



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 – August 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 August 2011 monitoring period. Mr. Don Misenheimer with RSG, performed the August site visit on August 12, 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-1 and W-3:** These wells have been determined to be watered out/totally clogged. **RSG is currently evaluating options to address this condition.**
2. **W-2 and W-4:** These wells have been determined to be partially watered out/partially clogged and are only able have minimal system pressure applied for LFG extraction. **RSG is currently evaluating options to address this condition.**
3. **W-5, W-6, W-7 & W-8:** Orifice plate sizes should continue to be evaluated and adjusted as necessary.
4. **Flare:** An extended flare collar should be considered for possible high wind related issues onsite.
5. **Blower:** RSG is continuing to evaluate the blower size for optimal system performance.

LFG EXTRACTION WELL MONITORING REQUIREMENTS

As set forth in the *Off-site Landfill Gas Mitigation Plan*¹, approved, via letter, on February 10,

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

2011 by NCDENR Division of Waste Management², monthly monitoring of the LFGCCS will include the following:

- CH₄, O₂, CO₂, and Pressure monitoring at each extraction well head;
- CH₄, O₂, CO₂, 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. As this plan is submitted and approved, monitoring requirements may be updated.

LFG EXTRACTION WELL MONITORING ACTIVITIES

RSG performed a return site visit on August 3rd to evaluate how system performance was affected by improvements completed on July 28, 2011. RSG arrived on site and measured either positive pressure or no vacuum at the LFG wells on the well field. RSG proceeded to the flare station and disassembled the piping between the inlet valve and the blower. The filter screen that was cleaned during the last site visit was removed and not reinstalled. The piping was re-connected.

RSG evaluated the pressure at various locations between the blower and the flare and subsequently removed the flame arrester. RSG pressure washed the flame arrester cartridge. The flare igniter was turned off and the blower was started to “blow out” all piping at the flare station to remove built-up flaking corrosion. The flame arrester cartridge was then reinstalled and the system reactivated. Before RSG left the site, there was approximately 19 inches of available vacuum at each of the LFG wells across the well field.

RSG returned to perform the flare station and well field monitoring on August 12, 2011. When RSG arrived to the site, there was approximately 35 inches of available vacuum at each of the LFG wells across the well field. 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 and W-3:** These wells have been determined to be watered out/totally clogged.
Outstanding Action Item: RSG is currently evaluating options to address this condition.

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

- **W-2 and W-4:** These wells have been determined to be partially watered out/partially clogged and are only able have minimal system pressure applied for LFG extraction. **Outstanding Action Item: RSG is currently evaluating options to address this condition.**
- **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.**
- A damaged PVC pipe leading from the sump into the site's only condensate tank was found to be damaged and vacuum was present. RSG repaired this pipe and subsequently opened the sump and confirmed no water was present. RSG added water into the sump to the appropriate level to stop vacuum at the condensate tank. No excessive liquid was found at the condensate tank.
- **Outstanding Action Item: RSG is continuing to evaluate the blower size for optimal system performance.**

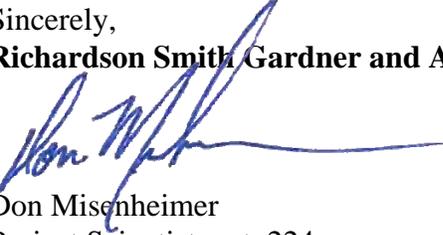
LFG MONITORING WELL (PERIMETER) MONITORING

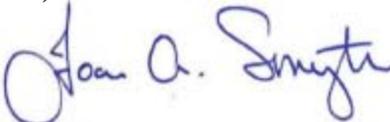
RSG personnel conducted the August 2011 monitoring of the perimeter LFG monitoring wells on August 12, 2011. Results of this monitoring event are included in **Attachment 1**. Monitoring wells P1, P3, and P7 each measured over the 100% LEL or 5% by volume of CH₄, while all other wells had no detectable concentrations of CH₄. These wells will continue to be monitored and data will be submitted in this reporting format.

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The next routine monitoring event is tentatively scheduled for the third week of September 2011.
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

Table



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.

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:

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

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)

β = 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

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

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

$$C = 0.5959 + 0.0312 \beta^{2.1} - 0.1840 \beta^8 + 91.71 \beta^{2.5} \left(\frac{Rn}{1000} \right)^{-0.75}$$

*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 calculation 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
www.lambdasquare.com

(800) 587-5423 / (631) 587-1000
FAX (631) 587-1011
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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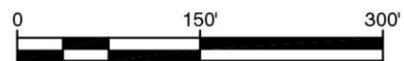
Figure

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



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.



RICHARDSON SMITH GARDNER & ASSOCIATES
INC. LIC. NO. C-282 (Engineering)
 www.rsgengineers.com

ph: 919-826-0577
 fax: 919-826-3899

14 N. Boylan Ave.
 Raleigh, N.C. 27603

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

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

Attachment 1

DENR USE ONLY:
NC DENR

Paper Report Electronic Data - Email CD (data loaded: Yes / No)

Doc/Event #:

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 Co. Closed MSW Landfill	2175 Brushy Creek Rd. Spruce Pine, NC	06-01	.0500	8-12-2011

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 Methane gas monitoring data
 Groundwater monitoring data from private water supply wells Corrective action data (specify) LFG System Data
 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.

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

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

Joan A. Smyth
Signature

8/25/11

Date

Affix NC Licensed/ Professional Geologist Seal

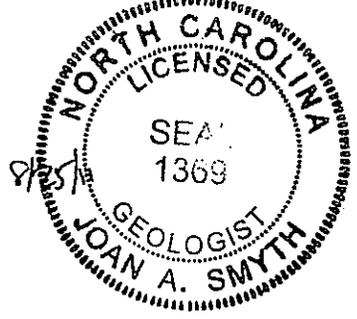
14 N. Boylan Avenue Raleigh, NC 27603

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

Date of Sampling: 8-12-11 NC Landfill Rule (.0500 or .1600): .0500

Name and Position of Sample Collector: DON MISENHEIMER (RSG)

Type and Serial Number of Gas Meter: GEM 2000 07002 HP Calibration Date of Gas Meter: 4-2010 CASP

Date and Time of Field Calibration: 8-12-11 10:00a

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: 0.54/min

Ambient Air Temperature: 85° Barometric Pressure: 27.17 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	7605	10:10a	7605	7100	7100	36.8	2.8	25.6	
P2	7605	10:15a	7605	0	0	0	13.1	9.8	
P3	7605	10:25a	7605	7100	7100	44.5	6.4	22.2	
P4	7605	10:33a	7605	0	0	0	16.7	4.4	
P5	7605	10:45a	7605	0	0	0	17.3	3.4	
P6	7605	10:50a	7605	0	0	0	13.2	6.3	
P7	7605	10:55a	7605	7100	7100	32.5	1.9	15.9	
P8	7605	10:59a	7605	0	0	0	14.2	2.3	

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 Misener RSG
SIGNATURE

PROTECT 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. RE-TESTS YIELDED NO SIGNIFICANT CHANGES.