RICHARDSON SMITH GARDNER
& ASSOCIATES
ENGINEERING & GEOLOGICAL
SERVICES

January 18, 2011

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

RE: Off-Site Landfill Gas Mitigation Plan
Avery County Closed MSW Landfill
Spruce Pine, North Carolina

Dear Ms. Drummond:

As you are aware, Richardson Smith Gardner (RSG) is assisting Avery County with landfill gas management at the closed Avery County MSW landfill. Currently, LFG has been detected on off-site properties to the north of Brushy Creek Road (Unimin property) and west of the closed landfill (Airport Authority property). The previous correspondence and investigations regarding the monitoring and evaluation of LFG at this property are summarized below.

Previous Correspondence

Previous correspondence relating to this project includes the following:

- Notice of Violation[1];
- Avery County LFG Monitoring Plan[2];
- Avery County LFG Monitoring Network Installation Report[3];
- Avery County Explosive Gas Concentration Notification[4];
- Avery County Plan for Off-Site LFG Investigation[5]; and
- Avery County Off-Site LFG Investigation Results[6].

Based upon the detection of LFG on off-site properties, a plan for the mitigation of LFG on adjacent properties is warranted. This letter is sent to outline proposed procedures for the mitigation of LFG on off-site properties. The adjacent properties and soil gas survey results are shown on **Figure 1**.

Compliance Plan

Avery County is committed to remediating the LFG that has migrated off-site. Avery County will achieve compliance through a phased approach to LFG recovery. This phased approach is

1 NCDENR Notice of Violation to Avery Co., October 29, 2009.
2 Richardson Smith Gardner & Assoc. Inc. Landfill Gas Monitoring Plan Avery County NC, January 29, 2010.
3 Letter from Joan Smyth, P.G. (RSG) to Bill Wagner (NCDENR), May 28, 2010
4 Letter from Joan Smyth, P.G. (RSG) to Bill Wagner (NCDENR), June 30, 2010
5 Letter from Joan Smyth, P.G. (RSG) to Jaclynne Drummond (NCDENR), October 4, 2010
6 Letter from Joan Smyth, P.G. (RSG) to Jaclynne Drummond (NCDENR), November 19, 2010

outlined in the following actions, which are addressed in more detail throughout this section:

- Reactivation of inactive LFG Extraction Wells;
- Enhancement of the LFG Collection and Control System (LFGCCS) Monitoring/Maintenance; and
- Evaluation of Additional Measures and Recommendations.

Our evaluation of landfill gas generation (summarized below) indicates a low flowrate of landfill gas from the site. Based upon this, we believe the majority of the gas on adjacent properties may be relict gas that has collected over a long period of time. It is expected that relief of the driving LFG pressures in the subsurface through collection will remediate the off-site impacts over time.

Reactivation of LFG Extraction Wells

In January 2009, four (4) LFG extraction wells were removed from the LFGCCS due to a fire that occurred in/near these wells. The fire destroyed the well heads at these locations. In 2009, RSG secured these well heads to provide protection for the environment by preventing free-venting near the surface of the landfill. At this time, we propose that these wells be rehabilitated with new well heads and new header pipes to allow for their reconnection to the LFGCCS. A map depicting these well locations and the approximate extent of LFG migration off-site is included as **Figure 1**. A schematic of the proposed well heads for wells W-5 though W8 are included in Appendix C of the approved Landfill Gas Monitoring Plan[2].

RSG also performed an analysis of current landfill gas generation and hydraulic analysis of the existing system components to confirm adequacy for enhanced operations. Based on our results, it appears that the existing system piping and handling systems are sufficient to convey and destroy all anticipated gas (<56 CFM) that would be collected from the existing wellfield. The summary analyses are included in **Attachment 1**.

The recovery of these wells to the LFGCCS will allow greater LFG capture across the entire landfill to reduce pressure gradients that are likely driving the LFG onto adjacent properties. Furthermore, installation of the landfill gas monitoring network and the off-site monitoring points will allow the system to be reviewed for effectiveness in reducing concentration and driving gradients. Historically, this information has not been available and true effectiveness has not been evaluated.

Revision of LFG Monitoring Plan

Upon approval of these proposed mitigation strategies, RSG will revise the LFG Monitoring Plan to include these actions. The revised monitoring plan will be submitted to NCDENR for approval.

LFGCCS Optimization and Operation

Historically, the LFGCCS has been minimally operated through the Energy Xchange to support the neighboring greenhouse. The County understands the critical nature of

LFGCCS operations to maximize LFG recovery and minimize the possibility of a fire, and will operate this system accordingly. Monthly monitoring and system adjustment for recovery optimization will be performed. Monthly monitoring of the LFGCCS as described in the Landfill Gas Management Plan will consist of:

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

Evaluation of Additional Measures

RSG will evaluate the data collected during the LFGCCS optimization and operation period. Within 45 days of the completion of the 12 month period, RSG will prepare an evaluation report. This report will summarize the data collected and provide conclusions and recommendations for any additional LFG recovery measures that are warranted for the recovery of LFG from adjacent properties.

Mitigation Schedule

The anticipated schedule for this mitigation plan for the facility is presented below:

- The repair and reconnection of wells W5 through W8 will be completed within 60 days of the approval of this plan;

- A revision of the LFG Monitoring Plan to include the proposed mitigation actions will be submitted within 60 days of approval of this plan;

- A report summarizing the field activities for the reconnection of these wells will be submitted to NCDENR within 60 days of completion of field work. This report will include surveys of key LFGCCS features and as-built diagrams of wellhead reconstruction;

- Monthly LFGCCS optimization and operation visits will begin upon completion of LFGCCS upgrade to include the additional wells. Field reports during this period will be provided to the Division via email.

- A report will be submitted within 60 days of the completion of the 12 month evaluation period which will include conclusions regarding the effectiveness of the LFGCCS optimization and operation as well as recommendations for additional measures, if required.

Record Keeping Program

The facility shall maintain documents relating to the LFGCCS and LFG monitoring in an operating record located at the office of the Site Manager or his designee. These records shall include all monitoring, maintenance and adjustment data for this operation. It will be presented upon request to DWM for inspection. A copy of this Off-Site LFG Mitigation Plan will be kept at the neighboring C&D landfill and transfer station facility and will be available for use at all times.

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.

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

Stacey A. Smith, P.E.
Project Manager
stacey@rsgengineers.com ext. 127

Attachments

CC: Buddy Norris – Avery County
Bill Wagner – NCDENR- ARO
Allen Gaither, NCDENR- ARO
File

Figure

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N.C. LIC. NO. C-0205 (engineering)
www.rsgengineers.com

FIGURE NO.	1
FILE NAME	AVERY-B0145
SCALE:	AS NOTED
PROJECT NO.	AVERY 10-2
CHECKED BY:	J.A.S.
DATE:	Nov. 2010
DRAWN BY:	C.T.J.

TITLE: OFF-SITE SOIL GAS SURVEY INVESTIGATION RESULTS OCT. 2010 AVERY COUNTY CLOSED MSWLF SPRUCE PINE, NC

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Attachment 1

Avery County MSW Landfill
Ingalls, North Carolina

LANDFILL GAS COLLECTION
SYSTEM
Calculations

AVERY COUNTY MSW LANDFILL
NC SOLID WASTE PERMIT NO. 06-01

LANDFILL GAS COLLECTION SYSTEM
CALCULATIONS

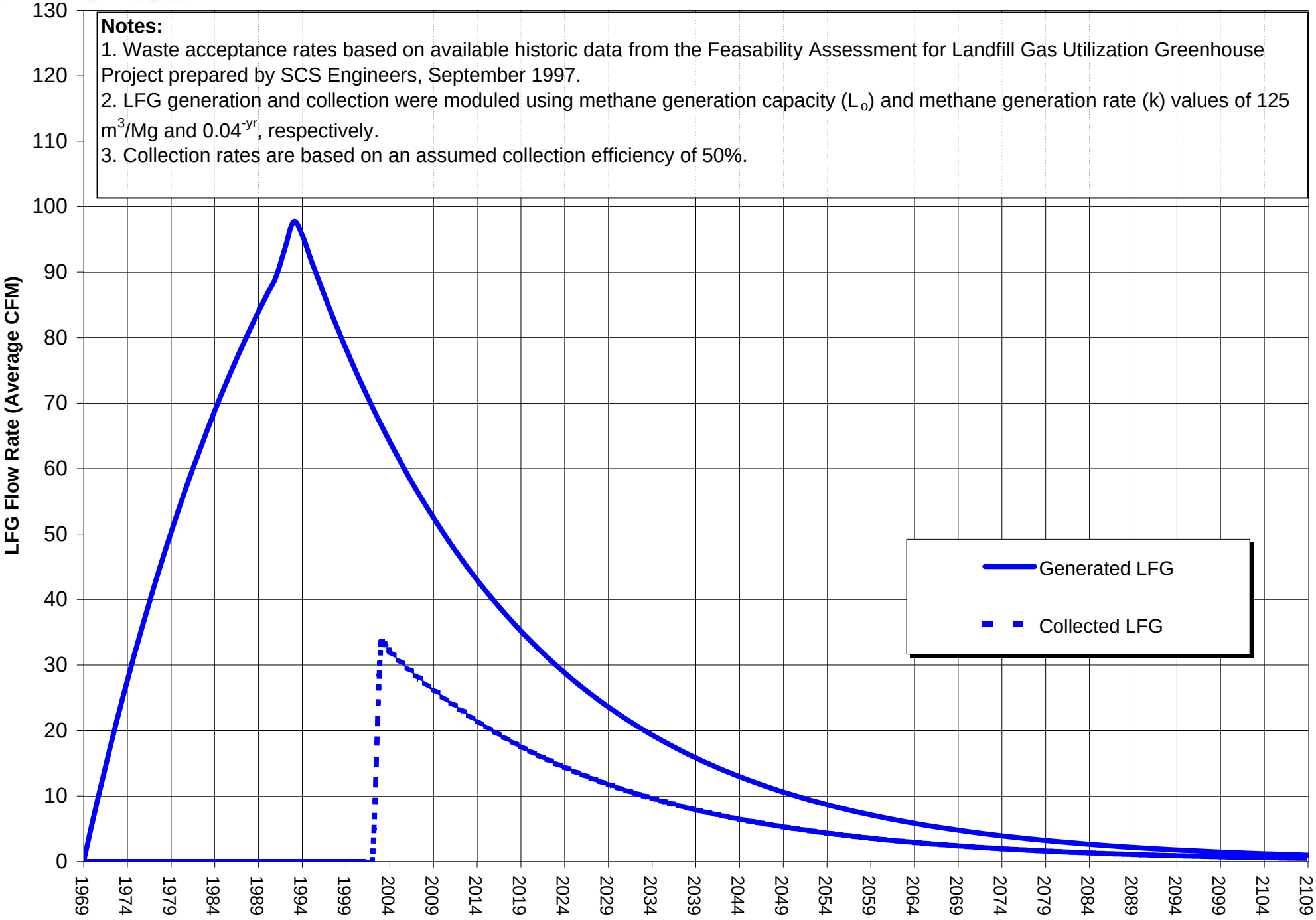
TABLE OF CONTENTS

1.0 Landfill Gas Emissions Model, Version 3.02

2.0 Collection System Hydraulic Model, KYPipe 2010 Version 5.001

Landfill Gas Emissions Model
LandGEM
Version 3.02

Avery County Landfill
Gas Generation and Collection Estimate



Avery County Landfill Gas Quantity Projections

Based on estimated waste acceptance.

