RICHARDSON SMITH GARDNER & ASSOCIATES
ENGINEERING & GEOLOGICAL SERVICES

August 25, 2011

Ms. Jaclynne Drummond
NCDENR DWM Solid Waste Section
1646 Mail Service Center
Raleigh, North Carolina 27699-1646

RE: Operations, Monitoring, and Maintenance Report – July 2011
Avery County Closed MSW Landfill
Spruce Pine, North Carolina

Dear Ms. Drummond:

This report provides information concerning the operation and monitoring (O&M) of the Avery County Closed MSW Landfill (Permit No. 06-01) Landfill Gas Collection and Control System (LFGCCS). This report covers the July 2011 monitoring period. Mr. Don Misenheimer with RSG, performed the July site visit on July 28, 2011. Details of this inspection are provided below.

ACTION LIST

RSG has identified the following items to be addressed in order for the LFGCCS to operate as designed:

1. **W-5, W-6, W-7 &W-8:** Orifice plate sizes should continue to be evaluated and adjusted as necessary.

2. **Flare:** An extended flare collar should be considered for possible high wind related issues onsite.

3. **Blower:** RSG is continuing to evaluate the blower size for optimal system performance.

4. **RSG will return to the site during the first week of August to evaluate the effectiveness of improvements completed during this site visit (see below).**

LFG EXTRACTION WELL MONITORING REQUIREMENTS

As set forth in the *Off-site Landfill Gas Mitigation Plan*[1], approved, via letter, on February 10, 2011 by NCDENR Division of Waste Management[2], monthly monitoring of the LFGCCS will include the following:

- CH_4, O_2, CO_2, and Pressure monitoring at each extraction well head;

[1] *Off-Site Gas Mitigation Plan*. Richardson Smith Gardner and Assoc. January 18, 2011
[2] *Off-Site Gas Mitigation Plan*- Approval. Letter from Jaclynne Drummond, NCDENR, February 10, 2011

- CH_4, O_2, CO_2, and Pressure monitoring at the flare station; and
- adjustment of LFGCCS to balance recovery and ensure safe operation of the system.

The County will maintain this LFGCCS for a period of at least 12 months to evaluate the effectiveness of increased LFG recovery from the waste mass in alleviating off-site migration of LFG. During this time, LFG monitoring at the landfill and for off-site properties will be continued on a monthly basis. Reporting of these results will be accordance with the approved LFG Monitoring Plan.

At this time RSG has not yet submitted the revised Landfill Gas Monitoring Plan, pending obtaining access agreements from off-site property owners. As this plan is submitted and approved, monitoring requirements may be updated.

LFG EXTRACTION WELL MONITORING ACTIVITIES

Flare station and well field monitoring was performed on July 28, 2011. The results of this event are summarized below. Recommended actions are made in **bold**. Well field data and flare station data are provided in the **attached Table 1**.

The following actions were taken at the well field and flare station during this period:

Well Field

- **W-1 through W-8:** All wells were adjusted to fully open during this monitoring event.

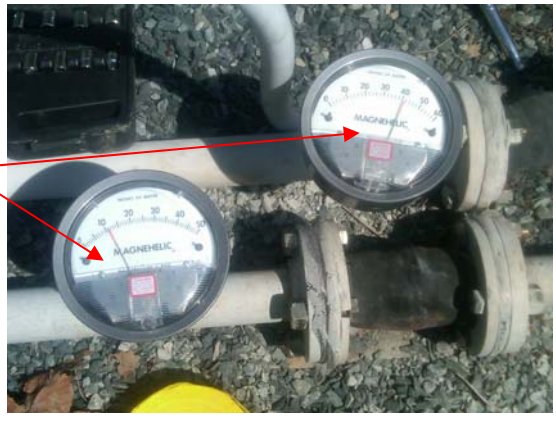
- **W-7**: The 0.25" orifice plate at this location has been determined to be the proper size at this location. **Outstanding Action Item: Orifice plate sizes on wells W-5, W-6, W-7 &W-8, should continue to be evaluated and adjusted as necessary**.

Flare Station

- The flare was burning and the temperature data logger at the flare was checked and determined to be operational during this site visit. **An extended flare collar should be considered for possible high wind related issues onsite.**

- The blower was shut down and two (2) Magnehelic gagues were replaced. The first gauge is located between the flare station inlet valve and the blower and measures vacuum. The second gauge replaced is located between the blower and the flare and measures pressure. The replaced gauges are shown below.

