Oneida-Herkimer Solid Waste Authority

Source-Separated Organics Feasibility Study

March 2017

Barton & Loguidice

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Prepared For:

Oneida-Herkimer Solid Waste
Management Authority
1600 Genesee Street
Utica, New York 13502

Prepared By:

Barton & Loguidice, D.P.C.
443 Electronics Parkway
Liverpool, New York 13088

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Executive Summary

Organics recovery opportunities, specifically for diverted food waste, are identified in the Oneida Herkimer Solid Waste Authority's (the Authority) Local Solid Waste Management Plan as a target for investigation during the current planning period. Recent legislation in neighboring states including Vermont, Massachusetts, and Connecticut now requires the separate collection of certain types of organics and diversion from disposal facilities. In light of these changes and recent New York State legislative proposals with support from Governor Cuomo, organics diversion has the potential to become a requirement in New York State. As a longtime leader in integrated solid waste management, the Authority has begun evaluating options for organics diversion to find a practical and economical solution to maximize recovery and recycling within its existing solid waste management system. This includes the collection, processing, and end use of the targeted organics.

The Authority, in partnership with the Oneida County Sewer District (OCSD), is currently evaluating the diversion of source-separated organics (SSO) from commercial entities in Oneida and Herkimer Counties. Commercial SSO is proposed to be processed and used as a high-strength feedstock to be co-digested with municipal sludge in the anaerobic digesters planned as part of upgrades to the Water Pollution Control Plant (WPCP). Delivery of the SSO and processing would occur at the Authority's Eastern Transfer Station (ETS) located in Utica, New York directly adjacent to the WPCP (see Figure 1). This feasibility study will specifically assess the quantity of available organics, the type and sizing of the collection and processing equipment, including any upgrades to the ETS, and any potential issues for collection and processing, within the context of the current solid waste management system. The study will also determine the economic feasibility and any impacts to existing solid waste management facilities, along with the potential for expansion of the system to other organic waste streams located in the Authority's service area.

Due to limited available information from surveys of targeted commercial entities, tonnage data for commercial facilities was calculated from similar facilities based on usage of each facility. This limited data set was compared to waste composition data from the New York State Department of Environmental Conservation's (NYSDEC) State Solid Waste Management Plan, Beyond Waste and actual landfilled tonnages. Combining the available survey data with the tonnage estimates and removing all food waste already diverted through donation or composting, resulted in available SSO for collection totaling approximately 15,000 tons per year. Applying the waste composition percentages from Beyond Waste to actual waste generation numbers collected between 2010 and 2015 from the Authority's service area results in estimated available SSO of 21,300 tons per year. This matches closely with the estimated total commercial SSO available, including food waste already allocated for uses such as donation and composting. Due to the anticipated incremental start to the organics diversion program beginning with those mandated by New York State, a range of expected SSO of 5,000 to 21,000 tons per year is assumed for sizing equipment. This assumes generator participation of 100% which, although unlikely, will allow for processing equipment to be conservatively sized.

Key components of SSO collection methods impacting the design of the transfer station area for SSO receipt and processing include collection frequency, container types, and collection vehicle types, among others. Other factors impacting collection and processing design are contamination in the SSO waste stream and anticipated peaks in commercial waste generation. In order to effectively design the waste receipt area and SSO processing system, the type and frequency of waste collection vehicle deliveries, as well as expected contamination quantities in the waste stream, would need to be identified. Some assumptions will need to be made, since waste collection methods vary throughout the Authority’s service area.

The critical components in the process flow for commercial SSO processing for anaerobic digestion are depackaging/contamination removal, particle size reduction, emulsification, flow equalization, and transportation. A brief summary of available equipment for the processing of organics for anaerobic digestion is included in Appendix A. Processed feedstock will be piped directly into a holding tank or wet well in order to allow for flow equalization, and will be pumped out at a constant rate, or as directed by the WPCP, to the anaerobic digester. Waste packaging material is conveyed separately out of the system for recycling or disposal. A schematic of the proposed process flow is included as Figure 2.

A cost estimate for the entire project, including the building addition, SSO processing equipment, and sanitary sewer upgrades but excluding this feasibility study, was developed totaling $2,655,000. This budget estimate includes a contingency of 25% due to the uncertainties involved in the project, including quality and quantity of waste received, quality of feedstock required for the anaerobic digesters, and local hauler and generator participation and support. The largest expenditure anticipated for the SSO processing facility is the building addition and modifications to the ETS. Estimates for the capital cost of the SSO processing equipment are based on the equipment manufacturer, desired process steps, and arrangement of equipment and include installation, piping, and loading equipment. Additional work required as part of the SSO processing project includes sanitary sewer upgrades, the cost of which has been included in this capital cost estimate. Funding from the NYSDEC Climate Smart Communities grant was pursued and granted totaling a maximum of $1,327,500 available for the project. Refer to Appendix B – Capital Cost Estimate for additional information.

In combination with the capital costs, the O&M costs to operate the SSO processing system will determine the future tip fee for commercial SSO accepted at the transfer station. In order to encourage generator participation in the source separation and separate collection of their organics, the future tip fee will likely need to be lowered from typical municipal solid waste (MSW), but the value will be determined by the costs to run the system. The tip fee must be economical for haulers but also allow for sustained operations of the processing equipment. In order to find the balance between generator economics and operations the Authority will conduct a market study in 2017 with haulers having previous experience with similar programs. This will allow for a more informed tip fee establishment in the future.

Removal of SSO from the waste stream for anaerobic digestion rather than landfilling will have several impacts to the existing solid waste management infrastructure and WPCP. Airspace consumption will decrease on an annual basis and extend the life of the landfill by approximately 1 to 7 years based on the maximum SSO tonnage available for diversion and which accounts for the increase in sludge from the WPCP requiring disposal, which is not related to this project. Diversion of organics from the landfill will decrease the moisture content and biodegradable fraction of the waste mass, resulting in less settlement and reduced landfill gas generation and energy production at the Authority's landfill gas to energy (LFGTE) Facility. Reduction in peak landfill gas generation from existing conditions is approximately 200 standard cubic feet per minute (scfm). Impacts to the WPCP are more difficult to quantify and include increased energy recovery and efficiency of the anaerobic digesters.

Several environmental review and permitting tasks will need to be undertaken for approval of this project, including environmental review under the State Environmental Quality Review Act (SEQRA), a modification to the transfer station's existing Part 360 permit, and an International Building Code review.

The separate collection and processing of commercial organics as a feedstock for the WPCP anaerobic digesters will be feasible, given the information that is currently available. The Authority is likely to pursue implementation of a commercial SSO collection program, given the results of this study and the funding available for capital investments. It is recommended that additional information be pursued regarding expected participation by generators and haulers, specifically regarding waste quantities and collection methods and frequencies. The Authority will conduct a market study to aid in determining project economics and refine estimations of the commercial SSO quantities available. It is not recommended to pursue a pilot program for food waste processing, especially given the proven success of the chosen processing equipment in other service areas, due to the substantial capital investment for processing equipment and transfer station modifications. Given the challenges identified herein for commercial organics collection and the unknowns involved in the project, it is not recommended that source-separated residential organics diversion be pursued at this time. The Authority will continue to monitor potential New York State legislation and its effects on a commercial SSO collection program as it proceeds with implementation of the program.

1.0 Introduction

The purpose of this study is to assess the feasibility of the collection and diversion of source-separated organics (SSO) from commercial and institutional entities located in Oneida and Herkimer Counties. SSO diverted from the Oneida-Herkimer Regional Landfill, located in the Town of Ava, Oneida County, New York, would be collected and processed at the Eastern Transfer Station (ETS), located in the City of Utica, for use as feedstock to be co-digested with sewage sludge in a planned anaerobic digestion system. The anaerobic digestion system was designed as part of significant upgrades planned for the Oneida County Sewer District's (OCSD) Water Pollution Control Plant (WPCP) located in the City of Utica, Oneida County, New York. See Figure 1 – Conceptual Site Plan for the location of these facilities. This feasibility study will specifically assess the quantity of available organics, the type and sizing of the collection and processing equipment, including any upgrades to the ETS, and any potential issues for collection and processing, within the context of the current solid waste management system. The study will also determine the economic feasibility and any impacts to existing solid waste management facilities, along with the potential for expansion of the system to other organic waste streams located in the Authority's service area.

2.0 Project Background

Organics recovery opportunities, specifically for diverted food waste, are identified in the Authority's Local Solid Waste Management Plan as a target for investigation during the current planning period. In addition, recent legislation in neighboring states including Vermont, Massachusetts, and Connecticut now requires the separate collection of certain types of organics and diversion from disposal facilities. In light of these changes and recent New York State legislative proposals with the support of Governor Cuomo, commercial organics diversion has the potential to become a requirement in New York State. As a long-time leader in solid waste management, the Authority has begun evaluating options for organics diversion to find a practical and economical solution to integrate into its existing solid waste management system. This includes the processing and end use of the targeted organics.

2.1 Current Organics Management

Although the Authority has a strong backyard composting program, including Authority-sponsored trailer load sales of home compost units, and an active composting education program especially at local schools, disposal is the primary outlet for organic waste generated in Oneida and Herkimer Counties. The Authority owns and operates the Oneida-Herkimer Regional Landfill, located in the Town of Ava, Oneida County, New York, which is the current disposal location for Oneida and Herkimer Counties waste including most organics. Oneida and Herkimer Counties operate under flow control and all waste disposed is managed exclusively at the Authority's facilities. Waste is collected at the source and hauled directly to the landfill or to one of two transfer stations; the ETS located in Utica, New York, or the Western Transfer Station (WTS) located in Rome, New York. Some municipalities collect their own waste or contract out haulers for waste collection. In other cases, generators contract out haulers individually or self-haul to the transfer stations. Organics are currently co-mingled with other waste and managed together for collection and disposal purposes. Due to the many difficulties associated with residential waste collection, only commercial SSO will be considered for the purposes of this feasibility study, but local composting and donation of food waste will continue to be encouraged and facilitated by the Authority. Residential organics will continue to be managed as a co-mingled waste stream with MSW.

Many commercial entities currently source separate organic wastes for other uses rather than disposal. Several grocers and restaurants donate food to local charities or not-for-profit organizations, such as churches, the Rescue Mission, and the Food Bank. Others send organics to a rendering plant or to farmers for use as animal feed, as is the case for the largest generator of organic waste in the region, FX Matt Brewery, with over 10,000 tons per year of organic waste diverted. Still others compost SSO in lieu of disposal. Since these entities currently have non-disposal outlets for SSO, they will not be included in the feasibility study as potential waste streams. Only commercial organics currently destined for disposal in the landfill will be targeted for diversion.

The Authority currently operates a yard waste composting facility adjacent to the ETS to manage green waste collected within Oneida and Herkimer Counties. The facility processes yard waste in windrows to generate compost, which is marketed throughout the service area for use by homeowners and businesses. Although this facility, as well as smaller food waste composting operations, could make operational changes to incorporate food waste for composting, the large quantities potentially available for diversion make this option impossible as it is located in an area with no area for expansion. Inclusion of food waste in composting operations could complicate operations and permitting of the facility as well as potentially impact the marketability of the product during transition from yard waste to combined composting with food waste. In addition, pursuing composting as an end use for organics will eliminate the ability to recover energy from the product as in anaerobic digestion. As such, processing methods other than composting for diverted commercial SSO were pursued.

2.2 OCSD Partnership

In order to facilitate inclusion into its existing solid waste management system, the Authority looked towards existing partnerships to ease the transition and optimize the economics of an SSO diversion program. OCSD, which owns and operates the WPCP located directly adjacent to the ETS in Utica, New York, currently partners with the Authority for the handling of sludge produced at the WPCP and leachate generated at the Oneida-Herkimer Regional Landfill. The Authority accepts the sludge produced at the WPCP for disposal at the landfill and OCSD accepts leachate generated at the landfill for treatment.

2.2.1 WPCP Upgrades

Upgrades to the WPCP are being undertaken by OCSD to increase the plant's treatment capacity and to add an anaerobic digestion system to handle biosolids and recover gas for power production. Current plant operations rely on two fluidized bed incinerators for biosolids disposal, but as part of the plant upgrades and recent changes to emissions standards, OCSD opted to pursue anaerobic digestion with combined heat and power engines for biosolids disposal with electricity generation and waste heat recovery. Two egg-shaped anaerobic digesters, 1.2 million gallons each, are being constructed to manage a flow rate of 86,000 gallons per day of municipal biosolids at the WPCP. The anticipated solids and organics to the digesters are 5.6% total solids (TS) and 75% volatile solids (VS). Part of the inclusion of the anaerobic digestion system into treatment operations includes a relocated septage receiving building for the digester complex and will require the relocation of the 4” sanitary sewer force main from the ETS. These upgrades are scheduled to be completed in 2018 for operation of the anaerobic digesters estimated in 2019, which makes the timing ideal to coincide with potential upgrades to the ETS to allow for organics processing.

2.2.2 Anaerobic Digestion

Anaerobic digestion is being pursued as the end use of diverted organics not only for the convenient siting and previous planning of such a facility adjacent to an existing Authority collection point (ETS), but also due to the advantages of anaerobic digestion over other options for organics recycling or conversion. Energy recovery, including utilizing waste heat and electricity on-site as well as selling excess power to the grid, is an important factor in the economics of organics diversion.[1] This is not possible if composting is used as the end use for diverted organics. Using the previously planned anaerobic digester complex will conserve land area without impacting the operations or product marketability of the existing composting facility, since construction of an entirely new anaerobic digestion or composting facility or expanding an existing compost facility will not be required. Co-digestion of a high strength waste stream, such as processed SSO, with biosolids will increase biogas production and the efficiency of the anaerobic digesters at the WPCP, resulting in greater energy production and recovery than from municipal biosolids alone.[2] Literature on co-digestion of municipal biosolids and SSO suggest biogas composition is approximately 55-70% methane,[3]

[1] Technical Document on Municipal Solid Waste Organics Processing, Environment Canada, 2013. Available at: http://www.compost.org/English/PDF/Technical_Document_MSW_Organics_Processing_2013.pdf. Accessed September 2016.

[2] Tapping the Energy Potential of Municipal Wastewater Treatment: Anaerobic Digestion and Combined Heat and Power in Massachusetts, Shutsu Chai Wong, Massachusetts Department of Environmental Protection, July 2011. Available at: http://www.mass.gov/eea/docs/dep/water/priorities/chp-11.pdf. Accessed September 2016.

[3] Anaerobic Digestion of Biodegradable Organics in Municipal Solid Waste, Shefali Verma, Columbia University, May 2002. Available at: http://www.compost.org/CCC_Science_Web_Site/pdf/Biogas/anaerobic%20Digestion%20of%20Biodegradable%20Organics%20in%20MSW.pdf. Accessed September 2016.

compared to 49% methane content in the landfill gas generated in the Oneida-Herkimer Regional Landfill in 2015. This is a result of more efficient biogas generation and collection during anaerobic digestion than during typical decomposition in a landfill with gas recovery for use in the LFGTE facility.

3.0 Commercial Source-Separated Organics Program

3.1 Predicted Organics Volume

Limited information is available on the total tonnage of SSO available for diversion from commercial entities. The Authority surveyed many of the commercial and institutional entities in their service area in order to estimate the amount of SSO that could potentially be collected. However, some of the institutions surveyed, including schools, hospitals, nursing homes, restaurants, hotels, and grocers, do not track the amount of food waste they produce. Tonnage data for these facilities was calculated based on usage of similar out-of-region facilities. For example, food waste generated at the schools was estimated based on the number of students and a set waste generation rate per student. Combining the available survey data with the estimates resulted in an approximate commercial SSO quantity of 31,700 tons per year. Commercial organics already recovered for other uses are quantified in the Authority's Planning Unit Reports and are summarized in Table 1 below. Removing all food waste allocated towards other uses, such as donation or composting, resulted in available commercial SSO for collection totaling approximately 15,000 tons per year. This assumes generator participation of 100% which, although unlikely, will allow for processing equipment to be sized conservatively.

Table 1 - Diverted Commercial Organics

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YEAR	RECOVERED COMMERCIAL/INDUSTRIAL FOOD WASTE (TONS/YEAR)[1]
2010	13,623
2011	15,107
2012	15,878
2013	18,012
2014	20,383
2015	17,112
Average:	**16,686**

Note:
[1]Authority Planning Unit Reports

All volume data was checked against the waste composition numbers per NYSDEC's State Solid Waste Management Plan, Beyond Waste. Data collected as part of the Beyond Waste Plan states that 46% of MSW is commercial, institutional, or industrial in origin, and that 25.2% of commercial and institutional wastes are food scraps.[4] Applying these waste composition percentages to actual waste generation numbers collected between 2010 and 2015 from the Authority's service area results in an estimated available SSO of 21,300 tons per year (see Table 2). This matches closely with the estimated total commercial SSO available, including food waste already allocated for uses such as donation and composting. Based on the expected phasing of the SSO collection program, a range of expected tonnages of 5,000 to 21,000 will be used moving forward to size equipment. This tonnage range assumes that in addition to larger generators that may be mandated by state legislation to participate in organics diversion, that smaller generators not subject to the legislation will voluntarily participate based on corporate green initiatives or economics.

