

August 25, 2014

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

**RE: Operations, Monitoring, and Maintenance Report – July 2014
Avery County Closed MSW Landfill
Spruce Pine, North Carolina**

Dear Ms. Drummond:

Smith Gardner, Inc. (S+G) is pleased to present this report concerning the operation and maintenance (O&M) of the Avery County Closed MSW Landfill (Permit No. 06-01) Landfill Gas Collection and Control System (LFGCCS) and monitoring of the on- and off-site landfill gas probes for the July 2014 monitoring period. Mr. Frank Terry with S+G performed the site visit on July 24, 2014. Site visit details are provided below.

CURRENT STATUS

S+G previously identified the following items to be addressed for the LFGCCS to operate as designed:

1. **LFGCCS System:** An expansion of the LFGCCS system, as proposed in the *Annual Landfill Gas Monitoring Report*¹, was previously approved² by the division of Waste Management. Phase One of the expansion project has been completed. S+G is reviewing the data collected to evaluate the improvements for effectiveness. A summary of this evaluation has been submitted to the division under separate cover including recommendations for additional work. This work plan has been approved by NCDENR and S+G plans to begin implementation in September.

LFG EXTRACTION WELL MONITORING PROGRAM

Monthly monitoring of the LFGCCS will continue and shall include the following items:

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

¹ *Annual Landfill Gas Monitoring Report*, Closed Avery County MSW Landfill. Submitted by Smith Gardner, Inc., November 2012.

² Approval response letter, Closed Avery County MSW Landfill (Annual Landfill Gas Monitoring Report). Sent by Jaclynne Drummond, Solid Waste Section, November 15, 2012.

The County will maintain this LFGCCS and will continue to evaluate the effectiveness of increased LFG recovery from the waste mass in alleviating off-site LFG migration. Results from monthly monitoring events will be reported in accordance with the approved LFG Monitoring Plan.

LFG EXTRACTION WELL MONITORING ACTIVITIES

S+G personnel performed the flare station and well field monitoring on July 24, 2014. Initial measurements indicated there was approximately 42 inches of available vacuum at each of the LFG wells across the well field. The results from this event are summarized below. Recommended actions are underlined. Well field data and flare station data are provided in the attached **Table 1**.

LFG Extraction Well Field

- **W-1 through W-10:** S+G performed CH₄, O₂, CO₂, and pressure monitoring. No adjustments were made to the extraction well heads during this monitoring event.

In general, liquid levels at the LFG extraction wells have slightly increased since 2011. Wells W-1 through W-4 continue to exhibit evidence that a majority of well perforations are partially or completely clogged. Liquid levels in newly installed wells W-9 and W-10 are at or just below the solid pipe, completely blocking all perforations. S+G will continue to evaluate this condition.

- **Orifice Plates:** S+G continues to evaluate orifice plate sizes at wells W-5, W-7, W-9, and W-10 during each site visit. As LFG flow potential at these locations is stable, the correct orifice plate sizes are currently installed.

Flare Station

- **Condensate Tank:** The condensate tank was observed during this site visit; the liquid was at an acceptable level. S+G will continue to monitor the liquid level of the condensate tank.
- **Filter Tank:** The filter tank was emptied during this site visit. S+G will continue to monitor the liquid level of the filter tank.
- **Flare operation:** Flare operation continues to be intermittent due to poor overall gas quality and low flow rate. S+G will continue to adjust the system to optimize gas flow and quality.