	LFG Generation & Collection							Carbon Credits		
Year	Generated LFG (cfy)	Generated LFG (cfm)	Collected LFG (cfm)	Collection Efficiency	Mcf/day	MMBtu/hr	MMBtu/day	tCH4	MTCO2E	MTCO2E
1969	0	0	0	0%	0	0.0	0	0	0	0
1970	3144567	6	0	0%	0	0.0	0	0	0	0
1971	6164447	12	0	0%	0	0.0	0	0	0	0
1972	9070075	17	0	0%	0	0.0	0	0	0	0
1973	11858306	23	0	0%	0	0.0	0	0	0	0
1974	14537208	28	0	0%	0	0.0	0	0	0	0
1975	17111070	33	0	0%	0	0.0	0	0	0	0
1976	19584008	37	0	0%	0	0.0	0	0	0	0
1977	21963448	42	0	0%	0	0.0	0	0	0	0
1978	24246122	46	0	0%	0	0.0	0	0	0	0
1979	26439292	50	0	0%	0	0.0	0	0	0	0
1980	28546466	54	0	0%	0	0.0	0	0	0	0
1981	30584881	58	0	0%	0	0.0	0	0	0	0
1982	32505241	62	0	0%	0	0.0	0	0	0	0
1983	34384964	65	0	0%	0	0.0	0	0	0	0
1984	36190983	69	0	0%	0	0.0	0	0	0	0
1985	37926186	72	0	0%	0	0.0	0	0	0	0
1986	39558689	75	0	0%	0	0.0	0	0	0	0
1987	41161843	78	0	0%	0	0.0	0	0	0	0
1988	42702136	81	0	0%	0	0.0	0	0	0	0
1989	44147371	84	0	0%	0	0.0	0	0	0	0
1990	45570600	87	0	0%	0	0.0	0	0	0	0
1991	46938023	89	0	0%	0	0.0	0	0	0	0
1992	49187712	94	0	0%	0	0.0	0	0	0	0
1993	51349189	98	0	0%	0	0.0	0	0	0	0
1994	50271642	96	0	0%	0	0.0	0	0	0	0
1995	48300463	92	0	0%	0	0.0	0	0	0	0
1996	46406574	88	0	0%	0	0.0	0	0	0	0
1997	44586947	85	0	0%	0	0.0	0	0	0	0
1998	42838667	82	0	0%	0	0.0	0	0	0	0
1999	41158939	78	0	0%	0	0.0	0	0	0	0
2000	39545074	75	0	0%	0	0.0	0	0	0	0
2001	37994490	72	0	0%	0	0.0	0	0	0	0
2002	36504704	69	0	0%	0	0.0	0	0	0	0
2003	35073334	67	33	50%	48	0.9	22	151	3,173	0
2004	33698089	64	32	50%	46	0.9	21	145	3,049	0
2005	32376768	62	31	50%	44	0.8	20	139	2,929	0
2006	31107257	59	30	50%	43	0.8	19	134	2,814	0
2007	29887524	57	28	50%	41	0.8	19	129	2,704	0
2008	28715617	55	27	50%	39	0.7	18	124	2,598	0
2009	27589662	52	26	50%	38	0.7	17	119	2,496	0
2010	26507856	50	25	50%	36	0.7	17	114	2,398	0
2011	25468468	48	24	50%	35	0.7	16	110	2,304	0
2012	24469835	47	23	50%	34	0.6	15	105	2,214	0
2013	23510359	45	22	50%	32	0.6	15	101	2,127	0
2014	22588505	43	21	50%	31	0.6	14	97	2,044	0
2015	21702797	41	21	50%	30	0.6	14	94	1,964	0
2016	20851818	40	20	50%	29	0.5	13	90	1,887	0
2017	20034207	38	19	50%	27	0.5	13	86	1,813	0
2018	19248654	37	18	50%	26	0.5	12	83	1,741	0
2019	18493904	35	18	50%	25	0.5	12	80	1,673	0
2020	17768747	34	17	50%	24	0.5	11	77	1,608	0
2021	17072025	32	16	50%	23	0.4	11	74	1,545	0
2022	16402621	31	16	50%	22	0.4	10	71	1,484	0
2023	15759465	30	15	50%	22	0.4	10	68	1,426	0
2024	15141528	29	14	50%	21	0.4	9	65	1,370	0
2025	14547820	28	14	50%	20	0.4	9	63	1,316	0
2026	13977392	27	13	50%	19	0.4	9	60	1,265	0
2027	13429330	26	13	50%	18	0.3	8	58	1,215	0
2028	12902759	25	12	50%	18	0.3	8	56	1,167	0
2029	12396834	24	12	50%	17	0.3	8	53	1,122	0
2030	11910747	23	11	50%	16	0.3	7	51	1,078	0
2031	11443720	22	11	50%	16	0.3	7	49	1,035	0
2032	10995006	21	10	50%	15	0.3	7	47	995	0
2033	10563885	20	10	50%	14	0.3	7	46	956	0
2034	10149669	19	10	50%	14	0.3	6	44	918	0
2035	9751695	19	9	50%	13	0.3	6	42	882	0
2036	9369326	18	9	50%	13	0.2	6	40	848	0
2037	9001949	17	9	50%	12	0.2	6	39	814	0
2038	8648978	16	8	50%	12	0.2	5	37	782	0
2039	8309847	16	8	50%	11	0.2	5	36	752	0
2040	7984013	15	8	50%	11	0.2	5	34	722	0
2041	7670955	15	7	50%	11	0.2	5	33	694	0
2042	7370173	14	7	50%	10	0.2	5	32	667	0
2043	7081184	13	7	50%	10	0.2	4	31	641	0
2044	6803527	13	6	50%	9	0.2	4	29	616	0
2045	6536757	12	6	50%	9	0.2	4	28	591	0
2046	6280447	12	6	50%	9	0.2	4	27	568	0

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Avery County Landfill Gas Quantity Projections

Based on estimated waste acceptance.

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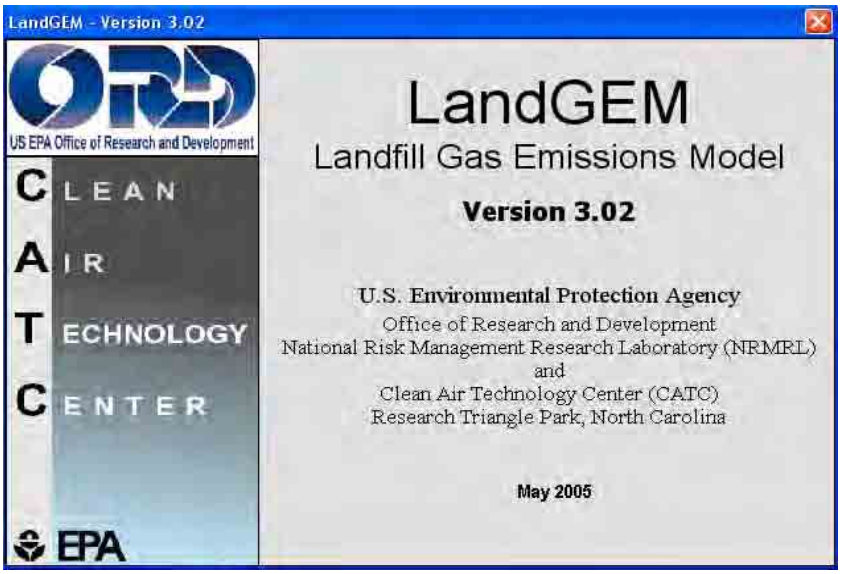
Year	Generated LFG (cfy)	Generated LFG (cfm)	Collected LFG (cfm)	Collection Efficiency	Mcf/day	MMBtu/hr	MMBtu/day	tCH4	MTCO2E	MTCO2E
2047	6034187	11	6	50%	8	0.2	4	26	546	0
2048	5797583	11	6	50%	8	0.2	4	25	525	0
2049	5570257	11	5	50%	8	0.1	3	24	504	0
2050	5351844	10	5	50%	7	0.1	3	23	484	0
2051	5141995	10	5	50%	7	0.1	3	22	465	0
2052	4940374	9	5	50%	7	0.1	3	21	447	0
2053	4746660	9	5	50%	7	0.1	3	20	429	0
2054	4560540	9	4	50%	6	0.1	3	20	413	0
2055	4381719	8	4	50%	6	0.1	3	19	396	0
2056	4209909	8	4	50%	6	0.1	3	18	381	0
2057	4044837	8	4	50%	6	0.1	3	17	366	0
2058	3886236	7	4	50%	5	0.1	2	17	352	0
2059	3733855	7	4	50%	5	0.1	2	16	338	0
2060	3587448	7	3	50%	5	0.1	2	15	325	0
2061	3446782	7	3	50%	5	0.1	2	15	312	0
2062	3311632	6	3	50%	5	0.1	2	14	300	0
2063	3181781	6	3	50%	4	0.1	2	14	288	0
2064	3057022	6	3	50%	4	0.1	2	13	277	0
2065	2937154	6	3	50%	4	0.1	2	13	266	0
2066	2821987	5	3	50%	4	0.1	2	12	255	0
2067	2711335	5	3	50%	4	0.1	2	12	245	0
2068	2605022	5	2	50%	4	0.1	2	11	236	0
2069	2502878	5	2	50%	3	0.1	2	11	226	0
2070	2404738	5	2	50%	3	0.1	2	10	218	0
2071	2310447	4	2	50%	3	0.1	1	10	209	0
2072	2219853	4	2	50%	3	0.1	1	10	201	0
2073	2132812	4	2	50%	3	0.1	1	9	193	0
2074	2049183	4	2	50%	3	0.1	1	9	185	0
2075	1968833	4	2	50%	3	0.1	1	8	178	0
2076	1891634	4	2	50%	3	0.0	1	8	171	0
2077	1817462	3	2	50%	2	0.0	1	8	164	0
2078	1746198	3	2	50%	2	0.0	1	8	158	0
2079	1677729	3	2	50%	2	0.0	1	7	152	0
2080	1611944	3	2	50%	2	0.0	1	7	146	0
2081	1548739	3	1	50%	2	0.0	1	7	140	0
2082	1488012	3	1	50%	2	0.0	1	6	135	0
2083	1429666	3	1	50%	2	0.0	1	6	129	0
2084	1373608	3	1	50%	2	0.0	1	6	124	0
2085	1319748	3	1	50%	2	0.0	1	6	119	0
2086	1268000	2	1	50%	2	0.0	1	5	115	0
2087	1218281	2	1	50%	2	0.0	1	5	110	0
2088	1170512	2	1	50%	2	0.0	1	5	106	0
2089	1124615	2	1	50%	2	0.0	1	5	102	0
2090	1080519	2	1	50%	1	0.0	1	5	98	0
2091	1038151	2	1	50%	1	0.0	1	4	94	0
2092	997444	2	1	50%	1	0.0	1	4	90	0
2093	958334	2	1	50%	1	0.0	1	4	87	0
2094	920757	2	1	50%	1	0.0	1	4	83	0
2095	884654	2	1	50%	1	0.0	1	4	80	0
2096	849966	2	1	50%	1	0.0	1	4	77	0
2097	816638	2	1	50%	1	0.0	1	4	74	0
2098	784618	1	1	50%	1	0.0	0	3	71	0
2099	753852	1	1	50%	1	0.0	0	3	68	0
2100	724293	1	1	50%	1	0.0	0	3	66	0
2101	695893	1	1	50%	1	0.0	0	3	63	0
2102	668607	1	1	50%	1	0.0	0	3	60	0
2103	642391	1	1	50%	1	0.0	0	3	58	0
2104	617202	1	1	50%	1	0.0	0	3	56	0
2105	593001	1	1	50%	1	0.0	0	3	54	0
2106	569749	1	1	50%	1	0.0	0	2	52	0
2107	547409	1	1	50%	1	0.0	0	2	50	0
2108	525945	1	1	50%	1	0.0	0	2	48	0
2109	505322	1	0	50%	1	0.0	0	2	46	0