Table 2 - Authority Potential Food Waste Recovery

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YEAR	TOTAL MSW GENERATED (TONS)[1]	FOOD WASTE IN MSW (TONS)[2]	COMMERCIAL INDUSTRIAL MSW GENERATED[3]	COMMERCIAL INDUSTRIAL FOOD IN MSW[4]
2010	185,686	42,708	85,416	21,525
2011	185,834	42,742	85,484	21,542
2012	180,504	41,516	83,032	20,924
2013	184,826	42,510	85,020	21,425
2014	187,175	43,050	86,101	21,697
2015	179,793	41,352	82,705	20,842
			Average:	**21,326**

Notes:
[1]Includes Food Recovered tons
[2]Food Scraps 23% of MSW Disposed as per *NYSDEC Beyond Waste*
[3]NYSDEC Beyond Waste, 46% of MSW is commercial/institutional/industrial, 54% is residential.
[4]NYSDEC Beyond Waste, Appendix H, Table H-2: 25.2% of MSW from commerical entities/institutions is food scraps

Diversion of organics is anticipated to occur in a phased manner, with larger generators (greater than 2 tons of SSO/week) participating first due to state mandates, and other generators following as economics, green initiatives, and/or further mandates dictate. In order to further refine the amount of SSO initially available one must take into account the effect of potential New York State Legislation. The potential SSO recycling legislation in New York State

[4] NYS Solid Waste Management Plan, Beyond Waste, 2010.

would require generators of greater than 2 tons per week of food or food scraps, based on an annual average, to donate edible food and compost or recycle what is not donated beginning in January of 2021. In addition, haulers or intermediaries, such as transfer stations, would need to ensure that SSO is taken ultimately to a certified organics recycler such as an animal feed operation, renderer, compost facility, anaerobic digestion facility, or other approved recyclers. Generators within 50 miles of a viable facility would be required to recycle food scraps.

Based on generator surveys, the Authority estimates that there are about ten area organics generators that would initially be mandated to recover their organics under the proposed State law. This does not include generators in the service area that are currently recovering their organics through donation, animal feed operations, or composting. Other smaller local generators that do not meet the mandated generation levels have indicated to the Authority willingness to participate in a local organics recovery project. There are also a significant number of chain restaurants that have corporate “green” initiatives as part of their mission statements. Many of these restaurants are likely to participate in an organics recovery program. The Authority estimates that a combination of newly mandated large generators with no current recovery, and smaller voluntary participants would generate approximately 5,000 tons of food and food scraps per year. Due to the unknown factors associated with the proposed legislation and voluntary participation in the program, a sensitivity analysis was performed to determine the feasibility of the program for a range of tonnages from the initial phase estimation of 5,000 tons per year to the maximum available SSO currently estimated at 21,000 tons per year.

3.2 Commercial SSO Collection

Commercial waste collection methods vary throughout the Authority’s service area. Haulers are contracted by municipalities or individuals for collection, or waste is self-hauled to the transfer stations or residential convenience stations. Some municipalities collect commercial waste with their own trucks and employees. As with waste and recyclables, commercial organics collection will be conducted by haulers operating in the service area.

The reduced pickup quantities and potential for odor associated with organics complicates separate collection of SSO from MSW. Separating waste streams at the source lowers waste quantities for collection per route stop unless collected in split-body, or compartmentalized, trucks. This has the potential to increase hauling costs due to multiple stops at each collection point. In addition, the potential for odors from organics may require consideration of modified collection schedules from typical weekly pickup in order to limit odor issues and encourage participation. However, since total waste quantities are not anticipated to change and tip fees will be reduced for organics to account for anticipated increased hauling costs, costs to generators are not anticipated to increase significantly. Since the Authority relies on many different haulers, both public and private, for waste collection, collection containers and pickup equipment will vary throughout the service area. The type of equipment used for collection will be highly dependent on specific haulers and the container type and size required for each generator.

Key components of collection impacting the design of the transfer station area for SSO receipt and processing include collection frequency, container types, and collection vehicle types, among others. Other factors impacting collection and processing design are contamination in the SSO waste stream and anticipated peaks in commercial waste generation. In order to effectively design the waste receipt area and SSO processing system, some assumptions would need to be made regarding the type and frequency of waste collection vehicle deliveries, as well as expected contamination quantities in the waste stream. Potential collection options implemented by haulers are discussed in the following sections. Proper estimation of the collection vehicle types, waste quantities, and drop-off frequencies will allow for proper design of the SSO receiving area and processing equipment.

3.2.1 Collection Frequency

The frequency of collection will be dependent on the amount of waste generated and the hauler. At a minimum, once weekly collection is recommended to prevent significant odor and vector issues, with additional pickups as necessary to account for peaks in SSO generation. These peaks could result from large events at schools, restaurants, hotels, or conference centers, loads of off-spec food received at grocery stores, or pickups following weekends or holidays. If odors or vectors become an issue, generators and/or haulers may consider multiple pickups per week.

The increased number of trips to each generator for separate MSW, recyclables, and organics collection may be offset by decreasing the frequency of non-recyclable waste pickup. If the majority organic stream is removed from the MSW waste stream, longer time intervals between MSW pickups could be possible, assuming generation quantities and odors allow. Larger collection containers for recyclables could also be considered for reduced pickup frequencies for recyclable materials.

More frequent collection will also minimize the required storage capacity of both processed and unprocessed organics at the transfer station, as well as the design capacity for processing equipment. Although it is not anticipated that significant storage would be required due to the potential for odor issues, large incoming quantities above the design capacity of the processing equipment will require significantly more storage capacity compared to a more equalized incoming waste volume. Quantities of waste unable to be processed during the permitted facility operational hours could potentially cause odor issues at the transfer station. Ideally, collection would occur at a rate that could be maintained by the processing equipment within the operational hours of the transfer station in order to eliminate storage of organics and reduce the potential for odors.

3.2.2 Collection Containers

Containers used for SSO collection will be dependent on the quantity of waste generated as well as the equipment available to haulers for pickups. Regardless of container size, several common features will be required. Due to the high moisture content anticipated of the SSO collected and the ultimate end use in an anaerobic digester, moisture content will need to be maintained. Containers will need to be watertight and completely enclosed to prevent leakage and odors. This could also be accomplished through rubber gasket seals or the use of bags for organics collection prior to placement in containers curbside. Some organics collection programs have implemented container cleaning to limit odors and encourage generator participation through on-site steam cleaning, collection of full toters with SSO for offsite emptying and empty container exchange with cleaning at the processing location with hot water, use of a pneumatic vacuum truck with sufficient suction for liquid removal, or the use of bags for collection prior to placement in containers to prevent contact with odorous wastes. Due to the operational difficulties associated with container cleaning or exchange, this option is not being considered by the Authority. For the purposes of equipment selection and sizing, the use of bags is recommended for the ease of use at the generation sources, containment of moisture and odors, and limitation of container double-handling. This will require a decontamination or depackaging step in the processing equipment for removal of the bags from the SSO.

Several container sizes for collection are available, as with typical MSW or recyclables collection, and will vary with each commercial generator. Container size and type is dependent on the quantity of waste generated, pickup frequency, and the contracted hauler's collection vehicle. Smaller generators, such as smaller markets or bakeries, may require only toters. This is similar to programs implemented for residential SSO collection seen in other areas such as New England, where SSO diversion is required, or other areas with local laws or pilot SSO programs in place. Toters are available in 32, 64, or 90-gallon sizes typically and could accommodate up to approximately 530 lbs of SSO per week (90-gallon) depending on the number of toters and peaks in generation and assuming once weekly collection. Typical commercial entities such as school districts, colleges, larger restaurants, health care and nursing centers will require larger volumes for collection such as front load dumpsters, which typically range from 2 cubic yards to 8 cubic yards in size. These would accommodate up to approximately 4.7 tons of SSO per week assuming once weekly collection. Toters or front-loading dumpsters would accommodate nearly all the commercial generators in the service area, assuming average weekly generation (i.e., not accounting for peaks). Larger generators could require roll-offs or compactors for weekly SSO collection. None are anticipated in the service area based on current data collected. See Table 4 for a summary of the anticipated collection methods.

Table 3 - Commercial SSO Collection Methods

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Waste Generator Size	No. of Generators	Container Size[1]	Container Type	Truck Type	Unloading Method
Up to 210 lbs per week	34	32 gal	Toter	Rear Loader or Automated Side Loader	Walkout
Up to 420 lbs per week	12	64 gal	Toter	Rear Loader or Automated Side Loader	Walkout
Up to 590 lbs per week	13	90 gal	Toter	Rear Loader or Automated Side Loader	Walkout
Up to 1.3 tons per week	505	2 CY	Front-load Dumpster	Front Loader	Mechanical Arm Unloading
Up to 5.3 tons per week	6	8 CY	Front-load Dumpster	Front Loader	Mechanical Arm Unloading
Large Generators (>2 tons/week)[2]	10				
Up to 23.7 tons per week	0	40 CY	Roll-Offs/ Compactors	Roll-Off Garbage Truck	Tipping roll-offs
Greater than 23.6 tons per week	0	Multiple pickups per week	Roll-Offs/ Compactors	Roll-Off Garbage Truck	Tipping roll-offs

Notes:

1. Assumes once weekly pickup
2. Large generators, defined by the NYSDEC as waste generators of more than 2 tons of organics per week, would be the first targeted by potential legislation for organics diversion.

3.2.3 Collection Vehicles

Collection vehicle types will be dependent on the type of container used for collection at the generator as well as the individual hauler. Anticipated collection vehicles required for the quantities of waste expected range from pickup or stake-body trucks up to roll-offs. Front end or rear end loading packer trucks are expected to be used primarily. Larger capacity modified rendering trucks could also be used for larger generators.

SSO pickup from toters depends on whether the toters are emptied curbside into the collection vehicle or taken full and exchanged with empty toters. Collection vehicles could be as simple as a pickup or stake-body truck for collection of full toters and exchange with empty toters. Other options include rear loading packer trucks for manual emptying of toters or use of mechanical side arms for automated loading curbside.

For generators requiring front load dumpsters for collection (approximately 550 pounds to 4.7 tons generated per week), front end loading garbage trucks will be required for SSO collection. Odor control is more difficult with the use of dumpsters for larger generators. One potential solution is the use of suction for waste collection. Vacuum hose adaptations to collection vehicles would remove nearly all liquid with the SSO so as to prevent significant odor issues. As previously discussed, collection in bags is another potential solution for odor control while retaining moisture. Use of multiple toters and/or multiple collections per week is also an option for larger generators to limit odors as well as streamline operations through the use of the same equipment and containers for every generator. Generators larger than 4.7 tons of SSO per week, would require roll-offs or compactors for SSO collection, however none are anticipated based on current data collection and estimates.

Factors impacting transfer station design include required truck clearances and methods for unloading. Both front end loading, rear end loading, and roll-off trucks require 25' of vertical clearance and varying lateral clearances. Front end loading vehicles require 16 feet-wide lateral clearance and 52-feet of service length for unloading and backing out.[5] Rear loading waste trucks unload by pushing waste out the back using a push plate and are anticipated to have similar clearance requirements. Roll-offs require 10 feet-wide lateral clearance and up to 75-feet of service length for unloading. Since the type of waste collection equipment is unknown, the maximum clearance requirements for front and rear-load trucks will be used for the SSO receiving area design. Roll-offs are not anticipated to be needed for commercial SSO collection.

3.2.4 Other Design Considerations

Although the processing equipment will include a step for depackaging and/or removal of contamination, especially if use of bags for collection is implemented, measures will still need to be taken to limit contamination at the source. Although biodegradable bags have been successfully used in collection for anaerobic digester feedstock, significant education for generators will need to be implemented to ensure the correct

[5] Enclosure and Facility Design Guidelines for Refuse and Recycling Containers, City of West Sacramento, California, October 2010. Available at: http://www.cityofwestsacramento.org/civica/filebank/blobdload.asp?blobid=6013. Accessed October 2016.

bags are used or to ensure removal of contaminants.[6,7] Significant contamination in the organics will cause issues for processing equipment. If excessive contamination is present, the processing equipment may not be able to remove unacceptable materials in their entirety and may result in contamination of the feedstock stream to the digester, or damage to the processing equipment. Certain hard or uncrushable materials such as rocks, pipes, etc. will not be able to be processed and could result in equipment damage.[8] Other materials, such as glass, could be processed with the SSO without damage to the equipment but would be undesirable in the anaerobic digesters. Estimates of the type and quantity of contamination will be necessary in order to properly size processing equipment as well as assess the tip fee for processing and disposal of the residue at the landfill. Although the type and quantity of contamination will vary, estimates typically range from 5 to 10% by weight and could be as much as 20% by weight of incoming SSO[9,10,11].

An important factor for minimizing contamination is education. Training by Authority staff should be implemented for each generator in order to outline proper procedures for SSO disposal and identify acceptable and unacceptable materials for disposal with SSO. Sufficient educational information should be made available on or near the collection containers to maximize the prevention of contamination at the source. This could include signage, toter or dumpster labels, or cut sheets with acceptable materials. Additionally, haulers and equipment operators should be trained on identification and safe removal of contamination, if possible, at all stages of collection and receipt prior to processing. Education on acceptable and unacceptable materials for SSO collection

[6] Anaerobic Digestion of Compostable Bags, BioCycle, Vol. 54, No. 10, p. 40, October 2013. Available at: https://www.biocycle.net/2013/10/25/anaerobic-digestion-of-compostable-bags/. Accessed November 2016.

[7] Performance Evaluation of Environmentally Degradable Plastic Packaging and Disposal Food Service Ware – Final Report, Chico Research Foundation, California State University, June 2007. Available at: http://www.calrecycle.ca.gov/Publications/Documents/Plastics/43208001.pdf. Accessed November 2016.

[8] Personal correspondence with EV New England sales representative Corey Plucker via email, regarding Scott Equipment Turbo Separator. September 13, 2016.

[9] Technical Document on Municipal Solid Waste Organics Processing, Environment Canada, 2013. Available at: http://www.compost.org/English/PDF/Technical_Document_MSW_Organics_Processing_2013.pdf. Accessed September 2016.

[10] Managing Compostable Bags at Anaerobic Digestion Plants, BioCycle, Vol. 53, No. 9, p. 37, September 2012. Available at: https://www.biocycle.net/2012/09/18/managing-compostable-bags-at-anaerobic-digestion-plants/

[11] Anaerobic Digestion of Biodegradable Organics in Municipal Solid Waste, Shefali Verma, Columbia University, May 2002. Available at: http://www.compost.org/CCC_Science_Web_Site/pdf/Biogas/anaerobic%20Digestion%20of%20Biodegradable%20Organics%20in%20MSW.pdf. Accessed September 2016.

and processing has been proven to be an important factor in the successful implementation of similar programs[12,13].

Another factor potentially impacting processing system design is the peak waste generation rate. Data available to estimate commercial SSO generation rates is limited, and currently is available only as annual totals. However, waste will not be generated and collected daily at the average daily tonnage based on the annual average tonnage; peaks in generation or collection will occur and will need to be processed in a timely manner. Operational days following holidays, long weekends, or events will likely experience greater waste quantities. Peaks could also occur after weekends, when grocery stores and restaurants remain open, but haulers do not operate. Waste generation from schools will be limited primarily to fall, winter, and spring, truncating the number of days over which their yearly tonnage would be generated and collected. Peaks in generation would need to be factored into the sizing of equipment to maintain functionality during periods of greater waste generation while minimizing the required storage.

[12] Source Separated Organic Materials Final Report, Town of Groton and Town of Stonington, Connecticut, July 2005. Available at: http://www.ct.gov/deep/lib/deep/compost/compost_pdf/groton_stonington_ssom_final_report.pdf. Accessed September 2016.

[13] Assessment of Residential Source Separated Organics Collection Options – A Study for the City of Minneapolis, Foth Infrastructure & Environment, LLC, October 2013. Available at: http://www.ci.minneapolis.mn.us/www/groups/public/@publicworks/documents/webcontent/wcms1p-121817.pdf. Accessed September 2016.

4.0 Source-Separated Organics Characterization

4.1 Predicted Organics Volume

Although data from the specific waste targeted for collection is currently unavailable, significant literature is available from other SSO collection systems regarding the properties of food waste to estimate the volumes to be processed. Using the estimated collected tons of SSO along with a number of assumptions from literature and the operational hours of the ETS, the hourly throughput for the proposed processing equipment, including moisture addition, can be estimated. See Table 3 for assumptions and calculations. Based on the range of targeted material of 5,000 to 21,000 tons per year and the estimated moisture addition at each tonnage, the expected throughput for the processing equipment sizing is two (2) to nine (9) tons per hour. Moisture addition totaling approximately 0.23 gallons per minute during operation for every 1,000 tons of material processed will be required in order to achieve a consistency of approximately 10% solids, as requested by WPCP for anaerobic digestion and to be able to pump the material. This will increase the volumetric flow to approximately 770 to 3,400 gallons per operational hour of the processing equipment. Moisture addition will be variable based on incoming material consistency. In order to not upset digester function with this high strength waste stream, a constant flow rate to the anaerobic digester complex should be maintained. This will require one or more tanks for storage and equalization, to allow for a constant, lower pump rate to the digester complex during non-operational hours rather than batch dosing.