LFG MONITORING WELL (PERIMETER) MONITORING PROGRAM

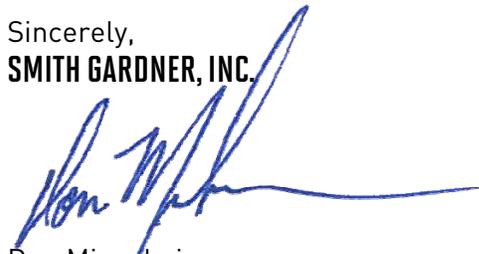
S+G personnel also performed monitoring of the perimeter LFG monitoring network on July 24, 2014. Monitoring wells P1, P3, P7 and P11 each measured over the 100% LEL or 5% by

Ms. Drummond
August 25, 2014
Page 3 of 3

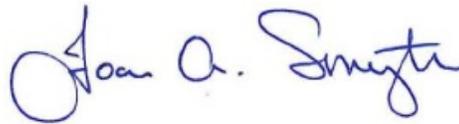
volume of CH₄. Monitoring well P13 measured 62% LEL or 3.1% by volume of CH₄. All other wells, monitored during this event, had no detectable concentrations of CH₄. Results of this monitoring event are included in **Attachment 1**. **Attachment 2** provides a methane concentration graph over time for monitoring wells that have historically had methane present. The current well network will continue to be monitored and data will be reported to NCDENR and the County.

The next routine monitoring event is scheduled for August 2014. 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,
SMITH GARDNER, INC.



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



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

Attachments

CC: Buddy Norris – Avery County
Deb Aja – NCDENR
File

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FIGURE

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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.



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

DRAWN: K.C.B.	APPROVED: D.M.M.	SCALE: AS SHOWN	FIGURE NO: 1
DATE: Dec 2013	PROJECT NO: AVERY 13-6	FILENAME: AVERY-B0216	

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

PREPARED FOR: _____

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TABLE

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TABLE 1
Avery County Closed MSW Landfill
Landfill Gas Collection and Control System Monitoring
July 2014

DataField CS - GEM Mode Data Output

Device ID	Date/Time	CH4	CO2	O2	Balance	Adj. Temperature	Init. Static Pressure	Adj. Static Pressure	Adj. Diff. Pressure	Init. Flow	Adj. Flow	System Pressure
	mm/dd/yyyy	%	%	%	%	degF	in H2O	in H2O	in H2O	Scfm	Scfm	in H2O
AVERY-W6	7/24/2014 7:32	68.5	27.5	0.4	3.6	71	-42.2	-42	-0.1	<<>>	<<>>	-42.05
AVERY-W5	7/24/2014 7:26	55.9	28.2	0.4	15.5	68	-42.1	-42	0	<<>>	<<>>	-41.9
AVERY-W2	7/24/2014 7:23	67.4	29.9	0	2.7	70	-42.1	-42.1	-0.3	<<>>	<<>>	-42.12
AVERY-W4	7/24/2014 7:17	23.3	24.7	0.3	51.7	70	-40	-39.2	0	<<>>	<<>>	-42.18
AVERY-W3	7/24/2014 6:57	34.7	27.2	0	38.1	69	-41.6	-41.6	0.8	2	2	-41.68
AveryW10	7/24/2014 6:53	7.3	16.3	6.1	70.3	73	-9.2	-9.2	0.3	33	37	-42.44
AVERY-W8	7/24/2014 7:01	13.2	21.7	1.7	63.4	72	-5.1	-0.1	-13.5	0	<<>>	-42.4
AVERY-W1	7/24/2014 6:49	13.2	22.9	2.4	61.5	70	-13.7	-13.5	0	3	4	-42.43
AVERY-W7	7/24/2014 7:29	24.2	16.5	6.9	52.4	72	-42.2	-42.1	0	<<>>	<<>>	-42.15
AVERY-W8	7/24/2014 7:21	28.3	13	13.4	45.3	72	-42.1	-42.1	0	0	<<>>	-42.14
Av-Flare	7/24/2014 6:38	32	24.7	2.1	41.2	N/A	0.8	N/A	N/A	18	N/A	N/A

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.

