SCS ENGINEERS Environmental Consultants & Contractors

June 28, 2024

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Subject: Landfill Gas Generation and Control Capacity Report Pursuant to Stipulated Order for Abatement (Case No. 6177-4), Chiquita Canyon Landfill (Facility ID 119219), Castaic, California

To Whom It May Concern:

SCS Engineers (SCS), on behalf of Chiquita Canyon, LLC (Chiquita), hereby provides the South Coast Air Quality Management District (SCAQMD) with a report on Chiquita's current and projected landfill gas (LFG) generation and control capacity per Condition No. 70 of the Stipulated Order for Abatement (SOFA) (Case No. 6177-4), as modified on April 24, 2024 (Modified SOFA), for the Chiquita Canyon Landfill (CCL or Landfill). Condition No. 70 of the Modified SOFA provides in relevant part:

> *70. Respondent shall, by June 28, 2024, submit a report on the landfill's current landfill gas generation and projected landfill gas generation for the next five calendar years, through the end of calendar year 2029. The current and projected landfill gas generation shall be estimated through use of U.S. EPA's Landfill Gas Emissions Model (LandGEM), and the Reaction Committee's analysis for additional landfill gas generated as a result of the ongoing reaction. The report shall include, at a minimum, the following items:*
>
> *a. LandGEM inputs, assumptions, and results;*
> *b. Reaction Committee analysis and associated rationale and supporting data or information; and*
> *c. A comparison of the estimated landfill gas generation, both current and projected, with the landfill's flaring capacity, both current and proposed, assuming one or more flares or thermal oxidizers are offline due to maintenance, overhaul, or other unforeseen circumstances.*
>
> *Based on the report findings, if the landfill gas generation is expected to exceed the landfill's flaring capacity when one or more flares or thermal oxidizers are offline, Respondent shall start the planning and procurement process for the addition of an additional flare, thermal oxidizer, or other landfill gas combustion/control equipment and ensure sufficient redundant control capacity to handle all generated landfill gas, assuming any one or more unit(s) is offline.*

BACKGROUND

The Landfill is a landfill/solid waste disposal facility located at 29201 Henry Mayo Dr., Castaic, California, 91384 (SCAQMD Facility No. 119219). In connection with the Landfill, Chiquita operates an LFG collection and control system (GCCS). The GCCS includes vertical LFG extraction wells, conveyance piping and landfill gas control devices (i.e., flares).

LANDFILL GAS GENERATION

The attached LandGEM gas generation model shows the associated inputs, assumptions and results for the estimated landfill gas generation for Chiquita (see Attachment A). The attached Reaction Committee report dated October 19, 2023 demonstrates the analysis and basis to estimate a 15% increase in LFG above the LandGEM model due to the reaction and its associated increased LFG flow (see Attachment B). The total estimated LFG generation is presented in the attached table and shows an expected maximum generation of 16,100 scfm in 2024 and 19,639 scfm in 2030 (see Attachment C).

CONTROL CAPACITY DISCUSSION

The Landfill currently has a control capacity of 18,700 scfm between the three (3) existing flares (Flares FL-1995, FL-2009, and FL-2023), and the one (1) existing portable thermal oxidizer at 4,700 scfm (Zeeco). The Landfill has submitted a permit application to the SCAQMD for an additional 6,000 scfm flare (Flare 4) that would replace the older, existing 4,000 scfm flare (FL-1995). We hope to have Flare 4 online in 2025 and this would increase flare control capacity to 20,700 scfm. For this discussion it was assumed that the third party LFG-to-energy plant would continue to remain offline and not be a portion of the control capacity.

The attached table shows the maximum expected LFG generation without any reduction for collection efficiency and the addition of another 6,000 scfm flare to provide control redundancy of the largest control device on-site. Based on this study and table, Chiquita needs to install and begin operating Flare 4 and Flare 5 as soon as possible, and it will not have 6,000 scfm of redundant capacity until the installation of Flare 5.

Per SOFA Condition No. 70, Chiquita will submit the permit application for Flare 5 by January 7, 2025, and has already begun the procurement process for Flare 4 despite not having received the approved permit application for Flare 4 that was submitted to the SCAQMD on October 30, 2023. Chiquita will wait to construct and begin operating Flare 4 until after it receives the permit.

CLOSING

If you have any questions or need any additional information, please contact the undersigned at (303) 519-4503.

Sincerely,

Evan Guignon, P.E.
Senior Project Professional
SCS Engineers

Bill Haley, P.E.
Project Director
SCS Engineers

Enclosures

cc: Steve Cassulo, Chiquita Canyon
Pat Sullivan, SCS Engineers
Bob Dick, SCS Engineers
Srividhya Viswanathan, SCS Engineers
Gabrielle Stephens, SCS Engineers

Summary Report

Landfill Name or Identifier: Chiquita Canyon Landfill

Date: Friday, June 28, 2024

Description/Comments:

NMOC concentration from Flare No. 2, December 20, 2022 Source Test, 7,925 ppmv, as methane to 1,475 as hexane. Actual tonnages 2010 - 2022.

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 i^{th} year (*Mg*)

t_{ij} = age of the j^{th} section of waste mass M_i accepted in the i^{th} 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	**1970**	
Landfill Closure Year (with 80-year limit)	**2047**	
Actual Closure Year (without limit)	***2047***	
Have Model Calculate Closure Year?	**No**	
Waste Design Capacity		*short tons*

MODEL PARAMETERS

Methane Generation Rate, k	**0.020**	*year^{-1}*
Potential Methane Generation Capacity, L_o	**170**	*m^3/Mg*
NMOC Concentration	**1,475**	*ppmv as hexane*
Methane Content	**50**	*% by volume*

GASES / POLLUTANTS SELECTED

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

WASTE ACCEPTANCE RATES

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
1970	665,909	732,500	0	0
1971	665,909	732,500	665,909	732,500
1972	665,909	732,500	1,331,818	1,465,000
1973	665,909	732,500	1,997,727	2,197,500
1974	665,909	732,500	2,663,636	2,930,000
1975	665,909	732,500	3,329,545	3,662,500
1976	665,909	732,500	3,995,455	4,395,000
1977	665,909	732,500	4,661,364	5,127,500
1978	665,909	732,500	5,327,273	5,860,000
1979	665,909	732,500	5,993,182	6,592,500
1980	665,909	732,500	6,659,091	7,325,000
1981	665,909	732,500	7,325,000	8,057,500
1982	665,909	732,500	7,990,909	8,790,000
1983	665,909	732,500	8,656,818	9,522,500
1984	665,909	732,500	9,322,727	10,255,000
1985	665,909	732,500	9,988,636	10,987,500
1986	665,909	732,500	10,654,545	11,720,000
1987	665,909	732,500	11,320,455	12,452,500
1988	665,909	732,500	11,986,364	13,185,000
1989	665,909	732,500	12,652,273	13,917,500
1990	665,909	732,500	13,318,182	14,650,000
1991	665,909	732,500	13,984,091	15,382,500
1992	665,909	732,500	14,650,000	16,115,000
1993	665,909	732,500	15,315,909	16,847,500
1994	665,909	732,500	15,981,818	17,580,000
1995	665,909	732,500	16,647,727	18,312,500
1996	665,909	732,500	17,313,636	19,045,000
1997	665,909	732,500	17,979,545	19,777,500
1998	665,909	732,500	18,645,455	20,510,000
1999	665,909	732,500	19,311,364	21,242,500
2000	665,909	732,500	19,977,273	21,975,000
2001	665,909	732,500	20,643,182	22,707,500
2002	665,909	732,500	21,309,091	23,440,000
2003	665,909	732,500	21,975,000	24,172,500
2004	665,909	732,500	22,640,909	24,905,000
2005	665,909	732,500	23,306,818	25,637,500
2006	665,909	732,500	23,972,727	26,370,000
2007	665,909	732,500	24,638,636	27,102,500
2008	665,909	732,500	25,304,545	27,835,000
2009	665,909	732,500	25,970,455	28,567,500