Table 4 - Anticipated Source-Separated Organic Waste Volumes

Table 4 - Anticipated Source-Separated Organic Waste Volumes						
Commercial SSO Available (from Authority Data)	1,500	5,000	10,000	15,000	22,000	Tons/year
ETS Operations Assumptions	52	52	52	52	52	weeks/year
	6	6	6	6	6	days/week
	6	6	6	6	6	holidays/year
	8	8	8	8	8	hours/day
Total Operational Days	306	306	306	306	306	days/year
Daily Tonnage Range (Available SSO / Operational Days)	5	16	33	49	72	Tons/day
Conversion Factor	2,000	2,000	2,000	2,000	2,000	lbs/ton
Bulk Density of Organic Waste[1]	5.8	5.8	5.8	5.8	5.8	lbs/gallon
Estimated Daily SSO Volume Range (Daily Tonnage/Bulk Density x CF)	1,690	5,634	11,269	16,903	24,792	gallons/day
Estimated Moisture Addition[2]	0.23	0.23	0.23	0.23	0.23	gallons/minute per 1,000 tons
(from equipment manufacturer)	13.8	13.8	13.8	13.8	13.8	gallons/hour per 1,000 tons
(Moisture addtion x 60min/hr x Operational hours)	166	552	1,104	1,656	2,429	gallons/day
Total Daily Volume Range (Daily SSO + Moisture Addition)	1,856	6,186	12,373	18,559	27,220	gallons/day
Required Equipment Capacity (Total Daily Volume / Operational Hours)	**230**	**770**	**1,550**	**2,320**	**3,400**	**gallons/hour minimum**

Notes:

1. Based on anticipated waste composition
2. Estimated liquid effluent at minimal solids required to achieve composite solids content of 10% or less.

4.2 Predicted Organic Strength

The organic strength of a waste stream is a key component in the efficiency of anaerobic digestion. Literature values for organic strength vary greatly for different types of feedstocks. Organic strength is typically measured in terms of the percent volatile solids (%VS) or the biodegradable organic fraction of a feedstock. The organic fraction is typically expressed as a weight percentage or a ratio of volatile solids to total solids (VS/TS). Food waste is considered a high strength waste, as it has a high ratio of VS to TS. The anticipated VS content of the SSO targeted for diversion is 4.25 to 9.0% VS, based on approximately 5 to 10% TS of the SSO waste stream and 85 to 90% VS/TS. This will change with the addition of moisture in order to pump the material to the anaerobic digester complex. In order to achieve a pumpable consistency with less than 10% TS, the addition of moisture with no added organic loading could lower the organic strength. However, SSO material is not a homogeneous mixture and the organic strength is expected to vary based on the type of waste received. Digesters are sensitive to changes in organic strength, so the flow of this high strength material to the anaerobic digester will be designed to be as near constant as possible. In comparison, the primary digester feedstock at the WPCP is municipal sludge which is typically homogeneous and has lower organic strength, ranging from 3 to 5% TS and 75 to 85% VS/TS. However, compared to the large quantity of sludge the anaerobic digesters are sized to handle, the estimated quantity of SSO is small and unlikely to disrupt anaerobic digester function.

5.0 SSO Processing

5.1 Process Flow

The critical components in the process flow for commercial SSO processing for anaerobic digestion are depackaging/contamination removal, particle size reduction, emulsification, flow equalization, and transportation. These process steps can be accomplished using any number of different equipment or methods, depending on the type of system or manufacturer chosen as well as the desired feedstock consistency at the anaerobic digester. The proposed system will include a waste unloading area for collection vehicles, a Scott Equipment Turbo Separator Model T30 including liquid manifold and loading hopper, holding tank(s) for flow equalization, and pump for liquid conveyance to the anaerobic digester. The Turbo Separator T30 unit will perform the depackaging, particle size reduction, and emulsification operations required for feedstock preparation. The end product will be piped directly into a holding tank in order to allow for flow equalization, so that large batches aren't pumped directly to the anaerobic digester, which could disrupt the system. The feedstock will be pumped out at a near constant rate, or as directed by the WPCP, to the sludge receiving building at the WPCP. A schematic of the proposed process flow is included as Figure 2.

5.2 Building Design and Layout

A separate area of the transfer station will be required to unload and sort collected SSO for processing (see Figure 3 – Conceptual Building Floor Plan). It is proposed to construct an addition to the current transfer station building for SSO processing. The building will need to be insulated and heated to maintain consistency of the material and the function of the processing equipment during the winter. This will consist of a sloped tip floor for collection vehicle unloading and push wall for the loading of the processing equipment. The tip floor will need to be large enough with sufficient horizontal and vertical clearance for the expected collection vehicles to unload indoors. Given the high moisture content expected, the tip floor will need to be sloped and equipped with a sump or drain for liquid collection. An epoxy coating may be necessary for any storage or staging areas to protect the tip floor from deterioration by the commercial organics materials. Collected liquid could be returned to the system through the liquid manifold in the processing equipment for moisture addition. A push wall will be necessary for loading equipment to pick up unloaded waste to load into the Turbo Separator hopper for processing. Typical transfer station equipment, such as a bucket loader or skid steer, will be used to consolidate unloaded waste and load the processing equipment. Given the small expected amount of commercial

SSO compared to the total waste received at the ETS, no additional mobile equipment is anticipated to be needed to maintain current operations. Sufficient clearance around the recessed tip floor and processing equipment will be necessary for maintenance and travel access for loading equipment. To the extent practicable, space for redundant equipment should be left in case of unexpected SSO quantities or future expansion. Additional building design considerations include a truck loadout for processed SSO slurry in the event the WPCP or the pumping system cannot accept the processed SSO. Potential New York State organics recovery legislation would mandate intermediate facilities to ensure organics are not disposed of in a landfill or at a waste-to-energy facility.

5.3 SSO Processing Equipment

5.3.1 Turbo Separator

The primary processing equipment required for the commercial SSO will be the Scott Equipment Turbo Separator Model T30, which will act as a depackager, shredder, and grinder. Several other manufacturers exist for similar equipment and systems. A brief summary of available equipment for the processing of organics for anaerobic digestion including equipment specifications and cost is included in Appendix A. Alternatively a custom system could be developed out of individual components if desired. For the purposes of this feasibility study, the Turbo Separator was chosen for its turn-key nature, ease of use, and known success for organics processing at similar facilities. See Figure 4 – Process Equipment Schematic for more detail on the Turbo Separator components.

The Turbo Separator consists of several components to achieve the desired feedstock consistency. These include a loading hopper, several conveyors for material movement through the system, the main Turbo Separator unit, liquid manifold, and organics pump or conveyor for removal of material from the system. The Turbo Separator can be batch fed or fed continuously, depending on incoming tonnage and frequency of hauler deliveries. SSO will be loaded into the hopper with a skid steer or bucket loader. Haulers could also tip directly into a below grade pit which feeds the system in place of the hopper to avoid double handling of material. However, this is not recommended. The loading of organics by ETS staff into the processing equipment will allow for quality control between the delivery and processing of waste. Staff would be able to identify unauthorized items or materials that may damage equipment in order to remove them prior to processing, which would not be possible if haulers tip directly into the system. Waste loaded into the hopper feeds into a twin screw infeed conveyor to reduce particle size and direct waste into the main compartment, the Turbo Separator.

The Turbo Separator is the main component of the processing system. Its primary function is particle size reduction and emulsification. The Turbo Separator also separates and removes the packaging and/or contamination from the organics stream. The main unit can be equipped with a liquid manifold for moisture addition at this step and other steps of the process if necessary. Although not required, in the case of processing SSO for digester feedstock, the addition of moisture will facilitate the emulsification and ability to pump the feedstock, if the moisture content of the incoming materials is not sufficient on its own. Controls on the processing equipment will assess the composition of the material output in order to adjust the moisture content as necessary. The processed SSO will be further mixed in the storage tank to maintain consistency. Current estimates for moisture addition are approximately 0.23 GPM of liquid effluent or clean water for every 1,000 tons per year of material received at the facility to achieve the desired moisture content greater than 90%. Graywater from the WPCP may be used for moisture addition if feasible. Actual moisture addition will depend on actual waste quantities received and the consistency of the incoming material. The processed organic material then passes through a screen, which can be customized to the desired particle size for anaerobic digestion. Organics are piped directly out the bottom of the system to a pump for conveyance or can be fed via single screw conveyor to a storage tank or vessel prior to pumping for removal from the system. It is recommended that the Authority employ the organics pump option as the final step in the process, so that organics can be conveyed into one of the storage tanks for equalization prior to transport to the WPCP, rather than batch loading to the anaerobic digesters which could disrupt their function.

The storage tanks will be located above grade and inside the building. Two 25,000 gallon tanks are estimated to be required for three days of processed SSO storage as well as for redundancy for tank maintenance and cleaning. In order to maintain the pumpable consistency of the processed SSO for anaerobic digestion, the tanks will need to be equipped with mixing capabilities. A submersible pump will convey organics at a constant rate of approximately 10 to 15 GPM, or as directed by the WPCP, to the anaerobic digester complex. Organics will be pumped through a 4” force main directly to the septage receiving building located at the anaerobic digester complex. The tanks will also be equipped with a loadout system for transportation by truck in case of pump downtime or in the event the WPCP cannot accept the processed SSO material, so that it can be transferred to other anaerobic digester facilities.

Packaging and contamination is removed from the Turbo Separator apart from the organic material. Waste material is conveyed via single screw conveyor out of the system for disposal. The conveyor would typically terminate over a dumpster or other means of waste collection in order to collect the plastics for disposal or baling for recycling. Due to the proximity of the organics processing facility to the ETS tip floor, the existing tip floor push wall could be modified so that the waste packaging could be conveyed through the wall separating the two areas for deposition of waste plastics directly onto the tip floor. This would eliminate the need to transfer the material to the tip floor using mobile equipment, which would increase the time available for equipment to load the organics processing equipment, as well as cut down on traffic between the organics processing facility and the tip floor.

6.0 Capital Cost

6.1 Building

The largest expenditure anticipated for the SSO processing facility is the building addition and modifications to the ETS. Some demolition of the existing building could be required in order to construct the addition for the SSO processing equipment. The building size is estimated at 4,900 square feet for the building structure, floor slab, and foundation. The building will also require a push wall for the transfer station equipment to load the SSO processing equipment. The total building capital cost estimate is $815,000. See Appendix B – Capital Cost Estimate for more detail on individual components.

6.2 Equipment

Estimates for the capital cost of the SSO processing equipment range based on the equipment manufacturer, desired process steps, and arrangement of equipment. Estimates from EV New England, a Turbo Separator distributor, range based on processing equipment model and added components, if any. The recommended setup for the Authority's SSO processing equipment is estimated at $239,660 for the T30 with organics conveyor, pump (up to 240 GPM), and spares kit. Additional estimates for processing equipment include SSO processing equipment installation and piping and loading equipment. It is anticipated that the existing equipment at the transfer station will be sufficient for operation and loading of the SSO processing equipment, but additional equipment is included in the cost estimate in case of unexpected participation or waste quantities received. SSO processing equipment capital cost estimates total $550,000. Refer to Appendix B – Capital Cost Estimate for more detail.

6.3 Sanitary Sewer Upgrades

Additional work required as part of the SSO processing project includes sanitary sewer upgrades. As part of upgrades to the WPCP, the septage receiving building will be relocated adjacent to the new digester complex, requiring relocation of the sanitary sewer line from the ETS. Manholes would be installed at that time along the force main for access in case of issues with the addition of organics pumping. Additional upgrades would include upgrades to the pump for increased capacity and the addition of one or more tanks for equalization of flows from the SSO processing equipment. Total capital anticipated for sanitary sewer upgrades is estimated at $334,000. See Appendix B – Capital Cost Estimate for additional information.

6.4 Climate Smart Communities Grant

Oneida County has been awarded funding through the NYSDEC's Climate Smart Communities Grant through the New York State Consolidated Funding Application for this project. This grant program offers a 50-50 match for municipalities to implement climate change adaptation or mitigation projects, which includes food waste diversion. Although the Authority will be responsible for construction and operation of the facility, Oneida County applied for the grant given its significant interest in and support of the project, as it could greatly improve operation of the anaerobic digester complex at its WPCP. The grant budget includes a conservative contingency of 25% as well as engineering, finance, legal and administrative fees estimated at 25% of the total. These comprise a significant portion of the capital cost estimate due to the uncertainties involved in the project, including quality and quantity of waste received, quality of feedstock required for the anaerobic digesters, and local hauler and generator participation and support. A cost estimate for the entire project, including the building addition, SSO processing equipment, and sanitary sewer upgrades, and contingencies but excluding this feasibility study, was developed totaling $2,655,000. The grant awarded to Oneida County, totals of 50% of the total project up to $1,327,500 with a 50% match from the Authority for the remainder.

7.0 Operations and Maintenance (O&M) Cost Estimate

In combination with the capital costs, the O&M costs to operate the SSO processing system will determine the cost of operations for the commercial SSO processing facility. In order to encourage participation in the source separation and separate collection of organics, the future tip fee will likely need to be lowered from typical MSW, but how much will be determined by the costs to run the system. The operations and maintenance costs quantified include building heating, electricity to operate equipment, and equipment maintenance.

7.1 Building O&M Costs

Building heating is required for freeze protection and will be minimal. The building heating load was modeled using Hourly Analysis Program (HAP) HVAC System Design Software. Inputs to the model include building size, heating type, and desired interior temperature. The building size as currently designed is 70' by 70' heated with natural gas to an interior temperature of 50°F. The interior temperature is for freeze protection only, so higher temperatures will result in larger heat loads and higher costs. No cooling was modeled for the building. Realistic assumptions for building materials and door sizes were input to complete the model. The estimated heating load for the building throughout the year is 633 therms. At the facility's natural gas cost of $2.55/therm, the total annual cost to heat the building is $1,614.15. This will be nearly constant regardless of the amount of SSO accepted

Consideration could also be given to the feasibility of using waste heat from the anaerobic digester complex for building heating. Some, if not all, of the heat recovered from the anaerobic digesters has been allocated for use at the WPCP. However, discussions with WPCP for any excess waste heat above the required uses at the plant could be pursued in lieu of natural gas heating at the processing facility for further cost and emissions savings.

7.2 Equipment

The SSO processing equipment will be operated using electricity. The electrical demand requirements vary for each tonnage in the expected range and are summarized in Table 5 below. The power requirements for individual components of the Turbo Separator were provided by EV New England, the equipment representative. Operational hours are assumed based on the tonnages and an assumed processing rate of eight (8) tons per hour over the six operational days per week. The pump is assumed to run nearly constantly to provide a continuous feed to the anaerobic digesters. Additional assumptions for lighting, receptacles, and miscellaneous mechanical and HVAC equipment were included based on the building size and purpose and do not vary with tonnage. Based on electrical usage costs at the facility of approximately $0.11/kWh, the annual electrical costs range from $14,989.01 to $23,017.60.

Table 5 - Estimated Electrical Loads

Building Ancillary Loads	SF	W/SF	kW	Hours/Week	Hours/Year	KWHr/Year	$/year
Lights	4,500	1.2	5.4	60	3,120	16,848	$1,853.28
Receptors	4,500	1	4.5	60	3,120	14,040	$1,544.40
Misc. Mechanical/HVAC	4,500	1	4.5	60	3,120	14,040	$1,544.40

Pump Loading	HP	kW	Hours/Week	Hours/Year	KWHr/Year	$/year
Pump (up to 240 gpm)	10	7.5	168	8,736	65,171	$7,168.76

Process Equipment Loads	HP	kW
Twin Infeed Conveyor	7.5	5.6
Twin Infeed Conveyor	7.5	5.6
Waste Packaging Conveyor	3	2.2
Separator	50	37.3
Organics Conveyor	3	2.2
Total	71	52.9

	Sensitivity Analysis SSO Tonnages			
Tons/Yr	5,000	10,000	15,000	20,000
Hrs/Wk	9.5	19.5	29.0	36.0
KWHr/Yr	26,165	53,708	79,873	99,152
$/Year	$2,878.17	$5,907.83	$8,786.00	$10,906.76
	Estimated Yearly Electrical Operations Cost			
	$14,989.01	$18,018.67	$20,896.84	$23,017.60

Additional O&M cost considerations include equipment maintenance. The primary maintenance costs considered are parts replacements. Typical spare parts replacements are the paddles and screens inside the main Turbo Separator unit. With an assumed replacement frequency of eight (8) paddles per year and eight screens every other year, as recommended by the manufacturer, the annual O&M costs for spare parts range from $860 to $5,072 with an average of $3,000 per year. Additional maintenance includes gear oil replacement for conveyors at approximately 5 gallons and $100 annually and a small amount of bearing lubricant at approximately $10 annually.

7.3 Commercial SSO Total Costs

The capital and O&M costs, as well as the disposal cost for organics to the WPCP and the handling and disposal of waste residue removed from the SSO stream during processing, all factor in to the cost of operations for the SSO processing facility. See Appendix C for a summary of the capital and O&M costs used to develop the future tip fee at varying tonnages. For comparison, Table 6 was developed with data from other New York State Planning Units with similar organics diversion programs. At the time of this report, no known mandatory County-wide SSO diversion programs were in place in New York State using anaerobic digestion, but others exist using composting in Onondaga, Tompkins, and Ulster Counties. Due to the lower MSW tip fee in the Authority's service area compared to the other counties with SSO diversion programs, the use of composting for recycling rather than anaerobic digestion, and the nature of the program (public vs. private), the difference in tip fee is less than in the comparison counties. Composting generally has fewer O&M requirements and costs associated with operations, resulting in lower tip fees for counties implementing composting as a means of organics processing. Private facilities generally operate in a larger service area than public facilities and may have access to more tonnage outside the solid waste planning units. In addition, counties with higher MSW tip fees may be able to subsidize other programs with MSW revenue in order to keep SSO tip fees lower and encourage participation in areas where diversion is not mandated. Table 6 is a summary of the Planning Unit comparison for other SSO diversion programs in New York State.

