

Annual Landfill Gas Monitoring Report

Avery County Closed MSW Landfill Permit No. 06-91

Prepared for:



**Avery County Solid Waste
P.O. Box 640
Newland, NC 28657**

November 2012

Prepared by:

SMITH+GARDNER

14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577



PRINTED ON 100% RECYCLED PAPER

This page intentionally left blank.

**Avery County Closed MSW Landfill
Permit No. 06-01**

Annual Landfill Gas Monitoring Report

Table of Contents

	<u>Page</u>
1.0 INTRODUCTION	1
2.0 LFG MONITORING.....	1
2.1 On-Site Monitoring Evaluation.....	1
2.2 Off-Site Monitoring Evaluation.....	1
3.0 LANDFILL GAS COLLECTION AND CONTROL SYSTEM	2
3.1 Well Field	2
3.1.1 Gas Quality.....	2
3.1.2 Gas Flow	3
3.1.3 Maintenance	3
3.1.4 Investigations	3
3.2 Flare Station	4
3.2.1 Gas Quality.....	4
3.2.2 Flow	4
3.2.3 Maintenance	4
3.3 Condensate Tank.....	5
3.3.1 Investigations	5
3.3.2 Maintenance	5
4.0 RECOMMENDATIONS	5
4.4 Wellfield	5
4.4.1 New Extraction Well Installation	5
4.4.2 Valve Installation	6
4.5 Flare Station	6
5.0 CONCLUSIONS	6

FIGURES

Figure 1	Site Map
Figure 2	Investigation Location Map

APPENDICES

Appendix A	Monthly LFGCCS Records
------------	------------------------

This page intentionally left blank.

1.0 INTRODUCTION

The Avery County Closed MSW Landfill is located on approximately 4.5 acres on Brushy Creek Road in Spruce Pine, North Carolina. This report has been prepared to document remedial monitoring and provide an annual performance evaluation of the Landfill Gas Collection and Control System (LFGCCS) in accordance with *Off-site Landfill Gas Mitigation Plan*¹, approved February 10, 2011 by the North Carolina Department of Environment and Natural Resources (NCDENR) Division of Waste Management (DWM)².

2.0 LFG MONITORING

Landfill gas (LFG) monitoring is conducted on a monthly basis and complies with EPA and NCDENR DWM requirements. According to 15A NCAC 13B.0503(2) concentrations of explosive gases at the landfill shall not exceed 25% of the Lower Explosive Limit (LEL) in site structures and the lower explosive limit for gases at the property boundary. Historically, LFG has been detected on the adjacent properties. It should be noted that methane (CH₄) concentrations of 5% are equal to 100% of the LEL while 15% CH₄ equals the Upper Explosive Limit (UEL). The site monitoring network consists of monitoring wells located both on-site and off-site. For ease of review, LFG measurements in this report are organized as "On-Site" and "Off-Site" for clarity in discussion regarding wells located on-site or off-site on adjacent properties. The Avery County Closed MSW Landfill currently has 13 LFG monitoring wells in the monitoring network, P-1 through P-13, eight (8) of which are located on-site and 5 of which are located on adjacent properties as shown on **Figure 1**.

S+G utilizes a Landtec GEM 2000 meter to collect the LFG monitoring data.

2.1 On-Site Monitoring Evaluation

Avery County has eight (8) on-site perimeter LFG monitoring wells that are monitored monthly. P-1 through P-4 are located on the north to northwestern property line, P-5 is located on the eastern property line and P-6 through P-8 are located on the southwestern property line of the site. Monitoring event results since May 2011 generally show that wells P-1 and P-7 consistently registered methane concentrations over the 100% LEL (or 5% by volume of CH₄). Monitoring well P-3, which consistently contained measurable concentrations over the 100% LEL or 5% by volume of CH₄ prior to the LFGCCS installation, appears to have decreasing concentrations, between approximately 50% and 100% of the LEL.

2.2 Off-Site Monitoring Evaluation

Avery county has five (5) off-site LFG monitoring wells that are monitored monthly. Landfill gas monitoring wells P-9, P-10 and P-11 are located northwest of the landfill on Unimin Corporation property; P-12 and P-13 are located southwest of the landfill on the

¹ *Off-Site Landfill Gas Mitigation Plan*. Richardson Smith Gardner and Assoc. January 18, 2011

² *Off-Site Landfill Gas Mitigation Plan- Approval*. Letter from Jaclynne Drummond, NCDENR, February 10, 2011

Avery County Airport property. Monitoring event results since May 2011 generally show that monitoring well P11 consistently registered landfill gas concentrations over the 100% LEL or 5% by volume of CH₄.

Structure monitoring on the airport property has yielded no detectable concentrations of CH₄ to date.

3.0 LANDFILL GAS COLLECTION AND CONTROL SYSTEM

The LFGCCS operated continually from May 2011 to July 2012 except when routine maintenance required the system to be shut down. On July 28, 2012, the LFGCCS was shut down due to possible air intrusion into the system from an unknown source. On August 30, 2012, an investigation into the possible air intrusion (discussed in **Section 3.3.1**) was performed in conjunction with a system expansion investigation to explore possible locations and methods for future system expansion (discussed in **Section 3.1.4**). Subsequently on September 25, 2012, repairs to address the air intrusion were performed (discussed in **Section 3.3.1**); it was also determined that the blower package (blower and motor) required replacement. The blower package was replaced on October 17, 2012 and is discussed in **Section 3.2.3**.

As required by the approved *Off-site Landfill Gas Mitigation Plan*, monthly wellfield monitoring included:

- CH₄, O₂, CO₂, and Pressure monitoring at each extraction well head; and
- Adjustment of the LFGCCS to balance recovery and ensure safe system operation.

3.1 Well Field

This section discusses the general LFGCCS performance, maintenance and additional investigations since May 2011. Monthly LFGCCS monitoring records are included in **Appendix A**.

The Avery County LFGCCS well field includes eight (8) LFG extraction wells. Well locations are shown on **Figure 1**. The overall physical well condition has not significantly changed over this report period (May 2011 to October 2012). The wellheads, above ground fittings and connections are in satisfactory condition.

3.1.1 Gas Quality

Percent CH₄ by volume has generally decreased in extraction wells W4 through W8 over time. The vacuum applied at these wells has been maintained at a level to maximize flow while minimizing air intrusion into the system. The decrease in CH₄ by volume suggests that the LFGCCS is reducing CH₄ in the well's area of influence.