Summary Report

Landfill Name or Identifier: Avery County Landfill

Date: Tuesday, January 11, 2011

Description/Comments:

About LandGEM:

First-Order Decomposition Rate Equation:

$$Q_{CH_4} = \sum_{i=1}^{n} \sum_{j=0.1}^{1} k L_o \left(\frac{M_i}{10} \right) e^{-k t_{ij}}$$

Where,

Q_{CH4} = annual methane generation in the year of the calculation ($m^3/year$)
i = 1-year time increment
n = (year of the calculation) - (initial year of waste acceptance)
j = 0.1-year time increment
k = methane generation rate ($year^{-1}$)
L_o = potential methane generation capacity (m^3/Mg)

M_i = mass of waste accepted in the ith year (Mg)
t_{ij} = age of the jth section of waste mass M_i accepted in the ith year (*decimal years*, e.g., 3.2 years)

LandGEM is based on a first-order decomposition rate equation for quantifying emissions from the decomposition of landfilled waste in municipal solid waste (MSW) landfills. The software provides a relatively simple approach to estimating landfill gas emissions. Model defaults are based on empirical data from U.S. landfills. Field test data can also be used in place of model defaults when available. Further guidance on EPA test methods, Clean Air Act (CAA) regulations, and other guidance regarding landfill gas emissions and control technology requirements can be found at http://www.epa.gov/ttnatw01/landfill/landflpg.html.

LandGEM is considered a screening tool — the better the input data, the better the estimates. Often, there are limitations with the available data regarding waste quantity and composition, variation in design and operating practices over time, and changes occurring over time that impact the emissions potential. Changes to landfill operation, such as operating under wet conditions through leachate recirculation or other liquid additions, will result in generating more gas at a faster rate. Defaults for estimating emissions for this type of operation are being developed to include in LandGEM along with defaults for convential landfills (no leachate or liquid additions) for developing emission inventories and determining CAA applicability. Refer to the Web site identified above for future updates.

Input Review

LANDFILL CHARACTERISTICS

Landfill Open Year	**1969**	
Landfill Closure Year (with 80-year limit)	**1994**	
Actual Closure Year (without limit)	***1994***	
Have Model Calculate Closure Year?	**No**	
Waste Design Capacity	**225,893**	*megagrams*

MODEL PARAMETERS

Methane Generation Rate, k	**0.040**	*$year^{-1}$*
Potential Methane Generation Capacity, L_o	**125**	*m^3/Mg*
NMOC Concentration	**595**	*ppmv as hexane*
Methane Content	**50**	*% by volume*

GASES / POLLUTANTS SELECTED

Gas / Pollutant #1:	**Total landfill gas**
Gas / Pollutant #2:	**Methane**
Gas / Pollutant #3:	**Carbon dioxide**
Gas / Pollutant #4:	**NMOC**

WASTE ACCEPTANCE RATES

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
1969	0	0	0	0
1970	10,000	11,000	0	0
1971	10,000	11,000	10,000	11,000
1972	10,000	11,000	20,000	22,000
1973	10,000	11,000	30,000	33,000
1974	10,000	11,000	40,000	44,000
1975	10,000	11,000	50,000	55,000
1976	10,000	11,000	60,000	66,000
1977	10,000	11,000	70,000	77,000
1978	10,000	11,000	80,000	88,000
1979	10,000	11,000	90,000	99,000
1980	10,000	11,000	100,000	110,000
1981	10,000	11,000	110,000	121,000
1982	10,000	11,000	120,000	132,000
1983	10,000	11,000	130,000	143,000
1984	10,000	11,000	140,000	154,000
1985	10,000	11,000	150,000	165,000
1986	10,000	11,000	160,000	176,000
1987	10,000	11,000	170,000	187,000
1988	10,000	11,000	180,000	198,000
1989	10,000	11,000	190,000	209,000
1990	10,000	11,000	200,000	220,000
1991	13,000	14,300	210,000	231,000
1992	13,000	14,300	223,000	245,300
1993	13,000	14,300	236,000	259,600
1994	0	0	249,000	273,900
1995	0	0	249,000	273,900
1996	0	0	249,000	273,900
1997	0	0	249,000	273,900
1998	0	0	249,000	273,900
1999	0	0	249,000	273,900
2000	0	0	249,000	273,900
2001	0	0	249,000	273,900
2002	0	0	249,000	273,900
2003	0	0	249,000	273,900
2004	0	0	249,000	273,900
2005	0	0	249,000	273,900
2006	0	0	249,000	273,900
2007	0	0	249,000	273,900
2008	0	0	249,000	273,900

WASTE ACCEPTANCE RATES (Continued)

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2009	0	0	249,000	273,900
2010	0	0	249,000	273,900
2011	0	0	249,000	273,900
2012	0	0	249,000	273,900
2013	0	0	249,000	273,900
2014	0	0	249,000	273,900
2015	0	0	249,000	273,900
2016	0	0	249,000	273,900
2017	0	0	249,000	273,900
2018	0	0	249,000	273,900
2019	0	0	249,000	273,900
2020	0	0	249,000	273,900
2021	0	0	249,000	273,900
2022	0	0	249,000	273,900
2023	0	0	249,000	273,900
2024	0	0	249,000	273,900
2025	0	0	249,000	273,900
2026	0	0	249,000	273,900
2027	0	0	249,000	273,900
2028	0	0	249,000	273,900
2029	0	0	249,000	273,900
2030	0	0	249,000	273,900
2031	0	0	249,000	273,900
2032	0	0	249,000	273,900
2033	0	0	249,000	273,900
2034	0	0	249,000	273,900
2035	0	0	249,000	273,900
2036	0	0	249,000	273,900
2037	0	0	249,000	273,900
2038	0	0	249,000	273,900
2039	0	0	249,000	273,900
2040	0	0	249,000	273,900
2041	0	0	249,000	273,900
2042	0	0	249,000	273,900
2043	0	0	249,000	273,900
2044	0	0	249,000	273,900
2045	0	0	249,000	273,900
2046	0	0	249,000	273,900
2047	0	0	249,000	273,900
2048	0	0	249,000	273,900

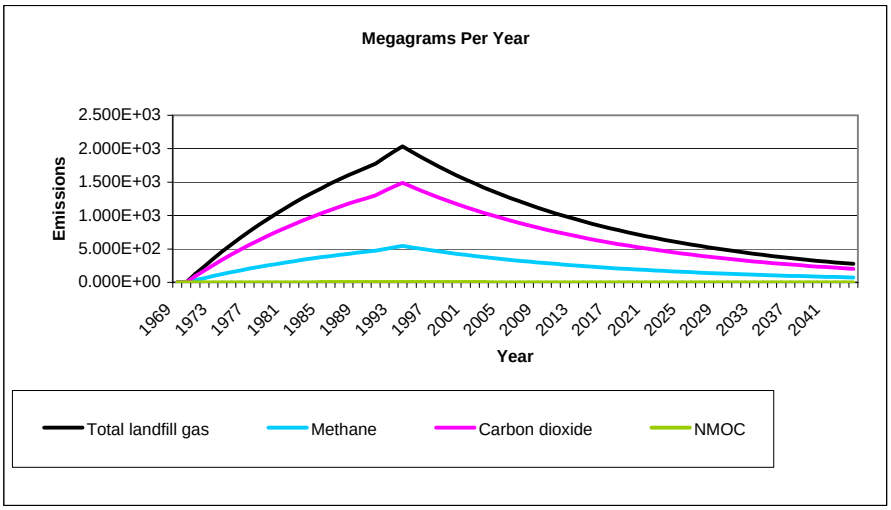
Pollutant Parameters

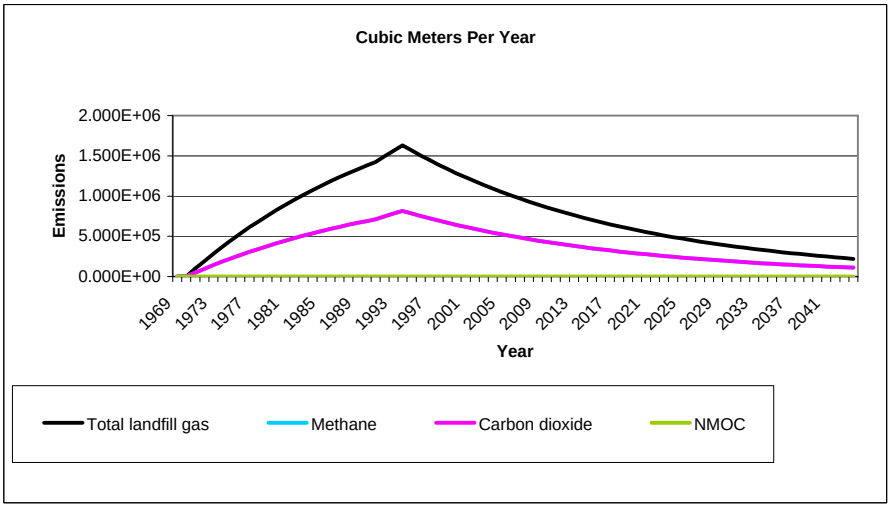
		Gas / Pollutant Default Parameters:		User-specified Pollutant Parameters:	
	Compound	Concentration (*ppmv*)	Molecular Weight	Concentration (*ppmv*)	Molecular Weight
Gases	Total landfill gas		0.00		
	Methane		16.04		
	Carbon dioxide		44.01		
	NMOC	4,000	86.18		
Pollutants	1,1,1-Trichloroethane (methyl chloroform) - HAP	0.48	133.41		
	1,1,2,2-Tetrachloroethane - HAP/VOC	1.1	167.85		
	1,1-Dichloroethane (ethylidene dichloride) - HAP/VOC	2.4	98.97		
	1,1-Dichloroethene (vinylidene chloride) - HAP/VOC	0.20	96.94		
	1,2-Dichloroethane (ethylene dichloride) - HAP/VOC	0.41	98.96		
	1,2-Dichloropropane (propylene dichloride) - HAP/VOC	0.18	112.99		
	2-Propanol (isopropyl alcohol) - VOC	50	60.11		
	Acetone	7.0	58.08		
	Acrylonitrile - HAP/VOC	6.3	53.06		
	Benzene - No or Unknown Co-disposal - HAP/VOC	1.9	78.11		
	Benzene - Co-disposal - HAP/VOC	11	78.11		
	Bromodichloromethane - VOC	3.1	163.83		
	Butane - VOC	5.0	58.12		
	Carbon disulfide - HAP/VOC	0.58	76.13		
	Carbon monoxide	140	28.01		
	Carbon tetrachloride - HAP/VOC	4.0E-03	153.84		
	Carbonyl sulfide - HAP/VOC	0.49	60.07		
	Chlorobenzene - HAP/VOC	0.25	112.56		
	Chlorodifluoromethane	1.3	86.47		
	Chloroethane (ethyl chloride) - HAP/VOC	1.3	64.52		
	Chloroform - HAP/VOC	0.03	119.39		
	Chloromethane - VOC	1.2	50.49		
	Dichlorobenzene - (HAP for para isomer/VOC)	0.21	147		
	Dichlorodifluoromethane	16	120.91		
	Dichlorofluoromethane - VOC	2.6	102.92		
	Dichloromethane (methylene chloride) - HAP	14	84.94		
	Dimethyl sulfide (methyl sulfide) - VOC	7.8	62.13		
	Ethane	890	30.07		
	Ethanol - VOC	27	46.08		

