Archivado: Viernes 19 de julio de 2024 a la 10:46:50 AM
De: Haley, William (Bill)
Enviado: Viernes 12 de julio de 2024 a la 4:52:10 PM
Para: Baitong Chen
Cc: Sullivan, Pat Dick, Bob Christina Ojeda Steve Cassulo Stephens, Gabrielle Viswanathan, Srividhya Nathaniel Dickel Fong, Cornelius Huff, Ray Lizabeth Gomez
Asunto: Asunto: Informe sobre la Capacidad de Generación y Control de LFG
Importancia: Normal
Sensibilidad: Ninguna
Adjunto:
LFG Generation and Control Capacity Report Revised.pdf

[REMITENTE EXTERNO: Tenga precaución con los enlaces/adjuntos]

Chris,

Observe a continuación las respuestas a los comentarios y el Informe modificado adjunto. Por favor, díganos si tienen alguna otra pregunta.

- * ¿Cómo se determinan los valores de los desechos en el lugar de cada año? Los valores de este informe no coinciden con lo que se informó en el informe anual más reciente de la Regla 1150.1 para 2023 (solo es consistente con los valores de los desechos de 2010 a 2022). Los valores de los desechos en el lugar se calcularon sumando el valor aceptado para desechos del año actual al total de desechos en el lugar en toneladas del año anterior. El modelo LandGEM y el informe anual de la Regla 1150.1 utilizan diferentes métodos para calcular las toneladas. Para el informe anual de la Regla 1150.1, SCS cuenta con datos históricos desde 1989; por lo tanto, desde 1970 hasta 1988, usamos un estimativo de desechos promedio en base al Desecho Total en el Lugar.
  No obstante, la Orden Estipulada le indica a Chiquita que utilice LandGEM de la EPA para estimar la generación de LFG conforme a la Condición 70. Para el modelo LandGEM, debemos utilizar una herramienta GHG específica que se convierte y se presenta a la EPA. La herramienta GHG requiere que utilicemos un estimativo de asignación de desechos hasta el año 2009 y usamos los valores reales desde 2010. Por lo tanto, para los propósitos de este informe y uso de la herramienta LandGEM, sumamos la cantidad de toneladas total desde 1970 hasta 2009 y usamos el estimativo de desechos promedio en base a los Desechos Totales en el Lugar.

- * ¿Cómo se calculan los desechos aceptados en los futuros años (2024-2030)? ¿El desecho máximo se prevé que es un máximo aceptado o permitido? Los desechos aceptados en los futuros años (2024 – 2030) se estimó utilizando la disposición de toneladas máximas anuales. Actualizamos el modelo LandGEM en base a la cantidad de toneladas máxima permitida de 1,800,000 del Permiso de Uso Condicional (CUP) más reciente y se actualizaron como corresponde las cantidades de generación de LFG máximas esperadas para 2024 y 2030 en el informe y en el Adjunto C.

- * ¿Cuál es la base de la concentración de NMOC especificada por el usuario de 1,475 ppmv como hexano, a diferencia del valor predeterminado de la CAA de 4,000 ppmv como hexano? La concentración de NMOC de hexano de 1,475 ppmv se tomó de la Prueba en el Origen del 20 de diciembre de 2022 de la Antorcha No. 2 como se indicó en la Descripción/los Comentarios de LandGEM en la página 4.

¡Gracias, le deseo un buen fin de semana!

William C. Haley, PE.*
Director del Proyecto
SCS ENGINEERS
*Matriculado en CO y TX

Dirección: 303-221-1719
No. de Celular: 303-519-4503
E-mail: wchaley@scsengineers.com

De: Baitong Chen <BChen@aqmd.gov>
Enviado: Miércoles 3 de julio de 2024 a la 4:04 PM
Para: Haley, William (Bill) <WCHaley@scsengineers.com>
Cc: Sullivan, Pat <PSullivan@SCSEngineers.com>; Dick, Bob <BDick@scsengineers.com>; Christina Ojeda <cojeda@aqmd.gov>; Steve Cassulo <Steven.Cassulo@WasteConnections.com>; Stephens, Gabrielle <gstephens@scsengineers.com>; Viswanathan, Srividhya <SViswanathan@scsengineers.com>; Nathaniel Dickel <NDickel@aqmd.gov>; Fong, Cornelius <CFong@scsengineers.com>; Huff, Ray <RHuff@SCSEngineers.com>; Lizabeth Gomez <LGomez@aqmd.gov>
Asunto: Asunto: Informe sobre la Capacidad de Generación y Control de LFG

Hola Bill y Bob,

Muchas gracias por proporcionar el informe sobre la capacidad de generación y control de

biogás. Después de revisar el informe, tenemos las siguientes preguntas:

- * ¿Cómo se determinan los valores de los desechos en el lugar de cada año? Los valores de este informe no coinciden con lo que se informó en el informe anual más reciente de la Regla 1150.1 para 2023 (solo es consistente con los valores de los desechos de 2010 a 2022).
- * ¿Cómo se calculan los desechos aceptados en los futuros años (2024-2030)? ¿El desecho máximo se prevé que es un máximo aceptado o permitido?
- * ¿Cuál es la base de la concentración de NMOC especificada por el usuario de 1,475 ppmv como hexano, a diferencia del valor predeterminado de la CAA de 4,000 ppmv como hexano?

