3                                    | ND                             | 0                      |
| MP-4                                    | ND                             | 0                      |
| MP-5                                    | ND                             | 0                      |
| MP-7R                                   | ND                             | 0                      |
| MP-9                                    | ND                             | 0                      |
| MP-10                                   | ND                             | 0                      |
| MP-11                                   | ND                             | 0                      |
| MP-12                                   | 42.9                           | 0                      |
| MP-13                                   | ND                             | 0                      |
| <b>SUBTITLE D LINED MSWLF</b>           |                                |                        |
| MP-14                                   | ND                             | 0                      |
| MP-18                                   | ND                             | 0                      |
| MP-19                                   | ND                             | 0                      |
| MP-20                                   | ND                             | 0                      |
| MP-21                                   | ND                             | 0                      |
| MP-22                                   | ND                             | 0                      |
| MP-23                                   | ND                             | 0                      |
| MP-24                                   | ND                             | 0                      |
| MP-25                                   | ND                             | 0                      |
| MP-26                                   | ND                             | 0                      |
| MP-27                                   | ND                             | 0                      |
| MP-28                                   | ND                             | 0                      |
| MP-29                                   | ND                             | 0                      |
| MP-30                                   | ND                             | 0                      |
| Maintenance Shop                        | ND                             | 0                      |
| Recycling Shop                          | ND                             | 0                      |
| NOTES: 1) ND - Not Detected             |                                |                        |
| 2) NM - Not Measured                    |                                |                        |

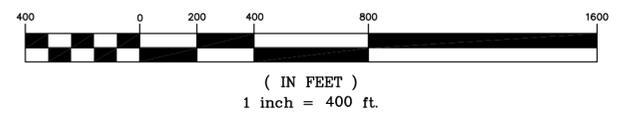
| LEGEND |   |
|--------|---|
|        | 2013 CONTOURS                             |
|        | PROPERTY LINE                             |
|        | MP-19 (METHANE) MONITORING PROBE LOCATION |
|        | ROAD                                      |
|        | BUFFER ZONE                               |
|        | WATER                                     |
|        | CULVERT PIPE                              |
|        | CULVERT HEADWALL                          |



ID# 655601475521  
 City of Albemarle  
 Deed Ref: 1413-274  
 105.06 Acres

- NOTES:
1. REFERENCE: EROSION CONTROL MASTER PLAN (SHEET 1 OF 4) BY HODGES, HARBIN, NEWBERRY & TRIBBLE, INC. DATED MARCH 2011.
  2. CONTOURS BY SPATIAL DATA CONSULTANTS, INC. PHOTOGRAPHY DATED JULY 29, 2013.
  3. METHANE WELLS WERE SURVEYED BY LAWRENCE ASSOCIATES NOVEMBER, 2013.
  4. CONTOURS FOR PROPERTY ID# 655601475521 AND THOSE OUTSIDE CITY OF ALBEMARLE LANDFILL SOUTHERN BOUNDARY CREATED FROM NCDOT CONTOURS IN MARCH 2016.

GRAPHIC SCALE



|  |   |
|--|---|
|  | 4301 TAGGART CREEK ROAD<br>CHARLOTTE, NC 28208<br>704-384-0913<br>704-384-0988 fax<br>www.shieldengineering.com |
|  | <b>GAS MONITORING PROBE LOCATION MAP</b>  |
| <b>CITY OF ALBEMARLE LANDFILL</b><br>STONY GAP ROAD<br>ALBEMARLE, NORTH CAROLINA<br>SHIELD #1110192-01 |   |
| DATE : 05/31/16  | DRAWN BY : RBS  |
| SCALE : AS SHOWN   | FIGURE : 1  |

H:\PROJECTS\2011\110192 - CITY OF ALBEMARLE LANDFILL\FIGURES\METHANE MONITORING PROBE LOCATION MAP 5-31-16.DWG

**APPENDIX A**

**(Landfill Gas Monitoring Data Form)**

NC Division of Waste Management - Solid Waste Section

Landfill Gas Monitoring Data Form

Notice: This form and any information attached to it are "Public Records" as defined in NC General Statute 132-1. As such, these documents are available for inspection and examination by any person upon request (NC General Statute 132-6).