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ATTACHMENT 1

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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 Landfill Permit Number: 06-01

Date of Sampling: 7-24-14 NC Landfill Rule (.0500 or .1600): .0500

Name and Position of Sample Collector: FRANK TERRY PM

Type and Serial Number of Gas Meter: GEM 2000 (GM7002) Calibration Date of Gas Meter: 4/28/14

Date and Time of Field Calibration: 7-24-14 9:40 AM

Type of Field Calibration Gas (15/15 or 35/50): 15/15 Expiration Date of Field Calibration Gas Canister: 9/2/14

Pump Rate of Gas Meter: 0.5 LPM

Ambient Air Temperature: 78° Barometric Pressure: 27.1 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	Notes
P1	150s	10:31	150s		>100	63.2	0.1	29.1	
P2	150s	11:05	150s		0	0	20	0	
P3	150s	11:11	150s		>100	61.1	0	34.5	
P4	150s	11:22	150s		0	0	15.2	7.8	
P5	150s	11:30	150s		0	0	19.8	0.9	
P6	150s	10:07	150s		0	0	12.7	7.2	
P7	150s	10:55	150s		>100	27.9	0	17.9	
P8	150s	9:52	150s		0	0	16.6	6.7	
P9	150s	11:56	150s		0	0	18.3	1.9	
P10	150s	11:40	150s		0	0	14.2	5.1	

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.


SIGNATURE

PROJECT MANAGER
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NC Division of Waste Management - Solid Waste Section

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Facility Name: Avery County Closed MSW Landfill Permit Number: 06-01

Date of Sampling: 7-24-14 NC Landfill Rule (.0500 or .1600): .0500

Name and Position of Sample Collector: FRANK TERRY PM

Type and Serial Number of Gas Meter: GEM 2000 (GM 7002) Calibration Date of Gas Meter: 4/28/14

Date and Time of Field Calibration: 7-24-14 9:40

Type of Field Calibration Gas (15/15 or 35/50): 15/15 Expiration Date of Field Calibration Gas Canister: 9/7/14

Pump Rate of Gas Meter: 0.5 LPM

Ambient Air Temperature: 78° Barometric Pressure: 27.1 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	Notes
P11	150s	11:51	150s		7100	50.6	.5	24.7	
P12	150s	10:47	150s		0	0	20.3	0	
P13	150s	12:07	150s		62	3.1	4.6	10.1	

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Facility Name: Avery County Closed MSW Landfill Permit Number: 06-01

Date of Sampling: 7-24-14 NC Landfill Rule (.0500 or .1600): .0500

Name and Position of Sample Collector: FRANK TERRY PM

Type and Serial Number of Gas Meter: GM2000 (GM7002) Calibration Date of Gas Meter: 4/28/14

Date and Time of Field Calibration: 7-24-14 9:40

Type of Field Calibration Gas (15/15 or 35/50): 15/15 Expiration Date of Field Calibration Gas Canister: 9/07/12

Pump Rate of Gas Meter: 0.5 LPM

Ambient Air Temperature: 78° Barometric Pressure: 27.1 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	Notes
AVERY COUNTY AIRPORT STRUCTURE #1									
NE Corner	>60s	12:15	>60s	0	0	0	20.8	0	
NW Corner	>60s	12:17	>60s	0	0	0	20.8	0	
SE Corner	>60s	12:19	>60s	0	0	0	20.8	0	
SW Corner	>60s	12:21	>60s	0	0	0	20.8	0	
ADD ANY ADDITIONAL LOCATIONS AT OR NEAR STRUCTURE WITH METHANE PRESENT BELOW OR ON ADDITIONAL SHEETS									

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.

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Date of Sampling: 7-24-14 NC Landfill Rule (.0500 or .1600): .0500

Name and Position of Sample Collector: FRANK TERRY PM

Type and Serial Number of Gas Meter: G2M2000 (GM7002) Calibration Date of Gas Meter: 4/28/14

Date and Time of Field Calibration: 7-24-14 9:40

Type of Field Calibration Gas (15/15 or 35/50): 15/15 Expiration Date of Field Calibration Gas Canister: 9/7/17