Por favor, proporcionen la información previa y un informe actualizado sobre la capacidad de generación y control de biogás antes del 12 de julio de 2024.

Gracias
Chris

De: Haley, William (Bill) <WCHaley@scsengineers.com>
Enviado: Viernes 28 de junio de 2024 a la 8:22 PM
Para: Christina Ojeda <cojeda@aqmd.gov>; Nathaniel Dickel <NDickel@aqmd.gov>; Baitong Chen <BChen@aqmd.gov>
Cc: Sullivan, Pat <PSullivan@SCSEngineers.com>; Dick, Bob <BDick@scsengineers.com>; Steve Cassulo <Steven.Cassulo@WasteConnections.com>; Stephens, Gabrielle <gstephens@scsengineers.com>; Viswanathan, Srividhya <SViswanathan@scsengineers.com>
Asunto: [EXTERNO] Informe sobre la Capacidad de Generación y

Control de LFG Hola a todos,

Según la Condición 70 de la Orden de Depuración Modificada, encontrarán adjunto el Informe sobre la Capacidad de Generación y Control de LFG.

Gracias, ¡les deseo un muy buen fin de semana!

William C. Haley, PE.*
Director del Proyecto
SCS ENGINEERS
*Matriculado en CO y TX

Dirección: 303-221-1719
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E-mail: wchaley@scsengineers.com

12 de julio de 2024

Baitong Chen, Ingeniero en Calidad del Aire, bchen@aqmd.gov
Nathaniel Dickel, Ingeniero Sénior en Calidad del Aire, ndickel@aqmd.gov Christina Ojeda, Inspectora de la Calidad del Aire, cojeda@aqmd.gov
Distrito de Gestión de la Calidad del Aire de la Costa Sur
21865 East Copley Drive
Diamond Bar, CA 91765-4182

Asunto: Informe Revisado sobre la Generación de Biogás y sobre la Capacidad de Control En Cumplimiento con la Orden de Depuración Estipulada Modificada (Caso No. 6177-4), Vertedero de Chiquita Canyon (Código de Centro 119219), Castaic, California

A Quien Corresponda:

SCS Engineers (SCS), en nombre de Chiquita Canyon, LLC (Chiquita), mediante el presente instrumento le proporciona al Distrito de Gestión de la Calidad del Aire de la Costa Sur (SCAQMD) un informe revisado sobre la generación de biogás (LFG) y sobre la capacidad de control actuales y proyectadas de Chiquita, según la Condición No. 70 de la Orden de Depuración Estipulada (SOFA) (Caso No. 6177-4) y su modificación con fecha 24 de abril de 2024 (SOFA Modificada), para el Vertedero de Chiquita Canyon (CCL o el Vertedero). El 28 de junio de 2024, Chiquita presentó un informe inicial sobre la capacidad de generación y control de LFG. Chiquita elaboró este informe revisado sobre la capacidad de generación y control de LFG en respuesta a la correspondencia electrónica del SCAQMD del 3 de julio de 2024 solicitando información adicional.

La Condición No. 70 de la SOFA Modificada indica en la parte relevante:

> *70. El demandado deberá presentar antes del 28 de junio de 2024 un informe sobre la generación de biogás actual del vertedero y sobre la generación de biogás proyectada para los siguientes cinco años calendario, hasta fines del año calendario 2029. La generación de biogás actual y proyectada se calculará mediante el uso del Modelo de Emisiones de Biogás (LandGEM) de la EPA de EE.UU. y el análisis del Comité de Reacción para todo biogás adicional generado como resultado de la reacción en curso. El informe deberá incluir, como mínimo, los siguientes puntos:*
>
> *a. Información de LandGEM, hipótesis y resultados;*
> *b. Análisis del Comité de Reacción y justificación asociada y datos o información de respaldo; y*
> *c. Un comparativo de la generación de biogás estimada, tanto actual o proyectada, con la capacidad de antorchas del vertedero, tanto actuales como propuestas, asumiendo que hay una o más antorchas u oxidantes térmicos fuera de línea debido a mantenimientos, reacondicionamientos u otras circunstancias imprevistas.*
>
> *En base a los hallazgos del informe, si se prevé que la generación de biogás excederá la capacidad de antorchas del vertedero cuando una o más antorchas u oxidantes térmicos estén fuera de línea, el Demandado deberá comenzar el proceso de planificación y adquisición de más antorchas adicionales, oxidantes térmicos u otros equipos de combustión/control de biogás y deberá asegurarse de que haya suficiente capacidad de control redundante para manejar todo el biogás generado, asumiendo que estarán fuera de línea una o más unidades.*

ANTECEDENTES

El Vertedero es un vertedero/centro de disposición de desechos sólidos ubicado en 29201 Henry Mayo Dr., Castaic, California, 91384 (SCAQMD Centro No. 119219). Con relación al Vertedero, Chiquita opera un sistema de recolección y control de LFG (GCCS). El GCCS incluye pozos verticales de extracción de LFG, tuberías de transporte y dispositivos de control de biogás (es decir, antorchas).