Table 6 - New York State Planning Units Organics Tip Fee Comparison

Table 6 - New York State Planning Units Organics Tip Fee Comparison				
Planning Unit	Authority	OCRRA	Tompkins	Ulster
Diverted Organics Type	Commercial	Residential/ Commercial	Residential/ Commercial	Commercial
Method for Organics Recycling	Anaerobic Digestion	Compost	Compost	Compost
Facility Type	Public	Public	Private	Public
MSW Tip Fee ($/ton)	$64.00	$84.00	$85.00	$103.00
Food Waste Tip Fee ($/ton)	TBD	$35.00	$50.00	$20.00
Difference in Tip Fee	TBD	58%	41%	81%
Planning Unit MSW and Organic Waste (2015 PU Reports)	179,793	347,096	58,335	123,758
Estimated Commercial Organics Available for Diversion[1,2]	20,842	40,235	6,762	14,346
Recycled Food Waste (tons) Handled by Planning Unit (2015 PU Reports)	216	6,316	117.58	670.27
Recycled Food Waste (tons) Total within Planning Unit (2015 PU Reports)	17,112	97,500	9,045[3]	2,033[4]
Planning Unit Diversion Rate (recycled food waste handled by PU / estimated commercial organics available in PU)	1%	16%	2%	3%

Notes:

[1]NYSDEC Beyond Waste, 46% of MSW is commercial/institutional/industrial, 54% is residential.

[2]NYSDEC Beyond Waste, Appendix H, Table H-2: 25.2% of MSW from commercial entities/institutions is food scraps

[3]Private facility – may import waste from outside of County.

[4]An estimated 50% of food waste handled within the Planning Unit is imported from outside of Ulster County.

8.0 Impacts to Oneida-Herkimer Regional Landfill

Removal of SSO from the waste stream for anaerobic digestion rather than landfill disposal will have several impacts to the existing solid waste management infrastructure. Airspace consumption will decrease on an annual basis and extend the life of the landfill from 1 to 7 years depending on the volume of organics recovered. Diversion of organics from the landfill will decrease the moisture content and biodegradable fraction of the waste mass, resulting in less settlement and reduced landfill gas generation and energy production at the LFGTE Facility. Reduction in peak landfill gas generation is approximately 200 scfm from existing conditions during the first 20 years of SSO processing operations.

8.1 Airspace Utilization

Removal of some organics from the waste stream will conserve landfill space and increase the landfill's site life. Since the Authority operates under flow control and a consistent service area, it is assumed that the diverted SSO will not be replaced by another waste stream to be landfilled as would be the case at a private site. However, changes in operations at the WPCP will result in additional waste material from the current quantity of sludge incinerator ash requiring disposal. Based on the range of commercial SSO tonnages available for diversion, 5,000 to 21,000 tons per year, and typical airspace consumption, the site life of the landfill will increase by 1 to 7 years due to the estimated annual tonnage reduction. This is based on the assumption that no additional waste stream will replace the diverted organics with the exception of the sludge from the anaerobic digesters, which is proposed to be landfilled. The sludge produced in the anaerobic digester complex is an increase in tonnage from the current incinerator operations. Additional sludge production from the anaerobic digesters compared to current WPCP operations is not related to this project.

8.2 Landfill Stability

By removing a portion of the SSO from the waste mass, less decomposition will occur over time following waste placement, resulting in improved landfill stability and less settlement. Some moisture and organics will be replaced by the addition of digested sludge from the WPCP, but these amounts are not significant compared to the loss of organics and moisture from the diverted SSO. The in-place density of the waste will not change as significantly over time as when organics are present, due to lower moisture content and a lower degradable organic content. The high moisture content of the organics percolates through the waste mass and is removed as leachate. The organic fraction decomposes into landfill gas, with the majority extracted from the landfill for energy recovery or emitted fugitively. With the removal of a portion of this waste as leachate and landfill gas, the waste will take up a smaller volume than when originally placed in the landfill. This is the primary cause of waste mass settlement, which will be reduced with the diversion of some organics. A reduction in settlement will increase landfill stability and maintain landfill cover system integrity once the final cover system is constructed.

8.3 Landfill Gas Production

The Oneida-Herkimer Regional Landfill currently operates an active gas collection and control system to manage landfill gas generated at the site. Gas is collected from the landfill through a system of vertical and horizontal collection wells under vacuum and is conveyed to the LFGTE facility, where it is destroyed in two internal combustion engine generator sets to generate electricity. The LFGTE facility has been operational since 2012. The site also employs two flares as back-up combustion devices during engine maintenance or other LFGTE downtime.

Diversion of commercial SSO from the landfill will decrease the moisture content and biodegradable fraction of the waste mass, resulting in lower gas production. Although not all organics will be diverted from the landfill, the shape of the facility's gas curve could also change due to the change in moisture content, which impacts key landfill gas generation modeling parameters including methane generation rate (k) and methane generation potential (L_o). Gas generation from the landfill was analyzed for the first 20 years of operation of the SSO processing facility, from 2018 through 2037. The existing waste-in-place landfill gas generation model uses a cumulative total of individual gas models developed for each putrescible waste stream accepted at the landfill: MSW, 50% of the construction and demolition debris (C&D), and sewage sludge. Waste quantities are based on actual waste placed through 2015 and projected waste based on the 5-year average for the remaining years. Modeled sewage sludge includes an additional 9,500 tons per year beginning in 2018 with the operation of the anaerobic digesters. Modeling parameters for each putrescible waste type for the existing landfill gas curve use site-specific values based on historical landfill gas generation and collection data and are included below:

MSW:

- Methane Generation Rate Constant (k) = 0.077/year
- Methane Generation Potential (L_o) = 155 m^3/Mg

C&D (50% putrescible):

- Methane Generation Rate Constant (k) = 0.04/year
- Methane Generation Potential (L_o) = 40 m^3/Mg

Sewage Sludge:

- Methane Generation Rate Constant (k) = 0.185/year
- Methane Generation Potential (L_o) = 25 m^3/Mg

Under current projections and waste acceptance rates, final waste placement and closure would occur in 2084. The peak landfill gas generation during the 20-year analysis period is 3,083 scfm in 2037. This results in an estimated peak collection of 2,312 scfm, assuming a collection efficiency of 75%.

If commercial SSO diversion is implemented, changes in moisture content and organic fraction will alter the modeling input parameters for landfill gas generation and change the shape of the gas curve. However, not all organics will be diverted from the waste mass. The projected landfill gas generation model following organics diversion was developed by subtracting the estimated gas generated from the diverted organics from the existing waste-in-place landfill gas generation model. A model was developed for each increment in the range of tonnages analyzed from 5,000 to 21,000 tons per year of diverted SSO. Modeling parameters for the proposed diverted organics scenarios are included below:

- Methane Generation Rate Constant (k) = 0.185/year
- Methane Generation Potential (L_o) = 75 m^3/Mg

Landfill gas generation curves were developed for each increment in the estimated range of SSO available for diversion using the modeling parameters above over the same 20-year period as existing conditions. Under the range of tonnages analyzed and projected waste acceptance rates, final waste placement and closure could occur from 2085 to 2091. The peak landfill gas generation during the 20-year analysis period occurs in 2037 and ranges from 2,886 scfm with 21,000 tons per year of SSO diverted to 3,038 scfm with 5,000 tons per year of SSO diverted. This results in an estimated peak collection ranging from 2,164 scfm to 2,279 scfm, assuming a collection efficiency of 75%, which is the average reported collection efficiency for MSW landfills per the Environmental Protection Agency's Air Pollutant Emission Factors standard (AP-42). See Appendix D for a comparison of the landfill gas generation curves under each scenario.

9.0 Permitting and Environmental Review

Several environmental review and permitting tasks will need to be undertaken for approval of this project, including environmental review under SEQRA, a modification to the transfer station's existing Part 360 operating permit, and an International Building Code review.

Review under SEQRA has already been completed for the WPCP upgrades and anaerobic digesters, but will still need to be completed for the separate collection and processing of commercial SSO. It is anticipated that the Authority would be the Lead Agency for SEQRA and that an environmental assessment form (EAF) would need to be completed for the project. Since this project is environmentally beneficial and will be located primarily on properties already developed and allocated for solid waste management and/or wastewater treatment, it is anticipated that this would result in a negative declaration. No environmental impact statement would need to be prepared.

Separate collection and processing of commercial SSO would also require a modification to the ETS Part 360 operating permit. Since this material is already collected at the transfer station but will now be source-separated and processed, the modification should be minor. The project will at a minimum require an updated or additional Operations & Maintenance Manual and Contingency Plan for the SSO processing.

Modifications to the ETS and construction of the building addition will require International Building Code review in order to obtain a building permit, as with the recent building addition at the ETS for bale storage. The addition will also require Department of State approval of the building permit. Since the type of activities performed at the facility will not change significantly, it is not anticipated that the class of building will change or will require any additional safeguards or engineering design from the existing structures.

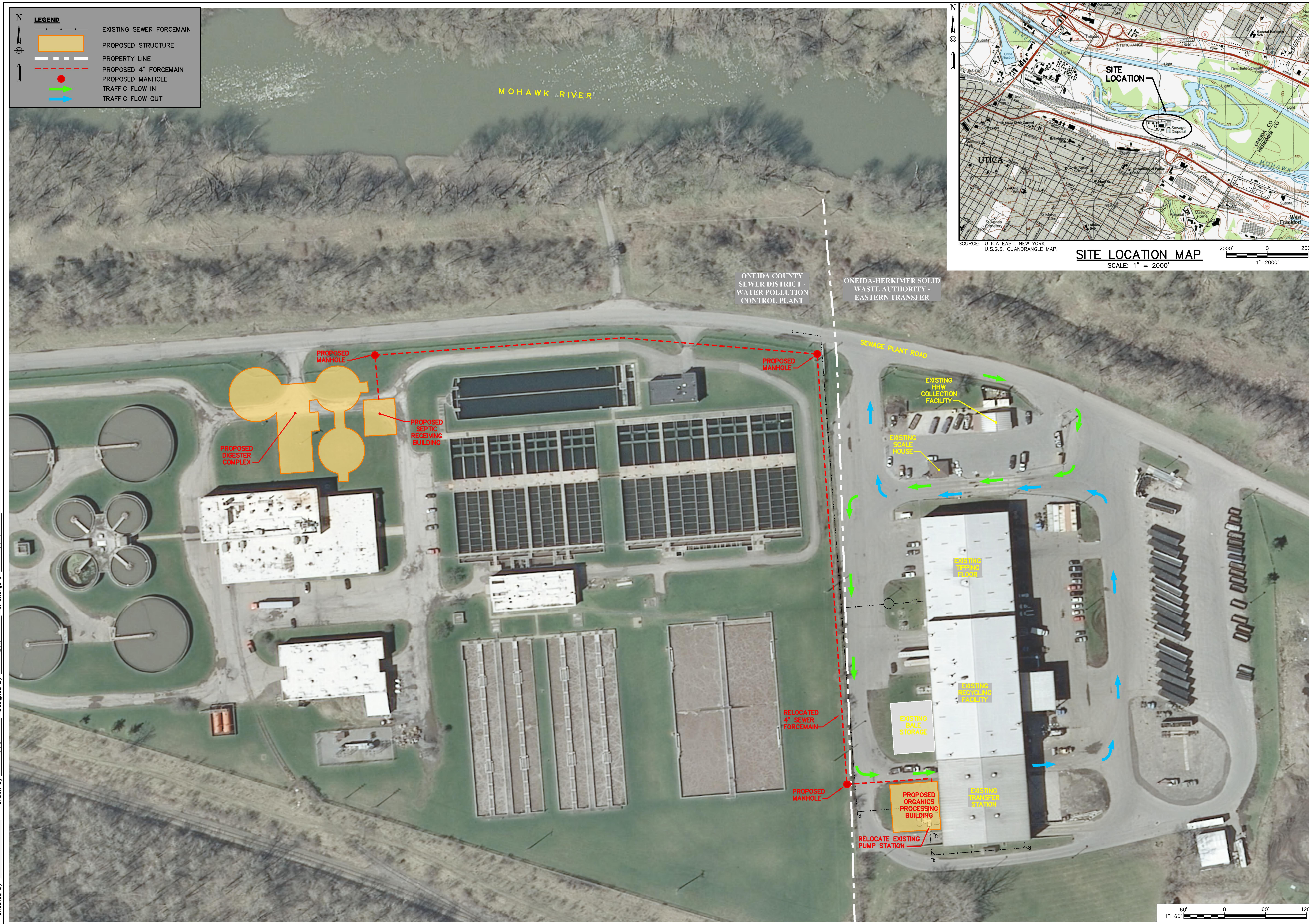
10.0 Conclusions and Recommendations

A commercial organics collection program will be feasible for integration with the WPCP anaerobic digesters with the tonnages available in the Authority's service area, the receipt of grant funding from the NYSDEC, and the participation of waste generators, haulers, and the WPCP. The Authority is likely to pursue implementation of a commercial SSO collection program based on the results of this study and the funding available for capital investments. It is recommended that additional information be pursued regarding expected participation by generators and haulers, specifically regarding waste quantities and collection methods and frequencies. The Authority plans to conduct a market study in 2017 with haulers who have participated in separate organics collection to determine what they have experienced regarding the logistics and economics of such a program. Although grant money has been received, it is not recommended to pursue a pilot program given the substantial capital investment for building modifications and processing equipment. Operation of processing equipment could be piloted through manufacturer demos at the site, if desired, but the function of the equipment has already been proved through widespread industry use in areas with similar programs. Given the potential difficulties in collection for commercial organics and the unknowns involved in the project, it is not recommended that source-separated residential organics diversion be pursued at this time. Following implementation of the commercial SSO collection program, if residential SSO diversion is found to be economically viable, the Authority could implement a residential SSO pilot program at that time to determine its widespread feasibility. The Authority will conduct the market study to aid in project economics, refine the estimations of commercial organics available for the project, and continue to monitor potential New York State legislation and its effects on a commercial SSO collection program as it proceeds with implementation of the program.

Figures

Figure 1

Conceptual Site Plan



NO ALTERATION PERMITTED HEREON EXCEPT AS PROVIDED UNDER SECTION 7209 SUBDIVISION 2 OF THE NEW YORK STATE EDUCATION LAW.

COMPLETED CONSTRUCTION

Significant Construction Changes Are Shown

By ______ Date ______

Ck'd ______ Date ______

REVISIONS

ONEIDA COUNTY SEWER DISTRICT/ONEIDA HERKIMER SOLID WASTE AUTHORITY
SSO COLLECTION AND PROCESSING FACILITY

CONCEPTUAL SITE PLAN

CITY OF UTICA ONEIDA COUNTY, NEW YORK

Barton & Loguidice, D.P.C.

Date: NOVEMBER, 2016

Scale: 1" = 60'

Sheet Number: 1

File Number: 260.055.001

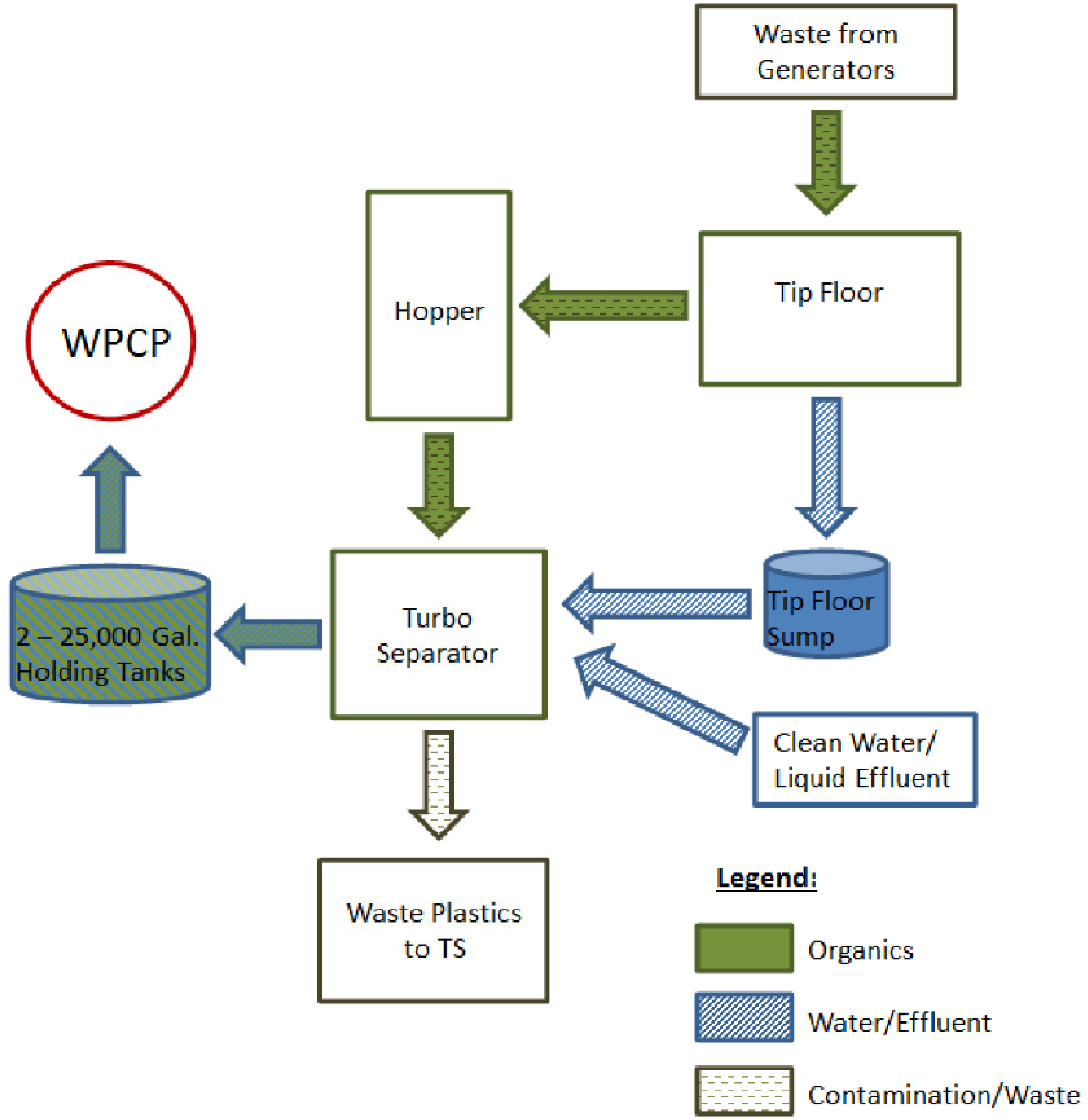
Plotted: Nov 01, 2016 – 1:52PM SYR By: bkp

Checked by ______ Drawn by JGS Designed by BKP In charge of CWH

Figure 2

Conceptual Process Flow Diagram

Plotted: Dec 12, 2016 – 1:37PM SYR By: bkp
Z:\BL-Vault\ID2\18217AD2-1C71-4823-8927-99D5C4054147\0\1088000-1088999\1088707\L\L\260.055.001_Process Flow Diagram (ID 1088707).dwg



Barton & Loguidice, D.P.C.