Conversely, in extraction wells W1 through W3, percent CH₄ by volume has generally remained constant. The vacuum at these wells has not been

maintained due to likely well clogging. It is unlikely the LFGCCS is effectively reducing CH₄ in these wells areas of influence.

Percent O₂ and balance gas by volume have been maintained at safe operating levels across the well field. O₂ levels were over 5% in W4 on two (2) occasions; on both occasions, the well was adjusted to reduce the amount of O₂ being drawn into the system and the issue was resolved by the next monitoring event.

3.1.2 Gas Flow

Gas flow across the wellfield averaged three (3) scfm³ for wells able to maintain a vacuum (W4 through W8). This low flow level is currently able to keep the system operational, however, potentially poses future problems with the ability of the flare to remain lit. **Section 4.4.1** provides recommendations that should improve total flow through the system.

3.1.3 Maintenance

General maintenance has been performed across the well-field during this report period. Maintenance items include inspections of wellheads and associated valves and ports, inspections and tightening of Fernco fittings, and inspections and tightening of Kanaflex hose.

3.1.4 Investigations

On August 30, 2012 a system expansion investigation to explore possible locations and methods for future system expansion was conducted. The first part of this investigation involved locating select segments of LFG transmission piping. Utilizing a backhoe, locations of pre-selected LFG header piping were located in areas near LFG extraction wells W1 and W3 to determine possible connection tie-ins for additional LFG extraction wells on the northern portion of the site, as discussed in **Section 4.4.1**. Location of the header pipe under the site access road was also investigated to determine possible connection tie-ins for an additional LFG extraction well on the southern portion of the site.

The second part of this investigation utilized the backhoe to dig test pits to determine the waste extent and subsurface conditions on the southwest portion of the site, near LFG monitoring well P-7. A thick layer of fill consisting of gravel, loose rock, and soil mix was identified as a migration pathway. The waste extent, subsurface conditions and migration pathway are critical components when evaluating present and future LFGCCS expansion/modification options.

Figure 2 shows the investigation locations.

³ scfm = standard cubic foot per minute

3.2 Flare Station

The over-all physical condition of the flare station is good. This section will discuss the gas quality, gas flow and maintenance at the flare station during this reporting period.

3.2.1 Gas Quality

Percent CH₄ by volume has generally been between 30 % and 40 % at the flare station. While these numbers are adequate for system operation, the percent of CH₄ seems to be generally decreasing over time.

Percent O₂ has been maintained at safe operating levels. O₂ levels exceeded 5% on two (2) occasions. The first occurrence was addressed by adjusting the wellfield to reduce the amount of O₂ being drawn into the system. The issue was resolved by the next monitoring event.

The second occurrence of increased O₂ levels at the flare station led to the LFGCCS being shut down and an air intrusion investigation being conducted (discussed in **Section 3.3.1**).

3.2.2 Flow

LFG flow at the flare station has not fluctuated significantly and has averaged approximately 19 scfm per month. As previously mentioned, this low flow level is currently able to keep the system operational, however, potentially poses future problems with the ability of the flare to remain lit. **Section 4.4.1** provides recommendations that should improve total flow through the system.

3.2.3 Maintenance

General maintenance has been performed at the flare station periodically during this report period. Maintenance items included the cleaning of piping, cleaning of the flame arrestor, valve and port inspection, igniter inspection, blower inspection, and liquid check and adjustment in the sump. S+G has evaluated the flare collar and has determined that it is adequate given the current average system flow. If system flow is increased in the future, S+G recommends that the flare color be extended, as discussed in **Section 4.5**.

On September 25, 2012, it was determined that the blower package (blower and motor) was inoperable and the entire blower package should be replaced. Avery County subsequently ordered a new blower package (same make and model previously on-site). S+G personnel returned to the site on October 17, 2012 and installed the new blower package; the LFGCCS was restarted.

3.3 Condensate Tank

3.3.1 Investigations

On August 30, 2012, S+G performed an investigation of possible sources of air intrusion into the system. After an above ground inspection of all above ground system elements, S+G determined that the condensate line between the sump and the condensate tank was the most likely area for the air intrusion and further investigation was warranted. The condensate line was excavated and multiple air leaks were found in the underground piping. Existing piping was cut on the system side of the air leaks and sealed shut in preparation for repair.

On September 25, 2012, S+G conducted a site visit to repair the underground condensate line from the sump to the condensate tank. S+G excavated approximately 3.5 feet below ground around the underground line and removed the damaged existing piping. New piping and fittings were installed and sealed. No leaks were noted. The newly repaired piping was buried.

Investigation locations are shown on **Figure 2**.

3.3.2 Maintenance

General maintenance has been performed at the condensate tank periodically during this report period. General maintenance items included pumping the condensate tank to a holding tank and inspection of above ground connections. Additional maintenance is discussed above in **Section 3.3.1**.

4.0 RECOMMENDATIONS

This section discusses recommended improvements to the LFGCCS, to mitigate continuing LFG migration from the landfill property.

4.4 Wellfield

4.4.1 New Extraction Well Installation

S+G recommends a phased approach to LFG system expansions and modifications. New LFG extraction wells should be installed on-site to improve overall system performance. The flow rate at current extraction wells are maximized and overall gas quality appears to be decreasing over time; additional CH_4 collection should be added in order to keep the LFGCCS operational. New extraction wells should improve over-all gas quality at the flare as well as substantially increasing LFG flow across the site. Without additional wells, the system cannot continue to operate as designed and the flare will have increasing difficulty maintaining ignition due to decreasing LFG concentrations and low flow noted in current wells, as mentioned in **Sections 3.1.1 and 3.1.2**.

S+G recommends a total of three (3) LFG extraction wells to be installed on-site in two (2) phases. Phase 1 should include the installation of two (2) LFG extraction wells (4 inches in diameter and approximately 60 feet deep) on the northern portion of the site between current extraction wells (W1 and W3) and the limits of waste near Brushy Creek road.

The Phase 1 well installation performance should be evaluated after the first six (6) months. If it is determined that the Phase 1 installations have had influence on the LFG monitoring wells along Brushy Creek Road and on the Unimin property, the second phase of well installation should be completed. Phase 2 should consist of installing one (1) additional well on the southwestern portion of the site between current well W8 and the condensate tank area. This well would be four inches in diameter and be installed to a depth of approximately 20 feet. The installation of this extraction well should help to intercept LFG migration from the waste mass to monitoring well P-7.

Recommended locations of additional extraction wells are provided on **Figure 3**.

4.4.2 Valve Installation

S+G recommends the installation of an isolation valve along the LFG header to isolate the southern string of wells (W5, W6 and W8). This installation is needed to perform maintenance on the wellfield while still allowing the system to operate. The recommended location of this isolation valve is provided on **Figure 3**.