GENERACIÓN DE BIOGÁS

El modelo de generación de gas LandGEM adjunto muestra la información asociada, las hipótesis y los resultados de la generación estimada de biogás para Chiquita (consulte el Adjunto A). El informe del Comité de Reacción con fecha 19 de octubre de 2023 demuestra que el análisis y la base para estimar un aumento del 15% en LFG por encima del modelo LandGEM debido a la reacción están asociados al aumento de flujo de LFG (consulte el Adjunto B). La generación de LFG total estimada se presenta en la tabla adjunta y muestra una generación máxima prevista de 16,123 scfm en 2024 y de 19,320 scfm en 2030 (consulte el Adjunto C).

ANÁLISIS DE LA CAPACIDAD DE CONTROL

El Vertedero actualmente tiene una capacidad de control de 18,700 scfm entre las tres (3) antorchas existentes (Antorchas FL-1995, FL-2009 y FL-2023) y el (1) oxidante térmico portable existente en 4,700 scfm (Zeeco). El Vertedero presentó una solicitud de permiso al SCAQMD para una antorcha adicional de 6,000 scfm (Antorcha 4) que reemplazaría a la antorcha más antigua existente de 4,000 scfm (FL-1995). Esperamos tener la Antorcha 4 en línea en 2025 y esto aumentaría la capacidad de control de antorchas a 20,700 scfm. Para este análisis se asumió que la planta externa de conversión de LFG a energía continuaría fuera de línea y no formaría parte de la capacidad de control.

La tabla adjunta muestra la generación de LFG máxima esperada sin ninguna reducción en la eficiencia de recolección y el agregado de otra antorcha de 6,000 scfm para proporcionar redundancia de control al dispositivo de control más grande del sitio. En base a este estudio y a la tabla, Chiquita debe instalar y comenzar a operar la Antorcha 4 y la Antorcha 5 lo antes posible y no tendrá 6,000 scfm de capacidad redundante hasta que se instale la Antorcha 5.

Según la Condición No. 70 de la SOFA, Chiquita presentará la solicitud del permiso para la Antorcha 5 antes del 7 de enero de 2025 y ya inició el proceso de adquisición de la Antorcha 4 a pesar de no haber recibido la solicitud de permiso aprobada para la Antorcha 4 que fue presentada por el SCAQMD el 30 de octubre de 2023. Chiquita esperará para construir y comenzar a operar la Antorcha 4 hasta después de recibir el permiso.

CIERRE

Si tiene alguna pregunta o si necesita más información adicional, por favor, comuníquese con el firmante llamando al (303) 519-4503.

Atentamente,

Evan Guignon, P.E.
Profesional del Proyecto Sénior
SCS Engineers

Bill Haley, P.E.
Director del Proyecto
SCS Engineers

Adjuntos

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: Thursday, July 11, 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	1,970,950	2,168,045	43,545,066	47,899,572
2024	1,970,955	2,168,050	45,516,016	50,067,617
2025	1,636,364	1,800,000	47,486,970	52,235,667
2026	1,636,364	1,800,000	49,123,334	54,035,667
2027	1,636,364	1,800,000	50,759,697	55,835,667
2028	1,636,364	1,800,000	52,396,061	57,635,667
2029	1,636,364	1,800,000	54,032,425	59,435,667
2030	1,636,364	1,800,000	55,668,788	61,235,667
2031	1,636,364	1,800,000	57,305,152	63,035,667
2032	1,636,364	1,800,000	58,941,516	64,835,667
2033	1,636,364	1,800,000	60,577,879	66,635,667
2034	1,636,364	1,800,000	62,214,243	68,435,667
2035	1,636,364	1,800,000	63,850,606	70,235,667
2036	1,636,364	1,800,000	65,486,970	72,035,667
2037	1,636,364	1,800,000	67,123,334	73,835,667
2038	1,636,364	1,800,000	68,759,697	75,635,667
2039	1,636,364	1,800,000	70,396,061	77,435,667
2040	1,636,364	1,800,000	72,032,425	79,235,667
2041	1,636,364	1,800,000	73,668,788	81,035,667
2042	1,636,364	1,800,000	75,305,152	82,835,667
2043	1,636,364	1,800,000	76,941,516	84,635,667
2044	1,636,364	1,800,000	78,577,879	86,435,667
2045	1,636,364	1,800,000	80,214,243	88,235,667
2046	1,636,364	1,800,000	81,850,606	90,035,667
2047	0	0	83,486,970	91,835,667
2048	0	0	83,486,970	91,835,667
2049	0	0	83,486,970	91,835,667