Facility Name: City of Albemarle Landfill Permit Number: #84-01

Date of Sampling: 5-18-16 NC Landfill Rule (.0500 or .1600): .1600

Name and Position of Sample Collector: Janna Harrison Staff Scientist

Type and Serial Number of Gas Meter: Canatec GEN5000+ SM 6502512 Calibration Date of Gas Meter: 1/25/14

Date and Time of Field Calibration: 5/11/16

Type of Field Calibration Gas (15/15 or 35/50): 35/50 Expiration Date of Field Calibration Gas Canister: 10/24/19

Pump Rate of Gas Meter: N/A

Ambient Air Temperature: 66° Barometric Pressure: 30.10 General Weather Conditions: Overcast

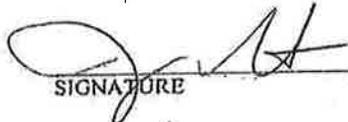
Instructions: Under "Location or LFG Well" identify the monitoring wells or describe the location for other tests (e.g., inside buildings). A drawing showing the location of test must be attached. Report methane readings in both % LEL and % methane by volume. A reading in percent methane by volume can be converted to % LEL as follows: % methane by volume = % LEL/20

| Location or LFG Well ID | Sample Tube Purge | Time | Time Pumped (s) | Initial %LEL | Stabilized %LEL | %CH4 by Volume | %O2  | %CO2 | H2S (ppm) | Notes Baro Press "Hg |
|-------------------------|-------------------|------|-----------------|--------------|-----------------|----------------|------|------|-----------|----------------------|
| MP-1                    | 60                | 1312 | 60              | —            | —               | 0.0            | 19.8 | 0.9  | 0         | 29.57                |
| MP-2                    | 60                | 1316 | 60              | —            | —               | 0.0            | 12.6 | 8.5  | 0         | 29.57                |
| MP-3                    | 60                | 1319 | 60              | —            | —               | 0.0            | 16.3 | 5.2  | 0         | 29.57                |
| MP-4                    | 60                | 1324 | 60              | —            | —               | 0.0            | 18.0 | 2.7  | 0         | 29.57                |
| MP-5                    | 60                | 1327 | 60              | —            | —               | 0.0            | 15.1 | 9.2  | 0         | 29.57                |
| MP-7R                   | 60                | 1333 | 60              | —            | —               | 0.0            | 13.7 | 2.5  | 0         | 29.57                |
| MP-9                    | 60                | 1339 | 60              | —            | —               | 0.0            | 12.5 | 8.9  | 0         | 29.57                |
| MP-10                   | 60                | 1342 | 60              | —            | —               | 0.0            | 17.7 | 3.5  | 0         | 29.57                |
| MP-11                   | 60                | 1346 | 60              | —            | —               | 0.0            | 14.3 | 7.0  | 0         | 29.57                |
| MP-12                   | 60                | 1351 | 60              | —            | —               | 42.9           | 0.3  | 27.1 | 0         | 29.57                |

If your facility has more gas monitoring locations than there is room on this form, please attach additional sheets listing the same information as contained on this form.

Certification

To the best of my knowledge, the information reported and statements made on this data submittal and attachments are true and correct. I am aware that there are significant penalties for making any false statement, representation, or certification including the possibility of a fine and imprisonment.