Replaced gauges



- Due to historically low vacuum readings across the well field, the inlet value at the flare station was removed and was confirmed to be functioning properly. RSG then proceeded by disconnecting the pipe fittings between the valve and the blower to check for blockages. A screen located in a flange (see above image) was found to be mostly clogged by a rust/mud substance (see below image). This screen was cleaned and replaced. The disconnected pipes were cleared of major rust residue and reconnected. The valve was reinstalled and the blower was restarted. **Outstanding Action Item: RSG will return to the site during the first week of August to evaluate the effectiveness of these improvements.**

- System vacuum readings before and after the knockout-pot were checked and since no significant loss in vacuum was noted, the knockout-pot was determined to be operating properly. The site's only condensate tank (as shown on **Figure 1**) was checked and no excessive liquid was found.

- **Outstanding Action Item: RSG is continuing to evaluate the blower size for optimal system performance.**

LFG MONITORING WELL (PERIMETER) MONITORING

RSG personnel conducted the July 2011 monitoring of the perimeter LFG monitoring wells on July 28, 2011. Results of this monitoring event are included in **Attachment 1**. Monitoring wells P1, P3, and P7 each measured over the 100% LEL or 5% by volume of CH_4, while all other wells had no detectable concentrations of CH_4. These wells will continue to be monitored and data will be submitted in this reporting format.

The next routine monitoring event is tentatively scheduled for the third week of August 2011, but a site visit is also planned for the first week of August for the evaluation of recent improvements. If you have any questions, or require additional information, please contact us at your earliest convenience at 919-828-0577 or by e-mail (address below).

Sincerely,
Richardson Smith Gardner and Associates, Inc.

Don Misenheimer
Project Scientist, ext. 224
don@rsgengineers.com

Joan A. Smyth, P.G.
Senior Hydrogeologist ext. 221
joan@rsgengineers.com

Attachments

CC: Buddy Norris – Avery County
Bill Wagner – NCDENR
Stacey Smith, P.E. – RSG
File

H:\Projects\Avery County (NC)\Avery 11-3 (MSW LFG Operations & Monitoring)\monitoring data\July_2011\Avery County MSW LFG Letter Report July 2011.doc

Table

DATE: August 16, 2011
BY: DMM

RICHARDSON SMITH GARDNER & ASSOCIATES
ENGINEERING & GEOLOGICAL SERVICES

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	CH4	CO2	O2	Balance	Adj. Temperature	Init. Temperature	Adj. Static Pressure	Init. Static Pressure	Baro	Adj. Flow	Init. Flow	Adj. Diff. Pressure	System Pressure
	mm/dd/yyyy	%	%	%	%	degF	degF	in H2O	in H2O	in Hg	Scfm	Scfm	in H2O	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 he 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.

Lambda Square Inc.
71 Deer Park Ave., Babylon, NY 11702
www.lambdasquare.com
(800) 587-5423 / (631) 587-1000
FAX (631) 587-1011
info@lambdasquare.com

Air & Gas Flow – Oripac Flow Meter

SCFM (Base Conditions 14.696 psi & 60 deg F.)

Conversion formula used to solve for flow rate based on plotting changes in inlet pressure and temperature. This formula is designed for use as a "quick check" reference only as the results may differ from the calculation values due to rounding, combining of variables, and making certain assumptions in an effort to keep the formula as abbreviated as possible. Equation source list available on request.

Input new h/w as well as new pressures and/or temperatures using the formula below:

$$SCFM = \frac{5.9816 \times (d^2) \times (K) \times (Y) \times \sqrt{h/w} \times \sqrt{\frac{2.703 \times P_L \times SG}{460 + T_L}}}{\frac{2.703 \times 14.7 \times SG}{460 + T_b}}$$

Where:

5.9816 = physical constant
d = bore in inches
K = flow coefficient
Y = expansion factor
h/w = differential pressure (inches w/c)
P_L = line pressure (psia)
T_L = line temperature (deg f)
T_b = base temperature (deg f)
ß = beta ratio (d/D)
SG = specific gravity at line conditions (air = 1.00)
SH = specific heat ratio cp/cv (air = 1.4)
Rn = reynolds number at max flow

$$K = C \times \frac{1}{\sqrt{1 - ß^4}}$$

$$Y = 1 - (.41 + .35\, ß^4)\left(\frac{h/w \times .0361}{P_L \times 1.4}\right)$$

$$C = 0.5959 + 0.0312\, ß^{2.1} - 0.1840\, ß^8 + 91.71\, ß^{2.5} \left(Rn^{-0.75}\right)^*$$

*Rn value can be extrapolated from existing calc sheet values. Modification to include actual Rn at new conditions is typically not necessary. Input variables (Rn) from "Normal" operating conditions from calculatin sheet.

Formulas for C, Y and K values are for justification purposes only. Refer to calculation sheet for Y and K values.

Lambda Square Inc.
71 Deer Park Ave., Babylon, NY 11702
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info@lambdasquare.com

ORIFICE SIZING PROGRAM

"Streamlined" print versions of the basic sizing formula are available from Lambda Square. These are designed for use as a "quick check" reference only as the results may differ from the calculation values due to rounding, combining of variables, and making certain assumptions in an effort to keep the formulas as abbreviated as possible.