4.5 Flare Station

Increased flow and gas quality, expected to be achieved by LFG system expansion, would produce a larger, hotter flame requiring an extended flare collar to extend the flame further from the ground surface. S+G recommends a flare collar extension be installed in conjunction with Phase 1 of the proposed wellfield expansion.

5.0 CONCLUSIONS

The LFGCCS has had limited effect on LFG migration off-site. This effect could be improved by expanding the current LFGCCS as described in the recommendations section of this report. Expanding the LFGCCS will also improve the overall system performance allowing for greater gas quality and flow at the flare, equating to the destruction of more CH₄ on-site. Monthly monitoring on-site will continue and upon NCDENR DWM approval of the above recommendations, S+G will begin the modifications as presented above

FIGURES

This page intentionally left blank.



© Smith Gardner Inc.

LEGEND

- EXISTING LANDFILL GAS PROBE
- ④ OFFSITE STRUCTURE TO BE MONITORED

REFERENCES

1. ADJACENT PROPERTIES ARE FROM AVERY COUNTY GIS MAPPING DEPARTMENT.
2. MONITORING WELL LOCATIONS FROM FIELD SURVEY DATED 1/14/08, BY SURVEYING SOLUTIONS, P.C.
3. PROPERTY LINE FROM FIELD SURVEY DATED APRIL 9, 2010, BY APPALACHIAN PROFESSIONAL LAND SURVEYORS & CONSULTANTS.
4. LFG PROBES LOCATIONS FROM FIELD SURVEY DATED APRIL 9, 2010, BY APPALACHIAN PROFESSIONAL LAND SURVEYORS & CONSULTANTS. PROBE P-2, P-3, AND P-9 THROUGH P-13 LOCATIONS WERE NOT SURVEYED AND ARE APPROXIMATE.

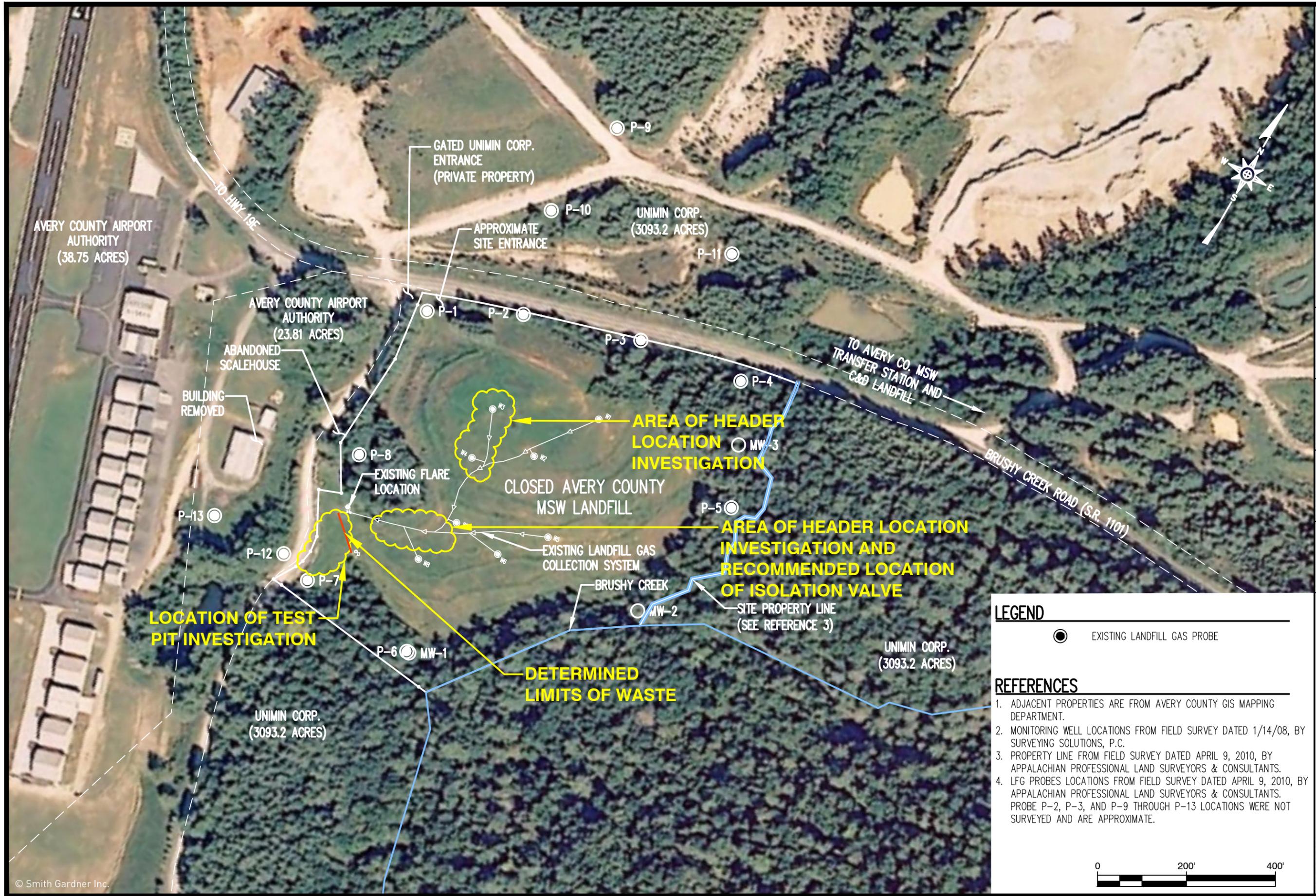


NC LIC. NO. C-0828 (ENGINEERING)
SMITH+GARDNER
 14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577

DRAWN:	W.R.B.	APPROVED:	D.M.M.	SCALE:	AS SHOWN	FIGURE NO.:	1
DATE:	Oct 2012	PROJECT NO.:	AVERY 12-6	FILENAME:	AVERY-B0192		

LANDFILL GAS MONITORING SYSTEM
AVERY COUNTY CLOSED MSWLF
SPRUCE PINE, NORTH CAROLINA

PREPARED FOR:



© Smith Gardner Inc.