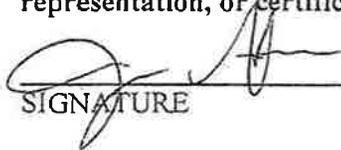
  
SIGNATURE

Staff Scientist  
TITLE

Facility Name: CITY OF ALBEMARLE LANDFILL Permit Number: #8401 Date of Sampling: 5-18-16

| Methane Probe ID | Sample Tube Purge | Time | Time Pumped (sec) | Initial %LEL | Stabilized %LEL | % CH4 by Volume | % O2 | % CO2 | H2S (ppm) | Baro Pressure <sup>sec</sup> "Hg | NOTES |
|------------------|-------------------|------|-------------------|--------------|-----------------|-----------------|------|-------|-----------|----------------------------------|-------|
| MP-13            | 60                | 1355 | 60                | -            | -               | 0.0             | 17.5 | 4.1   | 0         | 29.57                            |       |
| MP-14            | 60                | 1401 | 60                | -            | -               | 0.0             | 14.2 | 6.3   | 0         | 29.57                            |       |
| MP-18            | 60                | 1455 | 60                | -            | -               | 0.0             | 13.3 | 8.5   | 0         | 29.57                            |       |
| MP-19            | 60                | 1459 | 60                | -            | -               | 0.0             | 8.3  | 13.0  | 0         | 29.57                            |       |
| MP-20            | 60                | 1503 | 60                | -            | -               | 0.0             | 12.7 | 8.0   | 0         | 29.57                            |       |
| *MP-21           | 60                | 1452 | 60                | -            | -               | 0.0             | 18.3 | 2.6   | 0         | 29.57                            |       |
| *MP-22           | 60                | 1445 | 60                | -            | -               | 0.0             | 16.9 | 4.7   | 0         | 29.57                            |       |
| MP-23            | 60                | 1439 | 60                | -            | -               | 0.0             | 19.1 | 2.1   | 0         | 29.57                            |       |
| *MP-24           | 60                | 1435 | 60                | -            | -               | 0.0             | 20.1 | 0.8   | 0         | 29.57                            |       |
| MP-25            | 60                | 1425 | 60                | -            | -               | 0.0             | 19.2 | 1.8   | 0         | 29.57                            |       |
| *MP-26           | 60                | 1420 | 60                | -            | -               | 0.0             | 19.5 | 1.6   | 0         | 29.57                            |       |
| MP-27            | 60                | 1415 | 60                | -            | -               | 0.0             | 19.1 | 1.8   | 0         | 29.57                            |       |
| MP-28            | 60                | 1412 | 60                | -            | -               | 0.0             | 15.9 | 4.4   | 0         | 29.57                            |       |
| MP-29            | <del>40</del> 60  | 1406 | 60                | -            | -               | 0.0             | 13.6 | 6.7   | 0         | 29.57                            |       |
| MP-30            | 60                | 1430 | 60                | -            | -               | 0.0             | 18.7 | 2.1   | 0         | 29.57                            |       |
| *SHOP            | 60                | 1302 | 60                | -            | -               | 0.0             | 20.7 | 0.1   | 0         | 29.57                            |       |
| Recycle Shop     | 60                | 1306 | 60                | -            | -               | 0.0             | 20.6 | 0.1   | 0         | 29.57                            |       |
|                  |                   |      |                   |              |                 |                 |      |       |           |                                  |       |
|                  |                   |      |                   |              |                 |                 |      |       |           |                                  |       |
|                  |                   |      |                   |              |                 |                 |      |       |           |                                  |       |
|                  |                   |      |                   |              |                 |                 |      |       |           |                                  |       |
|                  |                   |      |                   |              |                 |                 |      |       |           |                                  |       |

**Certification:** To the best of my knowledge, the information reported and statements made on this data submittal and attachments are true and correct. I am aware that there are significant penalties for making any false statement, representation, or certification including the possibility of a fine and imprisonment.