Pollutant Parameters (Continued)

	Compound	Gas / Pollutant Default Parameters: Concentration (*ppmv*)	Molecular Weight	User-specified Pollutant Parameters: Concentration (*ppmv*)	Molecular Weight
Pollutants	Ethyl mercaptan (ethanethiol) - VOC	2.3	62.13		
	Ethylbenzene - HAP/VOC	4.6	106.16		
	Ethylene dibromide - HAP/VOC	1.0E-03	187.88		
	Fluorotrichloromethane - VOC	0.76	137.38		
	Hexane - HAP/VOC	6.6	86.18		
	Hydrogen sulfide	36	34.08		
	Mercury (total) - HAP	2.9E-04	200.61		
	Methyl ethyl ketone - HAP/VOC	7.1	72.11		
	Methyl isobutyl ketone - HAP/VOC	1.9	100.16		
	Methyl mercaptan - VOC	2.5	48.11		
	Pentane - VOC	3.3	72.15		
	Perchloroethylene (tetrachloroethylene) - HAP	3.7	165.83		
	Propane - VOC	11	44.09		
	t-1,2-Dichloroethene - VOC	2.8	96.94		
	Toluene - No or Unknown Co-disposal - HAP/VOC	39	92.13		
	Toluene - Co-disposal - HAP/VOC	170	92.13		
	Trichloroethylene (trichloroethene) - HAP/VOC	2.8	131.40		
	Vinyl chloride - HAP/VOC	7.3	62.50		
	Xylenes - HAP/VOC	12	106.16		

Graphs


Megagrams Per Year
Emissions
2.500E+03
2.000E+03
1.500E+03
1.000E+03
5.000E+02
0.000E+00
1969 1973 1977 1981 1985 1989 1993 1997 2001 2005 2009 2013 2017 2021 2025 2029 2033 2037 2041
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


Cubic Meters Per Year
Emissions
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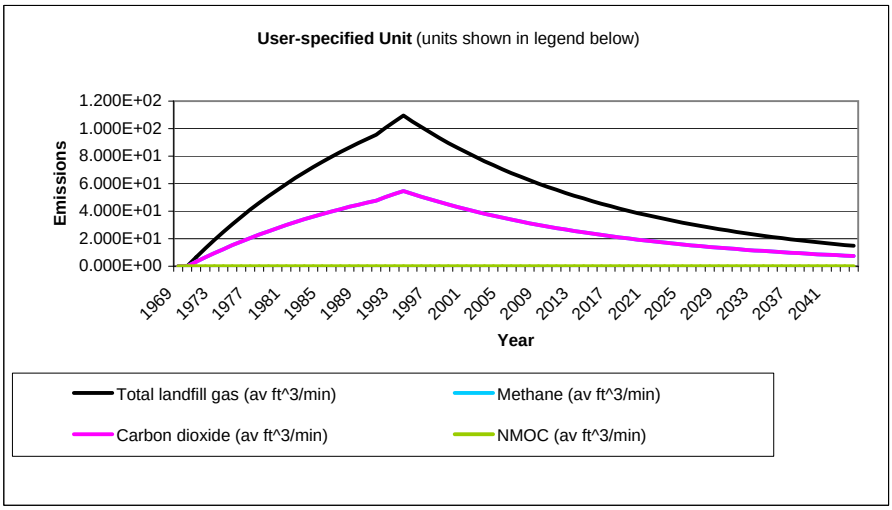
1.500E+06
1.000E+06
5.000E+05
0.000E+00
1969 1973 1977 1981 1985 1989 1993 1997 2001 2005 2009 2013 2017 2021 2025 2029 2033 2037 2041
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


User-specified Unit (units shown in legend below)
Emissions
1.200E+02
1.000E+02
8.000E+01
6.000E+01
4.000E+01
2.000E+01
0.000E+00
1969 1973 1977 1981 1985 1989 1993 1997 2001 2005 2009 2013 2017 2021 2025 2029 2033 2037 2041
Year
Total landfill gas (av ft^3/min)
Methane (av ft^3/min)
Carbon dioxide (av ft^3/min)
NMOC (av ft^3/min)

Results

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
1969	0	0	0	0	0	0
1970	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
1971	1.226E+02	9.815E+04	6.595E+00	3.274E+01	4.908E+04	3.297E+00
1972	2.403E+02	1.925E+05	1.293E+01	6.420E+01	9.623E+04	6.466E+00
1973	3.535E+02	2.831E+05	1.902E+01	9.442E+01	1.415E+05	9.509E+00
1974	4.622E+02	3.701E+05	2.487E+01	1.235E+02	1.851E+05	1.243E+01
1975	5.667E+02	4.538E+05	3.049E+01	1.514E+02	2.269E+05	1.524E+01
1976	6.670E+02	5.341E+05	3.589E+01	1.782E+02	2.671E+05	1.794E+01
1977	7.634E+02	6.113E+05	4.107E+01	2.039E+02	3.057E+05	2.054E+01
1978	8.561E+02	6.855E+05	4.606E+01	2.287E+02	3.428E+05	2.303E+01
1979	9.451E+02	7.568E+05	5.085E+01	2.524E+02	3.784E+05	2.542E+01
1980	1.031E+03	8.253E+05	5.545E+01	2.753E+02	4.126E+05	2.772E+01
1981	1.113E+03	8.910E+05	5.987E+01	2.972E+02	4.455E+05	2.993E+01
1982	1.192E+03	9.543E+05	6.412E+01	3.183E+02	4.771E+05	3.206E+01
1983	1.268E+03	1.015E+06	6.820E+01	3.386E+02	5.075E+05	3.410E+01
1984	1.340E+03	1.073E+06	7.212E+01	3.580E+02	5.367E+05	3.606E+01
1985	1.410E+03	1.129E+06	7.589E+01	3.767E+02	5.647E+05	3.794E+01
1986	1.478E+03	1.183E+06	7.950E+01	3.947E+02	5.916E+05	3.975E+01
1987	1.542E+03	1.235E+06	8.298E+01	4.120E+02	6.175E+05	4.149E+01
1988	1.604E+03	1.285E+06	8.632E+01	4.286E+02	6.424E+05	4.316E+01
1989	1.664E+03	1.333E+06	8.953E+01	4.445E+02	6.663E+05	4.477E+01
1990	1.721E+03	1.378E+06	9.262E+01	4.598E+02	6.892E+05	4.631E+01
1991	1.777E+03	1.423E+06	9.558E+01	4.745E+02	7.113E+05	4.779E+01
1992	1.866E+03	1.494E+06	1.004E+02	4.985E+02	7.472E+05	5.020E+01
1993	1.952E+03	1.563E+06	1.050E+02	5.215E+02	7.817E+05	5.252E+01
1994	2.035E+03	1.630E+06	1.095E+02	5.436E+02	8.148E+05	5.475E+01
1995	1.955E+03	1.566E+06	1.052E+02	5.223E+02	7.829E+05	5.260E+01
1996	1.879E+03	1.504E+06	1.011E+02	5.018E+02	7.522E+05	5.054E+01
1997	1.805E+03	1.445E+06	9.711E+01	4.821E+02	7.227E+05	4.856E+01
1998	1.734E+03	1.389E+06	9.331E+01	4.632E+02	6.944E+05	4.665E+01
1999	1.666E+03	1.334E+06	8.965E+01	4.451E+02	6.671E+05	4.482E+01
2000	1.601E+03	1.282E+06	8.613E+01	4.276E+02	6.410E+05	4.307E+01
2001	1.538E+03	1.232E+06	8.276E+01	4.109E+02	6.158E+05	4.138E+01
2002	1.478E+03	1.183E+06	7.951E+01	3.947E+02	5.917E+05	3.976E+01
2003	1.420E+03	1.137E+06	7.639E+01	3.793E+02	5.685E+05	3.820E+01
2004	1.364E+03	1.092E+06	7.340E+01	3.644E+02	5.462E+05	3.670E+01
2005	1.311E+03	1.050E+06	7.052E+01	3.501E+02	5.248E+05	3.526E+01
2006	1.259E+03	1.008E+06	6.775E+01	3.364E+02	5.042E+05	3.388E+01
2007	1.210E+03	9.689E+05	6.510E+01	3.232E+02	4.844E+05	3.255E+01
2008	1.163E+03	9.309E+05	6.255E+01	3.105E+02	4.654E+05	3.127E+01
2009	1.117E+03	8.944E+05	6.009E+01	2.983E+02	4.472E+05	3.005E+01
2010	1.073E+03	8.593E+05	5.774E+01	2.866E+02	4.297E+05	2.887E+01
2011	1.031E+03	8.256E+05	5.547E+01	2.754E+02	4.128E+05	2.774E+01
2012	9.906E+02	7.932E+05	5.330E+01	2.646E+02	3.966E+05	2.665E+01
2013	9.518E+02	7.621E+05	5.121E+01	2.542E+02	3.811E+05	2.560E+01
2014	9.145E+02	7.323E+05	4.920E+01	2.443E+02	3.661E+05	2.460E+01
2015	8.786E+02	7.035E+05	4.727E+01	2.347E+02	3.518E+05	2.364E+01
2016	8.441E+02	6.760E+05	4.542E+01	2.255E+02	3.380E+05	2.271E+01
2017	8.110E+02	6.495E+05	4.364E+01	2.166E+02	3.247E+05	2.182E+01
2018	7.792E+02	6.240E+05	4.193E+01	2.081E+02	3.120E+05	2.096E+01