Date	Scale
DECEMBER, 2016	NOT TO SCALE

ONEIDA COUNTY SEWER DISTRICT/ONEIDA HERKIMER SOLID WASTE AUTHORITY
SSO COLLECTION AND PROCESSING FACILITY

PROCESS FLOW DIAGRAM

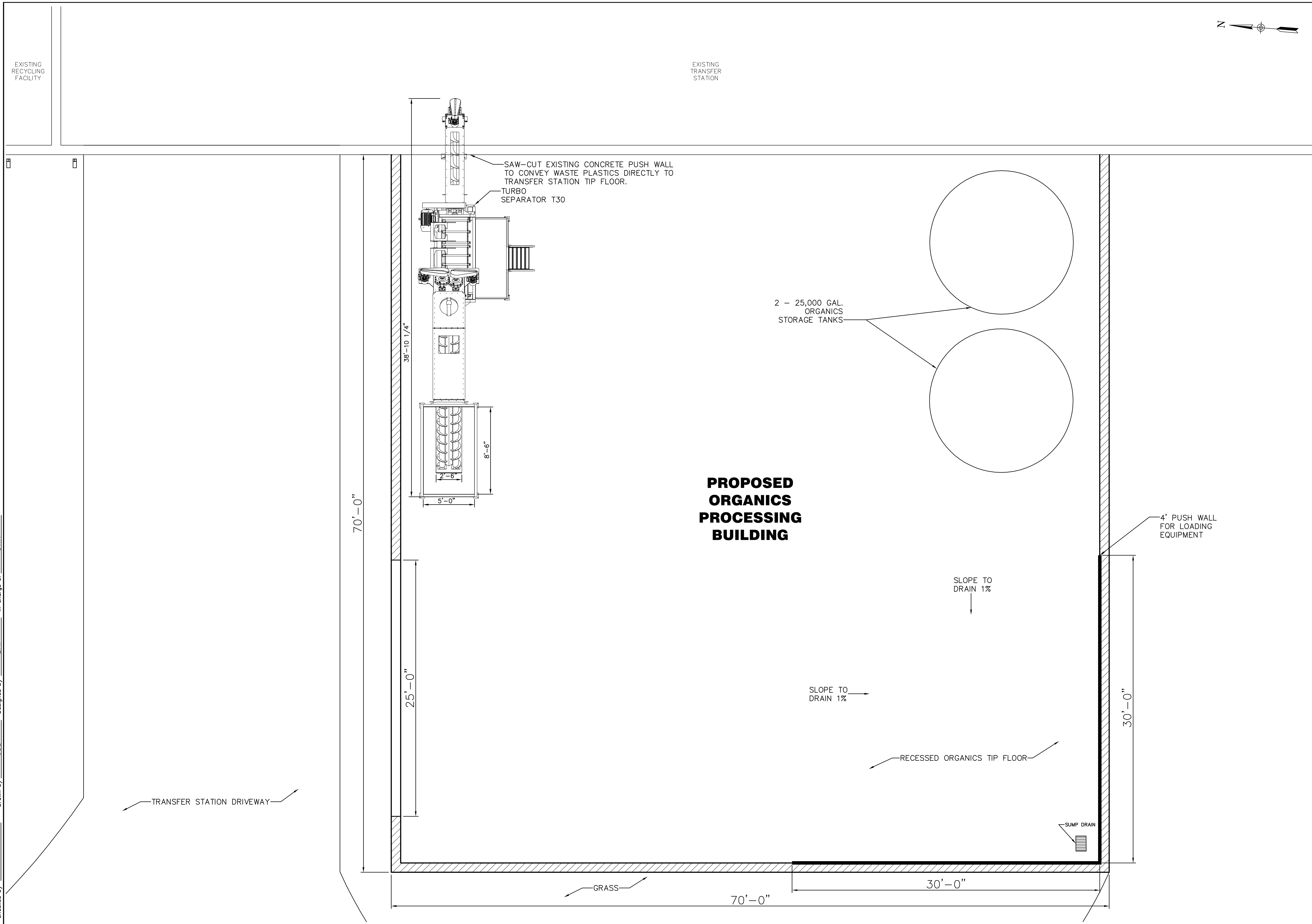
CITY OF UTICA ONEIDA COUNTY, NEW YORK

Figure Number 2

Project Number 260.055.001

Figure 3

Building Floor Plan



NO ALTERATION PERMITTED HEREON EXCEPT AS PROVIDED UNDER SECTION 7209 SUBDIVISION 2 OF THE NEW YORK STATE EDUCATION LAW.

COMPLETED CONSTRUCTION

Significant Construction Changes Are Shown

By ______ Date ______
Ck'd ______ Date ______

REVISIONS

ONEIDA COUNTY SEWER DISTRICT/ONEIDA HERKIMER SOLID WASTE AUTHORITY
SSO COLLECTION AND PROCESSING FACILITY

CONCEPTUAL BUILDING FLOOR PLAN

CITY OF UTICA — ONEIDA COUNTY, NEW YORK

Barton & Loguidice, D.P.C.

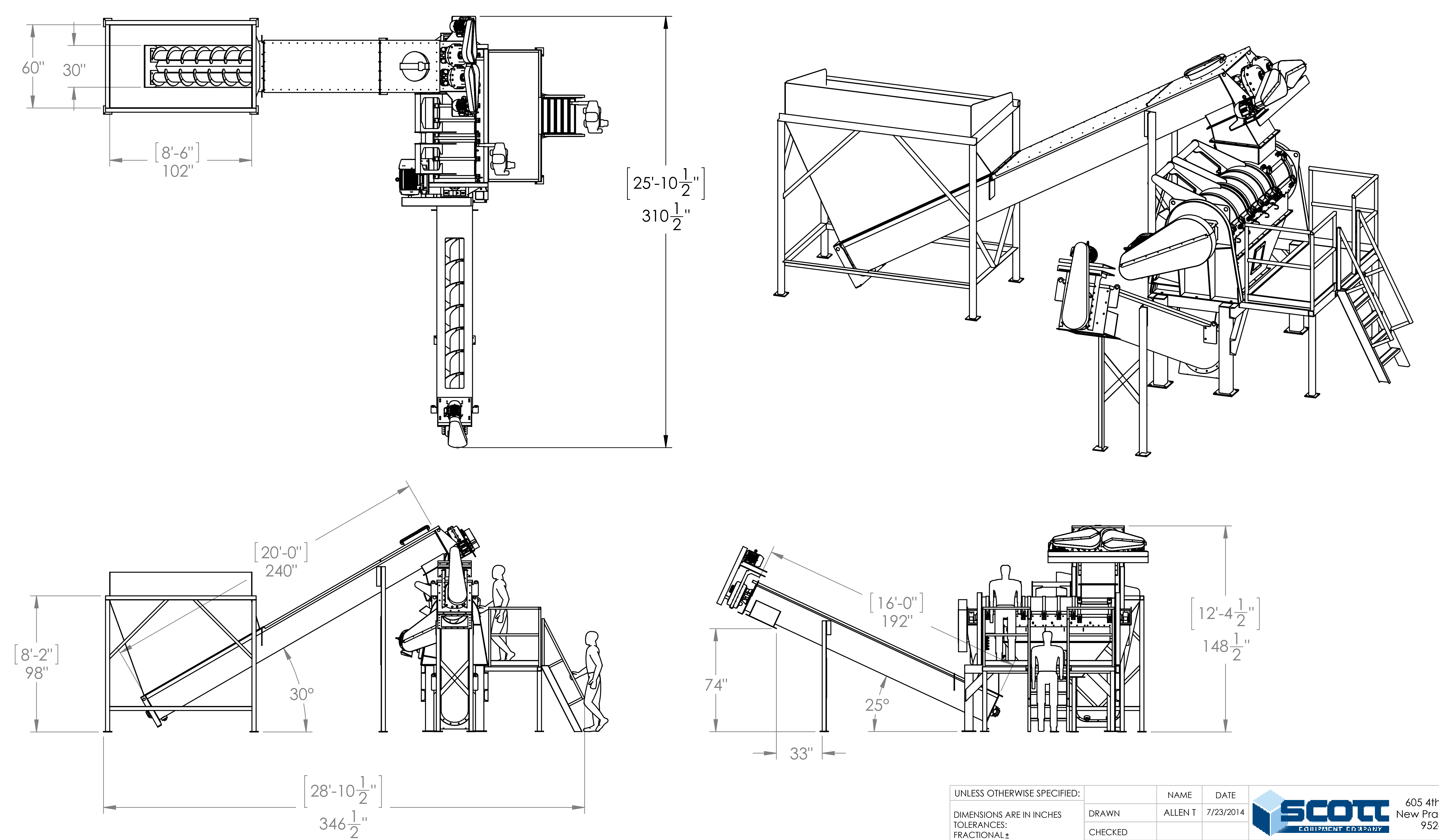
Date: NOVEMBER, 2016
Scale: 1/4" = 1'-0"
Sheet Number: 3
File Number: 260.055.001

Plotted: Nov 09, 2016 - 3:31PM SYR By: bkp
Z:\BL-Vault\ID2\18217A02-1C71-4823-8927-9905C4054147\0\1087000-1087999\1087969\L\L\260.055.001_Conceptual Building Floor Plan (ID 1087969).dwg

Checked by ______ Drawn by JGS Designed by BKP In charge of CWH

Figure 4

Processing Equipment Schematic



PRELIMINARY PLANT LAYOUT

PROPRIETARY AND CONFIDENTIAL

UNLESS OTHERWISE SPECIFIED:

DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ±
ANGULAR: MACH ± BEND ±
TWO PLACE DECIMAL ±
THREE PLACE DECIMAL ±

JOB #

MATERIAL
SEE PARTS

FINISH

DO NOT SCALE DRAWING

	NAME	DATE
DRAWN	ALLEN T	7/23/2014
CHECKED		
ENG APPR.		
MFG APPR.		
Q.A.		
SALES APPR.		
CUST APPR.		

SCOTT EQUIPMENT COMPANY
605 4th Avenue NW
New Prague, MN 56071
952-758-2591

TITLE:
PRELIMINARY LAYOUT

SIZE	DWG. NO.	REV
B	3096 PLANT LAYOUT	

SCALE: 1:70 WEIGHT: 16775.2 SHEET 1 OF 1

Appendices

Appendix A

Organics Processing Equipment Summary

Processing Equipment		Specs							
Manufacturer	**Model**	**Capacity**		**Footprint**	**Hopper Dimensions**	**Particle Size**	**Pros**	**Cons**	**Cost**
Cesaro	Tiger HS 640	20	TPH	8' x 20'	11.5' x 6.5'	Unknown	-Effective depackaging mechanism -Compact footprint	-Most expensive processing equipment -No flexibility in equipment layout -Compact design makes maintenance difficult	$ 460,000.00
Scott Industries	Turbo Separator T30	10	TPH	43' x 11' In-Line 29' x 26' L-shaped	5' x 10'	Customizable - 1/4" to 1 1/2"	-Known success in organics processing for anaerobic digestion -Flexibility in equipment layout - all parts are customizable -Machine parts are easily accesible for maintenance	-Potentially large footprint	$ 239,660.00
	Turbo Separator T42	16	TPH	41' x 14' In-Line 31' x 24' L-shaped	5' x 10'	Customizable - 1/4" to 1 1/2"	-Known success in organics processing for anaerobic digestion -Flexibility in equipment layout -Exceptional contamination handling	-Oversized for expected waste quantities -Potentially large footprint	$ 303,444.00
Vogelsang	Red Unit	30	TPH	8' x 8'	17" x 20.5" Opening	1/2"	-More compact unit than other processing equipment	-Small opening would limit size of incoming material and may require pre-processing -No depackaging mechanism	$ 218,019.68
JWC Environmental	Monster Industrial 7-SHRED-1H-3000	11	TPH	9.3' x 2.3'	30" x 21" Opening	1 1/4" x 7/8" x 7/8"	-Proven track record for waste maceration in wastewater treatment industry	-Shredder for cost comparison purposes - would need to fabricate other process components to sufficiently process material for digestion	$ 78,500.00

Appendix B

Capital Cost Estimate

BARTON & LOGUIDICE, D.P.C.
BUDGET ESTIMATE

PROJECT TITLE:
OHSWMA - Climate Smart Communities Grant Budget Estimate

LOCATION:
Utica, NY

B&L JOB NO.: 260.055.001

DATE PREPARED: July 28, 2016

ESTIMATED BY: BKP

ITEM NO.	ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
	Transfer Station Construction				
1	Mobilization/Demobilization	1	LS	$35,000.00	$35,000.00
2	Selective Bldg. Demolition	1	LS	$30,000.00	$30,000.00
3	9" Concrete Floor Slab	4500	SF	$30.00	$135,000.00
4	Foundation Walls	40	CY	$400.00	$16,000.00
5	Building	4500	SF	$125.00	$562,500.00
6	Steel Push Wall	1	LS	$36,500.00	$36,500.00
	TRANSFER STATION SUB-TOTAL				**$815,000.00**
	SSO Processing Equipment				
1	Scott Industries Model T42 Turbo Separator	1	LS	$350,000.00	$350,000.00
2	Installation & Piping	1	LS	$50,000.00	$50,000.00
3	Loading Equipment	1	LS	$150,000.00	$150,000.00
	SSO PROCESSING EQUIPMENT SUB-TOTAL				**$550,000.00**
	Sanitary Sewer Upgrades				
1	Furnish and Install 6" HDPE Forcemain - Open Cut	1400	LF	$60.00	$84,000.00
2	Pump Upgrades	1	LS	$30,000.00	$30,000.00
3	Paving and Restoration	1000	LF	$20.00	$20,000.00
4	Equalization Tank	2	EA	$25,000.00	$50,000.00
5	Manhole	3	EA	$50,000.00	$150,000.00
	SANITARY SEWER SUB-TOTAL				**$334,000.00**
	PROJECT SUB-TOTAL				**$1,699,000.00**
	Contingency (25%)				$425,000.00
	Engineering, Finance, Legal, and Administrative Fees (25%)				$531,000.00
	ESTIMATE OF PROBABLE CONSTRUCTION COST				**$2,655,000.00**
					$2,655,000.00