  
SIGNATURE

Staff Scientist  
TITLE

# CERTIFICATION OF CALIBRATION

ISSUED BY: Landtec North America Instrument Services Facility

Date of Calibration: January 25, 2016

Certificate Number: C502512-4/17381



Page 1 of 2



Landtec North America Instrument Services Facility, 850  
South Macedonia Street, Houston, TX 77064  
www.landteconline.com

Approved By: Signatory

*Photo Copied*

Customer: *Instrument Solutions*  
Attn: *Shirley Edw*  
Site:  
Instruments: *SC 9710*  
CGA:

Device/Model: *GEM 5000*

## Accredited Results:

| Methane (CH <sub>4</sub> ) |                        |                 |
|----------------------------|------------------------|-----------------|
| Certified Gas (%)          | Instrument Reading (%) | Uncertainty (%) |
| 5.0                        | 4.8                    | 0.42            |
| 15.0                       | 14.8                   | 0.66            |
| 50.0                       | 49.7                   | 1.05            |

| Carbon Dioxide (CO <sub>2</sub> ) |                        |                 |
|-----------------------------------|------------------------|-----------------|
| Certified Gas (%)                 | Instrument Reading (%) | Uncertainty (%) |
| 5.0                               | 4.9                    | 0.43            |
| 15.0                              | 14.8                   | 0.71            |
| 50.0                              | 49.8                   | 1.19            |

| Oxygen (O <sub>2</sub> ) |                        |                 |
|--------------------------|------------------------|-----------------|
| Certified Gas (%)        | Instrument Reading (%) | Uncertainty (%) |
| 21.0                     | 21.0                   | 0.25            |

Gas cylinders are traceable and details can be provided if requested.

CH<sub>4</sub>, CO<sub>2</sub> readings recorded at: 35.1 °C/95.2 °F

Barometric Pressure: 29.12 "Hg

O<sub>2</sub> readings recorded at: 24.9 °C/76.9 °F

Method of Test: The analyzer is calibrated in a temperature controlled chamber using reference gases. All analyzers are calibrated in accordance with our procedure ISP-17 using high purity grade gas.

All calibrations are performed in accordance with ISO 17025 at LANDTEC, an ISO 17025:2005 – accredited service facility through PILA.

*The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with NIST requirements.*

The calibration results published in this certificate were obtained using equipment capable of producing results that are traceable through NIST to the International System of Units (SI). Certification only applies to results shown in this certificate and may not be reproduced in full, except with the prior written approval of the issuing laboratory.

# CERTIFICATION OF CALIBRATION

Certificate Number  
G502512\_4/17381

PILA ACCREDITED CALIBRATION LABORATORY NO. 66916

Page 2 of 2

**Non Accredited results:**

| Pressure Transducers (inches of water column) |                 |               |                  |                |          |
|---|-----------------|---------------|------------------|----------------|----------|
| Transducer                                    | Certified (Low) | Reading (Low) | Certified (High) | Reading (High) | Accuracy |
| Static  | 0"              | 0.00"         | 40"              | 39.94"         | 2.0"     |
| Differential                                  | 0"              | 0.00"         | 4"               | 3.93"          | 0.7"     |

| Barometer (mbar)      |                       |
|-----------------------|-----------------------|
| Reference             | Instrument Reading    |
| 0986 mbar / 29.12 "Hg | 0985 mbar / 29.10 "Hg |

| Additional Gas Cells |                     |                          |
|----------------------|---------------------|--------------------------|
| Gas                  | Certified Gas (ppm) | Instrument Reading (ppm) |
| H2                   | 1003                | LOW                      |
| CO                   | 500                 | 481                      |
| H2S                  | 200                 | 196                      |

**As received gas check readings:**

| Methane (CH4)     |                        |
|-------------------|------------------------|
| Certified Gas (%) | Instrument Reading (%) |
| 5.0               | 4.8                    |
| 15.0              | 14.5                   |
| 50.0              | 47.9                   |

| Carbon Dioxide (CO2) |                        |
|----------------------|------------------------|
| Certified Gas (%)    | Instrument Reading (%) |
| 1.0                  | 0.9                    |
| 3.0                  | 2.8                    |
| 10.0                 | 9.5                    |

As received gas readings are provided for informational purposes only. The instrument readings are not certified.