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2019	7.487E+02	5.995E+05	4.028E+01	2.000E+02	2.998E+05	2.014E+01
2020	7.193E+02	5.760E+05	3.870E+01	1.921E+02	2.880E+05	1.935E+01
2021	6.911E+02	5.534E+05	3.718E+01	1.846E+02	2.767E+05	1.859E+01
2022	6.640E+02	5.317E+05	3.573E+01	1.774E+02	2.659E+05	1.786E+01
2023	6.380E+02	5.109E+05	3.433E+01	1.704E+02	2.554E+05	1.716E+01
2024	6.130E+02	4.908E+05	3.298E+01	1.637E+02	2.454E+05	1.649E+01
2025	5.889E+02	4.716E+05	3.169E+01	1.573E+02	2.358E+05	1.584E+01
2026	5.658E+02	4.531E+05	3.044E+01	1.511E+02	2.266E+05	1.522E+01
2027	5.437E+02	4.353E+05	2.925E+01	1.452E+02	2.177E+05	1.463E+01
2028	5.223E+02	4.183E+05	2.810E+01	1.395E+02	2.091E+05	1.405E+01
2029	5.019E+02	4.019E+05	2.700E+01	1.341E+02	2.009E+05	1.350E+01
2030	4.822E+02	3.861E+05	2.594E+01	1.288E+02	1.931E+05	1.297E+01
2031	4.633E+02	3.710E+05	2.493E+01	1.237E+02	1.855E+05	1.246E+01
2032	4.451E+02	3.564E+05	2.395E+01	1.189E+02	1.782E+05	1.197E+01
2033	4.277E+02	3.425E+05	2.301E+01	1.142E+02	1.712E+05	1.150E+01
2034	4.109E+02	3.290E+05	2.211E+01	1.098E+02	1.645E+05	1.105E+01
2035	3.948E+02	3.161E+05	2.124E+01	1.055E+02	1.581E+05	1.062E+01
2036	3.793E+02	3.037E+05	2.041E+01	1.013E+02	1.519E+05	1.020E+01
2037	3.644E+02	2.918E+05	1.961E+01	9.734E+01	1.459E+05	9.804E+00
2038	3.501E+02	2.804E+05	1.884E+01	9.353E+01	1.402E+05	9.419E+00
2039	3.364E+02	2.694E+05	1.810E+01	8.986E+01	1.347E+05	9.050E+00
2040	3.232E+02	2.588E+05	1.739E+01	8.634E+01	1.294E+05	8.695E+00
2041	3.105E+02	2.487E+05	1.671E+01	8.295E+01	1.243E+05	8.354E+00
2042	2.984E+02	2.389E+05	1.605E+01	7.970E+01	1.195E+05	8.026E+00
2043	2.867E+02	2.296E+05	1.542E+01	7.657E+01	1.148E+05	7.712E+00
2044	2.754E+02	2.206E+05	1.482E+01	7.357E+01	1.103E+05	7.409E+00
2045	2.646E+02	2.119E+05	1.424E+01	7.069E+01	1.060E+05	7.119E+00
2046	2.543E+02	2.036E+05	1.368E+01	6.791E+01	1.018E+05	6.840E+00
2047	2.443E+02	1.956E+05	1.314E+01	6.525E+01	9.781E+04	6.572E+00
2048	2.347E+02	1.879E+05	1.263E+01	6.269E+01	9.397E+04	6.314E+00
2049	2.255E+02	1.806E+05	1.213E+01	6.023E+01	9.029E+04	6.066E+00
2050	2.167E+02	1.735E+05	1.166E+01	5.787E+01	8.675E+04	5.828E+00
2051	2.082E+02	1.667E+05	1.120E+01	5.560E+01	8.334E+04	5.600E+00
2052	2.000E+02	1.602E+05	1.076E+01	5.342E+01	8.008E+04	5.380E+00
2053	1.922E+02	1.539E+05	1.034E+01	5.133E+01	7.694E+04	5.169E+00
2054	1.846E+02	1.478E+05	9.933E+00	4.932E+01	7.392E+04	4.967E+00
2055	1.774E+02	1.420E+05	9.544E+00	4.738E+01	7.102E+04	4.772E+00
2056	1.704E+02	1.365E+05	9.170E+00	4.552E+01	6.824E+04	4.585E+00
2057	1.637E+02	1.311E+05	8.810E+00	4.374E+01	6.556E+04	4.405E+00
2058	1.573E+02	1.260E+05	8.465E+00	4.202E+01	6.299E+04	4.232E+00
2059	1.512E+02	1.210E+05	8.133E+00	4.038E+01	6.052E+04	4.066E+00
2060	1.452E+02	1.163E+05	7.814E+00	3.879E+01	5.815E+04	3.907E+00
2061	1.395E+02	1.117E+05	7.507E+00	3.727E+01	5.587E+04	3.754E+00
2062	1.341E+02	1.074E+05	7.213E+00	3.581E+01	5.368E+04	3.607E+00
2063	1.288E+02	1.031E+05	6.930E+00	3.441E+01	5.157E+04	3.465E+00
2064	1.238E+02	9.910E+04	6.659E+00	3.306E+01	4.955E+04	3.329E+00
2065	1.189E+02	9.521E+04	6.397E+00	3.176E+01	4.761E+04	3.199E+00
2066	1.142E+02	9.148E+04	6.147E+00	3.052E+01	4.574E+04	3.073E+00
2067	1.098E+02	8.789E+04	5.906E+00	2.932E+01	4.395E+04	2.953E+00
2068	1.055E+02	8.445E+04	5.674E+00	2.817E+01	4.222E+04	2.837E+00
2069	1.013E+02	8.114E+04	5.452E+00	2.706E+01	4.057E+04	2.726E+00

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2070	9.735E+01	7.795E+04	5.238E+00	2.600E+01	3.898E+04	2.619E+00
2071	9.353E+01	7.490E+04	5.032E+00	2.498E+01	3.745E+04	2.516E+00
2072	8.987E+01	7.196E+04	4.835E+00	2.400E+01	3.598E+04	2.418E+00
2073	8.634E+01	6.914E+04	4.645E+00	2.306E+01	3.457E+04	2.323E+00
2074	8.296E+01	6.643E+04	4.463E+00	2.216E+01	3.321E+04	2.232E+00
2075	7.970E+01	6.382E+04	4.288E+00	2.129E+01	3.191E+04	2.144E+00
2076	7.658E+01	6.132E+04	4.120E+00	2.046E+01	3.066E+04	2.060E+00
2077	7.358E+01	5.892E+04	3.959E+00	1.965E+01	2.946E+04	1.979E+00
2078	7.069E+01	5.661E+04	3.803E+00	1.888E+01	2.830E+04	1.902E+00
2079	6.792E+01	5.439E+04	3.654E+00	1.814E+01	2.719E+04	1.827E+00
2080	6.526E+01	5.225E+04	3.511E+00	1.743E+01	2.613E+04	1.755E+00
2081	6.270E+01	5.021E+04	3.373E+00	1.675E+01	2.510E+04	1.687E+00
2082	6.024E+01	4.824E+04	3.241E+00	1.609E+01	2.412E+04	1.621E+00
2083	5.788E+01	4.635E+04	3.114E+00	1.546E+01	2.317E+04	1.557E+00
2084	5.561E+01	4.453E+04	2.992E+00	1.485E+01	2.226E+04	1.496E+00
2085	5.343E+01	4.278E+04	2.875E+00	1.427E+01	2.139E+04	1.437E+00
2086	5.133E+01	4.110E+04	2.762E+00	1.371E+01	2.055E+04	1.381E+00
2087	4.932E+01	3.949E+04	2.654E+00	1.317E+01	1.975E+04	1.327E+00
2088	4.739E+01	3.794E+04	2.549E+00	1.266E+01	1.897E+04	1.275E+00
2089	4.553E+01	3.646E+04	2.450E+00	1.216E+01	1.823E+04	1.225E+00
2090	4.374E+01	3.503E+04	2.353E+00	1.168E+01	1.751E+04	1.177E+00
2091	4.203E+01	3.365E+04	2.261E+00	1.123E+01	1.683E+04	1.131E+00
2092	4.038E+01	3.233E+04	2.173E+00	1.079E+01	1.617E+04	1.086E+00
2093	3.880E+01	3.107E+04	2.087E+00	1.036E+01	1.553E+04	1.044E+00
2094	3.728E+01	2.985E+04	2.006E+00	9.957E+00	1.492E+04	1.003E+00
2095	3.581E+01	2.868E+04	1.927E+00	9.566E+00	1.434E+04	9.634E-01
2096	3.441E+01	2.755E+04	1.851E+00	9.191E+00	1.378E+04	9.257E-01
2097	3.306E+01	2.647E+04	1.779E+00	8.831E+00	1.324E+04	8.894E-01
2098	3.176E+01	2.544E+04	1.709E+00	8.484E+00	1.272E+04	8.545E-01
2099	3.052E+01	2.444E+04	1.642E+00	8.152E+00	1.222E+04	8.210E-01
2100	2.932E+01	2.348E+04	1.578E+00	7.832E+00	1.174E+04	7.888E-01
2101	2.817E+01	2.256E+04	1.516E+00	7.525E+00	1.128E+04	7.579E-01
2102	2.707E+01	2.167E+04	1.456E+00	7.230E+00	1.084E+04	7.281E-01
2103	2.601E+01	2.082E+04	1.399E+00	6.946E+00	1.041E+04	6.996E-01
2104	2.499E+01	2.001E+04	1.344E+00	6.674E+00	1.000E+04	6.722E-01
2105	2.401E+01	1.922E+04	1.292E+00	6.412E+00	9.612E+03	6.458E-01
2106	2.307E+01	1.847E+04	1.241E+00	6.161E+00	9.235E+03	6.205E-01
2107	2.216E+01	1.775E+04	1.192E+00	5.919E+00	8.873E+03	5.962E-01
2108	2.129E+01	1.705E+04	1.146E+00	5.687E+00	8.525E+03	5.728E-01
2109	2.046E+01	1.638E+04	1.101E+00	5.464E+00	8.191E+03	5.503E-01