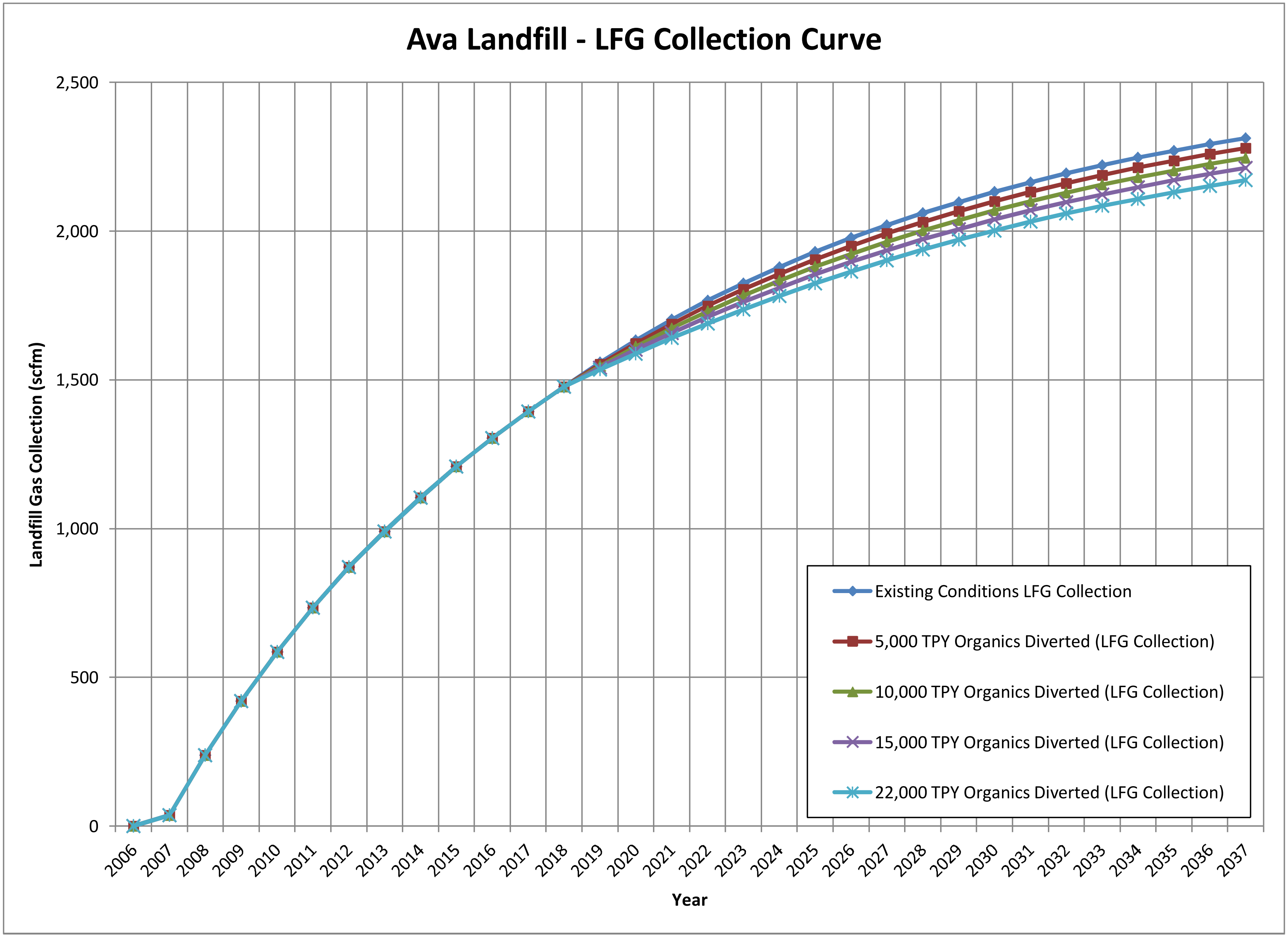
Appendix C

Tip Fee to Cover Costs

Organics Feasibility - Tip Fee Analysis				
Incoming SSO Tonnage	**5,000 tons**	**10,000 tons**	**15,000 tons**	**22,000 tons**
Capital Expense	$53,100.00	$53,100.00	$53,100.00	$53,100.00
Equipment O & M	$3,000.00	$3,000.00	$3,000.00	$3,000.00
Heat	$1,613.00	$1,613.00	$1,613.00	$1,613.00
Electricity	$14,989.01	$18,018.67	$20,896.84	$23,018.00
Water	$4,000.00	$4,000.00	$4,000.00	$4,000.00
OCSD Charges	$56,292.60	$112,594.30	$175,657.30	$247,447.20
Labor	$30,000.00	$30,000.00	$60,900.00	$60,900.00
Residue(10%)	$32,000.00	$64,000.00	$96,000.00	$140,800.00
Total Costs	$194,994.61	$286,325.97	$415,167.14	$533,878.20
Tip fee-Expense Only	$39.00	$28.63	$27.68	$24.27

Appendix D

Landfill Gas Generation Modeling



Ava Landfill - LFG Collection Curve
Landfill Gas Collection (scfm)
0
500
1,000
1,500
2,000
2,500
Year
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
Existing Conditions LFG Collection
5,000 TPY Organics Diverted (LFG Collection)
10,000 TPY Organics Diverted (LFG Collection)
15,000 TPY Organics Diverted (LFG Collection)
22,000 TPY Organics Diverted (LFG Collection)

Year	Existing Conditions[1]		5,000 TPY Organics Diversion		10,000 TPY Organics Diversion		15,000 TPY Organics Diversion		22,000 TPY Organics Diversion	
	Tonnage[2]	Peak LFG Generation	Tonnage	Peak LFG Generation	Tonnage	Peak LFG Generation	Tonnage	Peak LFG Generation	Tonnage	Peak LFG Generation
2018	264,325	1,970	259,325	1,970	254,325	1,970	249,325	1,970	242,325	1,970
2019	264,325	2,078	259,325	2,070	254,325	2,062	249,325	2,054	242,325	2,043
2020	264,325	2,177	259,325	2,163	254,325	2,149	249,325	2,134	242,325	2,114
2021	264,325	2,269	259,325	2,249	254,325	2,230	249,325	2,210	242,325	2,183
2022	264,325	2,354	259,325	2,330	254,325	2,306	249,325	2,282	242,325	2,248
2023	264,325	2,433	259,325	2,405	254,325	2,377	249,325	2,349	242,325	2,310
2024	264,325	2,505	259,325	2,474	254,325	2,443	249,325	2,412	242,325	2,369
2025	264,325	2,573	259,325	2,539	254,325	2,506	249,325	2,472	242,325	2,425
2026	264,325	2,635	259,325	2,599	254,325	2,564	249,325	2,528	242,325	2,478
2027	264,325	2,693	259,325	2,655	254,325	2,618	249,325	2,580	242,325	2,528
2028	264,325	2,746	259,325	2,707	254,325	2,668	249,325	2,629	242,325	2,575
2029	264,325	2,796	259,325	2,756	254,325	2,715	249,325	2,675	242,325	2,619
2030	264,325	2,842	259,325	2,800	254,325	2,759	249,325	2,718	242,325	2,660
2031	264,325	2,884	259,325	2,842	254,325	2,800	249,325	2,758	242,325	2,699
2032	264,325	2,924	259,325	2,881	254,325	2,838	249,325	2,796	242,325	2,736
2033	264,325	2,961	259,325	2,917	254,325	2,874	249,325	2,830	242,325	2,770
2034	264,325	2,995	259,325	2,951	254,325	2,907	249,325	2,863	242,325	2,802
2035	264,325	3,026	259,325	2,982	254,325	2,938	249,325	2,894	242,325	2,832
2036	264,325	3,056	259,325	3,011	254,325	2,966	249,325	2,922	242,325	2,859
2037	264,325	3,083	259,325	3,038	254,325	2,993	249,325	2,948	242,325	2,886

Notes:

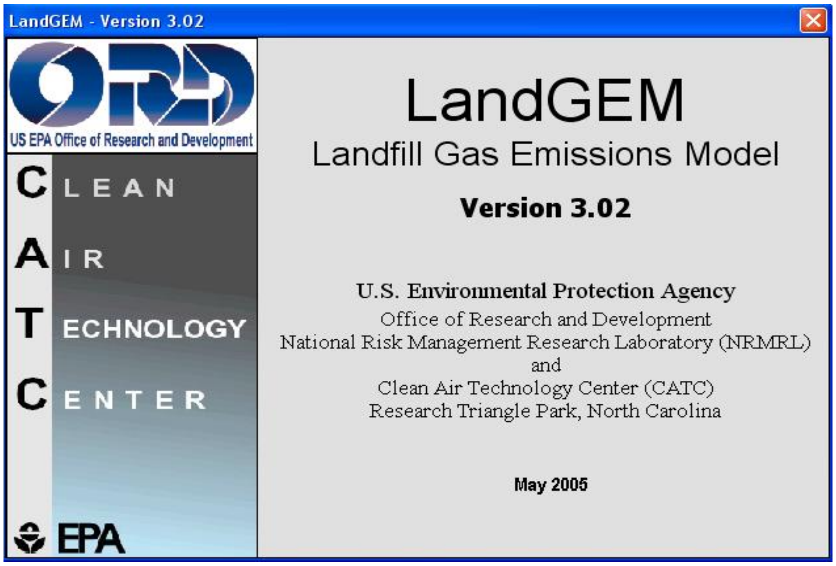
1. Degradable tonnages modeled include MSW, sewage sludge, and 50% of the C&D. Inerts comprising remaining tonnage not modeled.

2. Total tonnage represents the average waste received minus 3,300 TPY of sludge incinerator ash plus 9,500 TPY of sludge from the anaerobic digesters beginning in 2018.

OHSWMA Regional Landfill
EPA GHG Modeling Results - LFG Generation by Waste Category

Collection Eff. = **80%**

Year	MSW Waste Model (scfm)	C&D Waste Model (scfm)	Sewage Sludge Waste Model (scfm)	Total LFG Generated (scfm)	Total LFG Collected (scfm)
2006	0	0	0	0	0
2007	50	0	0	50	40
2008	303	11	5	319	255
2009	530	21	10	561	449
2010	736	30	14	780	624
2011	923	39	17	979	783
2012	1,094	47	20	1,160	928
2013	1,243	54	23	1,320	1,056
2014	1,385	63	24	1,473	1,178
2015	1,516	70	25	1,611	1,289
2016	1,635	77	27	1,739	1,391
2017	1,747	84	28	1,859	1,487
2018	1,851	90	29	1,970	1,576
2019	1,947	97	34	2,078	1,662
2020	2,036	103	39	2,177	1,742
2021	2,118	109	42	2,269	1,815
2022	2,194	114	46	2,354	1,883
2023	2,265	120	48	2,433	1,946
2024	2,330	125	50	2,505	2,004
2025	2,390	130	52	2,573	2,058
2026	2,446	135	54	2,635	2,108
2027	2,498	139	55	2,693	2,154
2028	2,546	144	56	2,746	2,197
2029	2,591	148	57	2,796	2,237
2030	2,632	152	58	2,842	2,273
2031	2,670	156	58	2,884	2,307
2032	2,705	160	59	2,924	2,339
2033	2,738	164	59	2,961	2,368
2034	2,768	167	60	2,995	2,396
2035	2,796	170	60	3,026	2,421
2036	2,822	174	60	3,056	2,444
2037	2,846	177	60	3,083	2,466
2038	2,868	180	60	3,108	2,487
2039	2,656	173	50	2,878	2,303
2040	2,459	166	42	2,666	2,133



Summary Report

Landfill Name or Identifier: OHSWMA Regionall Landfill

Date: Tuesday, January 24, 2017

Description/Comments:

About LandGEM:

First-Order Decomposition Rate Equation:

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

Where,

Q_{CH_4} = 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	**2006**	
Landfill Closure Year (with 80-year limit)	**2037**	
Actual Closure Year (without limit)	***2037***	
Have Model Calculate Closure Year?	**No**	
Waste Design Capacity		*short tons*

MODEL PARAMETERS

Methane Generation Rate, k	**0.077**	*$year^{-1}$*
Potential Methane Generation Capacity, L_o	**155**	*m^3/Mg*
NMOC Concentration	**46**	*ppmv as hexane*
Methane Content	**50**	*% by volume*

GASES / POLLUTANTS SELECTED

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

WASTE ACCEPTANCE RATES

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2006	32,223	35,445	0	0
2007	166,110	182,721	32,223	35,445
2008	161,881	178,069	198,332	218,166
2009	158,761	174,637	360,214	396,235
2010	156,210	171,831	518,975	570,872
2011	154,891	170,380	675,185	742,703
2012	149,239	164,163	830,075	913,083
2013	151,649	166,814	979,315	1,077,246
2014	150,779	165,857	1,130,964	1,244,060
2015	150,361	165,397	1,281,743	1,409,917
2016	150,930	166,023	1,432,103	1,575,314
2017	150,930	166,023	1,583,033	1,741,337
2018	150,930	166,023	1,733,963	1,907,360
2019	150,930	166,023	1,884,893	2,073,383
2020	150,930	166,023	2,035,823	2,239,406
2021	150,930	166,023	2,186,753	2,405,429
2022	150,930	166,023	2,337,683	2,571,452
2023	150,930	166,023	2,488,613	2,737,475
2024	150,930	166,023	2,639,543	2,903,498
2025	150,930	166,023	2,790,473	3,069,521
2026	150,930	166,023	2,941,403	3,235,544
2027	150,930	166,023	3,092,333	3,401,567
2028	150,930	166,023	3,243,263	3,567,590
2029	150,930	166,023	3,394,193	3,733,613
2030	150,930	166,023	3,545,123	3,899,636
2031	150,930	166,023	3,696,053	4,065,659
2032	150,930	166,023	3,846,983	4,231,682
2033	150,930	166,023	3,997,913	4,397,705
2034	150,930	166,023	4,148,843	4,563,728
2035	150,930	166,023	4,299,773	4,729,751
2036	150,930	166,023	4,450,703	4,895,774
2037	150,930	166,023	4,601,633	5,061,797
2038	0	0	4,752,563	5,227,820
2039	0	0	4,752,563	5,227,820
2040	0	0	4,752,563	5,227,820
2041	0	0	4,752,563	5,227,820
2042	0	0	4,752,563	5,227,820
2043	0	0	4,752,563	5,227,820
2044	0	0	4,752,563	5,227,820
2045	0	0	4,752,563	5,227,820

WASTE ACCEPTANCE RATES (Continued)

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	(short tons/year)	(Mg)	(short tons)
2046	0	0	4,752,563	5,227,820
2047	0	0	4,752,563	5,227,820
2048	0	0	4,752,563	5,227,820
2049	0	0	4,752,563	5,227,820
2050	0	0	4,752,563	5,227,820
2051	0	0	4,752,563	5,227,820
2052	0	0	4,752,563	5,227,820
2053	0	0	4,752,563	5,227,820
2054	0	0	4,752,563	5,227,820
2055	0	0	4,752,563	5,227,820
2056	0	0	4,752,563	5,227,820
2057	0	0	4,752,563	5,227,820
2058	0	0	4,752,563	5,227,820
2059	0	0	4,752,563	5,227,820
2060	0	0	4,752,563	5,227,820
2061	0	0	4,752,563	5,227,820
2062	0	0	4,752,563	5,227,820
2063	0	0	4,752,563	5,227,820
2064	0	0	4,752,563	5,227,820
2065	0	0	4,752,563	5,227,820
2066	0	0	4,752,563	5,227,820
2067	0	0	4,752,563	5,227,820
2068	0	0	4,752,563	5,227,820
2069	0	0	4,752,563	5,227,820
2070	0	0	4,752,563	5,227,820
2071	0	0	4,752,563	5,227,820
2072	0	0	4,752,563	5,227,820
2073	0	0	4,752,563	5,227,820
2074	0	0	4,752,563	5,227,820
2075	0	0	4,752,563	5,227,820
2076	0	0	4,752,563	5,227,820
2077	0	0	4,752,563	5,227,820
2078	0	0	4,752,563	5,227,820
2079	0	0	4,752,563	5,227,820
2080	0	0	4,752,563	5,227,820
2081	0	0	4,752,563	5,227,820
2082	0	0	4,752,563	5,227,820
2083	0	0	4,752,563	5,227,820
2084	0	0	4,752,563	5,227,820
2085	0	0	4,752,563	5,227,820

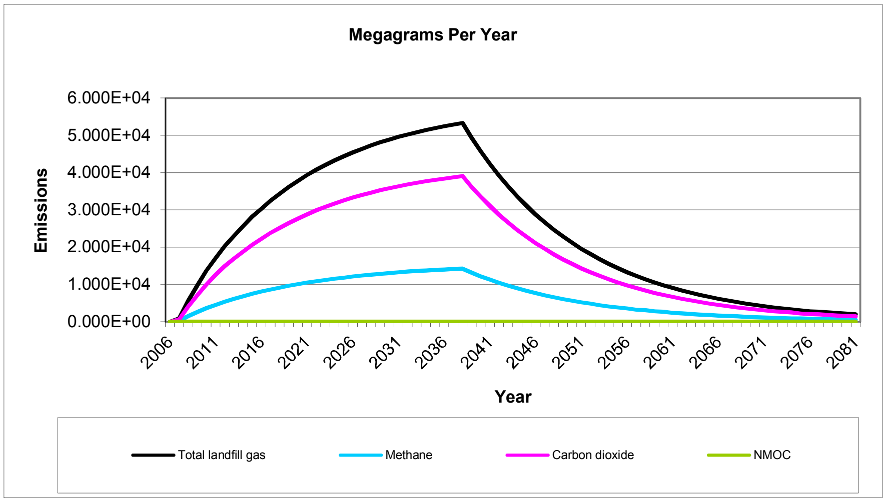
Pollutant Parameters

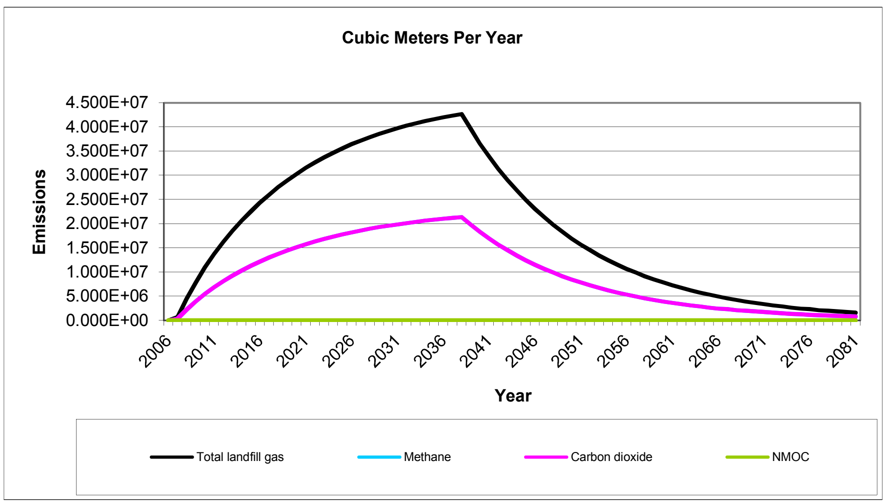
	Gas / Pollutant Default Parameters:			User-specified Pollutant Parameters:	
	Compound	Concentration (*ppmv*)	Molecular Weight	Concentration (*ppmv*)	Molecular Weight
Gases	Total landfill gas		0.00		
	Methane		16.04		
	Carbon dioxide		44.01		
	NMOC	4,000	86.18		
Pollutants	1,1,1-Trichloroethane (methyl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