WASTE ACCEPTANCE RATES (Continued)

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2010	990,725	1,089,797	26,636,364	29,300,000
2011	1,209,375	1,330,312	27,627,088	30,389,797
2012	842,605	926,866	28,836,463	31,720,109
2013	935,751	1,029,326	29,679,068	32,646,975
2014	1,009,278	1,110,206	30,614,819	33,676,301
2015	977,637	1,075,401	31,624,097	34,786,507
2016	1,288,789	1,417,668	32,601,735	35,861,908
2017	1,355,931	1,491,524	33,890,524	37,279,576
2018	1,391,054	1,530,160	35,246,455	38,771,100
2019	1,541,862	1,696,048	36,637,509	40,301,260
2020	1,711,799	1,882,978	38,179,370	41,997,307
2021	1,835,140	2,018,654	39,891,169	43,880,286
2022	1,818,756	2,000,632	41,726,309	45,898,940
2023	1,818,756	2,000,632	43,545,066	47,899,572
2024	1,818,756	2,000,632	45,363,822	49,900,204
2025	1,818,756	2,000,632	47,182,578	51,900,836
2026	1,818,756	2,000,632	49,001,335	53,901,468
2027	1,818,756	2,000,632	50,820,091	55,902,100
2028	1,818,756	2,000,632	52,638,848	57,902,733
2029	1,818,756	2,000,632	54,457,604	59,903,365
2030	1,818,756	2,000,632	56,276,361	61,903,997
2031	1,818,756	2,000,632	58,095,117	63,904,629
2032	1,818,756	2,000,632	59,913,874	65,905,261
2033	1,818,756	2,000,632	61,732,630	67,905,893
2034	1,818,756	2,000,632	63,551,386	69,906,525
2035	1,818,756	2,000,632	65,370,143	71,907,157
2036	1,818,756	2,000,632	67,188,899	73,907,789
2037	1,818,756	2,000,632	69,007,656	75,908,421
2038	1,818,756	2,000,632	70,826,412	77,909,053
2039	1,818,756	2,000,632	72,645,169	79,909,686
2040	1,818,756	2,000,632	74,463,925	81,910,318
2041	1,818,756	2,000,632	76,282,682	83,910,950
2042	1,818,756	2,000,632	78,101,438	85,911,582
2043	1,818,756	2,000,632	79,920,194	87,912,214
2044	1,818,756	2,000,632	81,738,951	89,912,846
2045	1,818,756	2,000,632	83,557,707	91,913,478
2046	1,818,756	2,000,632	85,376,464	93,914,110
2047	0	0	87,195,220	95,914,742
2048	0	0	87,195,220	95,914,742
2049	0	0	87,195,220	95,914,742

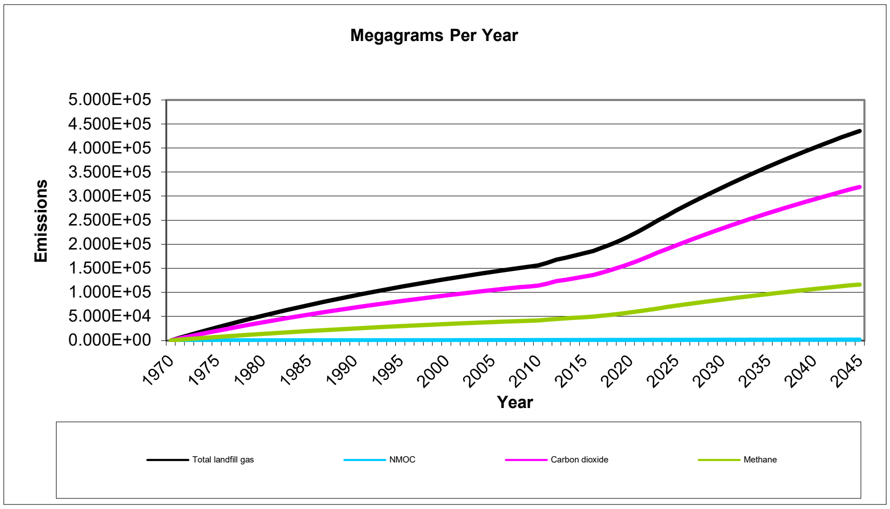
Pollutant Parameters

	Compound	Gas / Pollutant Default Parameters: Concentration (*ppmv*)	Molecular Weight	User-specified Pollutant Parameters: 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)

	Gas / Pollutant Default Parameters:			User-specified Pollutant Parameters:	
	Compound	Concentration (*ppmv*)	Molecular Weight	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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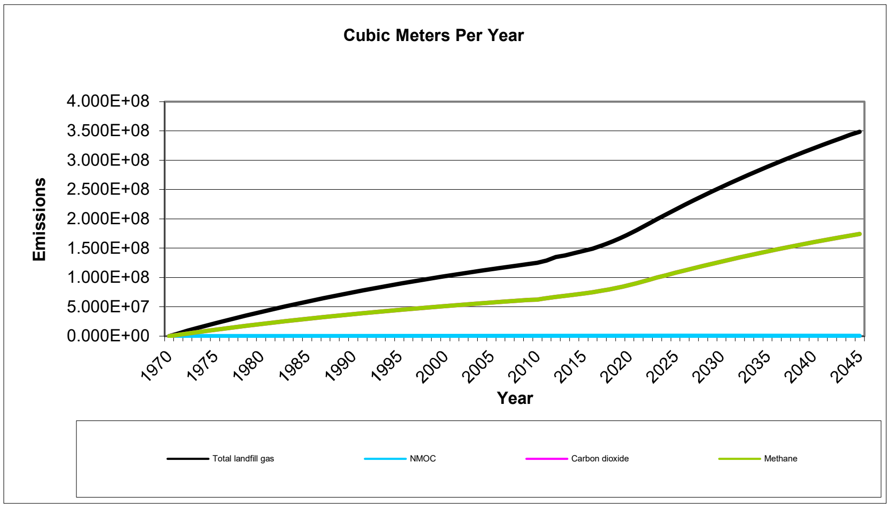
4.000E+05
3.500E+05
3.000E+05
2.500E+05
2.000E+05
1.500E+05
1.000E+05
5.000E+04
0.000E+00
1970 1975 1980 1985 1990 1995 2000 2005 2010 2015 2020 2025 2030 2035 2040 2045
Year
Total landfill gas
NMOC
Carbon dioxide
Methane