PREPARED BY: _____ NC LIC. NO. C-0828 (ENGINEERING)

SMITH+GARDNER
 14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577

FIGURE NO.	2
SCALE:	AS SHOWN
APPROVED:	D.M.M.
DRAWN:	W.R.B.
PROJECT NO.:	AVERY 12-6
DATE:	Oct 2012
FILENAME:	AVERY-B0193

LEGEND

● EXISTING LANDFILL GAS PROBE

REFERENCES

1. ADJACENT PROPERTIES ARE FROM AVERY COUNTY GIS MAPPING DEPARTMENT.
2. MONITORING WELL LOCATIONS FROM FIELD SURVEY DATED 1/14/08, BY SURVEYING SOLUTIONS, P.C.
3. PROPERTY LINE FROM FIELD SURVEY DATED APRIL 9, 2010, BY APPALACHIAN PROFESSIONAL LAND SURVEYORS & CONSULTANTS.
4. LFG PROBES LOCATIONS FROM FIELD SURVEY DATED APRIL 9, 2010, BY APPALACHIAN PROFESSIONAL LAND SURVEYORS & CONSULTANTS. PROBE P-2, P-3, AND P-9 THROUGH P-13 LOCATIONS WERE NOT SURVEYED AND ARE APPROXIMATE.

PREPARED FOR:
LFGCCS
INVESTIGATIVE LOCATIONS
AVERY COUNTY CLOSED MSWLF
SPRUCE PINE, NORTH CAROLINA



© Smith Gardner Inc.

LEGEND

● EXISTING LANDFILL GAS PROBE

REFERENCES

1. ADJACENT PROPERTIES ARE FROM AVERY COUNTY GIS MAPPING DEPARTMENT.
2. MONITORING WELL LOCATIONS FROM FIELD SURVEY DATED 1/14/08, BY SURVEYING SOLUTIONS, P.C.
3. PROPERTY LINE FROM FIELD SURVEY DATED APRIL 9, 2010, BY APPALACHIAN PROFESSIONAL LAND SURVEYORS & CONSULTANTS.
4. LFG PROBES LOCATIONS FROM FIELD SURVEY DATED APRIL 9, 2010, BY APPALACHIAN PROFESSIONAL LAND SURVEYORS & CONSULTANTS. PROBE P-2, P-3, AND P-9 THROUGH P-13 LOCATIONS WERE NOT SURVEYED AND ARE APPROXIMATE.



PREPARED BY: _____ NC LIC. NO. C-0828 (ENGINEERING)

SMITH+GARDNER
 14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577

FIGURE NO:	3
SCALE:	AS SHOWN
APPROVED:	D.M.M.
PROJECT NO:	AVERY-12-6
DATE:	Oct 2012
FILENAME:	AVERY-B0194

PREPARED FOR:
**LFGCCS
 RECOMMENDATIONS
 AVERY COUNTY CLOSED MSWLF
 SPRUCE PINE, NORTH CAROLINA**

APPENDIX A

This page intentionally left blank.



DATE: May 3, 2011
 BY: FAT, DMM

Table 1
Avery County Closed MSW Landfill
Landfill Gas Collection and Control System Monitoring
May 2011

DataField CS - GEM Mode Data Output

Device ID	Date/Time mm/dd/yyyy	CH4 %	CO2 %	O2 %	Balance %	Adj. Temperature degF	Init. Temperature degF	Adj. Static Pressure in H2O	Init. Static Pressure in H2O	Baro in Hg	Adj. Flow Scfm	Init. Flow Scfm	Adj. Diff. Pressure in H2O	System Pressure in H2O
AVERY-W1	5/3/2011 11:29	70.6	28.3	0.9	0.2	75	75	0	-3.6	27.24	<<>	1	-0.582	-3.63
AVERY-W2	5/3/2011 11:31	72.1	27	0.2	0.7	75	75	-3.6	-3.7	27.18	2	3	0.004	-3.63
AVERY-W3	5/3/2011 11:33	70.8	28.7	0.4	0.1	75	75	-0.1	-3.6	27.19	4	1	0.011	-3.55
AVERY-W4	5/3/2011 11:36	69.6	29.9	0.4	0.1	75	75	-3.5	-3.4	27.19	<<>	<<>	-0.006	-3.7
AVERY-W5	5/3/2011 9:30	67.5	32	0.4	0.1	75	75	-3.9	-3.9	27.26	1	1	0.305	-4.23
AVERY-W6	5/3/2011 9:26	68.8	29.9	0.1	1.2	75	75	-3.8	-3.7	27.26	3	3	1.241	-4.84
AVERY-W7	5/3/2011 8:31	38.3	27.8	0	33.9	75	75	-0.6	-0.6	27.25	1	1	4.983	-5.49
AVERY-W8	5/3/2011 9:21	54.8	33.9	0.1	11.2	75	75	-4.4	-4.4	27.27	2	2	0.512	-4.87
Flare Station	5/3/2011 11:15	60.4	29.9	0.2	9.5	75	75	--	--	--	13*	--	0.25	-3.9

The differential pressure measurement should be positive. A negative differential pressure indicates no gas flow. Negative differential pressure may be the result of dirt or water obstructing the pitot tube perforations. Overpulling by adjacent extractions wells may also result in negative pressure being displayed.

* The flow at the flare station was calculated using a formula, not the GEM 2000.



DATE: June 9, 2011
 BY: DMM

Table 1
Avery County Closed MSW Landfill
Landfill Gas Collection and Control System Monitoring
June 2011

DataField CS - GEM Mode Data Output

Device ID	Date/Time mm/dd/yyyy	CH4 %	CO2 %	O2 %	Balance %	Adj. Temperature degF	Init. Temperature degF	Adj. Static Pressure in H2O	Init. Static Pressure in H2O	Baro in Hg	Adj. Flow Scfm	Init. Flow Scfm	Adj. Diff. Pressure in H2O	System Pressure in H2O
AVERY-W1	6/9/2011 16:02	72.2	26.7	0.9	0.2	75	75	0	-2.5	27.16	<<>>	<<>>	-0.021	-2.44
AVERY-W2	6/9/2011 16:06	73.9	23.8	1.1	1.2	75	75	0.1	-2.5	27.16	<<>>	<<>>	-0.658	-2.48
AVERY-W3	6/9/2011 16:13	70.9	27.6	0.6	0.9	75	75	-2.5	-2.4	27.17	<<>>	<<>>	-0.048	-2.98
AVERY-W4	6/9/2011 16:16	66.5	30.5	0	3	75	75	-2.4	-2.5	27.17	<<>>	<<>>	-0.068	-2.92
AVERY-W5	6/9/2011 16:26	65.4	32.4	0	2.2	75	75	-2.8	-2.8	27.17	1	1	0.156	-3.33
AVERY-W6	6/9/2011 16:30	41.7	28.8	0	29.5	75	75	-2.4	-2.5	27.24	2	2	0.486	-3.1
AVERY-W7	6/9/2011 16:33	37.6	26.4	0.1	35.9	75	75	-0.5	-0.5	27.23	0	0	2.5	-3.16
AVERY-W8	6/9/2011 16:36	31.6	27.9	0.2	40.3	75	75	-2.8	-2.7	27.23	1	1	0.259	-3.55
Flare Station	6/9/2011 16:44	51	25.3	0.1	23.6	75	75	NA	NA	NA	24*	NA		-3.4

The differential pressure measurement should be positive. A negative differential pressure indicates no gas flow. Negative differential pressure may be the result of dirt or water obstructing the pitot tube perforations. Overpulling by adjacent extractions wells may also result in negative pressure being displayed.