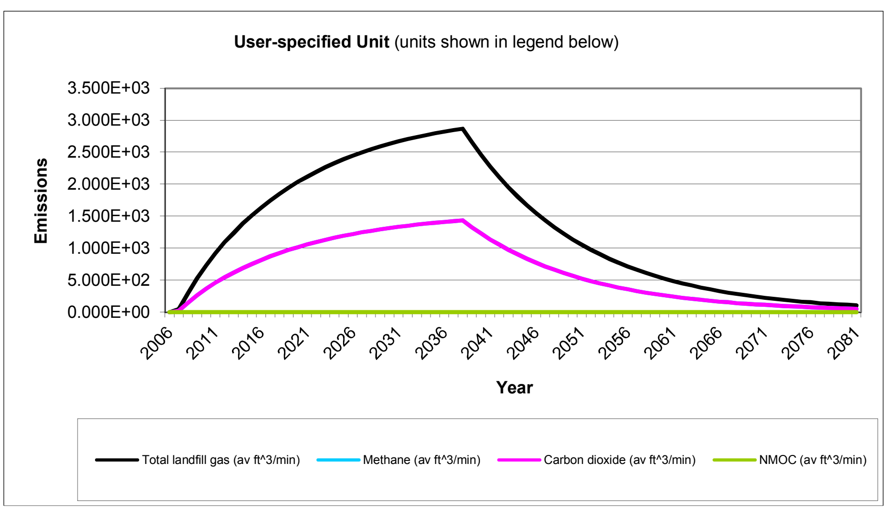
Pollutant Parameters (Continued)

	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
6.000E+04
5.000E+04
4.000E+04
3.000E+04
2.000E+04
1.000E+04
0.000E+00
Emissions
2006 2011 2016 2021 2026 2031 2036 2041 2046 2051 2056 2061 2066 2071 2076 2081
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


Cubic Meters Per Year
4.500E+07
4.000E+07
3.500E+07
3.000E+07
2.500E+07
2.000E+07
1.500E+07
1.000E+07
5.000E+06
0.000E+00
Emissions
2006 2011 2016 2021 2026 2031 2036 2041 2046 2051 2056 2061 2066 2071 2076 2081
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


User-specified Unit (units shown in legend below)
3.500E+03
3.000E+03
2.500E+03
2.000E+03
1.500E+03
1.000E+03
5.000E+02
0.000E+00
Emissions
2006 2011 2016 2021 2026 2031 2036 2041 2046 2051 2056 2061 2066 2071 2076 2081
Year
Total landfill gas (av ft^3/min)
Methane (av ft^3/min)
Carbon dioxide (av ft^3/min)
NMOC (av ft^3/min)

Results

Year	Total landfill gas			Methane		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
2006	0	0	0	0	0	0
2007	9.251E+02	7.408E+05	4.977E+01	2.471E+02	3.704E+05	2.489E+01
2008	5.625E+03	4.504E+06	3.027E+02	1.503E+03	2.252E+06	1.513E+02
2009	9.856E+03	7.892E+06	5.303E+02	2.633E+03	3.946E+06	2.651E+02
2010	1.368E+04	1.096E+07	7.362E+02	3.655E+03	5.478E+06	3.681E+02
2011	1.715E+04	1.374E+07	9.229E+02	4.582E+03	6.868E+06	4.615E+02
2012	2.033E+04	1.628E+07	1.094E+03	5.430E+03	8.139E+06	5.469E+02
2013	2.311E+04	1.850E+07	1.243E+03	6.172E+03	9.251E+06	6.216E+02
2014	2.575E+04	2.062E+07	1.385E+03	6.878E+03	1.031E+07	6.927E+02
2015	2.817E+04	2.256E+07	1.516E+03	7.524E+03	1.128E+07	7.578E+02
2016	3.040E+04	2.434E+07	1.635E+03	8.119E+03	1.217E+07	8.177E+02
2017	3.248E+04	2.601E+07	1.747E+03	8.675E+03	1.300E+07	8.737E+02
2018	3.440E+04	2.755E+07	1.851E+03	9.190E+03	1.377E+07	9.255E+02
2019	3.619E+04	2.898E+07	1.947E+03	9.666E+03	1.449E+07	9.735E+02
2020	3.784E+04	3.030E+07	2.036E+03	1.011E+04	1.515E+07	1.018E+03
2021	3.937E+04	3.152E+07	2.118E+03	1.052E+04	1.576E+07	1.059E+03
2022	4.078E+04	3.266E+07	2.194E+03	1.089E+04	1.633E+07	1.097E+03
2023	4.209E+04	3.371E+07	2.265E+03	1.124E+04	1.685E+07	1.132E+03
2024	4.331E+04	3.468E+07	2.330E+03	1.157E+04	1.734E+07	1.165E+03
2025	4.443E+04	3.558E+07	2.390E+03	1.187E+04	1.779E+07	1.195E+03
2026	4.547E+04	3.641E+07	2.446E+03	1.215E+04	1.821E+07	1.223E+03
2027	4.643E+04	3.718E+07	2.498E+03	1.240E+04	1.859E+07	1.249E+03
2028	4.733E+04	3.790E+07	2.546E+03	1.264E+04	1.895E+07	1.273E+03
2029	4.815E+04	3.856E+07	2.591E+03	1.286E+04	1.928E+07	1.295E+03
2030	4.892E+04	3.917E+07	2.632E+03	1.307E+04	1.958E+07	1.316E+03
2031	4.962E+04	3.974E+07	2.670E+03	1.325E+04	1.987E+07	1.335E+03
2032	5.028E+04	4.026E+07	2.705E+03	1.343E+04	2.013E+07	1.353E+03
2033	5.089E+04	4.075E+07	2.738E+03	1.359E+04	2.037E+07	1.369E+03
2034	5.145E+04	4.120E+07	2.768E+03	1.374E+04	2.060E+07	1.384E+03
2035	5.197E+04	4.161E+07	2.796E+03	1.388E+04	2.081E+07	1.398E+03
2036	5.245E+04	4.200E+07	2.822E+03	1.401E+04	2.100E+07	1.411E+03
2037	5.289E+04	4.236E+07	2.846E+03	1.413E+04	2.118E+07	1.423E+03
2038	5.331E+04	4.269E+07	2.868E+03	1.424E+04	2.134E+07	1.434E+03
2039	4.936E+04	3.952E+07	2.656E+03	1.318E+04	1.976E+07	1.328E+03
2040	4.570E+04	3.659E+07	2.459E+03	1.221E+04	1.830E+07	1.229E+03
2041	4.231E+04	3.388E+07	2.277E+03	1.130E+04	1.694E+07	1.138E+03
2042	3.918E+04	3.137E+07	2.108E+03	1.046E+04	1.569E+07	1.054E+03
2043	3.627E+04	2.905E+07	1.952E+03	9.689E+03	1.452E+07	9.758E+02
2044	3.359E+04	2.689E+07	1.807E+03	8.971E+03	1.345E+07	9.035E+02
2045	3.110E+04	2.490E+07	1.673E+03	8.306E+03	1.245E+07	8.365E+02
2046	2.879E+04	2.305E+07	1.549E+03	7.691E+03	1.153E+07	7.745E+02
2047	2.666E+04	2.135E+07	1.434E+03	7.121E+03	1.067E+07	7.171E+02
2048	2.468E+04	1.976E+07	1.328E+03	6.593E+03	9.882E+06	6.640E+02
2049	2.285E+04	1.830E+07	1.230E+03	6.104E+03	9.150E+06	6.148E+02
2050	2.116E+04	1.694E+07	1.138E+03	5.652E+03	8.472E+06	5.692E+02
2051	1.959E+04	1.569E+07	1.054E+03	5.233E+03	7.844E+06	5.270E+02
2052	1.814E+04	1.453E+07	9.759E+02	4.845E+03	7.263E+06	4.880E+02
2053	1.680E+04	1.345E+07	9.036E+02	4.486E+03	6.724E+06	4.518E+02
2054	1.555E+04	1.245E+07	8.366E+02	4.154E+03	6.226E+06	4.183E+02
2055	1.440E+04	1.153E+07	7.746E+02	3.846E+03	5.765E+06	3.873E+02

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2056	1.333E+04	1.067E+07	7.172E+02	3.561E+03	5.337E+06	3.586E+02
2057	1.234E+04	9.884E+06	6.641E+02	3.297E+03	4.942E+06	3.320E+02
2058	1.143E+04	9.151E+06	6.149E+02	3.053E+03	4.576E+06	3.074E+02
2059	1.058E+04	8.473E+06	5.693E+02	2.826E+03	4.236E+06	2.846E+02
2060	9.797E+03	7.845E+06	5.271E+02	2.617E+03	3.923E+06	2.636E+02
2061	9.071E+03	7.264E+06	4.880E+02	2.423E+03	3.632E+06	2.440E+02
2062	8.399E+03	6.725E+06	4.519E+02	2.243E+03	3.363E+06	2.259E+02
2063	7.776E+03	6.227E+06	4.184E+02	2.077E+03	3.113E+06	2.092E+02
2064	7.200E+03	5.765E+06	3.874E+02	1.923E+03	2.883E+06	1.937E+02
2065	6.666E+03	5.338E+06	3.587E+02	1.781E+03	2.669E+06	1.793E+02
2066	6.172E+03	4.943E+06	3.321E+02	1.649E+03	2.471E+06	1.660E+02
2067	5.715E+03	4.576E+06	3.075E+02	1.527E+03	2.288E+06	1.537E+02
2068	5.291E+03	4.237E+06	2.847E+02	1.413E+03	2.119E+06	1.423E+02
2069	4.899E+03	3.923E+06	2.636E+02	1.309E+03	1.962E+06	1.318E+02
2070	4.536E+03	3.632E+06	2.441E+02	1.212E+03	1.816E+06	1.220E+02
2071	4.200E+03	3.363E+06	2.260E+02	1.122E+03	1.682E+06	1.130E+02
2072	3.889E+03	3.114E+06	2.092E+02	1.039E+03	1.557E+06	1.046E+02
2073	3.601E+03	2.883E+06	1.937E+02	9.617E+02	1.442E+06	9.686E+01
2074	3.334E+03	2.669E+06	1.794E+02	8.905E+02	1.335E+06	8.968E+01
2075	3.087E+03	2.472E+06	1.661E+02	8.245E+02	1.236E+06	8.303E+01
2076	2.858E+03	2.288E+06	1.538E+02	7.634E+02	1.144E+06	7.688E+01
2077	2.646E+03	2.119E+06	1.424E+02	7.068E+02	1.059E+06	7.118E+01
2078	2.450E+03	1.962E+06	1.318E+02	6.544E+02	9.809E+05	6.591E+01
2079	2.268E+03	1.816E+06	1.220E+02	6.059E+02	9.082E+05	6.102E+01
2080	2.100E+03	1.682E+06	1.130E+02	5.610E+02	8.409E+05	5.650E+01
2081	1.945E+03	1.557E+06	1.046E+02	5.194E+02	7.786E+05	5.231E+01
2082	1.801E+03	1.442E+06	9.687E+01	4.809E+02	7.209E+05	4.844E+01
2083	1.667E+03	1.335E+06	8.969E+01	4.453E+02	6.675E+05	4.485E+01
2084	1.544E+03	1.236E+06	8.305E+01	4.123E+02	6.180E+05	4.152E+01
2085	1.429E+03	1.144E+06	7.689E+01	3.817E+02	5.722E+05	3.845E+01
2086	1.323E+03	1.060E+06	7.119E+01	3.535E+02	5.298E+05	3.560E+01
2087	1.225E+03	9.811E+05	6.592E+01	3.273E+02	4.905E+05	3.296E+01
2088	1.134E+03	9.084E+05	6.103E+01	3.030E+02	4.542E+05	3.052E+01
2089	1.050E+03	8.410E+05	5.651E+01	2.805E+02	4.205E+05	2.825E+01
2090	9.725E+02	7.787E+05	5.232E+01	2.598E+02	3.894E+05	2.616E+01
2091	9.004E+02	7.210E+05	4.844E+01	2.405E+02	3.605E+05	2.422E+01
2092	8.337E+02	6.676E+05	4.485E+01	2.227E+02	3.338E+05	2.243E+01
2093	7.719E+02	6.181E+05	4.153E+01	2.062E+02	3.090E+05	2.076E+01
2094	7.147E+02	5.723E+05	3.845E+01	1.909E+02	2.861E+05	1.923E+01
2095	6.617E+02	5.299E+05	3.560E+01	1.768E+02	2.649E+05	1.780E+01
2096	6.127E+02	4.906E+05	3.296E+01	1.637E+02	2.453E+05	1.648E+01
2097	5.673E+02	4.542E+05	3.052E+01	1.515E+02	2.271E+05	1.526E+01
2098	5.252E+02	4.206E+05	2.826E+01	1.403E+02	2.103E+05	1.413E+01
2099	4.863E+02	3.894E+05	2.616E+01	1.299E+02	1.947E+05	1.308E+01
2100	4.503E+02	3.606E+05	2.423E+01	1.203E+02	1.803E+05	1.211E+01
2101	4.169E+02	3.338E+05	2.243E+01	1.114E+02	1.669E+05	1.122E+01
2102	3.860E+02	3.091E+05	2.077E+01	1.031E+02	1.545E+05	1.038E+01
2103	3.574E+02	2.862E+05	1.923E+01	9.546E+01	1.431E+05	9.614E+00
2104	3.309E+02	2.650E+05	1.780E+01	8.839E+01	1.325E+05	8.902E+00
2105	3.064E+02	2.453E+05	1.648E+01	8.184E+01	1.227E+05	8.242E+00
2106	2.837E+02	2.272E+05	1.526E+01	7.577E+01	1.136E+05	7.631E+00

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
2107	2.627E+02	2.103E+05	1.413E+01	7.016E+01	1.052E+05	7.066E+00
2108	2.432E+02	1.947E+05	1.308E+01	6.496E+01	9.737E+04	6.542E+00
2109	2.252E+02	1.803E+05	1.211E+01	6.014E+01	9.015E+04	6.057E+00
2110	2.085E+02	1.669E+05	1.122E+01	5.569E+01	8.347E+04	5.608E+00
2111	1.930E+02	1.546E+05	1.039E+01	5.156E+01	7.728E+04	5.193E+00
2112	1.787E+02	1.431E+05	9.616E+00	4.774E+01	7.156E+04	4.808E+00
2113	1.655E+02	1.325E+05	8.903E+00	4.420E+01	6.625E+04	4.452E+00
2114	1.532E+02	1.227E+05	8.243E+00	4.093E+01	6.134E+04	4.122E+00
2115	1.419E+02	1.136E+05	7.632E+00	3.789E+01	5.680E+04	3.816E+00
2116	1.313E+02	1.052E+05	7.067E+00	3.508E+01	5.259E+04	3.533E+00
2117	1.216E+02	9.738E+04	6.543E+00	3.248E+01	4.869E+04	3.272E+00
2118	1.126E+02	9.016E+04	6.058E+00	3.008E+01	4.508E+04	3.029E+00
2119	1.043E+02	8.348E+04	5.609E+00	2.785E+01	4.174E+04	2.805E+00
2120	9.653E+01	7.730E+04	5.193E+00	2.578E+01	3.865E+04	2.597E+00
2121	8.937E+01	7.157E+04	4.809E+00	2.387E+01	3.578E+04	2.404E+00
2122	8.275E+01	6.626E+04	4.452E+00	2.210E+01	3.313E+04	2.226E+00
2123	7.662E+01	6.135E+04	4.122E+00	2.047E+01	3.068E+04	2.061E+00
2124	7.094E+01	5.681E+04	3.817E+00	1.895E+01	2.840E+04	1.908E+00
2125	6.568E+01	5.260E+04	3.534E+00	1.754E+01	2.630E+04	1.767E+00
2126	6.082E+01	4.870E+04	3.272E+00	1.624E+01	2.435E+04	1.636E+00
2127	5.631E+01	4.509E+04	3.030E+00	1.504E+01	2.254E+04	1.515E+00
2128	5.214E+01	4.175E+04	2.805E+00	1.393E+01	2.087E+04	1.402E+00
2129	4.827E+01	3.865E+04	2.597E+00	1.289E+01	1.933E+04	1.299E+00
2130	4.469E+01	3.579E+04	2.405E+00	1.194E+01	1.789E+04	1.202E+00
2131	4.138E+01	3.314E+04	2.226E+00	1.105E+01	1.657E+04	1.113E+00
2132	3.831E+01	3.068E+04	2.061E+00	1.023E+01	1.534E+04	1.031E+00
2133	3.548E+01	2.841E+04	1.909E+00	9.476E+00	1.420E+04	9.543E-01
2134	3.285E+01	2.630E+04	1.767E+00	8.774E+00	1.315E+04	8.836E-01
2135	3.041E+01	2.435E+04	1.636E+00	8.123E+00	1.218E+04	8.181E-01
2136	2.816E+01	2.255E+04	1.515E+00	7.521E+00	1.127E+04	7.575E-01
2137	2.607E+01	2.088E+04	1.403E+00	6.964E+00	1.044E+04	7.014E-01
2138	2.414E+01	1.933E+04	1.299E+00	6.448E+00	9.665E+03	6.494E-01
2139	2.235E+01	1.790E+04	1.203E+00	5.970E+00	8.949E+03	6.013E-01
2140	2.069E+01	1.657E+04	1.113E+00	5.528E+00	8.285E+03	5.567E-01
2141	1.916E+01	1.534E+04	1.031E+00	5.118E+00	7.671E+03	5.154E-01
2142	1.774E+01	1.421E+04	9.545E-01	4.739E+00	7.103E+03	4.772E-01
2143	1.643E+01	1.315E+04	8.837E-01	4.387E+00	6.576E+03	4.419E-01
2144	1.521E+01	1.218E+04	8.182E-01	4.062E+00	6.089E+03	4.091E-01
2145	1.408E+01	1.128E+04	7.576E-01	3.761E+00	5.638E+03	3.788E-01
2146	1.304E+01	1.044E+04	7.015E-01	3.482E+00	5.220E+03	3.507E-01