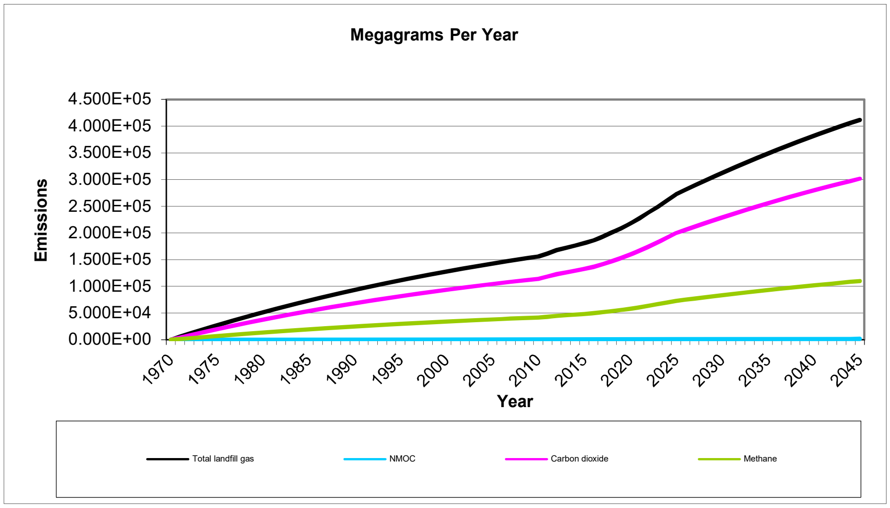
Pollutant Parameters

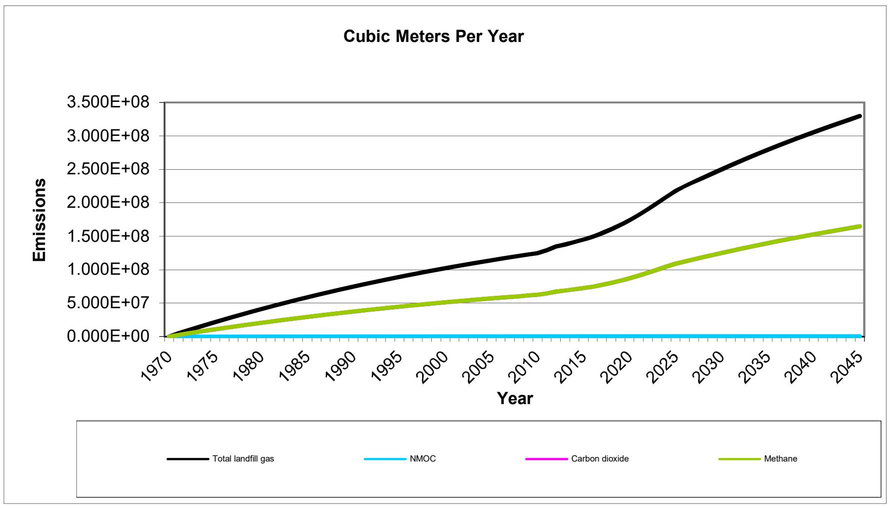
		Gas / Pollutant Default Parameters:		User-specified Pollutant Parameters:	
	Compound	Concentration (*ppmv*)	Molecular Weight	Concentration (*ppmv*)	Molecular Weight
Gases	Total landfill gas		0.00		
	Methane		16.04		
	Carbon dioxide		44.01		
	NMOC	4,000	86.18		
Pollutants	1,1,1-Trichloroethane (methyl 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		

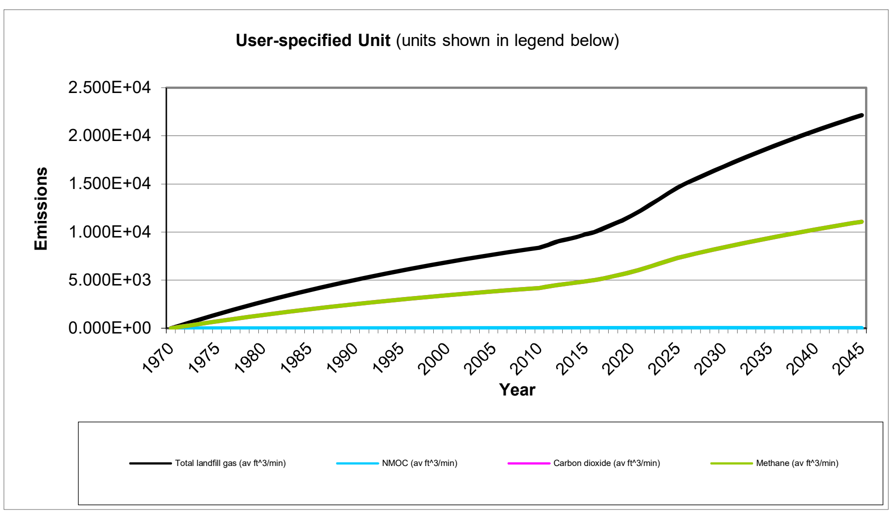
Pollutant Parameters (Continued)