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
1969	0	0	0	0	0	0
1970	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
1971	8.983E+01	4.908E+04	3.297E+00	2.093E-01	5.840E+01	3.924E-03
1972	1.761E+02	9.623E+04	6.466E+00	4.105E-01	1.145E+02	7.694E-03
1973	2.591E+02	1.415E+05	9.509E+00	6.037E-01	1.684E+02	1.132E-02
1974	3.387E+02	1.851E+05	1.243E+01	7.894E-01	2.202E+02	1.480E-02
1975	4.153E+02	2.269E+05	1.524E+01	9.677E-01	2.700E+02	1.814E-02
1976	4.888E+02	2.671E+05	1.794E+01	1.139E+00	3.178E+02	2.135E-02
1977	5.595E+02	3.057E+05	2.054E+01	1.304E+00	3.637E+02	2.444E-02
1978	6.274E+02	3.428E+05	2.303E+01	1.462E+00	4.079E+02	2.741E-02
1979	6.926E+02	3.784E+05	2.542E+01	1.614E+00	4.503E+02	3.025E-02
1980	7.553E+02	4.126E+05	2.772E+01	1.760E+00	4.910E+02	3.299E-02
1981	8.155E+02	4.455E+05	2.993E+01	1.900E+00	5.302E+02	3.562E-02
1982	8.734E+02	4.771E+05	3.206E+01	2.035E+00	5.678E+02	3.815E-02
1983	9.290E+02	5.075E+05	3.410E+01	2.165E+00	6.039E+02	4.058E-02
1984	9.824E+02	5.367E+05	3.606E+01	2.289E+00	6.386E+02	4.291E-02
1985	1.034E+03	5.647E+05	3.794E+01	2.409E+00	6.720E+02	4.515E-02
1986	1.083E+03	5.916E+05	3.975E+01	2.524E+00	7.041E+02	4.731E-02
1987	1.130E+03	6.175E+05	4.149E+01	2.634E+00	7.348E+02	4.937E-02
1988	1.176E+03	6.424E+05	4.316E+01	2.740E+00	7.644E+02	5.136E-02
1989	1.220E+03	6.663E+05	4.477E+01	2.842E+00	7.929E+02	5.327E-02
1990	1.262E+03	6.892E+05	4.631E+01	2.940E+00	8.202E+02	5.511E-02
1991	1.302E+03	7.113E+05	4.779E+01	3.034E+00	8.464E+02	5.687E-02
1992	1.368E+03	7.472E+05	5.020E+01	3.187E+00	8.891E+02	5.974E-02
1993	1.431E+03	7.817E+05	5.252E+01	3.334E+00	9.302E+02	6.250E-02
1994	1.492E+03	8.148E+05	5.475E+01	3.476E+00	9.696E+02	6.515E-02
1995	1.433E+03	7.829E+05	5.260E+01	3.339E+00	9.316E+02	6.260E-02
1996	1.377E+03	7.522E+05	5.054E+01	3.208E+00	8.951E+02	6.014E-02
1997	1.323E+03	7.227E+05	4.856E+01	3.083E+00	8.600E+02	5.778E-02
1998	1.271E+03	6.944E+05	4.665E+01	2.962E+00	8.263E+02	5.552E-02
1999	1.221E+03	6.671E+05	4.482E+01	2.846E+00	7.939E+02	5.334E-02
2000	1.173E+03	6.410E+05	4.307E+01	2.734E+00	7.628E+02	5.125E-02
2001	1.127E+03	6.158E+05	4.138E+01	2.627E+00	7.328E+02	4.924E-02
2002	1.083E+03	5.917E+05	3.976E+01	2.524E+00	7.041E+02	4.731E-02
2003	1.041E+03	5.685E+05	3.820E+01	2.425E+00	6.765E+02	4.545E-02
2004	9.998E+02	5.462E+05	3.670E+01	2.330E+00	6.500E+02	4.367E-02
2005	9.606E+02	5.248E+05	3.526E+01	2.238E+00	6.245E+02	4.196E-02
2006	9.229E+02	5.042E+05	3.388E+01	2.151E+00	6.000E+02	4.031E-02
2007	8.868E+02	4.844E+05	3.255E+01	2.066E+00	5.765E+02	3.873E-02
2008	8.520E+02	4.654E+05	3.127E+01	1.985E+00	5.539E+02	3.721E-02
2009	8.186E+02	4.472E+05	3.005E+01	1.907E+00	5.322E+02	3.576E-02
2010	7.865E+02	4.297E+05	2.887E+01	1.833E+00	5.113E+02	3.435E-02
2011	7.556E+02	4.128E+05	2.774E+01	1.761E+00	4.912E+02	3.301E-02
2012	7.260E+02	3.966E+05	2.665E+01	1.692E+00	4.720E+02	3.171E-02
2013	6.975E+02	3.811E+05	2.560E+01	1.625E+00	4.535E+02	3.047E-02
2014	6.702E+02	3.661E+05	2.460E+01	1.562E+00	4.357E+02	2.927E-02
2015	6.439E+02	3.518E+05	2.364E+01	1.500E+00	4.186E+02	2.813E-02
2016	6.187E+02	3.380E+05	2.271E+01	1.442E+00	4.022E+02	2.702E-02
2017	5.944E+02	3.247E+05	2.182E+01	1.385E+00	3.864E+02	2.596E-02
2018	5.711E+02	3.120E+05	2.096E+01	1.331E+00	3.713E+02	2.495E-02

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2019	5.487E+02	2.998E+05	2.014E+01	1.279E+00	3.567E+02	2.397E-02
2020	5.272E+02	2.880E+05	1.935E+01	1.228E+00	3.427E+02	2.303E-02
2021	5.065E+02	2.767E+05	1.859E+01	1.180E+00	3.293E+02	2.212E-02
2022	4.867E+02	2.659E+05	1.786E+01	1.134E+00	3.164E+02	2.126E-02
2023	4.676E+02	2.554E+05	1.716E+01	1.090E+00	3.040E+02	2.042E-02
2024	4.492E+02	2.454E+05	1.649E+01	1.047E+00	2.921E+02	1.962E-02
2025	4.316E+02	2.358E+05	1.584E+01	1.006E+00	2.806E+02	1.885E-02
2026	4.147E+02	2.266E+05	1.522E+01	9.664E-01	2.696E+02	1.811E-02
2027	3.984E+02	2.177E+05	1.463E+01	9.285E-01	2.590E+02	1.740E-02
2028	3.828E+02	2.091E+05	1.405E+01	8.921E-01	2.489E+02	1.672E-02
2029	3.678E+02	2.009E+05	1.350E+01	8.571E-01	2.391E+02	1.607E-02
2030	3.534E+02	1.931E+05	1.297E+01	8.235E-01	2.297E+02	1.544E-02
2031	3.395E+02	1.855E+05	1.246E+01	7.912E-01	2.207E+02	1.483E-02
2032	3.262E+02	1.782E+05	1.197E+01	7.602E-01	2.121E+02	1.425E-02
2033	3.134E+02	1.712E+05	1.150E+01	7.304E-01	2.038E+02	1.369E-02
2034	3.011E+02	1.645E+05	1.105E+01	7.017E-01	1.958E+02	1.315E-02
2035	2.893E+02	1.581E+05	1.062E+01	6.742E-01	1.881E+02	1.264E-02
2036	2.780E+02	1.519E+05	1.020E+01	6.478E-01	1.807E+02	1.214E-02
2037	2.671E+02	1.459E+05	9.804E+00	6.224E-01	1.736E+02	1.167E-02
2038	2.566E+02	1.402E+05	9.419E+00	5.980E-01	1.668E+02	1.121E-02
2039	2.466E+02	1.347E+05	9.050E+00	5.745E-01	1.603E+02	1.077E-02
2040	2.369E+02	1.294E+05	8.695E+00	5.520E-01	1.540E+02	1.035E-02
2041	2.276E+02	1.243E+05	8.354E+00	5.304E-01	1.480E+02	9.941E-03
2042	2.187E+02	1.195E+05	8.026E+00	5.096E-01	1.422E+02	9.552E-03
2043	2.101E+02	1.148E+05	7.712E+00	4.896E-01	1.366E+02	9.177E-03
2044	2.019E+02	1.103E+05	7.409E+00	4.704E-01	1.312E+02	8.817E-03
2045	1.939E+02	1.060E+05	7.119E+00	4.519E-01	1.261E+02	8.471E-03
2046	1.863E+02	1.018E+05	6.840E+00	4.342E-01	1.211E+02	8.139E-03
2047	1.790E+02	9.781E+04	6.572E+00	4.172E-01	1.164E+02	7.820E-03
2048	1.720E+02	9.397E+04	6.314E+00	4.008E-01	1.118E+02	7.513E-03
2049	1.653E+02	9.029E+04	6.066E+00	3.851E-01	1.074E+02	7.219E-03
2050	1.588E+02	8.675E+04	5.828E+00	3.700E-01	1.032E+02	6.936E-03
2051	1.526E+02	8.334E+04	5.600E+00	3.555E-01	9.918E+01	6.664E-03
2052	1.466E+02	8.008E+04	5.380E+00	3.416E-01	9.529E+01	6.403E-03
2053	1.408E+02	7.694E+04	5.169E+00	3.282E-01	9.155E+01	6.152E-03
2054	1.353E+02	7.392E+04	4.967E+00	3.153E-01	8.796E+01	5.910E-03
2055	1.300E+02	7.102E+04	4.772E+00	3.029E-01	8.452E+01	5.679E-03
2056	1.249E+02	6.824E+04	4.585E+00	2.911E-01	8.120E+01	5.456E-03
2057	1.200E+02	6.556E+04	4.405E+00	2.797E-01	7.802E+01	5.242E-03
2058	1.153E+02	6.299E+04	4.232E+00	2.687E-01	7.496E+01	5.036E-03
2059	1.108E+02	6.052E+04	4.066E+00	2.582E-01	7.202E+01	4.839E-03
2060	1.064E+02	5.815E+04	3.907E+00	2.480E-01	6.920E+01	4.649E-03
2061	1.023E+02	5.587E+04	3.754E+00	2.383E-01	6.648E+01	4.467E-03
2062	9.826E+01	5.368E+04	3.607E+00	2.290E-01	6.388E+01	4.292E-03
2063	9.440E+01	5.157E+04	3.465E+00	2.200E-01	6.137E+01	4.123E-03
2064	9.070E+01	4.955E+04	3.329E+00	2.114E-01	5.896E+01	3.962E-03
2065	8.714E+01	4.761E+04	3.199E+00	2.031E-01	5.665E+01	3.806E-03
2066	8.373E+01	4.574E+04	3.073E+00	1.951E-01	5.443E+01	3.657E-03
2067	8.044E+01	4.395E+04	2.953E+00	1.875E-01	5.230E+01	3.514E-03
2068	7.729E+01	4.222E+04	2.837E+00	1.801E-01	5.025E+01	3.376E-03
2069	7.426E+01	4.057E+04	2.726E+00	1.730E-01	4.828E+01	3.244E-03

Results (Continued)