---- EQUATION SOURCES -----

Lambda Square calculations are preformed using the ORIFICE2 software sizing program developed and marketed by FlowSoft Inc. ORIFICE2 primarily utilizes the equations as found in the *Flow Measurement Engineering Handbook*, 2nd edition by R.W. Miller, available through McGraw Hill publishing (800) 262-4729. as well as other equations which are published in a number of widely used publications. The bibliography section lists those publications and the user is urged to obtain a copy for reference.

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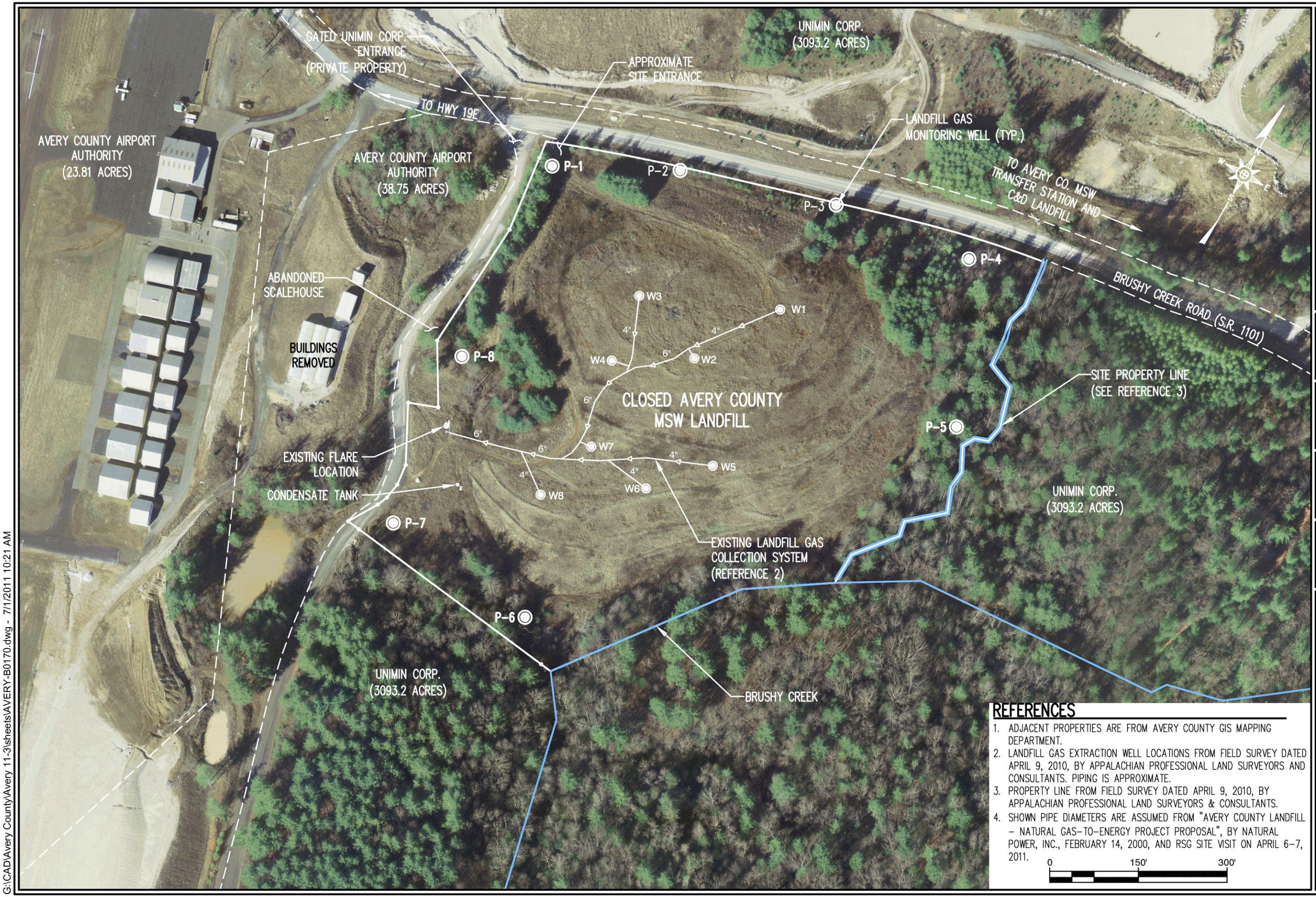
Figure



REFERENCES

1. ADJACENT PROPERTIES ARE FROM AVERY COUNTY GIS MAPPING DEPARTMENT.
2. LANDFILL GAS EXTRACTION WELL LOCATIONS FROM FIELD SURVEY DATED APRIL 9, 2010, BY APPALACHIAN PROFESSIONAL LAND SURVEYORS AND CONSULTANTS. PIPING IS APPROXIMATE.
3. PROPERTY LINE FROM FIELD SURVEY DATED APRIL 9, 2010, BY APPALACHIAN PROFESSIONAL LAND SURVEYORS & CONSULTANTS.
4. SHOWN PIPE DIAMETERS ARE ASSUMED FROM "AVERY COUNTY LANDFILL – NATURAL GAS-TO-ENERGY PROJECT PROPOSAL", BY NATURAL POWER, INC., FEBRUARY 14, 2000, AND RSG SITE VISIT ON APRIL 6-7, 2011.