Cubic Meters Per Year
Emissions
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2.000E+08
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1.000E+08
5.000E+07
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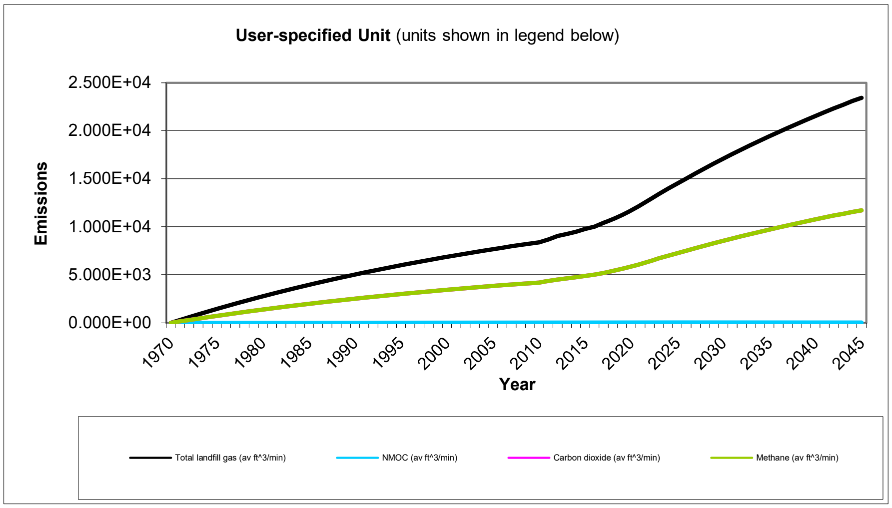
1970 1975 1980 1985 1990 1995 2000 2005 2010 2015 2020 2025 2030 2035 2040 2045
Year
Total landfill gas
NMOC
Carbon dioxide
Methane


User-specified Unit (units shown in legend below)
Emissions
2.500E+04
2.000E+04
1.500E+04
1.000E+04
5.000E+03
0.000E+00
1970 1975 1980 1985 1990 1995 2000 2005 2010 2015 2020 2025 2030 2035 2040 2045
Year
Total landfill gas (av ft^3/min)
NMOC (av ft^3/min)
Carbon dioxide (av ft^3/min)
Methane (av ft^3/min)

Results

Year	Total landfill gas			NMOC		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
1970	0	0	0	0	0	0
1971	5.604E+03	4.488E+06	3.015E+02	2.373E+01	6.619E+03	4.448E-01
1972	1.110E+04	8.887E+06	5.971E+02	4.698E+01	1.311E+04	8.807E-01
1973	1.648E+04	1.320E+07	8.868E+02	6.978E+01	1.947E+04	1.308E+00
1974	2.176E+04	1.742E+07	1.171E+03	9.213E+01	2.570E+04	1.727E+00
1975	2.693E+04	2.157E+07	1.449E+03	1.140E+02	3.181E+04	2.137E+00
1976	3.200E+04	2.563E+07	1.722E+03	1.355E+02	3.780E+04	2.540E+00
1977	3.698E+04	2.961E+07	1.989E+03	1.565E+02	4.367E+04	2.934E+00
1978	4.185E+04	3.351E+07	2.251E+03	1.772E+02	4.943E+04	3.321E+00
1979	4.662E+04	3.733E+07	2.508E+03	1.974E+02	5.507E+04	3.700E+00
1980	5.130E+04	4.108E+07	2.760E+03	2.172E+02	6.060E+04	4.071E+00
1981	5.589E+04	4.476E+07	3.007E+03	2.366E+02	6.602E+04	4.436E+00
1982	6.039E+04	4.836E+07	3.249E+03	2.557E+02	7.133E+04	4.793E+00
1983	6.480E+04	5.189E+07	3.486E+03	2.743E+02	7.654E+04	5.142E+00
1984	6.912E+04	5.535E+07	3.719E+03	2.926E+02	8.164E+04	5.485E+00
1985	7.336E+04	5.874E+07	3.947E+03	3.106E+02	8.664E+04	5.821E+00
1986	7.751E+04	6.206E+07	4.170E+03	3.281E+02	9.155E+04	6.151E+00
1987	8.158E+04	6.532E+07	4.389E+03	3.454E+02	9.635E+04	6.474E+00
1988	8.557E+04	6.852E+07	4.604E+03	3.623E+02	1.011E+05	6.790E+00
1989	8.948E+04	7.165E+07	4.814E+03	3.788E+02	1.057E+05	7.101E+00
1990	9.331E+04	7.472E+07	5.020E+03	3.950E+02	1.102E+05	7.405E+00
1991	9.707E+04	7.773E+07	5.222E+03	4.109E+02	1.146E+05	7.703E+00
1992	1.007E+05	8.067E+07	5.420E+03	4.265E+02	1.190E+05	7.995E+00
1993	1.044E+05	8.356E+07	5.615E+03	4.418E+02	1.233E+05	8.282E+00
1994	1.079E+05	8.640E+07	5.805E+03	4.568E+02	1.274E+05	8.563E+00
1995	1.114E+05	8.917E+07	5.992E+03	4.715E+02	1.315E+05	8.838E+00
1996	1.148E+05	9.190E+07	6.174E+03	4.859E+02	1.355E+05	9.107E+00
1997	1.181E+05	9.456E+07	6.354E+03	5.000E+02	1.395E+05	9.372E+00
1998	1.214E+05	9.718E+07	6.529E+03	5.138E+02	1.433E+05	9.631E+00
1999	1.246E+05	9.974E+07	6.702E+03	5.274E+02	1.471E+05	9.885E+00
2000	1.277E+05	1.023E+08	6.871E+03	5.406E+02	1.508E+05	1.013E+01
2001	1.308E+05	1.047E+08	7.036E+03	5.537E+02	1.545E+05	1.038E+01
2002	1.338E+05	1.071E+08	7.198E+03	5.664E+02	1.580E+05	1.062E+01
2003	1.367E+05	1.095E+08	7.357E+03	5.789E+02	1.615E+05	1.085E+01
2004	1.396E+05	1.118E+08	7.513E+03	5.912E+02	1.649E+05	1.108E+01
2005	1.425E+05	1.141E+08	7.666E+03	6.032E+02	1.683E+05	1.131E+01
2006	1.453E+05	1.163E+08	7.816E+03	6.150E+02	1.716E+05	1.153E+01
2007	1.480E+05	1.185E+08	7.962E+03	6.266E+02	1.748E+05	1.174E+01
2008	1.507E+05	1.206E+08	8.106E+03	6.379E+02	1.780E+05	1.196E+01
2009	1.533E+05	1.227E+08	8.247E+03	6.490E+02	1.811E+05	1.216E+01
2010	1.559E+05	1.248E+08	8.385E+03	6.598E+02	1.841E+05	1.237E+01
2011	1.611E+05	1.290E+08	8.668E+03	6.821E+02	1.903E+05	1.279E+01
2012	1.681E+05	1.346E+08	9.044E+03	7.117E+02	1.985E+05	1.334E+01
2013	1.719E+05	1.376E+08	9.246E+03	7.276E+02	2.030E+05	1.364E+01
2014	1.763E+05	1.412E+08	9.487E+03	7.465E+02	2.083E+05	1.399E+01
2015	1.813E+05	1.452E+08	9.756E+03	7.677E+02	2.142E+05	1.439E+01
2016	1.860E+05	1.489E+08	1.001E+04	7.873E+02	2.197E+05	1.476E+01
2017	1.931E+05	1.547E+08	1.039E+04	8.177E+02	2.281E+05	1.533E+01
2018	2.007E+05	1.607E+08	1.080E+04	8.498E+02	2.371E+05	1.593E+01
2019	2.085E+05	1.669E+08	1.122E+04	8.825E+02	2.462E+05	1.654E+01