		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


Megagrams Per Year
4.500E+05
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
Emissions
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
3.500E+08
3.000E+08
2.500E+08
2.000E+08
1.500E+08
1.000E+08
5.000E+07
0.000E+00
Emissions
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)
2.500E+04
2.000E+04
1.500E+04
1.000E+04
5.000E+03
0.000E+00
Emissions
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	2.606E+05	2.087E+08	1.402E+04	1.103E+03	3.078E+05	2.068E+01
2025	2.720E+05	2.178E+08	1.464E+04	1.152E+03	3.213E+05	2.159E+01
2026	2.804E+05	2.245E+08	1.509E+04	1.187E+03	3.312E+05	2.225E+01
2027	2.886E+05	2.311E+08	1.553E+04	1.222E+03	3.409E+05	2.291E+01
2028	2.967E+05	2.376E+08	1.596E+04	1.256E+03	3.504E+05	2.354E+01
2029	3.046E+05	2.439E+08	1.639E+04	1.289E+03	3.597E+05	2.417E+01
2030	3.123E+05	2.501E+08	1.680E+04	1.322E+03	3.689E+05	2.479E+01
2031	3.199E+05	2.562E+08	1.721E+04	1.354E+03	3.779E+05	2.539E+01
2032	3.273E+05	2.621E+08	1.761E+04	1.386E+03	3.866E+05	2.598E+01
2033	3.346E+05	2.680E+08	1.800E+04	1.417E+03	3.952E+05	2.656E+01
2034	3.418E+05	2.737E+08	1.839E+04	1.447E+03	4.037E+05	2.712E+01
2035	3.488E+05	2.793E+08	1.877E+04	1.477E+03	4.120E+05	2.768E+01
2036	3.556E+05	2.848E+08	1.913E+04	1.506E+03	4.201E+05	2.822E+01
2037	3.624E+05	2.902E+08	1.950E+04	1.534E+03	4.280E+05	2.876E+01
2038	3.690E+05	2.955E+08	1.985E+04	1.562E+03	4.358E+05	2.928E+01
2039	3.754E+05	3.006E+08	2.020E+04	1.590E+03	4.434E+05	2.979E+01
2040	3.818E+05	3.057E+08	2.054E+04	1.616E+03	4.509E+05	3.030E+01
2041	3.880E+05	3.107E+08	2.087E+04	1.643E+03	4.583E+05	3.079E+01
2042	3.941E+05	3.156E+08	2.120E+04	1.668E+03	4.655E+05	3.127E+01
2043	4.000E+05	3.203E+08	2.152E+04	1.694E+03	4.725E+05	3.175E+01
2044	4.059E+05	3.250E+08	2.184E+04	1.718E+03	4.794E+05	3.221E+01
2045	4.116E+05	3.296E+08	2.215E+04	1.743E+03	4.862E+05	3.267E+01
2046	4.173E+05	3.341E+08	2.245E+04	1.767E+03	4.928E+05	3.311E+01
2047	4.228E+05	3.385E+08	2.275E+04	1.790E+03	4.993E+05	3.355E+01
2048	4.144E+05	3.318E+08	2.230E+04	1.754E+03	4.894E+05	3.289E+01
2049	4.062E+05	3.253E+08	2.185E+04	1.720E+03	4.798E+05	3.223E+01
2050	3.981E+05	3.188E+08	2.142E+04	1.686E+03	4.703E+05	3.160E+01
2051	3.903E+05	3.125E+08	2.100E+04	1.652E+03	4.609E+05	3.097E+01
2052	3.825E+05	3.063E+08	2.058E+04	1.620E+03	4.518E+05	3.036E+01
2053	3.750E+05	3.002E+08	2.017E+04	1.587E+03	4.429E+05	2.976E+01
2054	3.675E+05	2.943E+08	1.977E+04	1.556E+03	4.341E+05	2.917E+01
2055	3.603E+05	2.885E+08	1.938E+04	1.525E+03	4.255E+05	2.859E+01
2056	3.531E+05	2.828E+08	1.900E+04	1.495E+03	4.171E+05	2.802E+01
2057	3.461E+05	2.772E+08	1.862E+04	1.465E+03	4.088E+05	2.747E+01
2058	3.393E+05	2.717E+08	1.825E+04	1.436E+03	4.007E+05	2.692E+01
2059	3.326E+05	2.663E+08	1.789E+04	1.408E+03	3.928E+05	2.639E+01
2060	3.260E+05	2.610E+08	1.754E+04	1.380E+03	3.850E+05	2.587E+01
2061	3.195E+05	2.559E+08	1.719E+04	1.353E+03	3.774E+05	2.536E+01
2062	3.132E+05	2.508E+08	1.685E+04	1.326E+03	3.699E+05	2.485E+01
2063	3.070E+05	2.458E+08	1.652E+04	1.300E+03	3.626E+05	2.436E+01