Pump Rate of Gas Meter: 0.5 LPM

Ambient Air Temperature: 78° Barometric Pressure: 27.1 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	Notes
AVERY COUNTY AIRPORT STRUCTURE #2									
NE Corner	>60s	12:23	>60s	0	0	0	20.9	0	
NW Corner	>60s	12:25	>60s	0	0	0	20.9	0	
SE Corner	>60s	12:27	>60s	0	0	0	20.9	0	
SW Corner	>60s	12:29	>60s	0	0	0	20.9	0	
ADD ANY ADDITIONAL LOCATIONS AT OR NEAR STRUCTURE WITH METHANE PRESENT BELOW OR ON ADDITIONAL SHEETS									

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Date of Sampling: 7-24-14 NC Landfill Rule (.0500 or .1600): .0500

Name and Position of Sample Collector: FRANK TERRY PM

Type and Serial Number of Gas Meter: GEM2000 (GM7002) Calibration Date of Gas Meter: 4/28/14

Date and Time of Field Calibration: 7-24-14 9:40

Type of Field Calibration Gas (15/15 or 35/50): 15/15 Expiration Date of Field Calibration Gas Canister: 9/7/17

Pump Rate of Gas Meter: 0.5 LPM

Ambient Air Temperature: 78° Barometric Pressure: 27.1 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	Notes
AVERY COUNTY AIRPORT STRUCTURE #4									
NE Corner	>60s	12:39	>60s	0	0	0	20.9	0	
NW Corner	>60s	12:41	>60s	0	0	0	20.9	0	
SE Corner	>60s	12:43	>60s	0	0	0	20.9	0	
SW Corner	>60s	12:45	>60s	0	0	0	20.9	0	
ADD ANY ADDITIONAL LOCATIONS AT OR NEAR STRUCTURE WITH METHANE PRESENT BELOW OR ON ADDITIONAL SHEETS									

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.

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Name and Position of Sample Collector: FRANK TERRY PM

Type and Serial Number of Gas Meter: GM 2000 (GM7002) Calibration Date of Gas Meter: 4/28/14

Date and Time of Field Calibration: 7-24-14 9:40

Type of Field Calibration Gas (15/15 or 35/50): 15/15 Expiration Date of Field Calibration Gas Canister: 9/7/17

Pump Rate of Gas Meter: 0.5 LPM

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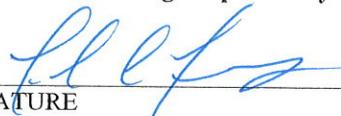
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Location or LFG Well ID	Sample Tube Purge	Time	Time Pumped (s)	Initial %LEL	Stabilized %LEL	%CH4 by Volume	%O2	%CO2	Notes
AVERY COUNTY AIRPORT STRUCTURE #5									
NE Corner	760s	12:47	760s	0	0	0	20.9	0	
NW Corner	760s	12:49	760s	0	0	0	20.9	0	
SE Corner	760s	12:51	760s	0	0	0	20.9	0	
SW Corner	760s	12:53	760s	0	0	0	20.9	0	
ADD ANY ADDITIONAL LOCATIONS AT OR NEAR STRUCTURE WITH METHANE PRESENT BELOW OR ON ADDITIONAL SHEETS									

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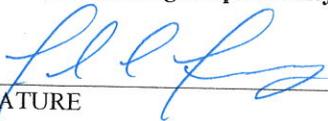
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Location or LFG Well ID	Sample Tube Purge	Time	Time Pumped (s)	Initial %LEL	Stabilized %LEL	%CH4 by Volume	%O2	%CO2	Notes
AVERY COUNTY AIRPORT STRUCTURE #6									
NE Corner	>60s	12:55	>60s	0	0	0	20.9	0	
NW Corner	>60s	12:57	>60s	0	0	0	20.9	0	
SE Corner	>60s	12:59	>60s	0	0	0	20.9	0	
SW Corner	>60s	13:01	>60s	0	0	0	20.9	0	
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PROJECT MANAGER
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ATTACHMENT 2