Results (Continued)

Year	Total landfill gas			NMOC		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
2020	2.173E+05	1.740E+08	1.169E+04	9.200E+02	2.567E+05	1.725E+01
2021	2.274E+05	1.821E+08	1.224E+04	9.628E+02	2.686E+05	1.805E+01
2022	2.383E+05	1.909E+08	1.282E+04	1.009E+03	2.815E+05	1.892E+01
2023	2.489E+05	1.993E+08	1.339E+04	1.054E+03	2.940E+05	1.976E+01
2024	2.593E+05	2.076E+08	1.395E+04	1.098E+03	3.063E+05	2.058E+01
2025	2.695E+05	2.158E+08	1.450E+04	1.141E+03	3.183E+05	2.139E+01
2026	2.795E+05	2.238E+08	1.504E+04	1.183E+03	3.301E+05	2.218E+01
2027	2.892E+05	2.316E+08	1.556E+04	1.225E+03	3.416E+05	2.295E+01
2028	2.988E+05	2.393E+08	1.608E+04	1.265E+03	3.529E+05	2.371E+01
2029	3.082E+05	2.468E+08	1.658E+04	1.305E+03	3.640E+05	2.446E+01
2030	3.174E+05	2.542E+08	1.708E+04	1.344E+03	3.749E+05	2.519E+01
2031	3.264E+05	2.614E+08	1.756E+04	1.382E+03	3.855E+05	2.590E+01
2032	3.353E+05	2.685E+08	1.804E+04	1.419E+03	3.960E+05	2.661E+01
2033	3.439E+05	2.754E+08	1.850E+04	1.456E+03	4.062E+05	2.729E+01
2034	3.524E+05	2.822E+08	1.896E+04	1.492E+03	4.163E+05	2.797E+01
2035	3.608E+05	2.889E+08	1.941E+04	1.527E+03	4.261E+05	2.863E+01
2036	3.689E+05	2.954E+08	1.985E+04	1.562E+03	4.357E+05	2.928E+01
2037	3.769E+05	3.018E+08	2.028E+04	1.596E+03	4.452E+05	2.991E+01
2038	3.848E+05	3.081E+08	2.070E+04	1.629E+03	4.545E+05	3.054E+01
2039	3.925E+05	3.143E+08	2.112E+04	1.662E+03	4.635E+05	3.115E+01
2040	4.000E+05	3.203E+08	2.152E+04	1.693E+03	4.724E+05	3.174E+01
2041	4.074E+05	3.262E+08	2.192E+04	1.725E+03	4.812E+05	3.233E+01
2042	4.146E+05	3.320E+08	2.231E+04	1.755E+03	4.897E+05	3.290E+01
2043	4.217E+05	3.377E+08	2.269E+04	1.785E+03	4.981E+05	3.347E+01
2044	4.287E+05	3.433E+08	2.306E+04	1.815E+03	5.063E+05	3.402E+01
2045	4.355E+05	3.487E+08	2.343E+04	1.844E+03	5.144E+05	3.456E+01
2046	4.422E+05	3.541E+08	2.379E+04	1.872E+03	5.223E+05	3.509E+01
2047	4.487E+05	3.593E+08	2.414E+04	1.900E+03	5.300E+05	3.561E+01
2048	4.398E+05	3.522E+08	2.366E+04	1.862E+03	5.195E+05	3.491E+01
2049	4.311E+05	3.452E+08	2.320E+04	1.825E+03	5.092E+05	3.421E+01
2050	4.226E+05	3.384E+08	2.274E+04	1.789E+03	4.991E+05	3.354E+01
2051	4.142E+05	3.317E+08	2.229E+04	1.754E+03	4.893E+05	3.287E+01
2052	4.060E+05	3.251E+08	2.185E+04	1.719E+03	4.796E+05	3.222E+01
2053	3.980E+05	3.187E+08	2.141E+04	1.685E+03	4.701E+05	3.158E+01
2054	3.901E+05	3.124E+08	2.099E+04	1.652E+03	4.608E+05	3.096E+01
2055	3.824E+05	3.062E+08	2.057E+04	1.619E+03	4.516E+05	3.035E+01
2056	3.748E+05	3.001E+08	2.017E+04	1.587E+03	4.427E+05	2.974E+01
2057	3.674E+05	2.942E+08	1.977E+04	1.555E+03	4.339E+05	2.916E+01
2058	3.601E+05	2.884E+08	1.937E+04	1.525E+03	4.253E+05	2.858E+01
2059	3.530E+05	2.826E+08	1.899E+04	1.494E+03	4.169E+05	2.801E+01
2060	3.460E+05	2.771E+08	1.862E+04	1.465E+03	4.087E+05	2.746E+01
2061	3.391E+05	2.716E+08	1.825E+04	1.436E+03	4.006E+05	2.691E+01
2062	3.324E+05	2.662E+08	1.789E+04	1.407E+03	3.926E+05	2.638E+01
2063	3.258E+05	2.609E+08	1.753E+04	1.380E+03	3.849E+05	2.586E+01
2064	3.194E+05	2.558E+08	1.718E+04	1.352E+03	3.772E+05	2.535E+01
2065	3.131E+05	2.507E+08	1.684E+04	1.325E+03	3.698E+05	2.484E+01
2066	3.069E+05	2.457E+08	1.651E+04	1.299E+03	3.624E+05	2.435E+01
2067	3.008E+05	2.409E+08	1.618E+04	1.273E+03	3.553E+05	2.387E+01
2068	2.948E+05	2.361E+08	1.586E+04	1.248E+03	3.482E+05	2.340E+01
2069	2.890E+05	2.314E+08	1.555E+04	1.224E+03	3.413E+05	2.293E+01
2070	2.833E+05	2.268E+08	1.524E+04	1.199E+03	3.346E+05	2.248E+01

Results (Continued)