2064	3.009E+05	2.410E+08	1.619E+04	1.274E+03	3.554E+05	2.388E+01
2065	2.950E+05	2.362E+08	1.587E+04	1.249E+03	3.484E+05	2.341E+01
2066	2.891E+05	2.315E+08	1.555E+04	1.224E+03	3.415E+05	2.294E+01
2067	2.834E+05	2.269E+08	1.525E+04	1.200E+03	3.347E+05	2.249E+01
2068	2.778E+05	2.224E+08	1.494E+04	1.176E+03	3.281E+05	2.204E+01
2069	2.723E+05	2.180E+08	1.465E+04	1.153E+03	3.216E+05	2.161E+01
2070	2.669E+05	2.137E+08	1.436E+04	1.130E+03	3.152E+05	2.118E+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	2.616E+05	2.095E+08	1.407E+04	1.108E+03	3.090E+05	2.076E+01
2072	2.564E+05	2.053E+08	1.380E+04	1.086E+03	3.029E+05	2.035E+01
2073	2.513E+05	2.013E+08	1.352E+04	1.064E+03	2.969E+05	1.995E+01
2074	2.464E+05	1.973E+08	1.326E+04	1.043E+03	2.910E+05	1.955E+01
2075	2.415E+05	1.934E+08	1.299E+04	1.022E+03	2.852E+05	1.916E+01
2076	2.367E+05	1.895E+08	1.274E+04	1.002E+03	2.796E+05	1.878E+01
2077	2.320E+05	1.858E+08	1.248E+04	9.823E+02	2.740E+05	1.841E+01
2078	2.274E+05	1.821E+08	1.224E+04	9.628E+02	2.686E+05	1.805E+01
2079	2.229E+05	1.785E+08	1.199E+04	9.438E+02	2.633E+05	1.769E+01
2080	2.185E+05	1.750E+08	1.176E+04	9.251E+02	2.581E+05	1.734E+01
2081	2.142E+05	1.715E+08	1.152E+04	9.068E+02	2.530E+05	1.700E+01
2082	2.099E+05	1.681E+08	1.130E+04	8.888E+02	2.480E+05	1.666E+01
2083	2.058E+05	1.648E+08	1.107E+04	8.712E+02	2.431E+05	1.633E+01
2084	2.017E+05	1.615E+08	1.085E+04	8.540E+02	2.382E+05	1.601E+01
2085	1.977E+05	1.583E+08	1.064E+04	8.371E+02	2.335E+05	1.569E+01
2086	1.938E+05	1.552E+08	1.043E+04	8.205E+02	2.289E+05	1.538E+01
2087	1.900E+05	1.521E+08	1.022E+04	8.042E+02	2.244E+05	1.508E+01
2088	1.862E+05	1.491E+08	1.002E+04	7.883E+02	2.199E+05	1.478E+01
2089	1.825E+05	1.461E+08	9.820E+03	7.727E+02	2.156E+05	1.448E+01
2090	1.789E+05	1.433E+08	9.625E+03	7.574E+02	2.113E+05	1.420E+01
2091	1.754E+05	1.404E+08	9.435E+03	7.424E+02	2.071E+05	1.392E+01
2092	1.719E+05	1.376E+08	9.248E+03	7.277E+02	2.030E+05	1.364E+01
2093	1.685E+05	1.349E+08	9.065E+03	7.133E+02	1.990E+05	1.337E+01
2094	1.651E+05	1.322E+08	8.885E+03	6.992E+02	1.951E+05	1.311E+01
2095	1.619E+05	1.296E+08	8.709E+03	6.853E+02	1.912E+05	1.285E+01
2096	1.587E+05	1.271E+08	8.537E+03	6.718E+02	1.874E+05	1.259E+01
2097	1.555E+05	1.245E+08	8.368E+03	6.584E+02	1.837E+05	1.234E+01
2098	1.524E+05	1.221E+08	8.202E+03	6.454E+02	1.801E+05	1.210E+01
2099	1.494E+05	1.197E+08	8.040E+03	6.326E+02	1.765E+05	1.186E+01
2100	1.465E+05	1.173E+08	7.880E+03	6.201E+02	1.730E+05	1.162E+01
2101	1.436E+05	1.150E+08	7.724E+03	6.078E+02	1.696E+05	1.139E+01
2102	1.407E+05	1.127E+08	7.571E+03	5.958E+02	1.662E+05	1.117E+01
2103	1.379E+05	1.105E+08	7.421E+03	5.840E+02	1.629E+05	1.095E+01
2104	1.352E+05	1.083E+08	7.275E+03	5.724E+02	1.597E+05	1.073E+01
2105	1.325E+05	1.061E+08	7.130E+03	5.611E+02	1.565E+05	1.052E+01
2106	1.299E+05	1.040E+08	6.989E+03	5.500E+02	1.534E+05	1.031E+01
2107	1.273E+05	1.020E+08	6.851E+03	5.391E+02	1.504E+05	1.011E+01
2108	1.248E+05	9.994E+07	6.715E+03	5.284E+02	1.474E+05	9.905E+00
2109	1.223E+05	9.796E+07	6.582E+03	5.180E+02	1.445E+05	9.709E+00
2110	1.199E+05	9.603E+07	6.452E+03	5.077E+02	1.416E+05	9.517E+00