0 150' 300'

RICHARDSON SMITH GARDNER & ASSOCIATES
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14 N. Boylan Ave. Raleigh, N.C. 27603
ph: 919-828-0577 fax: 919-828-3899
www.rsgengineers.com

FIGURE NO.	1
FILE NAME	AVERY-B0170
SCALE:	AS NOTED
PROJECT NO.	AVERY 11-3
CHECKED BY:	D.M.M.
DRAWN BY:	J.A.L.
DATE:	Jul. 2011

TITLE:
EXISTING LANDFILL GAS EXTRACTION SYSTEM
AVERY COUNTY CLOSED MSWLF
SPRUCE PINE, NC

G:\CAD\Avery County\Avery 11-3\sheets\AVERY-B0170.dwg - 7/1/2011 10:21 AM

Attachment 1

DENR USE ONLY: ☐ Paper Report ☐ Electronic Data - Email CD (data loaded: Yes / No) Doc/Event #:

NC DENR
Division of Waste Management - Solid Waste

Environmental Monitoring Reporting 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).

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):

Richardson Smith Gardner and Associates, Inc.

Contact for questions about data formatting. Include data preparer's name, telephone number and E-mail address:

Name: Joan A. Smyth, P.G. Phone: 919-828-0577 x 221

E-mail: joan@rsgengineers.com

Facility name:	Facility Address:	Facility Permit #	NC Landfill Rule: (.0500 or .1600)	Actual sampling dates (e.g., October 20-24, 2006)
Avery County Closed MSW Landfill	Brushy Creek Road Spruce Pine, NC	06-01	.0500	July 28, 2011

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
☐ Groundwater monitoring data from private water supply wells
☐ Leachate monitoring data
☐ Surface water monitoring data
☒ Methane gas monitoring data
☐ Corrective action data (specify) _____
☐ Other(specify) _____

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.

Joan A. Smyth, P.G. | Senior Hydrogeologist | 919-828-0577 x 221

Facility Representative Name (Print) | Title | (Area Code) Telephone Number

Joan A. Smyth 8/25/11

Signature | Date

Affix NC Licensed/ Professional Geologist Seal

NORTH CAROLINA LICENSED SEAL 1369 GEOLOGIST JOAN A. SMYTH

8/29/11

14 N. Boylan Avenue Raleigh, NC 27603

Facility Representative Address

C-0828

NC PE Firm License Number (If applicable effective May 1, 2009)

Revised 6/2009

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: Closed Avery County MSW LF Permit Number: 06-01

Date of Sampling: 7.28.11 NC Landfill Rule (.0500 or .1600): .0500

Name and Position of Sample Collector: Don Mosenheimer (RSG)

Type and Serial Number of Gas Meter: LFG 2000 GM 07002 ** Calibration Date of Gas Meter: 4.24.10 INSP

Date and Time of Field Calibration: 7.28.11 7:30

Type of Field Calibration Gas (15/15 or 35/50): 15/15 Expiration Date of Field Calibration Gas Canister: 4.2013

Pump Rate of Gas Meter: 0.5 L/min

Ambient Air Temperature: 88° Barometric Pressure: 27.35 General Weather Conditions: P. Sunny

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	Notes
P1	760s	7:35	760s	7100	7100	56.0	0.2	28.0	
P2	760s	7:37	760s	0	0	0	5.9	18.8	
P3	760s	7:40	760s	7100	7100	64.8	0.0	33.7	
P4	760s	7:43	760s	0	0	0	16.0	4.6	
P5	760s	7:50	760s	0	0	0	19.2	0.3	
P6	760s	7:55	760s	0	0	0	15.2	3.3	
P7	760s	8:01	760s	7100	7100	34.9	0.0	16.2	
P8	760s	8:15	760s	0	0	0	17.9	2.1	

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.

Don J RSG
SIGNATURE

Project Scientist
TITLE

* NOTE: METER WAS FIELD CAL'D USING 15/15 GAS, THEREFORE HIGH READINGS MAY NOT HAVE A HIGH LEVEL OF ACCURACY. THE GEM 2000 WAS RE-CAL'D AFTER HIGH READINGS WERE FOUND. RG TESTS YEILDED NO SIGNIFICATE CHANGES