Year	Total landfill gas			NMOC		
	(Mg/year)	(m 3 /year)	(av ft^3/min)	(Mg/year)	(m 3 /year)	(av ft^3/min)
2071	2.777E+05	2.223E+08	1.494E+04	1.176E+03	3.280E+05	2.204E+01
2072	2.722E+05	2.179E+08	1.464E+04	1.152E+03	3.215E+05	2.160E+01
2073	2.668E+05	2.136E+08	1.435E+04	1.129E+03	3.151E+05	2.117E+01
2074	2.615E+05	2.094E+08	1.407E+04	1.107E+03	3.089E+05	2.075E+01
2075	2.563E+05	2.052E+08	1.379E+04	1.085E+03	3.027E+05	2.034E+01
2076	2.512E+05	2.012E+08	1.352E+04	1.064E+03	2.967E+05	1.994E+01
2077	2.463E+05	1.972E+08	1.325E+04	1.043E+03	2.909E+05	1.954E+01
2078	2.414E+05	1.933E+08	1.299E+04	1.022E+03	2.851E+05	1.916E+01
2079	2.366E+05	1.895E+08	1.273E+04	1.002E+03	2.795E+05	1.878E+01
2080	2.319E+05	1.857E+08	1.248E+04	9.819E+02	2.739E+05	1.841E+01
2081	2.273E+05	1.820E+08	1.223E+04	9.625E+02	2.685E+05	1.804E+01
2082	2.228E+05	1.784E+08	1.199E+04	9.434E+02	2.632E+05	1.768E+01
2083	2.184E+05	1.749E+08	1.175E+04	9.247E+02	2.580E+05	1.733E+01
2084	2.141E+05	1.714E+08	1.152E+04	9.064E+02	2.529E+05	1.699E+01
2085	2.099E+05	1.680E+08	1.129E+04	8.885E+02	2.479E+05	1.665E+01
2086	2.057E+05	1.647E+08	1.107E+04	8.709E+02	2.430E+05	1.632E+01
2087	2.016E+05	1.615E+08	1.085E+04	8.536E+02	2.381E+05	1.600E+01
2088	1.976E+05	1.583E+08	1.063E+04	8.367E+02	2.334E+05	1.568E+01
2089	1.937E+05	1.551E+08	1.042E+04	8.201E+02	2.288E+05	1.537E+01
2090	1.899E+05	1.520E+08	1.022E+04	8.039E+02	2.243E+05	1.507E+01
2091	1.861E+05	1.490E+08	1.001E+04	7.880E+02	2.198E+05	1.477E+01
2092	1.824E+05	1.461E+08	9.816E+03	7.724E+02	2.155E+05	1.448E+01
2093	1.788E+05	1.432E+08	9.621E+03	7.571E+02	2.112E+05	1.419E+01
2094	1.753E+05	1.404E+08	9.431E+03	7.421E+02	2.070E+05	1.391E+01
2095	1.718E+05	1.376E+08	9.244E+03	7.274E+02	2.029E+05	1.364E+01
2096	1.684E+05	1.349E+08	9.061E+03	7.130E+02	1.989E+05	1.337E+01
2097	1.651E+05	1.322E+08	8.882E+03	6.989E+02	1.950E+05	1.310E+01
2098	1.618E+05	1.296E+08	8.706E+03	6.850E+02	1.911E+05	1.284E+01
2099	1.586E+05	1.270E+08	8.533E+03	6.715E+02	1.873E+05	1.259E+01
2100	1.555E+05	1.245E+08	8.364E+03	6.582E+02	1.836E+05	1.234E+01
2101	1.524E+05	1.220E+08	8.199E+03	6.452E+02	1.800E+05	1.209E+01
2102	1.494E+05	1.196E+08	8.036E+03	6.324E+02	1.764E+05	1.185E+01
2103	1.464E+05	1.172E+08	7.877E+03	6.199E+02	1.729E+05	1.162E+01
2104	1.435E+05	1.149E+08	7.721E+03	6.076E+02	1.695E+05	1.139E+01
2105	1.407E+05	1.126E+08	7.568E+03	5.955E+02	1.661E+05	1.116E+01
2106	1.379E+05	1.104E+08	7.418E+03	5.838E+02	1.629E+05	1.094E+01
2107	1.352E+05	1.082E+08	7.272E+03	5.722E+02	1.596E+05	1.073E+01
2108	1.325E+05	1.061E+08	7.128E+03	5.609E+02	1.565E+05	1.051E+01
2109	1.299E+05	1.040E+08	6.986E+03	5.498E+02	1.534E+05	1.031E+01
2110	1.273E+05	1.019E+08	6.848E+03	5.389E+02	1.503E+05	1.010E+01

Results (Continued)

Year	Carbon dioxide			Methane		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
1970	0	0	0	0	0	0
1971	4.107E+03	2.244E+06	1.508E+02	1.497E+03	2.244E+06	1.508E+02
1972	8.133E+03	4.443E+06	2.985E+02	2.964E+03	4.443E+06	2.985E+02
1973	1.208E+04	6.599E+06	4.434E+02	4.403E+03	6.599E+06	4.434E+02
1974	1.595E+04	8.712E+06	5.854E+02	5.812E+03	8.712E+06	5.854E+02
1975	1.974E+04	1.078E+07	7.245E+02	7.194E+03	1.078E+07	7.245E+02
1976	2.346E+04	1.281E+07	8.610E+02	8.549E+03	1.281E+07	8.610E+02
1977	2.710E+04	1.480E+07	9.947E+02	9.876E+03	1.480E+07	9.947E+02
1978	3.067E+04	1.675E+07	1.126E+03	1.118E+04	1.675E+07	1.126E+03
1979	3.417E+04	1.867E+07	1.254E+03	1.245E+04	1.867E+07	1.254E+03
1980	3.760E+04	2.054E+07	1.380E+03	1.370E+04	2.054E+07	1.380E+03
1981	4.096E+04	2.238E+07	1.504E+03	1.493E+04	2.238E+07	1.504E+03
1982	4.426E+04	2.418E+07	1.625E+03	1.613E+04	2.418E+07	1.625E+03
1983	4.749E+04	2.594E+07	1.743E+03	1.731E+04	2.594E+07	1.743E+03
1984	5.066E+04	2.767E+07	1.859E+03	1.846E+04	2.767E+07	1.859E+03
1985	5.376E+04	2.937E+07	1.973E+03	1.959E+04	2.937E+07	1.973E+03
1986	5.680E+04	3.103E+07	2.085E+03	2.070E+04	3.103E+07	2.085E+03
1987	5.979E+04	3.266E+07	2.195E+03	2.179E+04	3.266E+07	2.195E+03
1988	6.271E+04	3.426E+07	2.302E+03	2.286E+04	3.426E+07	2.302E+03
1989	6.558E+04	3.582E+07	2.407E+03	2.390E+04	3.582E+07	2.407E+03
1990	6.838E+04	3.736E+07	2.510E+03	2.492E+04	3.736E+07	2.510E+03
1991	7.114E+04	3.886E+07	2.611E+03	2.593E+04	3.886E+07	2.611E+03
1992	7.384E+04	4.034E+07	2.710E+03	2.691E+04	4.034E+07	2.710E+03
1993	7.648E+04	4.178E+07	2.807E+03	2.787E+04	4.178E+07	2.807E+03
1994	7.908E+04	4.320E+07	2.903E+03	2.882E+04	4.320E+07	2.903E+03
1995	8.162E+04	4.459E+07	2.996E+03	2.975E+04	4.459E+07	2.996E+03
1996	8.411E+04	4.595E+07	3.087E+03	3.065E+04	4.595E+07	3.087E+03
1997	8.655E+04	4.728E+07	3.177E+03	3.154E+04	4.728E+07	3.177E+03
1998	8.894E+04	4.859E+07	3.265E+03	3.242E+04	4.859E+07	3.265E+03
1999	9.129E+04	4.987E+07	3.351E+03	3.327E+04	4.987E+07	3.351E+03
2000	9.359E+04	5.113E+07	3.435E+03	3.411E+04	5.113E+07	3.435E+03
2001	9.584E+04	5.236E+07	3.518E+03	3.493E+04	5.236E+07	3.518E+03
2002	9.805E+04	5.357E+07	3.599E+03	3.574E+04	5.357E+07	3.599E+03
2003	1.002E+05	5.475E+07	3.679E+03	3.653E+04	5.475E+07	3.679E+03
2004	1.023E+05	5.591E+07	3.757E+03	3.730E+04	5.591E+07	3.757E+03
2005	1.044E+05	5.705E+07	3.833E+03	3.806E+04	5.705E+07	3.833E+03
2006	1.065E+05	5.816E+07	3.908E+03	3.880E+04	5.816E+07	3.908E+03
2007	1.085E+05	5.925E+07	3.981E+03	3.953E+04	5.925E+07	3.981E+03
2008	1.104E+05	6.032E+07	4.053E+03	4.024E+04	6.032E+07	4.053E+03
2009	1.123E+05	6.137E+07	4.124E+03	4.094E+04	6.137E+07	4.124E+03
2010	1.142E+05	6.240E+07	4.193E+03	4.163E+04	6.240E+07	4.193E+03
2011	1.181E+05	6.450E+07	4.334E+03	4.303E+04	6.450E+07	4.334E+03
2012	1.232E+05	6.730E+07	4.522E+03	4.490E+04	6.730E+07	4.522E+03
2013	1.260E+05	6.881E+07	4.623E+03	4.591E+04	6.881E+07	4.623E+03
2014	1.292E+05	7.060E+07	4.744E+03	4.710E+04	7.060E+07	4.744E+03
2015	1.329E+05	7.260E+07	4.878E+03	4.844E+04	7.260E+07	4.878E+03
2016	1.363E+05	7.446E+07	5.003E+03	4.967E+04	7.446E+07	5.003E+03
2017	1.415E+05	7.733E+07	5.196E+03	5.159E+04	7.733E+07	5.196E+03
2018	1.471E+05	8.036E+07	5.400E+03	5.361E+04	8.036E+07	5.400E+03
2019	1.528E+05	8.346E+07	5.608E+03	5.568E+04	8.346E+07	5.608E+03