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	1.910E+05	1.043E+08	7.010E+03	6.961E+04	1.043E+08	7.010E+03
2025	1.994E+05	1.089E+08	7.318E+03	7.266E+04	1.089E+08	7.318E+03
2026	2.055E+05	1.123E+08	7.543E+03	7.490E+04	1.123E+08	7.543E+03
2027	2.115E+05	1.156E+08	7.764E+03	7.710E+04	1.156E+08	7.764E+03
2028	2.174E+05	1.188E+08	7.981E+03	7.925E+04	1.188E+08	7.981E+03
2029	2.232E+05	1.219E+08	8.194E+03	8.136E+04	1.219E+08	8.194E+03
2030	2.289E+05	1.250E+08	8.402E+03	8.342E+04	1.250E+08	8.402E+03
2031	2.345E+05	1.281E+08	8.606E+03	8.545E+04	1.281E+08	8.606E+03
2032	2.399E+05	1.311E+08	8.806E+03	8.744E+04	1.311E+08	8.806E+03
2033	2.453E+05	1.340E+08	9.002E+03	8.938E+04	1.340E+08	9.002E+03
2034	2.505E+05	1.368E+08	9.194E+03	9.129E+04	1.368E+08	9.194E+03
2035	2.556E+05	1.396E+08	9.383E+03	9.316E+04	1.396E+08	9.383E+03
2036	2.607E+05	1.424E+08	9.567E+03	9.500E+04	1.424E+08	9.567E+03
2037	2.656E+05	1.451E+08	9.748E+03	9.680E+04	1.451E+08	9.748E+03
2038	2.704E+05	1.477E+08	9.926E+03	9.856E+04	1.477E+08	9.926E+03
2039	2.752E+05	1.503E+08	1.010E+04	1.003E+05	1.503E+08	1.010E+04
2040	2.798E+05	1.529E+08	1.027E+04	1.020E+05	1.529E+08	1.027E+04
2041	2.844E+05	1.553E+08	1.044E+04	1.036E+05	1.553E+08	1.044E+04
2042	2.888E+05	1.578E+08	1.060E+04	1.053E+05	1.578E+08	1.060E+04
2043	2.932E+05	1.602E+08	1.076E+04	1.069E+05	1.602E+08	1.076E+04
2044	2.975E+05	1.625E+08	1.092E+04	1.084E+05	1.625E+08	1.092E+04
2045	3.017E+05	1.648E+08	1.107E+04	1.100E+05	1.648E+08	1.107E+04
2046	3.058E+05	1.671E+08	1.122E+04	1.115E+05	1.671E+08	1.122E+04
2047	3.098E+05	1.693E+08	1.137E+04	1.129E+05	1.693E+08	1.137E+04
2048	3.037E+05	1.659E+08	1.115E+04	1.107E+05	1.659E+08	1.115E+04
2049	2.977E+05	1.626E+08	1.093E+04	1.085E+05	1.626E+08	1.093E+04
2050	2.918E+05	1.594E+08	1.071E+04	1.063E+05	1.594E+08	1.071E+04
2051	2.860E+05	1.563E+08	1.050E+04	1.042E+05	1.563E+08	1.050E+04
2052	2.804E+05	1.532E+08	1.029E+04	1.022E+05	1.532E+08	1.029E+04
2053	2.748E+05	1.501E+08	1.009E+04	1.002E+05	1.501E+08	1.009E+04
2054	2.694E+05	1.472E+08	9.887E+03	9.817E+04	1.472E+08	9.887E+03
2055	2.640E+05	1.442E+08	9.691E+03	9.623E+04	1.442E+08	9.691E+03
2056	2.588E+05	1.414E+08	9.499E+03	9.432E+04	1.414E+08	9.499E+03
2057	2.537E+05	1.386E+08	9.311E+03	9.245E+04	1.386E+08	9.311E+03
2058	2.487E+05	1.358E+08	9.127E+03	9.062E+04	1.358E+08	9.127E+03
2059	2.437E+05	1.331E+08	8.946E+03	8.883E+04	1.331E+08	8.946E+03
2060	2.389E+05	1.305E+08	8.769E+03	8.707E+04	1.305E+08	8.769E+03
2061	2.342E+05	1.279E+08	8.595E+03	8.535E+04	1.279E+08	8.595E+03
2062	2.295E+05	1.254E+08	8.425E+03	8.366E+04	1.254E+08	8.425E+03
2063	2.250E+05	1.229E+08	8.258E+03	8.200E+04	1.229E+08	8.258E+03
2064	2.205E+05	1.205E+08	8.095E+03	8.038E+04	1.205E+08	8.095E+03
2065	2.162E+05	1.181E+08	7.935E+03	7.878E+04	1.181E+08	7.935E+03
2066	2.119E+05	1.158E+08	7.777E+03	7.722E+04	1.158E+08	7.777E+03
2067	2.077E+05	1.135E+08	7.623E+03	7.570E+04	1.135E+08	7.623E+03
2068	2.036E+05	1.112E+08	7.472E+03	7.420E+04	1.112E+08	7.472E+03
2069	1.995E+05	1.090E+08	7.325E+03	7.273E+04	1.090E+08	7.325E+03
2070	1.956E+05	1.069E+08	7.179E+03	7.129E+04	1.069E+08	7.179E+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	1.917E+05	1.047E+08	7.037E+03	6.988E+04	1.047E+08	7.037E+03