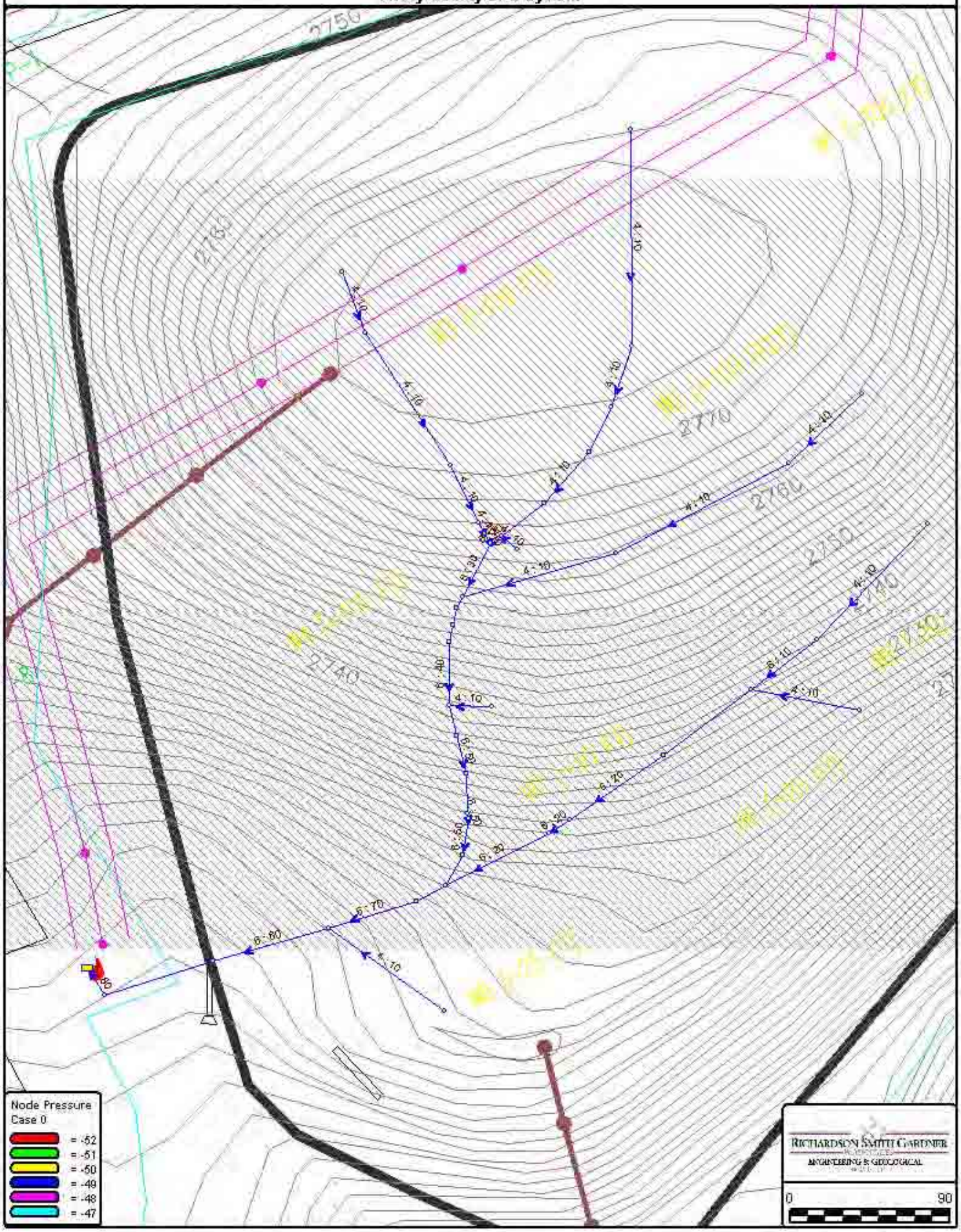
Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2070	7.135E+01	3.898E+04	2.619E+00	1.663E-01	4.638E+01	3.116E-03
2071	6.855E+01	3.745E+04	2.516E+00	1.597E-01	4.456E+01	2.994E-03
2072	6.586E+01	3.598E+04	2.418E+00	1.535E-01	4.282E+01	2.877E-03
2073	6.328E+01	3.457E+04	2.323E+00	1.475E-01	4.114E+01	2.764E-03
2074	6.080E+01	3.321E+04	2.232E+00	1.417E-01	3.952E+01	2.656E-03
2075	5.841E+01	3.191E+04	2.144E+00	1.361E-01	3.798E+01	2.552E-03
2076	5.612E+01	3.066E+04	2.060E+00	1.308E-01	3.649E+01	2.452E-03
2077	5.392E+01	2.946E+04	1.979E+00	1.257E-01	3.506E+01	2.355E-03
2078	5.181E+01	2.830E+04	1.902E+00	1.207E-01	3.368E+01	2.263E-03
2079	4.978E+01	2.719E+04	1.827E+00	1.160E-01	3.236E+01	2.174E-03
2080	4.783E+01	2.613E+04	1.755E+00	1.114E-01	3.109E+01	2.089E-03
2081	4.595E+01	2.510E+04	1.687E+00	1.071E-01	2.987E+01	2.007E-03
2082	4.415E+01	2.412E+04	1.621E+00	1.029E-01	2.870E+01	1.928E-03
2083	4.242E+01	2.317E+04	1.557E+00	9.884E-02	2.758E+01	1.853E-03
2084	4.075E+01	2.226E+04	1.496E+00	9.497E-02	2.649E+01	1.780E-03
2085	3.916E+01	2.139E+04	1.437E+00	9.124E-02	2.546E+01	1.710E-03
2086	3.762E+01	2.055E+04	1.381E+00	8.767E-02	2.446E+01	1.643E-03
2087	3.615E+01	1.975E+04	1.327E+00	8.423E-02	2.350E+01	1.579E-03
2088	3.473E+01	1.897E+04	1.275E+00	8.093E-02	2.258E+01	1.517E-03
2089	3.337E+01	1.823E+04	1.225E+00	7.775E-02	2.169E+01	1.457E-03
2090	3.206E+01	1.751E+04	1.177E+00	7.470E-02	2.084E+01	1.400E-03
2091	3.080E+01	1.683E+04	1.131E+00	7.178E-02	2.002E+01	1.345E-03
2092	2.959E+01	1.617E+04	1.086E+00	6.896E-02	1.924E+01	1.293E-03
2093	2.843E+01	1.553E+04	1.044E+00	6.626E-02	1.848E+01	1.242E-03
2094	2.732E+01	1.492E+04	1.003E+00	6.366E-02	1.776E+01	1.193E-03
2095	2.625E+01	1.434E+04	9.634E-01	6.116E-02	1.706E+01	1.146E-03
2096	2.522E+01	1.378E+04	9.257E-01	5.876E-02	1.639E+01	1.102E-03
2097	2.423E+01	1.324E+04	8.894E-01	5.646E-02	1.575E+01	1.058E-03
2098	2.328E+01	1.272E+04	8.545E-01	5.425E-02	1.513E+01	1.017E-03
2099	2.237E+01	1.222E+04	8.210E-01	5.212E-02	1.454E+01	9.770E-04
2100	2.149E+01	1.174E+04	7.888E-01	5.008E-02	1.397E+01	9.387E-04
2101	2.065E+01	1.128E+04	7.579E-01	4.811E-02	1.342E+01	9.019E-04
2102	1.984E+01	1.084E+04	7.281E-01	4.623E-02	1.290E+01	8.665E-04
2103	1.906E+01	1.041E+04	6.996E-01	4.441E-02	1.239E+01	8.325E-04
2104	1.831E+01	1.000E+04	6.722E-01	4.267E-02	1.190E+01	7.999E-04
2105	1.759E+01	9.612E+03	6.458E-01	4.100E-02	1.144E+01	7.685E-04
2106	1.690E+01	9.235E+03	6.205E-01	3.939E-02	1.099E+01	7.384E-04
2107	1.624E+01	8.873E+03	5.962E-01	3.785E-02	1.056E+01	7.094E-04
2108	1.560E+01	8.525E+03	5.728E-01	3.636E-02	1.014E+01	6.816E-04
2109	1.499E+01	8.191E+03	5.503E-01	3.494E-02	9.747E+00	6.549E-04

2010 KY Pipe Program Results
Calculations & Maps

KYPIPE ANALYSIS FOR
SYSTEM WITH THE FOLLOWING PARAMETERS:

WELL DEMAND: -10 CFM
FLOW: -80 CFM

Avery County LFG System



```
***  GAS2008 Version 1.0 ***
GAS DISTRIBUTION NETWORK ANALYSIS
COPYRIGHT 2007 - DON J. WOOD, SRINI LINGIEDDY
LEXINGTON, KY
Updated March 2007


INPUT DATA FILE NAME FOR THIS SIMULATION  = C:\Users\ADMINI~1.RSG\DOCUME~1\KYPI
PE~1\User\Avery.DAT
OUTPUT DATA FILE NAME FOR THIS SIMULATION = C:\Users\ADMINI~1.RSG\DOCUME~1\KYPI
PE~1\User\Avery.OT2

DATE FOR THIS COMPUTER RUN       : 12-06-2010
START TIME FOR THIS COMPUTER RUN : 14:51:12:47


SUMMARY OF DISTRIBUTION SYSTEM CHARACTERISTICS:
-----------------------------------------------


NUMBER OF PIPES           =    30
NUMBER OF JUNCTION NODES  =    30

UNITS SPECIFIED           = ENGLISH



PROPERTIES OF THE GAS FOR THIS ANALYSIS ARE:

 OPERATING TEMPERATURE                =     100.00 DEGREES FAHRENHEIT
 REFERENCE DENSITY (@ STD. PRESSURE) =    .71E-01 POUNDS / CUBIC FOOT
 GAS MOLECULAR WEIGHT                =      28.97
 GAS SPECIFIC GRAVITY                =       1.00
 RATIO OF SPECIFIC HEATS             =       1.00
 GAS CONSTANT                        =      53.34
 ABSOLUTE VISCOSITY                  =    .88E-05 POUND SECONDS/SQUARE FOOT


USER SPECIFIED FLOW UNITS (USFU)      = SCF / MIN.
USER SPECIFIED PRESSURE UNITS (USPU) = INCHES OF WATER (GAUGE)


-------  SUMMARY OF PIPE NETWORK GEOMETRIC AND OPERATING DATA  -------
```

PIPE NAME	NODE #1	NODE #2	LENGTH (FT.)	DIAM. (IN.)	ROUGHNESS (MILLIFEET)	SUM-M FACT.	PUMP ID	ELEVATION CHANGE
P-1	J-1	J-23	122.0	3.6	******	.0	0	.0
P-2	J-3	J-10	57.0	3.6	******	.0	0	.0
P-3	J-2	J-15	97.0	3.6	******	.0	0	.0
P-4	J-5	J-17	7.0	3.6	******	.0	0	.0
P-5	J-15	J-6	12.0	3.6	******	.0	0	.0
P-6	J-7	J-5	7.0	3.6	******	.0	0	.0
P-7	J-7	J-8	34.0	5.8	******	.0	0	.0

P-8	J-9	J-19	2.0	5.8	******	.0	0	.0
P-9	J-10	J-27	109.0	3.6	******	.0	0	.0
P-10	J-8	J-25	62.0	5.8	******	.0	0	.0
P-11	J-11	J-21	125.0	5.8	******	.0	0	.0
P-12	J-13	J-20	66.0	5.8	******	.0	0	.0
P-13	J-13	J-14	70.0	5.8	******	.0	0	.0
P-14	J-14	J-28	132.0	5.8	******	.0	0	.0
P-15	J-14	J-16	80.0	3.6	******	.0	0	.0
P-16	J-15	J-7	7.0	5.8	******	.0	0	.0
P-17	J-17	J-18	36.0	3.6	******	.0	0	.0
P-18	J-18	J-24	89.0	3.6	******	.0	0	.0
P-19	J-19	J-13	41.0	5.8	******	.0	0	.0
P-20	J-20	J-11	14.0	5.8	******	.0	0	.0
P-21	J-21	J-29	47.0	5.8	******	.0	0	.0
P-22	J-21	J-22	63.0	3.6	******	.0	0	.0
P-23	J-23	J-2	36.0	3.6	******	.0	0	.0
P-24	J-24	J-4	37.0	3.6	******	.0	0	.0
P-25	J-25	J-9	63.0	5.8	******	.0	0	.0
P-26	J-25	J-26	24.0	3.6	******	.0	0	.0
P-27	J-27	J-8	90.0	3.6	******	.0	0	.0
P-28	J-28	R-1	18.0	3.6	******	.0	0	.0
P-29	J-29	J-12	90.0	3.6	******	.0	0	.0