Results (Continued)

Year	Carbon dioxide			Methane		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
2020	1.593E+05	8.700E+07	5.846E+03	5.804E+04	8.700E+07	5.846E+03
2021	1.667E+05	9.105E+07	6.118E+03	6.074E+04	9.105E+07	6.118E+03
2022	1.747E+05	9.543E+07	6.412E+03	6.367E+04	9.543E+07	6.412E+03
2023	1.824E+05	9.967E+07	6.697E+03	6.649E+04	9.967E+07	6.697E+03
2024	1.900E+05	1.038E+08	6.976E+03	6.927E+04	1.038E+08	6.976E+03
2025	1.975E+05	1.079E+08	7.249E+03	7.198E+04	1.079E+08	7.249E+03
2026	2.048E+05	1.119E+08	7.518E+03	7.465E+04	1.119E+08	7.518E+03
2027	2.120E+05	1.158E+08	7.781E+03	7.726E+04	1.158E+08	7.781E+03
2028	2.190E+05	1.196E+08	8.038E+03	7.981E+04	1.196E+08	8.038E+03
2029	2.259E+05	1.234E+08	8.291E+03	8.232E+04	1.234E+08	8.291E+03
2030	2.326E+05	1.271E+08	8.539E+03	8.478E+04	1.271E+08	8.539E+03
2031	2.392E+05	1.307E+08	8.781E+03	8.719E+04	1.307E+08	8.781E+03
2032	2.457E+05	1.342E+08	9.019E+03	8.955E+04	1.342E+08	9.019E+03
2033	2.521E+05	1.377E+08	9.252E+03	9.187E+04	1.377E+08	9.252E+03
2034	2.583E+05	1.411E+08	9.481E+03	9.414E+04	1.411E+08	9.481E+03
2035	2.644E+05	1.444E+08	9.705E+03	9.636E+04	1.444E+08	9.705E+03
2036	2.704E+05	1.477E+08	9.924E+03	9.854E+04	1.477E+08	9.924E+03
2037	2.762E+05	1.509E+08	1.014E+04	1.007E+05	1.509E+08	1.014E+04
2038	2.820E+05	1.541E+08	1.035E+04	1.028E+05	1.541E+08	1.035E+04
2039	2.876E+05	1.571E+08	1.056E+04	1.048E+05	1.571E+08	1.056E+04
2040	2.931E+05	1.601E+08	1.076E+04	1.068E+05	1.601E+08	1.076E+04
2041	2.986E+05	1.631E+08	1.096E+04	1.088E+05	1.631E+08	1.096E+04
2042	3.039E+05	1.660E+08	1.115E+04	1.107E+05	1.660E+08	1.115E+04
2043	3.091E+05	1.688E+08	1.134E+04	1.126E+05	1.688E+08	1.134E+04
2044	3.142E+05	1.716E+08	1.153E+04	1.145E+05	1.716E+08	1.153E+04
2045	3.192E+05	1.744E+08	1.172E+04	1.163E+05	1.744E+08	1.172E+04
2046	3.241E+05	1.770E+08	1.190E+04	1.181E+05	1.770E+08	1.190E+04
2047	3.289E+05	1.797E+08	1.207E+04	1.199E+05	1.797E+08	1.207E+04
2048	3.224E+05	1.761E+08	1.183E+04	1.175E+05	1.761E+08	1.183E+04
2049	3.160E+05	1.726E+08	1.160E+04	1.152E+05	1.726E+08	1.160E+04
2050	3.097E+05	1.692E+08	1.137E+04	1.129E+05	1.692E+08	1.137E+04
2051	3.036E+05	1.658E+08	1.114E+04	1.106E+05	1.658E+08	1.114E+04
2052	2.976E+05	1.626E+08	1.092E+04	1.085E+05	1.626E+08	1.092E+04
2053	2.917E+05	1.593E+08	1.071E+04	1.063E+05	1.593E+08	1.071E+04
2054	2.859E+05	1.562E+08	1.049E+04	1.042E+05	1.562E+08	1.049E+04
2055	2.802E+05	1.531E+08	1.029E+04	1.021E+05	1.531E+08	1.029E+04
2056	2.747E+05	1.501E+08	1.008E+04	1.001E+05	1.501E+08	1.008E+04
2057	2.693E+05	1.471E+08	9.883E+03	9.813E+04	1.471E+08	9.883E+03
2058	2.639E+05	1.442E+08	9.687E+03	9.619E+04	1.442E+08	9.687E+03
2059	2.587E+05	1.413E+08	9.496E+03	9.428E+04	1.413E+08	9.496E+03
2060	2.536E+05	1.385E+08	9.308E+03	9.242E+04	1.385E+08	9.308E+03
2061	2.486E+05	1.358E+08	9.123E+03	9.059E+04	1.358E+08	9.123E+03
2062	2.436E+05	1.331E+08	8.943E+03	8.879E+04	1.331E+08	8.943E+03
2063	2.388E+05	1.305E+08	8.766E+03	8.704E+04	1.305E+08	8.766E+03
2064	2.341E+05	1.279E+08	8.592E+03	8.531E+04	1.279E+08	8.592E+03
2065	2.294E+05	1.253E+08	8.422E+03	8.362E+04	1.253E+08	8.422E+03
2066	2.249E+05	1.229E+08	8.255E+03	8.197E+04	1.229E+08	8.255E+03
2067	2.204E+05	1.204E+08	8.092E+03	8.034E+04	1.204E+08	8.092E+03
2068	2.161E+05	1.180E+08	7.931E+03	7.875E+04	1.180E+08	7.931E+03
2069	2.118E+05	1.157E+08	7.774E+03	7.719E+04	1.157E+08	7.774E+03
2070	2.076E+05	1.134E+08	7.620E+03	7.566E+04	1.134E+08	7.620E+03

Results (Continued)