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TABLE 1
Avery County Closed MSW Landfill
Landfill Gas Collection and Control System Monitoring
May 2011 - July 2014

DATE	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13
May-11	21.8	0	54.8	0	0	0	31.8	0	NA	NA	NA	NA	NA
Jun-11	61.6	0	66.7	0	0	0	32.2	0	NA	NA	NA	NA	NA
Jul-11	56	0	64.8	0	0	0	34.9	0	NA	NA	NA	NA	NA
Aug-11	36.8	0	44.5	0	0	0	32.5	0	NA	NA	NA	NA	NA
Sep-11	29.9	0	45.5	0	0	0	33.4	0	NA	NA	NA	NA	NA
Oct-11	30	0	50.4	0	0	0	35	0	NA	NA	NA	NA	NA
Nov-11	43.8	0	54.2	0	0	0	42.3	0	0	0	36.2	0	0
Dec-11	36.8	0	44.1	0	0	0	36.7	0	0	0	39.3	0.2	1.6
Jan-12	49.4	0	0	0	0	0	36.6	0	0	0	26.8	0	2.1
Feb-12	27.3	0	36.4	0	0	0	34.4	0	0	0	41.4	0	0.6
Mar-12	65.7	0	62.9	0	0	0	35.6	0	0	0	38.2	0	1.7
Apr-12	58.1	0	51.1	0	0	0	34.2	0	0	0	45.1	0	1.9
May-12	54.5	0	2.8	0	0	0	33.1	0	0	0	34.2	0	2.3
Jun-12	56.3	0	2.3	0	0	0	36.9	0	0	0	34.9	0	1.3
Oct-12	55.1	0	63.6	0	0	0	34.2	0	0	0	47.5	0	2.4
Nov-12	56.2	0	66.3	0	0	0	37	0	0	0	41.7	0	0.1
Dec-12	52.6	0	59.7	0	0	0	42.9	0	0	0	45.7	0	0.3
Jan-13	45.9	0	49.8	0	0	0	42.7	0	0	0	39.6	0	0
Feb-13	65.6	0	64.1	0	0	0	32.3	0	0	0	53.8	0	0
Mar-13	33.6	0	58.9	0	0	0	32	0	0	0	58.4	0	1.8
Apr-13	36.7	0	59.9	0	0	0	31.4	0	0	0	59.9	0	0
May-13	28.1	0	56.2	0	0	0	24.9	0	0	0	49.1	0	0
Jun-13	17.7	0	51.9	0	0	0	28.2	0	0	0	41	0	6.5
Jul-13	27.4	0	55	0	0	0	24.2	0	0	0	46.2	0	0
Aug-13	9	0	60.8	0	0	0	26.1	0	0	0	41.7	0	0
Sep-13	7.3	0	63.7	0	0	0	33.3	0	0	0	58.2	0	0
Oct-13	8.1	0	50.4	0	0	0	32.1	0	0	0	54.2	0	0
Nov-13	4.1	0	19.2	0	0	0	33.1	0	0	0	41.4	0	0.8
Dec-13	34.8	0	47.7	0	0	0	32.2	0	0	0	39.7	0	1.8
Jan-14	36.2	0	48	0	0	0	39.9	0	0	0	44.7	0	0
Feb-14	58.4	0	62.6	0	0	0	33	0	0	0	53.3	0	3.2
Mar-14	61.3	0	0	0	0	0	29.3	0	0	0	43.1	0	1.8
Apr-14	59.4	0	40.2	0	0	0	30.1	0	0	0	52.7	0	0
May-14	66.2	0	52.8	0	0	0	29.3	0	0	0	50.3	0	3.9
Jun-14	61.8	0	54.7	0	0	0	28	0	0	0	50.2	0	2.9
Jul-14	63.2	0	61.1	0	0	0	27.9	0	0	0	50.6	0	3.1

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Avery County MSW Landfill Landfill Gas Monitoring Well Network Methane Concentrations Between May 2011 and July 2014

% CH4 by
Volume