JUNCTION NAME	NODE TITLE	DEMAND (USFU)	FPN PRESSURE
J-1		-10.00	
J-2		.00	
J-3		-10.00	
J-4		-10.00	
J-5		.00	
J-6		-10.00	
J-7		.00	
J-8		.00	
J-9		.00	
J-10		.00	
J-11		.00	
J-12		-10.00	
J-13		.00	
J-14		.00	
J-15		.00	
J-16		-10.00	
J-17		.00	
J-18		.00	
J-19		.00	
J-20		.00	
J-21		.00	
J-22		-10.00	
J-23		.00	
J-24		.00	
J-25		.00	
J-26		-10.00	
J-27		.00	
J-28		.00	
J-29		.00	

R-1 .00 -52.00

==========

========== RESULTS FOR THIS SIMULATION FOLLOW ==========

Solution was obtained in 2 trials
Flow Accuracy = .0000[< .005]
RV Accuracy = .0000[< .001]

PIPE NO.	NODE #1	NODE #2	FLOW (USFU)	LOSS (USPU)	VELOCITY (FT/S)	DENSITY (#/CF)	FRICTION FACTOR	AREA RATIO
P-1	J-1	J-23	10.000	.00	2.84	.062	.0000	.005
P-2	J-3	J-10	10.000	.00	2.84	.062	.0000	.005
P-3	J-2	J-15	10.000	.00	2.84	.062	.0000	.005
P-4	J-5	J-17	-10.000	.00	2.84	.062	.0000	.005
P-5	J-15	J-6	-10.000	.00	2.84	.062	.0000	.005
P-6	J-7	J-5	-10.000	.00	2.84	.062	.0000	.005
P-7	J-7	J-8	30.000	.00	3.35	.062	.0000	.006
P-8	J-9	J-19	50.000	.00	5.59	.062	.0000	.009
P-9	J-10	J-27	10.000	.00	2.84	.062	.0000	.005
P-10	J-8	J-25	40.000	.00	4.47	.062	.0000	.008
P-11	J-11	J-21	-20.000	.00	2.24	.062	.0000	.004
P-12	J-13	J-20	-20.000	.00	2.24	.062	.0000	.004
P-13	J-13	J-14	70.000	.00	7.83	.062	.0000	.013
P-14	J-14	J-28	80.000	.00	8.94	.062	.0000	.015
P-15	J-14	J-16	-10.000	.00	2.84	.062	.0000	.005
P-16	J-15	J-7	20.000	.00	2.24	.062	.0000	.004
P-17	J-17	J-18	-10.000	.00	2.84	.062	.0000	.005
P-18	J-18	J-24	-10.000	.00	2.84	.062	.0000	.005
P-19	J-19	J-13	50.000	.00	5.59	.062	.0000	.009
P-20	J-20	J-11	-20.000	.00	2.24	.062	.0000	.004
P-21	J-21	J-29	-10.000	.00	1.12	.062	.0000	.002
P-22	J-21	J-22	-10.000	.00	2.84	.062	.0000	.005
P-23	J-23	J-2	10.000	.00	2.84	.062	.0000	.005
P-24	J-24	J-4	-10.000	.00	2.84	.062	.0000	.005
P-25	J-25	J-9	50.000	.00	5.59	.062	.0000	.009
P-26	J-25	J-26	-10.000	.00	2.84	.062	.0000	.005
P-27	J-27	J-8	10.000	.00	2.84	.062	.0000	.005
P-28	J-28	R-1	80.000	.00	22.71	.062	.0000	.038
P-29	J-29	J-12	-10.000	.00	2.84	.062	.0000	.005
R-1	R-1	R-1	-80.000	.00	.00	.062	.0000	.000

JUNCTION NAME	NODE TITLE	DEMAND (USFU)	PRESSURE (USPU)	PRESSURE (PSIA)	PRESSURE (PSIG)	DENSITY #/CF

J-1	-10.00	-52.00	12.82	-1.88	.062
J-2	.00	-52.00	12.82	-1.88	.062
J-3	-10.00	-52.00	12.82	-1.88	.062
J-4	-10.00	-52.00	12.82	-1.88	.062
J-5	.00	-52.00	12.82	-1.88	.062
J-6	-10.00	-52.00	12.82	-1.88	.062
J-7	.00	-52.00	12.82	-1.88	.062
J-8	.00	-52.00	12.82	-1.88	.062
J-9	.00	-52.00	12.82	-1.88	.062
J-10	.00	-52.00	12.82	-1.88	.062
J-11	.00	-52.00	12.82	-1.88	.062
J-12	-10.00	-52.00	12.82	-1.88	.062
J-13	.00	-52.00	12.82	-1.88	.062
J-14	.00	-52.00	12.82	-1.88	.062
J-15	.00	-52.00	12.82	-1.88	.062
J-16	-10.00	-52.00	12.82	-1.88	.062
J-17	.00	-52.00	12.82	-1.88	.062
J-18	.00	-52.00	12.82	-1.88	.062
J-19	.00	-52.00	12.82	-1.88	.062
J-20	.00	-52.00	12.82	-1.88	.062
J-21	.00	-52.00	12.82	-1.88	.062
J-22	-10.00	-52.00	12.82	-1.88	.062
J-23	.00	-52.00	12.82	-1.88	.062
J-24	.00	-52.00	12.82	-1.88	.062
J-25	.00	-52.00	12.82	-1.88	.062
J-26	-10.00	-52.00	12.82	-1.88	.062
J-27	.00	-52.00	12.82	-1.88	.062
J-28	.00	-52.00	12.82	-1.88	.062
J-29	.00	-52.00	12.82	-1.88	.062
R-1	.00	-52.00	12.82	-1.88	.062

* This designates the use of default density in a low pressure region

THE NET SYSTEM DEMAND (USFU) = -80.000

SUMMARY OF INFLOWS(+).AND.OUTFLOWS(-) :

NAME	FLOW (USFU)	FPN	TITLE
R-1	-80.0		R-1

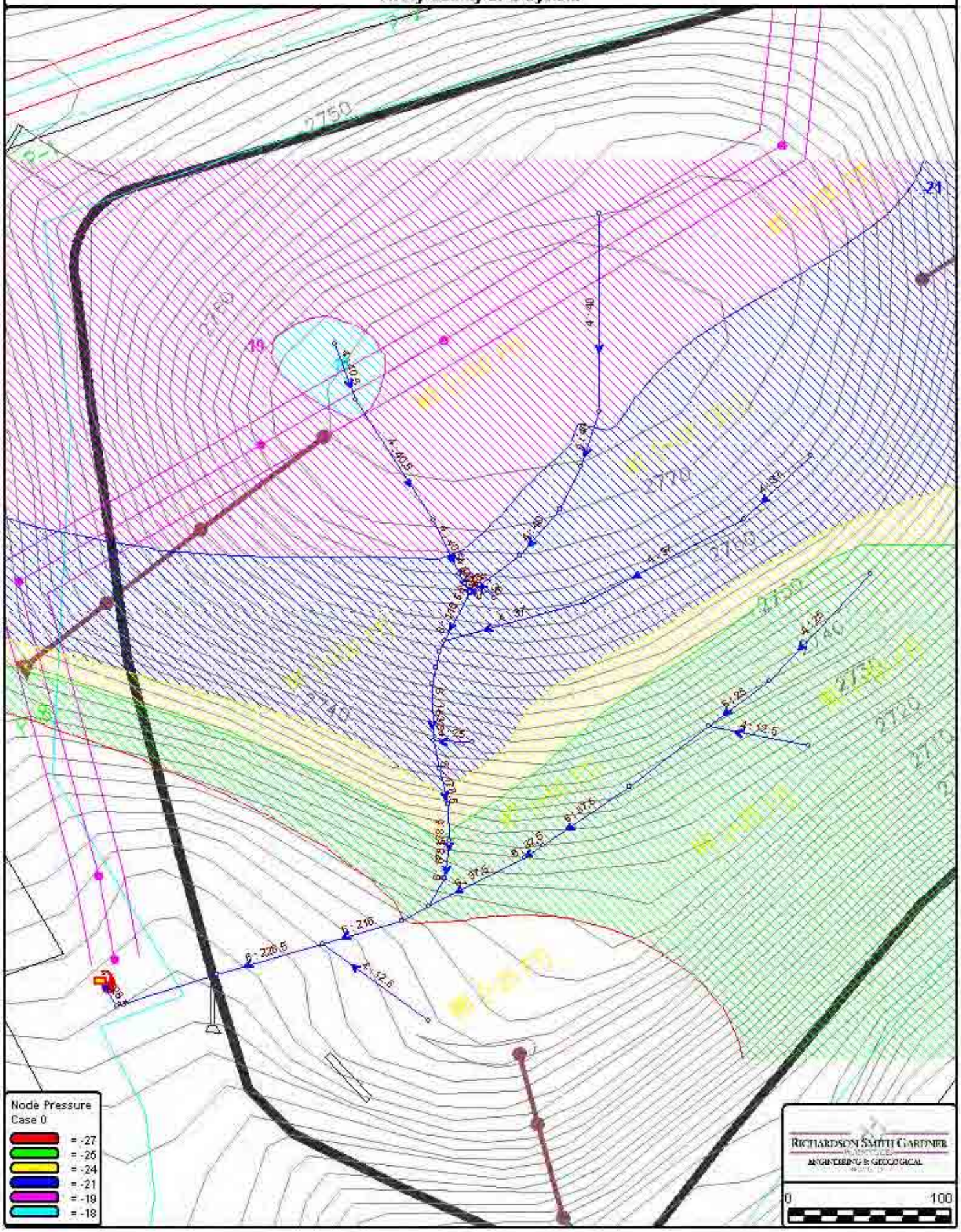
MAXIMUM MACH NUMBER = .02 IN LINE NO. P-28

SUMMARY OF MINIMUM.AND.MAXIMUM VELOCITIES (FT/S)

MINIMUM		MAXIMUM	
R-1	.00	P-28	22.71
P-21	1.12	P-14	8.94
P-11	2.24	P-13	7.83
P-1	2.84	P-25	5.59

```
P-7        3.35  P-10        4.47


 ---------------------------------------------------
 SUMMARY OF MINIMUM.AND.MAXIMUM LOSS/1000. (PSI )
 ---------------------------------------------------
       MINIMUM          MAXIMUM
 ----------------------------------------
P-7        3.35  P-10        4.47
P-7        3.35  P-10        4.47
P-7        3.35  P-10        4.47
P-7        3.35  P-10        4.47
P-7        3.35  P-10        4.47


 ------------------------------------------------
 SUMMARY OF MINIMUM.AND.MAXIMUM PRESSURES (USPU)
 ------------------------------------------------
       MINIMUM          MAXIMUM
 ----------------------------------------
J-1      -52.00  R-1       -52.00
J-1      -52.00  R-1       -52.00
J-1      -52.00  R-1       -52.00
J-1      -52.00  R-1       -52.00
J-1      -52.00  R-1       -52.00


 *************************    END OF KYGAS SIMULATION   ************************


 DATE FOR THIS COMPUTER RUN       : 12-06-2010
 START TIME FOR THIS COMPUTER RUN : 14:51:12:47
```

KYPIPE ANALYSIS FOR
SYSTEM WITH THE FOLLOWING PARAMETERS:

MAXIMUM WELL DEMAND
FLOW: -228 CFM

Avery County LFG System