Year	Carbon dioxide			Methane		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2071	2.035E+05	1.112E+08	7.469E+03	7.417E+04	1.112E+08	7.469E+03
2072	1.995E+05	1.090E+08	7.322E+03	7.270E+04	1.090E+08	7.322E+03
2073	1.955E+05	1.068E+08	7.177E+03	7.126E+04	1.068E+08	7.177E+03
2074	1.916E+05	1.047E+08	7.034E+03	6.985E+04	1.047E+08	7.034E+03
2075	1.879E+05	1.026E+08	6.895E+03	6.846E+04	1.026E+08	6.895E+03
2076	1.841E+05	1.006E+08	6.759E+03	6.711E+04	1.006E+08	6.759E+03
2077	1.805E+05	9.860E+07	6.625E+03	6.578E+04	9.860E+07	6.625E+03
2078	1.769E+05	9.665E+07	6.494E+03	6.448E+04	9.665E+07	6.494E+03
2079	1.734E+05	9.473E+07	6.365E+03	6.320E+04	9.473E+07	6.365E+03
2080	1.700E+05	9.286E+07	6.239E+03	6.195E+04	9.286E+07	6.239E+03
2081	1.666E+05	9.102E+07	6.115E+03	6.072E+04	9.102E+07	6.115E+03
2082	1.633E+05	8.922E+07	5.994E+03	5.952E+04	8.922E+07	5.994E+03
2083	1.601E+05	8.745E+07	5.876E+03	5.834E+04	8.745E+07	5.876E+03
2084	1.569E+05	8.572E+07	5.759E+03	5.719E+04	8.572E+07	5.759E+03
2085	1.538E+05	8.402E+07	5.645E+03	5.605E+04	8.402E+07	5.645E+03
2086	1.508E+05	8.236E+07	5.534E+03	5.494E+04	8.236E+07	5.534E+03
2087	1.478E+05	8.073E+07	5.424E+03	5.386E+04	8.073E+07	5.424E+03
2088	1.448E+05	7.913E+07	5.317E+03	5.279E+04	7.913E+07	5.317E+03
2089	1.420E+05	7.756E+07	5.211E+03	5.174E+04	7.756E+07	5.211E+03
2090	1.392E+05	7.602E+07	5.108E+03	5.072E+04	7.602E+07	5.108E+03
2091	1.364E+05	7.452E+07	5.007E+03	4.972E+04	7.452E+07	5.007E+03
2092	1.337E+05	7.304E+07	4.908E+03	4.873E+04	7.304E+07	4.908E+03
2093	1.311E+05	7.160E+07	4.811E+03	4.777E+04	7.160E+07	4.811E+03
2094	1.285E+05	7.018E+07	4.715E+03	4.682E+04	7.018E+07	4.715E+03
2095	1.259E+05	6.879E+07	4.622E+03	4.589E+04	6.879E+07	4.622E+03
2096	1.234E+05	6.743E+07	4.530E+03	4.498E+04	6.743E+07	4.530E+03
2097	1.210E+05	6.609E+07	4.441E+03	4.409E+04	6.609E+07	4.441E+03
2098	1.186E+05	6.478E+07	4.353E+03	4.322E+04	6.478E+07	4.353E+03
2099	1.162E+05	6.350E+07	4.267E+03	4.236E+04	6.350E+07	4.267E+03
2100	1.139E+05	6.224E+07	4.182E+03	4.153E+04	6.224E+07	4.182E+03
2101	1.117E+05	6.101E+07	4.099E+03	4.070E+04	6.101E+07	4.099E+03
2102	1.095E+05	5.980E+07	4.018E+03	3.990E+04	5.980E+07	4.018E+03
2103	1.073E+05	5.862E+07	3.939E+03	3.911E+04	5.862E+07	3.939E+03
2104	1.052E+05	5.746E+07	3.861E+03	3.833E+04	5.746E+07	3.861E+03
2105	1.031E+05	5.632E+07	3.784E+03	3.757E+04	5.632E+07	3.784E+03
2106	1.011E+05	5.521E+07	3.709E+03	3.683E+04	5.521E+07	3.709E+03
2107	9.905E+04	5.411E+07	3.636E+03	3.610E+04	5.411E+07	3.636E+03
2108	9.709E+04	5.304E+07	3.564E+03	3.539E+04	5.304E+07	3.564E+03
2109	9.517E+04	5.199E+07	3.493E+03	3.469E+04	5.199E+07	3.493E+03
2110	9.328E+04	5.096E+07	3.424E+03	3.400E+04	5.096E+07	3.424E+03

October 19, 2023
File No: 07214017.93

Steve Cassulo
District Manager
Chiquita Canyon, LLC
29201 Henry Mayo Dr.
Castaic, California 91384

Subject: **Chiquita Canyon Landfill – Response to Los Angeles County Public Works Letter Dated September 20, 2023 – Explanation of 15 Percent Increase in LFG Generation and Interim Measures to Increase Control Capacity.**

Dear Mr. Cassulo:

On September 20, 2023, Los Angeles County Public Works (PW) provided Chiquita Canyon, LLC (Chiquita) with additional comments on Chiquita's initial Condition 69 report. PW's requests included Chiquita "elaborate on how the 15% LFG generation [due to the reaction] was estimated, including all assumptions made." Another request asked to "elaborate on the Landfill's interim effort to bridge the gap in its flaring capacity while waiting for [permanent] flare permits."

SCS Engineers (SCS) has prepared this response letter providing the requested information.

BASIS FOR AN ESTIMATED 15% INCREASE IN LFG GENERATION:

As you are aware, landfill gas (LFG), is produced as a byproduct of anaerobic digestion of organic waste materials by microbial colonies in municipal solid waste (MSW). This process is referred to as, "methanogenesis" due to the significant generation of methane, which is one of the primary components of LFG, which is well understood within the solid waste industry. As a result of this well-known process in MSW, various algorithms and models have been developed as tools to estimate the quantity (both mass-based and volume-based quantities) of LFG that will be generated by the decomposition of wastes with a known composition.

The United States Environmental Protection Agency's Landfill Gas Emissions Model (LandGEM) is an example of such a tool, which can be utilized to estimate the quantity of individual constituents of landfill gas (such as methane and carbon dioxide), as well as the quantity of the LFG mixture. In the context of designing LFG equipment and infrastructure and documenting the rated capacity, the LFG flowrate is often expressed in volume-based quantity per unit time, such as cubic feet per minute (cfm).

However, the production of gas within a landfill in which a discrete portion of the waste mass is exhibiting multiple characteristics that are consistent with elevated temperature landfill (ETLF) or reaction conditions, is not as well understood. Under ETLF conditions, the typical waste decomposition processes (i.e., methanogenesis) associated with anaerobic digestion of MSW are impeded, due to heat accumulation. As a result, certain abiotic (non-biological) processes and reactions within the buried wastes are present instead. For purposes of this discussion, the gas produced within an ETLF by abiotic processes will be referred to as “Reaction Gas” (RG) to distinguish it from typical LFG produced by traditional methanogenesis.

The exact processes and reactions involved in production of RG are not well-documented within literature, and corresponding algorithms and models to estimate the quantity of RG are not readily available (especially any models that have been empirically confirmed by field measurements). The use of a first-order decay model similar to LandGEM to estimate projected RG flowrates may not be appropriate because under these conditions, microbes are not metabolically synthesizing the waste as during traditional methanogenesis.