<<>> = measurement out of range of GEM 2000 meter. The reading was likely too low for measurement by the instrument.

* The flow at the flare station was calculated with readings gathered on 6/27/11, using an orifice plate gas flow formula.



DATE: August 16, 2011
 BY: DMM

Table 1
Avery County Closed MSW Landfill
Landfill Gas Collection and Control System Monitoring
July 2011

DataField CS - GEM Mode Data Output

Device ID	Date/Time mm/dd/yyyy	CH4 %	CO2 %	O2 %	Balance %	Adj. Temperature degF	Init. Temperature degF	Adj. Static Pressure in H2O	Init. Static Pressure in H2O	Baro in Hg	Adj. Flow Scfm	Init. Flow Scfm	Adj. Diff. Pressure in H2O	System Pressure in H2O
AVERY-W1	7/28/2011 11:27	64.8	24.4	3.1	7.7	75	75	-2	-2.1	27.35	12	486	0.099	-2.19
AVERY-W2	7/28/2011 11:31	61.1	22.4	3.2	13.3	75	75	-1.9	-1.9	27.33	3	56	0.007	-2.03
AVERY-W3	7/28/2011 11:35	69.3	28.8	0.4	1.5	75	75	-1.8	-1.9	27.33	2	<<>>	0.005	-1.87
AVERY-W4	7/28/2011 11:39	61.7	27.2	2	9.1	75	75	-1.9	-1.9	27.34	<<>>	<<>>	-0.004	-1.97
AVERY-W5	7/28/2011 11:51	61.8	29.9	1.3	7	75	75	-2	-2	27.39	0	37	0.083	-2.09
AVERY-W6	7/28/2011 11:54	51.3	26.6	0.9	21.2	75	75	-1.8	-1.7	27.39	1	57	0.289	-2.1
AVERY-W7	7/28/2011 11:47	53.8	30.3	0	15.9	75	75	-0.1	-0.1	27.39	0	25	1.95	-2.12
AVERY-W8	7/28/2011 11:58	44.9	27.7	0.5	26.9	75	75	-1.8	-2	27.41	1	37	0.162	-2.09
Flare Station	7/28/2011 12:14	42.3	21.5	4.8	31.2	75	75	NA	NA	NA	11*	NA		-2.9

The differential pressure measurement should be positive. A negative differential pressure indicates no gas flow. Negative differential pressure may be the result of dirt or water obstructing the pitot tube perforations. Overpulling by adjacent extractions wells may also result in negative pressure being displayed.

<<>> = measurement out of range of GEM 2000 meter. The reading was likely too low for measurement by the instrument.

* The flow at the flare station was calculated with readings gathered on 7/28/11, using the orifice plate gas flow formula provided on the next page. Measurements to calculate the flow were taken after the system was restarted, subsequent to being shut down for several hours. The flow measurement provided is not assumed to be indicative of the system fully charged.



DATE: August 25, 2011
 BY: DMM

Table 1
Avery County Closed MSW Landfill
Landfill Gas Collection and Control System Monitoring
August 2011

DataField CS - GEM Mode Data Output

Device ID	Date/Time mm/dd/yyyy	CH4 %	CO2 %	O2 %	Balance %	Adj. Temperature degF	Init. Temperature degF	Adj. Static Pressure in H2O	Init. Static Pressure in H2O	Baro in Hg	Adj. Flow Scfm	Init. Flow Scfm	Adj. Diff. Pressure in H2O	System Pressure in H2O
AVERY-W1	8/12/2011 8:40	52.5	22.4	4.8	20.3	72	72	-35.5	-34.7	-34.7	<<>>	<<>>	-0.004	-36.06
AVERY-W2	8/12/2011 8:52	73.7	20.8	2.1	3.4	72	72	-10.5	-0.9	-0.9	2	4	0.005	-34.17
AVERY-W3	8/12/2011 8:56	64.5	27.4	1.6	6.5	72	72	-32.6	-32.9	-32.9	3	<<>>	0.011	-34.34
AVERY-W4	8/12/2011 9:05	73.8	22.7	1	2.5	72	72	-4.5	-1.1	-1.1	<<>>	23	-0.012	-34.24
AVERY-W5	8/12/2011 7:58	47.5	33.9	0	18.6	72	72	-27.8	-27.8	-27.8	5	5	3.063	-30.63
AVERY-W6	8/12/2011 8:07	25	26.1	2.2	46.7	72	72	-14.8	-18.5	-18.5	7	11	5.849	-32.36
AVERY-W7	8/12/2011 8:16	9.1	21.6	0.8	68.5	72	72	-0.8	-1.3	-1.3	1	2	6.132	-33.28
AVERY-W8	8/12/2011 8:30	15.2	25.6	0.9	58.3	72	72	-10	-25.7	-25.7	2	8	0.591	-36.28
Flare Station	8/12/2011 10:01	27.6	20.7	5.9	45.8	72	72	NA	NA	NA	24*	NA		-36.6

The differential pressure measurement should be positive. A negative differential pressure indicates no gas flow. Negative differential pressure may be the result of dirt or water obstructing the pitot tube perforations. Overpulling by adjacent extractions wells may also result in negative pressure being displayed.

<<>> = measurement out of range of GEM 2000 meter. The reading was likely too low for measurement by the instrument.

* The flow at the flare station was calculated with readings gathered on 8/12/11, using the orifice plate gas flow formula provided on the next page.