**WWW.LANDTECNA.COM**

LANDTECNA North America Instrument Services Facility - 850 South Via Lata, Suite 107, Torrance, CA 90503



**CALIBRATION LOG**  
**LANDTEC - GEM 5000+**

Instrument: LANDTEC

Serial Number: GEM 5000

|                                       |  |                                     |
|---------------------------------------|--|-------------------------------------|
| <b>Calibrated materials required:</b> |  | Lot: LAO-341TSM-1 (CO2 10%,CH4 10%) |
| Lot: KAP-1-17 O2 (20.9%)              |  | Exp: 11/12/2018                     |
| Exp: 11/6/2019                        |  |                                     |
| Lot: IAP-161-4-5 (O2 4%)              |  | Lot: DAP-399-1 (CO2 35%,CH4 50%)    |
| Exp: 10/2/2019                        |  | Exp: 6/24/2019                      |
| Lot: KAP-98-200-1 H2S (200ppm)        |  | Lot: LAP-49-1000-5 CO (1000ppm)     |
| Exp: 1/2/2017                         |  | Exp: 11/23/19                       |

Carbon Filter Saturation (CH4) - Condition: PASS Initials: DSR

**Gas Calibration Check Performed at Room Temperature**

**GEM 5000 - ZERO AIR CALIBRATION**

| SENSOR    | Initial Reading | CAL Reading | Tolerance | Comments |
|-----------|-----------------|-------------|-----------|----------|
| CO (ppm)  | 0.0             | 0.0         | +/- 5 ppm |          |
| H2S (ppm) | 0.0             | 0.0         | +/- 5 ppm |          |
| O2 (%)    | 21.1            | 20.9        | +/- 1.0%  |          |
| CH4 (%)   | 0.0             | 0.0         | +/- 0.5%  |          |
| H2 (%)    | -6.0            | 0           | +/- 1.5%  |          |

**GEM 5000 - MULTI SPAN GAS CALIBRATION**

**CH4 HIGH CALIBRATION**

| SENSOR  | Initial Reading | CAL Reading | Tolerance | Comments |
|---------|-----------------|-------------|-----------|----------|
| CH4 (%) | 47.5            | 50.0        | +/- 0.5%  |          |
| CO2 (%) | 32.6            | 35.0        | +/- 1.5%  |          |
| O2 (%)  | -0.2            | 0.0         | +/- 1.5%  |          |

**CH4 LOW CALIBRATION**

| SENSOR  | Initial Reading | CAL Reading | Tolerance | Comments |
|---------|-----------------|-------------|-----------|----------|
| CH4 (%) | 10.4            | 10.0        | +/- 0.5%  |          |
| CO2 (%) | 10.1            | 10.0        | +/- 1.5%  |          |
| O2 (%)  | -0.2            | 0.0         | +/- 1.5%  |          |

**O2 LOW CALIBRATION**

| SENSOR | Initial Reading | CAL Reading | Tolerance | Comments |
|--------|-----------------|-------------|-----------|----------|
| O2 (%) | 4.7             | 4.0         | +/- 0.5%  |          |

**O2 HIGH CALIBRATION**

| SENSOR | Initial Reading | CAL Reading | Tolerance | Comments |
|--------|-----------------|-------------|-----------|----------|
| O2 (%) | 22.2            | 20.9        | +/- 0.5%  |          |

**CO CALIBRATION**

| SENSOR   | Initial Reading | CAL Reading | Tolerance  | Comments |
|----------|-----------------|-------------|------------|----------|
| CO (ppm) | 1029            | 1000        | +/- 50 ppm |          |

**H2S CALIBRATION**

| SENSOR    | Initial Reading | CAL Reading | Tolerance  | Comments |
|-----------|-----------------|-------------|------------|----------|
| H2S (ppm) | 200             | 200         | +/- 10 ppm |          |

Signature: LMS

Date: 5/11/2016