Accordingly, engineering design exercises for sizing equipment to combust a gas stream that is a composite of LFG and RG typically consider the following:

- ETLF circumstances increase composite gas (LFG + RG) quantities (on a volumetric flowrate basis) because the increase in temperature expands gas volume in accordance with the ideal gas law (pV=nRT), where p represents pressure, V volume, n amount of substance, R ideal gas constant and T for temperature.

- ETLF circumstances decrease LFG quantities (on both a mass and volumetric basis) because the increased heat present within the waste matrix distresses certain species of methanogens (those that are characterized as mesophilic) and impedes their metabolic synthesis of the waste materials that produces LFG.

- RG, as a byproduct of abiotic processes and reactions, may potentially be produced in greater quantity than LFG produced by anaerobic digestion from the same unit of solid waste. While not a direct comparison, the pyrolytic gas yield of the organic fraction of MSW has been demonstrated to be significantly greater than the pyrolytic gas yield of anaerobic digestion (AD) solid residuals (digestate)[1].

For purposes of estimating the composite gas (LFG + RG) quantity that may warrant collection, management, and destruction at the Landfill, a 15 percent (%) inflation to the facility-wide LFG recovery rates, calculated using the industry-accepted algorithms and models, was applied in the flare capacity analysis to address ETLF during a 5-year period.

This was derived based on the following two approaches:

[1] Refer to “Pyrolysis of raw and anaerobically digested organic fractions of municipal solid waste: Kinetics, thermodynamics, and product characterization” Yuming Wen,, Ziyi Shi, Shule Wang, Wangzhong Mu, P¨ar G¨oran J¨onsson, Weihong Yang, Chemical Engineering Journal 415 (2021) 129064, https://doi.org/10.1016/j.cej.2021.129064

1) We considered the average LFG wellhead temperature during 2020, which was estimated to be approximately 135 degrees Fahrenheit (F), and compared it to the average LFG wellhead temperature during 2022, which was estimated to be approximately 155 F. The resulting increase in temperature constitutes a 14.8% increase, which would correlate to a consistent increase in gas volume if all other parameters (pressure, number of moles, and gas constant) remain the same.

2) Separately, we determined the approximate portion of the waste mass affected by ETLF conditions and applied an RG rate of production to that portion, while maintaining the standard LFG rate to the remainder of the waste mass. The portion of the waste mass affected by ETLF conditions in the northwestern portion is believed to be less than 15% of the total waste in-place. Assuming that RG quantities produced from this area are twice that of the typical LFG that would be produced, and assuming that LFG production from this area is completely impeded by the heat, then:

   Reaction Gas (RG) in Northwestern Zone = (Facility-Wide LFG x 0.15) x 2.0 = 0.3 x Facility-Wide LFG
   Total Composite Gas = (Facility-Wide LFG x 0.85) + RG = 1.15 x Facility-Wide LFG

Clearly both approaches are subject to various uncertainties and assumptions but are deemed to offer a reasonable suitable approach and methodology in the absence of empirically verified algorithms and models for gas generation at ETLFs.

CONTROL CAPACITY DISCUSSION

The Landfill currently has a control capacity of 9,600 scfm between the two (2) existing flares (Flares 1 and 2), each at 4,000 standard cubic feet per minute (scfm), and the one (1) existing portable thermal oxidizer at 1,600 scfm (TOX 1). The third party LFG-to-energy plant also provides additional control capacity, but Chiquita aims to have sufficient flaring capacity on its own.

The Landfill is actively constructing one (1) new 6,000 scfm flare (Flare 3) that is required by the South Coast Air Quality Management District (SCAQMD) to be online by November 24, 2023. We anticipate having it online by that deadline. The Landfill will also be submitting a permit application to the SCAQMD for an additional 6,000 scfm flare (Flare 4) by October 31, 2023. Flare 4 would replace the older, existing 4,000 scfm flare. We hope to have Flare 4 online in 2025, but it will depend on the time it takes SCAQMD to process the permit application.

In the interim, the Landfill has secured an additional portable thermal oxidizer with a capacity of 4,700 scfm (TOX 2) that will be delivered to the Site on October 20, 2023, and expected to be operational by mid-November 2023. With the addition of Flare 3 and TOX 2, the short-term capacity of Site will increase to 20,300 scfm, which is in excess of the peak predicated LFG plus reaction gas flow of 15,400 scfm. Table 1 provides LFG generation including reaction gas flows and a breakdown of control capacity.

Based on the capacity numbers in Table 1, the landfill is expected to have adequate gas control capacity to handle the increased gas production from the reaction with a margin of safety, once TOX 2 and/or Flare 3 comes on-line. Until that time, the site is at a deficit for gas control.

Table 1. Control Capacity Discussion

Year		2023 (Current)	2023 (w/Flare 3)	2023 (w/Flare 3 + TOX)	2024	2025
LandGEM LFG Generation	(scfm)	13,400	13,400	13,400	14,000	14,500
LFG Generation (Reaction Gas increase)	**15%**	**15,400**	**15,400**	**15,400**	**16,100**	**16,700**
Flare FL-100 (Flare 1)	(scfm)	4,000	4,000	4,000	4,000	4,000
Flare FL-150 (Flare 2)	(scfm)	4,000	4,000	4,000	4,000	
TOX-1	(scfm)	1,600	1,600	1,600	1,600	
TOX-2	(scfm)			4,700	4,700	4,700
Flare FL-120 (Flare 3)	(scfm)		6,000	6,000	6,000	6,000
Flare FL-130 (Flare 4)	(scfm)					6,000
Total Flare Capacity	(scfm)	**9,600**	**15,600**	**20,300**	**20,300**	**20,700**

CLOSING

If you have any questions regarding information contained in this submittal, please contact the undersigned at 858-571-5500.

Sincerely,

Srividhya Viswanathan, P.E.
Vice President
SCS ENGINEERS

Robert E. Dick, PE, BCEE
Senior Vice President
SCS ENGINEERS

cc: Cornelius Fong, SCS Engineers
William C. Haley, PE., SCS Engineers
Gabrielle Stephens, SCS Engineers
Patrick S Sullivan, SCS Engineers
Ray Huff, SCS Engineers

Landfill Gas Generation and Control Capacity Chart

Year		2024	2025	2026	2027	2028	2029	2030
LandGEM LFG Generation	(scfm)	13,950	14,500	15,040	15,560	16,080	16,580	17,080
LFG Generation (with reaction gas increase)	15%	16,043	16,675	17,296	17,894	18,492	19,067	19,642
LFG Generation (with 6000 scfm redundancy)			**22,675**	**23,296**	**23,894**	**24,492**	**25,067**	**25,642**
Flare 1(FL-1995)	(scfm)	4,000	-	-	-	-	-	-
Flare 2(FL-2009)		4,000	4,000	4,000	4,000	4,000	4,000	4,000
TOX (Zeeco)		4,700	4,700	4,700	4,700	4,700	4,700	4,700
Flare 3(FL-2023)		6,000	6,000	6,000	6,000	6,000	6,000	6,000
Flare 4			6,000	6,000	6,000	6,000	6,000	6,000
Flare 5				6,000	6,000	6,000	6,000	6,000
Flare Capacity	(scfm)	**18,700**	**20,700**	**26,700**	**26,700**	**26,700**	**26,700**	**26,700**
Total Capacity	(scfm)	**18,700**	**20,700**	**26,700**	**26,700**	**26,700**	**26,700**	**26,700**