DATE: September 15, 2011

BY: DMM

**Table 1
Avery County Closed MSW Landfill
Landfill Gas Collection and Control System Monitoring
September 2011**

DataField CS - GEM Mode Data Output

Device ID	Date/Time mm/dd/yyyy	CH4 %	CO2 %	O2 %	Balance %	Adj. Temperature degF	Init. Static Pressure in H2O	Adj. Static Pressure in H2O	Adj. Diff. Pressure in H2O	Init. Flow Scfm	Adj. Flow Scfm	System Pressure in H2O
Avery-W1	9/15/2011 10:51	69.6	30.3	0	0.1	71	-39.6	-39.8	-0.004	<<>>	<<>>	-40.23
Avery-W2	9/15/2011 11:01	75.6	25.3	0	0	71	-2.4	-13.3	0.015	<<>>	<<>>	-38.11
Avery-W3	9/15/2011 11:04	66.7	30.1	0.1	3.1	72	-35.1	-35.1	0.018	4	5	-38.38
Avery-W4	9/15/2011 11:08	67.1	22.6	1.6	8.7	71	-2.9	-2.9	0.201	18	18	-38.32
Avery-W5	9/15/2011 10:17	36.9	28.4	0	34.7	70	-33.3	-33.4	4.531	6	6	-37.59
Avery-W6	9/15/2011 10:26	7	19.5	3.4	70.1	72	-15.8	-6.3	-0.02	9	<<>>	-40.45
Avery-W7	9/15/2011 10:33	15.7	25.8	0	58.5	71	-0.6	-0.6	6.602	1	1	-40.49
Avery-W8	9/15/2011 10:37	14.7	26.1	0	59.2	71	-6.9	-6.8	0.674	2	2	-40.49
Flare Station	9/15/2011 10:15	28.4	23.7	1.6	47.3	72	NA	NA	NA	NA	24*	-38.79

The differential pressure measurement should be positive. A negative differential pressure indicates no gas flow. Negative differential pressure may be the result of dirt or water obstructing the pitot tube perforations. Overpulling by adjacent extractions wells may also result in negative pressure being displayed.

<<>> = measurement out of range of GEM 2000 meter. The reading was likely too low for measurement by the instrument.

* The flow at the flare station was calculated with readings gathered on 9/15/11, using the orifice plate gas flow formula provided on the next page.



DATE: October 26, 2011

BY: DMM

**Table 1
Avery County Closed MSW Landfill
Landfill Gas Collection and Control System Monitoring
October 2011**

DataField CS - GEM Mode Data Output

Device ID	Date/Time mm/dd/yyyy	CH4 %	CO2 %	O2 %	Balance %	Adj. Temperature degF	Init. Static Pressure in H2O	Adj. Static Pressure in H2O	Adj. Diff. Pressure in H2O	Init. Flow Scfm	Adj. Flow Scfm	System Pressure in H2O
Avery-W1	10/26/2011 9:43	67.3	29.8	0.8	2.1	68	-40.4	-40.4	-0.005	4	<<>>	-40.53
Avery-W2	10/26/2011 9:47	49.4	29.5	0.1	21	70	-24.8	-25.9	0.001	3	1	-39.96
Avery-W3	10/26/2011 9:56	64	32.2	0	3.8	60	-35.4	-36.2	0.027	5	6	-39.79
Avery-W4	10/26/2011 10:03	41.1	16.2	8.4	34.3	68	-3.8	-5.2	-0.002	1	<<>>	-39.74
Avery-W5	10/26/2011 10:13	23.8	25.3	1	49.9	72	-35.4	-17.5	0.344	6	1	-41.56
Avery-W6	10/26/2011 10:17	47.8	25.2	4.6	22.4	70	-1.8	-1.9	0.002	<<>>	0	-41.73
Avery-W7	10/26/2011 10:20	14.6	24	0.8	60.6	69	-1	-0.7	0.022	1	0	-42.36
Avery-W8	10/26/2011 10:26	19.3	25.8	1.3	53.6	70	-6.2	-4.2	0.156	4	1	-41.59
Flare Station	10/26/2011 11:30	32	26.6	1.5	39.9	70	NA	NA	NA	NA	17*	-41

The differential pressure measurement should be positive. A negative differential pressure indicates no gas flow. Negative differential pressure may be the result of dirt or water obstructing the pitot tube perforations. Overpulling by adjacent extraction wells may also result in negative pressure being displayed.

<<>> = measurement out of range of GEM 2000 meter. The reading was likely too low for measurement by the instrument.

* The flow at the flare station was calculated with readings gathered on 10/26/11, using the orifice plate gas flow formula provided on the next page.



DATE: November 29, 2011

BY: DMM

**Table 1
Avery County Closed MSW Landfill
Landfill Gas Collection and Control System Monitoring
November 2011**

DataField CS - GEM Mode Data Output

Device ID	Date/Time mm/dd/yyyy	CH4 %	CO2 %	O2 %	Balance %	Adj. Temperature degF	Init. Static Pressure in H2O	Adj. Static Pressure in H2O	Adj. Diff. Pressure in H2O	Init. Flow Scfm	Adj. Flow Scfm	System Pressure in H2O
Avery-W1	11/22/2011 10:43	67.6	27.8	1.2	3.4	63	-40.8	-40.9	0.013	6	4	-41.06
Avery-W2	11/22/2011 10:46	48.6	27.5	0.2	23.7	65	-31.8	-31.8	0.021	3	5	-41.13
Avery-W3	11/22/2011 10:49	63.6	31.7	0.5	4.2	65	-38.4	-38.3	0.007	1	3	-41.01
Avery-W4	11/22/2011 10:51	66.1	23.6	2.2	8.1	67	-4	-4	-0.005	2	<<>>	-41.04
Avery-W5	11/22/2011 10:56	31.9	25.4	0	42.7	69	-10.6	-10.6	0.685	2	2	-41.49
Avery-W6	11/22/2011 11:00	68.9	30.8	0	0.3	70	-0.1	-1.5	0.254	<<>>	1	-41.71
Avery-W7	11/22/2011 11:03	64.2	35.1	0.5	0.2	65	0.1	0.1	0.899	<<>>	0	-41.66
Avery-W8	11/22/2011 11:05	62.6	36.7	0.3	0.4	63	0.1	-0.4	0.05	0	0	-41.63
Flare Station	11/22/2011 11:08	32	26.6	1.5	39.9	70	NA	NA	NA	NA	21*	-41

The differential pressure measurement should be positive. A negative differential pressure indicates no gas flow. Negative differential pressure may be the result of dirt or water obstructing the pitot tube perforations. Overpulling by adjacent extraction wells may also result in negative pressure being displayed.

<<>> = measurement out of range of GEM 2000 meter. The reading was likely too low for measurement by the instrument.

* The flow at the flare station was calculated with readings gathered on 11/22/11, using the orifice plate gas flow formula provided on the next page.