2072	1.879E+05	1.027E+08	6.898E+03	6.849E+04	1.027E+08	6.898E+03
2073	1.842E+05	1.006E+08	6.761E+03	6.714E+04	1.006E+08	6.761E+03
2074	1.806E+05	9.864E+07	6.628E+03	6.581E+04	9.864E+07	6.628E+03
2075	1.770E+05	9.669E+07	6.496E+03	6.450E+04	9.669E+07	6.496E+03
2076	1.735E+05	9.477E+07	6.368E+03	6.323E+04	9.477E+07	6.368E+03
2077	1.700E+05	9.289E+07	6.242E+03	6.197E+04	9.289E+07	6.242E+03
2078	1.667E+05	9.105E+07	6.118E+03	6.075E+04	9.105E+07	6.118E+03
2079	1.634E+05	8.925E+07	5.997E+03	5.954E+04	8.925E+07	5.997E+03
2080	1.601E+05	8.748E+07	5.878E+03	5.837E+04	8.748E+07	5.878E+03
2081	1.570E+05	8.575E+07	5.762E+03	5.721E+04	8.575E+07	5.762E+03
2082	1.539E+05	8.405E+07	5.648E+03	5.608E+04	8.405E+07	5.648E+03
2083	1.508E+05	8.239E+07	5.536E+03	5.497E+04	8.239E+07	5.536E+03
2084	1.478E+05	8.076E+07	5.426E+03	5.388E+04	8.076E+07	5.426E+03
2085	1.449E+05	7.916E+07	5.319E+03	5.281E+04	7.916E+07	5.319E+03
2086	1.420E+05	7.759E+07	5.213E+03	5.177E+04	7.759E+07	5.213E+03
2087	1.392E+05	7.606E+07	5.110E+03	5.074E+04	7.606E+07	5.110E+03
2088	1.365E+05	7.455E+07	5.009E+03	4.974E+04	7.455E+07	5.009E+03
2089	1.338E+05	7.307E+07	4.910E+03	4.875E+04	7.307E+07	4.910E+03
2090	1.311E+05	7.163E+07	4.813E+03	4.779E+04	7.163E+07	4.813E+03
2091	1.285E+05	7.021E+07	4.717E+03	4.684E+04	7.021E+07	4.717E+03
2092	1.260E+05	6.882E+07	4.624E+03	4.591E+04	6.882E+07	4.624E+03
2093	1.235E+05	6.746E+07	4.532E+03	4.500E+04	6.746E+07	4.532E+03
2094	1.210E+05	6.612E+07	4.443E+03	4.411E+04	6.612E+07	4.443E+03
2095	1.186E+05	6.481E+07	4.355E+03	4.324E+04	6.481E+07	4.355E+03
2096	1.163E+05	6.353E+07	4.268E+03	4.238E+04	6.353E+07	4.268E+03
2097	1.140E+05	6.227E+07	4.184E+03	4.154E+04	6.227E+07	4.184E+03
2098	1.117E+05	6.104E+07	4.101E+03	4.072E+04	6.104E+07	4.101E+03
2099	1.095E+05	5.983E+07	4.020E+03	3.991E+04	5.983E+07	4.020E+03
2100	1.073E+05	5.864E+07	3.940E+03	3.912E+04	5.864E+07	3.940E+03
2101	1.052E+05	5.748E+07	3.862E+03	3.835E+04	5.748E+07	3.862E+03
2102	1.031E+05	5.634E+07	3.786E+03	3.759E+04	5.634E+07	3.786E+03
2103	1.011E+05	5.523E+07	3.711E+03	3.684E+04	5.523E+07	3.711E+03
2104	9.909E+04	5.413E+07	3.637E+03	3.612E+04	5.413E+07	3.637E+03
2105	9.713E+04	5.306E+07	3.565E+03	3.540E+04	5.306E+07	3.565E+03
2106	9.521E+04	5.201E+07	3.495E+03	3.470E+04	5.201E+07	3.495E+03
2107	9.332E+04	5.098E+07	3.425E+03	3.401E+04	5.098E+07	3.425E+03
2108	9.147E+04	4.997E+07	3.358E+03	3.334E+04	4.997E+07	3.358E+03
2109	8.966E+04	4.898E+07	3.291E+03	3.268E+04	4.898E+07	3.291E+03
2110	8.789E+04	4.801E+07	3.226E+03	3.203E+04	4.801E+07	3.226E+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:

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[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
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Ray Huff, SCS Engineers

Landfill Gas Generation and Control Capacity Chart

Year		2024	2025	2026	2027	2028	2029	2030
LandGEM LFG Generation	(scfm)	14,020	14,640	15,090	15,530	15,960	16,390	16,800
LFG Generation (with reaction gas increase)	15%	16,123	16,836	17,354	17,860	18,354	18,849	19,320
LFG Generation (with 6000 scfm redundancy)			**22,836**	**23,354**	**23,860**	**24,354**	**24,849**	**25,320**
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**