DATE: December 21, 2011

BY: DMM

**Table 1
Avery County Closed MSW Landfill
Landfill Gas Collection and Control System Monitoring
December 2011**

DataField CS - GEM Mode Data Output

Device ID	Date/Time mm/dd/yyyy	CH4 %	CO2 %	O2 %	Balance %	Adj. Temperature degF	Init. Static Pressure in H2O	Adj. Static Pressure in H2O	Adj. Diff. Pressure in H2O	Init. Flow Scfm	Adj. Flow Scfm	System Pressure in H2O
Avery-W1	12/12/2011 14:08	61	26	2.5	10.5	62	-41.7	-41.7	-0.041	132	<<>>	-42.02
Avery-W2	12/12/2011 14:11	49.1	26.3	1.2	23.4	62	-32.9	-32.9	-0.006	2	<<>>	-41.08
Avery-W3	12/12/2011 14:14	57.5	29.3	1.6	11.6	61	-38.2	-38.2	-0.053	<<>>	<<>>	-41.84
Avery-W4	12/12/2011 14:18	50.8	18.6	5.6	25	70	-4.9	-4.9	-0.155	<<>>	<<>>	-41.47
Avery-W5	12/12/2011 14:22	28.1	25.1	0.6	46.2	60	-19.8	-19.8	1.614	4	4	-42.02
Avery-W6	12/12/2011 14:24	24.4	24.6	0	51	60	-2.7	-2.5	0.169	2	1	-42.14
Avery-W7	12/12/2011 14:27	34.5	29.1	0	36.4	61	0	0	0.672	0	0	-41.74
Avery-W8	12/12/2011 14:30	36.8	29.3	0.1	33.8	60	-1.8	-1.7	0.073	0	0	-42.01
Flare Station	12/12/2011 14:36	38.4	24.4	2.9	34.3	NA	0.5	NA	0.6	19	NA	-42.87

The differential pressure measurement should be positive. A negative differential pressure indicates no gas flow. Negative differential pressure may be the result of dirt or water obstructing the pitot tube perforations. Overpulling by adjacent extraction wells may also result in negative pressure being displayed.

<<>> = measurement out of range of GEM 2000 meter. The reading was likely too low for measurement by the instrument.



DATE: January 18, 2012

BY: DMM

**Table 1
Avery County Closed MSW Landfill
Landfill Gas Collection and Control System Monitoring
January 2012**

DataField CS - GEM Mode Data Output

Device ID	Date/Time mm/dd/yyyy	CH4 %	CO2 %	O2 %	Balance %	Adj. Temperature degF	Init. Static Pressure in H2O	Adj. Static Pressure in H2O	Adj. Diff. Pressure in H2O	Init. Flow Scfm	Adj. Flow Scfm	System Pressure in H2O
Avery-W1	1/18/2012 10:31	70.8	26.5	0.6	2.1	50	-42.1	-42.2	0.003	3	2	-42.32
Avery-W2	1/18/2012 10:34	53	25.5	0	21.5	65	-33.9	-33.9	0.012	2	4	-42.26
Avery-W3	1/18/2012 10:38	62.4	28.1	0.1	9.4	50	-38.6	-38.5	0.008	1	3	-42.29
Avery-W4	1/18/2012 10:43	73.8	22.5	0	3.7	50	-4.6	-7	-0.04	0	<<>>	-41.84
Avery-W5	1/18/2012 10:48	29.5	24.4	0	46.1	55	-21.2	-21.3	1.496	3	3	-41.93
Avery-W6	1/18/2012 10:51	18.9	23	0.1	58	50	-4.3	-4.2	0.178	1	1	-41.81
Avery-W7	1/18/2012 10:55	23.6	22.6	<<<<	N/A	50	-2	-1.8	0.855	<<>>	<<>>	-42.12
Avery-W8	1/18/2012 10:57	37.5	27.7	0	34.8	55	-3.6	-3.6	0.156	1	1	-41.99
Flare Station	1/18/2012 11:03	40.5	23.3	2.9	33.3	N/A	0.1	N/A	0.608	18	N/A	-42.44

The differential pressure measurement should be positive. A negative differential pressure indicates no gas flow. Negative differential pressure may be the result of dirt or water obstructing the pitot tube perforations. Overpulling by adjacent extraction wells may also result in negative pressure being displayed.

<<>> = measurement out of range of GEM 2000 meter. The reading was likely too low for measurement by the instrument.



DATE: March 26, 2012

BY: DMM

**Table 1
Avery County Closed MSW Landfill
Landfill Gas Collection and Control System Monitoring
February 2012**

DataField CS - GEM Mode Data Output

Device ID	Date/Time mm/dd/yyyy	CH4 %	CO2 %	O2 %	Balance %	Adj. Temperature degF	Init. Static Pressure in H2O	Adj. Static Pressure in H2O	Adj. Diff. Pressure in H2O	Init. Flow Scfm	Adj. Flow Scfm	System Pressure in H2O
Avery-W1	2/28/2012 13:05	69.1	25.9	0.9	4.1	70	-42.2	-42.1	-0.006	<<>>	<<>>	-42.33
Avery-W2	2/28/2012 13:07	48.1	24.9	0.1	26.9	60	-35.4	-35.3	-0.004	2	<<>>	-42.26
Avery-W3	2/28/2012 13:10	62.2	27.5	0.3	10	60	-39.7	-39.7	-0.017	<<>>	<<>>	-42.24
Avery-W4	2/28/2012 13:13	31.9	24.3	0	43.8	64	-21.6	-20.7	-0.023	<<>>	<<>>	-42.49
Avery-W5	2/28/2012 13:20	25.9	23	0.1	51	64	-20.6	-20.6	1.44	3	3	-42.33
Avery-W6	2/28/2012 13:22	17.1	21.3	0	61.6	61	-3.3	-3.3	0.23	1	1	-42.47
Avery-W7	2/28/2012 13:17	33.2	24.2	<<<<	N/A	64	-0.2	-0.2	0.212	<<>>	<<>>	-42.46
Avery-W8	2/28/2012 13:25	31.7	25.8	0.1	42.4	60	-2.6	-2.6	0.208	1	1	-42.42
Flare Station	2/28/2012 13:30	36.4	21.4	2.7	39.5	N/A	0.6	N/A	0.185	22	N/A	-42.54

The differential pressure measurement should be positive. A negative differential pressure indicates no gas flow. Negative differential pressure may be the result of dirt or water obstructing the pitot tube perforations. Overpulling by adjacent extraction wells may also result in negative pressure being displayed.

<<>> = measurement out of range of GEM 2000 meter. The reading was likely too low for measurement by the instrument.



DATE: March 26, 2012

BY: DMM

**Table 1
Avery County Closed MSW Landfill
Landfill Gas Collection and Control System Monitoring
March 2012**

DataField CS - GEM Mode Data Output

Device ID	Date/Time mm/dd/yyyy	CH4 %	CO2 %	O2 %	Balance %	Adj. Temperature degF	Init. Static Pressure in H2O	Adj. Static Pressure in H2O	Adj. Diff. Pressure in H2O	Init. Flow Scfm	Adj. Flow Scfm	System Pressure in H2O
Avery-W1	3/22/2012 9:23	70.3	29.3	0.2	0.2	65	-42.2	-42.1	0.008	4	3	-42.22
Avery-W2	3/22/2012 9:27	53.7	28.1	0.2	18	67	-35	-41.3	0.03	5	6	-41.37
Avery-W3	3/22/2012 9:29	65.4	30.1	0.3	4.2	68	-38.8	-39.7	0.022	2	5	-41.14
Avery-W4	3/22/2012 9:32	74.6	24.3	0.1	1	68	-0.3	-1.9	0.006	2	3	-40.97
Avery-W5	3/22/2012 9:37	31.9	26.3	0	41.8	75	-20.4	-21.7	1.988	3	4	-40.38
Avery-W6	3/22/2012 9:40	19.4	24.1	0	56.5	75	-3.4	-3.5	0.175	1	1	-40.42
Avery-W7	3/22/2012 9:42	54.6	30.8	0	14.6	75	-0.3	-0.7	3.256	0	0	-39.96
Avery-W8	3/22/2012 9:46	33.2	28.9	0	37.9	75	-3	-4.6	0.756	0	2	-39.41
Flare Station	3/22/2012 9:49	42.2	26	1.4	30.4	75	0.8	N/A	0.485	18	N/A	-42.26

The differential pressure measurement should be positive. A negative differential pressure indicates no gas flow. Negative differential pressure may be the result of dirt or water obstructing the pitot tube perforations. Overpulling by adjacent extraction wells may also result in negative pressure being displayed.

<<>> = measurement out of range of GEM 2000 meter. The reading was likely too low for measurement by the instrument.



DATE: April 20, 2012

BY: DMM

**Table 1
Avery County Closed MSW Landfill
Landfill Gas Collection and Control System Monitoring
April 2012**

DataField CS - GEM Mode Data Output

Device ID	Date/Time mm/dd/yyyy	CH4 %	CO2 %	O2 %	Balance %	Adj. Temperature degF	Init. Static Pressure in H2O	Adj. Static Pressure in H2O	Adj. Diff. Pressure in H2O	Init. Flow Scfm	Adj. Flow Scfm	System Pressure in H2O
Avery-W1	4/17/2012 11:53	71.1	27.6	1.2	0.1	75	-39.8	-39.9	-0.015	<<>>	<<>>	-39.85
Avery-W2	4/17/2012 11:56	54	26.6	0.1	19.3	73	-39.8	-39.3	-0.008	<<>>	<<>>	-40.36
Avery-W3	4/17/2012 11:59	65	29.9	0.2	4.9	74	-39.8	-39.8	-0.024	<<>>	<<>>	-40.15
Avery-W4	4/17/2012 12:02	24.1	23.9	0.3	51.7	75	-31.4	-31.5	-0.04	<<>>	<<>>	-40.26
Avery-W5	4/17/2012 12:07	27	24.3	0.9	47.8	72	-24.4	-24.5	1.596	3	3	-40.42
Avery-W6	4/17/2012 12:10	8.5	20.5	1.7	69.3	75	-4.3	-4.4	0.188	1	1	-40.3
Avery-W7	4/17/2012 12:13	8.8	18	2.5	70.7	72	-1.5	-1.6	3.867	1	1	-40.29
Avery-W8	4/17/2012 12:16	14.7	23.9	0.6	60.8	75	-11.3	-9.1	0.217	3	1	-40.91
Flare Station	4/17/2012 12:24	33.2	22.9	2.6	41.3	N/A	0.9	N/A	0.437	<<>>	17	41.2

The differential pressure measurement should be positive. A negative differential pressure indicates no gas flow. Negative differential pressure may be the result of dirt or water obstructing the pitot tube perforations. Overpulling by adjacent extraction wells may also result in negative pressure being displayed.

<<>> = measurement out of range of GEM 2000 meter. The reading was likely too low for measurement by the instrument.



DATE: May 31, 2012
 BY: DMM

Table 1
Avery County Closed MSW Landfill
Landfill Gas Collection and Control System Monitoring
May 2012

DataField CS - GEM Mode Data Output

Device ID	Date/Time mm/dd/yyyy	CH4 %	CO2 %	O2 %	Balance %	Adj. Temperature degF	Init. Static Pressure in H2O	Adj. Static Pressure in H2O	Adj. Diff. Pressure in H2O	Init. Flow Scfm	Adj. Flow Scfm	System Pressure in H2O
Avery-W1	5/24/2012 10:23	68.8	27.8	0	3.4	72	-40.6	-40.6	0.004	<<>>	2	-40.61
Avery-W2	5/24/2012 10:26	49.9	26.4	0.4	23.3	73	-35.5	-35.5	0.004	2	2	-40.61
Avery-W3	5/24/2012 10:29	60.2	27.3	0.3	12.2	74	-39.2	-39.1	0.003	1	2	-40.67
Avery-W4	5/24/2012 10:32	25.3	21.9	0.2	52.6	74	-30.9	-30.9	0.004	2	1	-40.69
Avery-W5	5/24/2012 10:36	28.2	24	0.8	47	72	-25.8	-26	1.53	3	3	-40.85
Avery-W6	5/24/2012 10:39	11.3	20.4	0.2	68.1	73	-4.4	-4.4	0.174	1	1	-40.86
Avery-W7	5/24/2012 10:44	14	22.3	0.5	63.2	74	-3.4	-3.5	3.716	0	0	-38.87
Avery-W8	5/24/2012 10:41	29.2	26.5	0	44.3	74	-4.8	-4.8	0.14	3	<<>>	-40.76
Flare Station	5/24/2012 10:49	34.8	23.4	1.6	40.2	N/A	0.9	N/A	0.469	<<>>	16	40.9

The differential pressure measurement should be positive. A negative differential pressure indicates no gas flow. Negative differential pressure may be the result of dirt or water obstructing the pitot tube perforations. Overpulling by adjacent extraction wells may also result in negative pressure being displayed.

<<>> = measurement out of range of GEM 2000 meter. The reading was likely too low for measurement by the instrument.