Results (Continued)

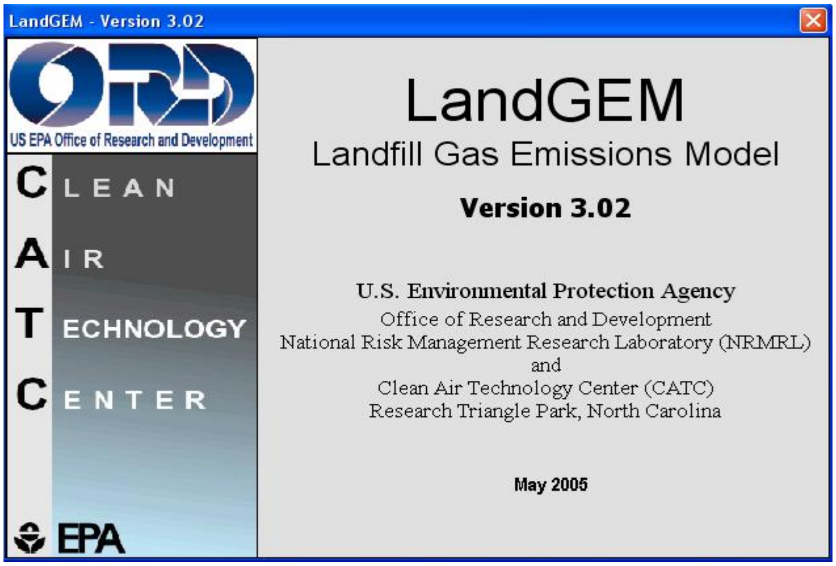
Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2006	0	0	0	0	0	0
2007	6.780E+02	3.704E+05	2.489E+01	1.221E-01	3.407E+01	2.289E-03
2008	4.123E+03	2.252E+06	1.513E+02	7.427E-01	2.072E+02	1.392E-02
2009	7.223E+03	3.946E+06	2.651E+02	1.301E+00	3.630E+02	2.439E-02
2010	1.003E+04	5.478E+06	3.681E+02	1.807E+00	5.040E+02	3.386E-02
2011	1.257E+04	6.868E+06	4.615E+02	2.265E+00	6.318E+02	4.245E-02
2012	1.490E+04	8.139E+06	5.469E+02	2.684E+00	7.488E+02	5.031E-02
2013	1.693E+04	9.251E+06	6.216E+02	3.051E+00	8.511E+02	5.719E-02
2014	1.887E+04	1.031E+07	6.927E+02	3.400E+00	9.484E+02	6.372E-02
2015	2.064E+04	1.128E+07	7.578E+02	3.719E+00	1.038E+03	6.971E-02
2016	2.228E+04	1.217E+07	8.177E+02	4.013E+00	1.120E+03	7.523E-02
2017	2.380E+04	1.300E+07	8.737E+02	4.288E+00	1.196E+03	8.038E-02
2018	2.521E+04	1.377E+07	9.255E+02	4.542E+00	1.267E+03	8.515E-02
2019	2.652E+04	1.449E+07	9.735E+02	4.778E+00	1.333E+03	8.956E-02
2020	2.773E+04	1.515E+07	1.018E+03	4.996E+00	1.394E+03	9.365E-02
2021	2.885E+04	1.576E+07	1.059E+03	5.198E+00	1.450E+03	9.743E-02
2022	2.989E+04	1.633E+07	1.097E+03	5.385E+00	1.502E+03	1.009E-01
2023	3.085E+04	1.685E+07	1.132E+03	5.558E+00	1.550E+03	1.042E-01
2024	3.174E+04	1.734E+07	1.165E+03	5.718E+00	1.595E+03	1.072E-01
2025	3.256E+04	1.779E+07	1.195E+03	5.866E+00	1.637E+03	1.100E-01
2026	3.332E+04	1.821E+07	1.223E+03	6.004E+00	1.675E+03	1.125E-01
2027	3.403E+04	1.859E+07	1.249E+03	6.131E+00	1.710E+03	1.149E-01
2028	3.468E+04	1.895E+07	1.273E+03	6.248E+00	1.743E+03	1.171E-01
2029	3.529E+04	1.928E+07	1.295E+03	6.357E+00	1.774E+03	1.192E-01
2030	3.585E+04	1.958E+07	1.316E+03	6.458E+00	1.802E+03	1.211E-01
2031	3.637E+04	1.987E+07	1.335E+03	6.552E+00	1.828E+03	1.228E-01
2032	3.685E+04	2.013E+07	1.353E+03	6.638E+00	1.852E+03	1.244E-01
2033	3.729E+04	2.037E+07	1.369E+03	6.719E+00	1.874E+03	1.259E-01
2034	3.770E+04	2.060E+07	1.384E+03	6.793E+00	1.895E+03	1.273E-01
2035	3.809E+04	2.081E+07	1.398E+03	6.861E+00	1.914E+03	1.286E-01
2036	3.844E+04	2.100E+07	1.411E+03	6.925E+00	1.932E+03	1.298E-01
2037	3.877E+04	2.118E+07	1.423E+03	6.984E+00	1.948E+03	1.309E-01
2038	3.907E+04	2.134E+07	1.434E+03	7.038E+00	1.964E+03	1.319E-01
2039	3.617E+04	1.976E+07	1.328E+03	6.517E+00	1.818E+03	1.222E-01
2040	3.349E+04	1.830E+07	1.229E+03	6.034E+00	1.683E+03	1.131E-01
2041	3.101E+04	1.694E+07	1.138E+03	5.587E+00	1.559E+03	1.047E-01
2042	2.871E+04	1.569E+07	1.054E+03	5.173E+00	1.443E+03	9.696E-02
2043	2.658E+04	1.452E+07	9.758E+02	4.789E+00	1.336E+03	8.977E-02
2044	2.461E+04	1.345E+07	9.035E+02	4.434E+00	1.237E+03	8.312E-02
2045	2.279E+04	1.245E+07	8.365E+02	4.106E+00	1.145E+03	7.696E-02
2046	2.110E+04	1.153E+07	7.745E+02	3.801E+00	1.061E+03	7.126E-02
2047	1.954E+04	1.067E+07	7.171E+02	3.520E+00	9.819E+02	6.598E-02
2048	1.809E+04	9.882E+06	6.640E+02	3.259E+00	9.092E+02	6.109E-02
2049	1.675E+04	9.150E+06	6.148E+02	3.017E+00	8.418E+02	5.656E-02
2050	1.551E+04	8.472E+06	5.692E+02	2.794E+00	7.794E+02	5.237E-02
2051	1.436E+04	7.844E+06	5.270E+02	2.587E+00	7.216E+02	4.849E-02
2052	1.329E+04	7.263E+06	4.880E+02	2.395E+00	6.682E+02	4.489E-02
2053	1.231E+04	6.724E+06	4.518E+02	2.217E+00	6.186E+02	4.157E-02
2054	1.140E+04	6.226E+06	4.183E+02	2.053E+00	5.728E+02	3.849E-02
2055	1.055E+04	5.765E+06	3.873E+02	1.901E+00	5.303E+02	3.563E-02

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
2056	9.770E+03	5.337E+06	3.586E+02	1.760E+00	4.910E+02	3.299E-02
2057	9.046E+03	4.942E+06	3.320E+02	1.630E+00	4.546E+02	3.055E-02
2058	8.376E+03	4.576E+06	3.074E+02	1.509E+00	4.210E+02	2.828E-02
2059	7.755E+03	4.236E+06	2.846E+02	1.397E+00	3.898E+02	2.619E-02
2060	7.180E+03	3.923E+06	2.636E+02	1.294E+00	3.609E+02	2.425E-02
2061	6.648E+03	3.632E+06	2.440E+02	1.198E+00	3.341E+02	2.245E-02
2062	6.155E+03	3.363E+06	2.259E+02	1.109E+00	3.094E+02	2.079E-02
2063	5.699E+03	3.113E+06	2.092E+02	1.027E+00	2.864E+02	1.925E-02
2064	5.277E+03	2.883E+06	1.937E+02	9.506E-01	2.652E+02	1.782E-02
2065	4.886E+03	2.669E+06	1.793E+02	8.802E-01	2.456E+02	1.650E-02
2066	4.524E+03	2.471E+06	1.660E+02	8.150E-01	2.274E+02	1.528E-02
2067	4.188E+03	2.288E+06	1.537E+02	7.546E-01	2.105E+02	1.414E-02
2068	3.878E+03	2.119E+06	1.423E+02	6.986E-01	1.949E+02	1.310E-02
2069	3.591E+03	1.962E+06	1.318E+02	6.469E-01	1.805E+02	1.213E-02
2070	3.325E+03	1.816E+06	1.220E+02	5.989E-01	1.671E+02	1.123E-02
2071	3.078E+03	1.682E+06	1.130E+02	5.545E-01	1.547E+02	1.039E-02
2072	2.850E+03	1.557E+06	1.046E+02	5.134E-01	1.432E+02	9.624E-03
2073	2.639E+03	1.442E+06	9.686E+01	4.754E-01	1.326E+02	8.911E-03
2074	2.443E+03	1.335E+06	8.968E+01	4.402E-01	1.228E+02	8.251E-03
2075	2.262E+03	1.236E+06	8.303E+01	4.075E-01	1.137E+02	7.639E-03
2076	2.095E+03	1.144E+06	7.688E+01	3.773E-01	1.053E+02	7.073E-03
2077	1.939E+03	1.059E+06	7.118E+01	3.494E-01	9.747E+01	6.549E-03
2078	1.796E+03	9.809E+05	6.591E+01	3.235E-01	9.024E+01	6.064E-03
2079	1.662E+03	9.082E+05	6.102E+01	2.995E-01	8.356E+01	5.614E-03
2080	1.539E+03	8.409E+05	5.650E+01	2.773E-01	7.736E+01	5.198E-03
2081	1.425E+03	7.786E+05	5.231E+01	2.568E-01	7.163E+01	4.813E-03
2082	1.320E+03	7.209E+05	4.844E+01	2.377E-01	6.632E+01	4.456E-03
2083	1.222E+03	6.675E+05	4.485E+01	2.201E-01	6.141E+01	4.126E-03
2084	1.131E+03	6.180E+05	4.152E+01	2.038E-01	5.686E+01	3.820E-03
2085	1.047E+03	5.722E+05	3.845E+01	1.887E-01	5.264E+01	3.537E-03
2086	9.698E+02	5.298E+05	3.560E+01	1.747E-01	4.874E+01	3.275E-03
2087	8.979E+02	4.905E+05	3.296E+01	1.618E-01	4.513E+01	3.032E-03
2088	8.314E+02	4.542E+05	3.052E+01	1.498E-01	4.178E+01	2.807E-03
2089	7.698E+02	4.205E+05	2.825E+01	1.387E-01	3.869E+01	2.599E-03
2090	7.127E+02	3.894E+05	2.616E+01	1.284E-01	3.582E+01	2.407E-03
2091	6.599E+02	3.605E+05	2.422E+01	1.189E-01	3.317E+01	2.228E-03
2092	6.110E+02	3.338E+05	2.243E+01	1.101E-01	3.071E+01	2.063E-03
2093	5.657E+02	3.090E+05	2.076E+01	1.019E-01	2.843E+01	1.910E-03
2094	5.238E+02	2.861E+05	1.923E+01	9.436E-02	2.633E+01	1.769E-03
2095	4.850E+02	2.649E+05	1.780E+01	8.737E-02	2.437E+01	1.638E-03
2096	4.490E+02	2.453E+05	1.648E+01	8.089E-02	2.257E+01	1.516E-03
2097	4.157E+02	2.271E+05	1.526E+01	7.490E-02	2.090E+01	1.404E-03
2098	3.849E+02	2.103E+05	1.413E+01	6.935E-02	1.935E+01	1.300E-03
2099	3.564E+02	1.947E+05	1.308E+01	6.421E-02	1.791E+01	1.204E-03
2100	3.300E+02	1.803E+05	1.211E+01	5.945E-02	1.659E+01	1.114E-03
2101	3.055E+02	1.669E+05	1.122E+01	5.504E-02	1.536E+01	1.032E-03
2102	2.829E+02	1.545E+05	1.038E+01	5.096E-02	1.422E+01	9.553E-04
2103	2.619E+02	1.431E+05	9.614E+00	4.719E-02	1.316E+01	8.845E-04
2104	2.425E+02	1.325E+05	8.902E+00	4.369E-02	1.219E+01	8.190E-04
2105	2.245E+02	1.227E+05	8.242E+00	4.045E-02	1.129E+01	7.583E-04
2106	2.079E+02	1.136E+05	7.631E+00	3.745E-02	1.045E+01	7.021E-04

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2107	1.925E+02	1.052E+05	7.066E+00	3.468E-02	9.675E+00	6.500E-04
2108	1.782E+02	9.737E+04	6.542E+00	3.211E-02	8.958E+00	6.019E-04
2109	1.650E+02	9.015E+04	6.057E+00	2.973E-02	8.294E+00	5.573E-04
2110	1.528E+02	8.347E+04	5.608E+00	2.753E-02	7.679E+00	5.160E-04
2111	1.415E+02	7.728E+04	5.193E+00	2.549E-02	7.110E+00	4.777E-04
2112	1.310E+02	7.156E+04	4.808E+00	2.360E-02	6.583E+00	4.423E-04
2113	1.213E+02	6.625E+04	4.452E+00	2.185E-02	6.095E+00	4.095E-04
2114	1.123E+02	6.134E+04	4.122E+00	2.023E-02	5.644E+00	3.792E-04
2115	1.040E+02	5.680E+04	3.816E+00	1.873E-02	5.225E+00	3.511E-04
2116	9.626E+01	5.259E+04	3.533E+00	1.734E-02	4.838E+00	3.251E-04
2117	8.913E+01	4.869E+04	3.272E+00	1.606E-02	4.480E+00	3.010E-04
2118	8.252E+01	4.508E+04	3.029E+00	1.487E-02	4.148E+00	2.787E-04
2119	7.641E+01	4.174E+04	2.805E+00	1.377E-02	3.840E+00	2.580E-04
2120	7.074E+01	3.865E+04	2.597E+00	1.274E-02	3.556E+00	2.389E-04
2121	6.550E+01	3.578E+04	2.404E+00	1.180E-02	3.292E+00	2.212E-04
2122	6.065E+01	3.313E+04	2.226E+00	1.093E-02	3.048E+00	2.048E-04
2123	5.615E+01	3.068E+04	2.061E+00	1.012E-02	2.822E+00	1.896E-04
2124	5.199E+01	2.840E+04	1.908E+00	9.366E-03	2.613E+00	1.756E-04
2125	4.814E+01	2.630E+04	1.767E+00	8.672E-03	2.419E+00	1.626E-04
2126	4.457E+01	2.435E+04	1.636E+00	8.030E-03	2.240E+00	1.505E-04
2127	4.127E+01	2.254E+04	1.515E+00	7.434E-03	2.074E+00	1.394E-04
2128	3.821E+01	2.087E+04	1.402E+00	6.884E-03	1.920E+00	1.290E-04
2129	3.538E+01	1.933E+04	1.299E+00	6.373E-03	1.778E+00	1.195E-04
2130	3.276E+01	1.789E+04	1.202E+00	5.901E-03	1.646E+00	1.106E-04
2131	3.033E+01	1.657E+04	1.113E+00	5.464E-03	1.524E+00	1.024E-04
2132	2.808E+01	1.534E+04	1.031E+00	5.059E-03	1.411E+00	9.483E-05
2133	2.600E+01	1.420E+04	9.543E-01	4.684E-03	1.307E+00	8.780E-05
2134	2.407E+01	1.315E+04	8.836E-01	4.337E-03	1.210E+00	8.129E-05
2135	2.229E+01	1.218E+04	8.181E-01	4.015E-03	1.120E+00	7.527E-05
2136	2.064E+01	1.127E+04	7.575E-01	3.718E-03	1.037E+00	6.969E-05
2137	1.911E+01	1.044E+04	7.014E-01	3.442E-03	9.603E-01	6.452E-05
2138	1.769E+01	9.665E+03	6.494E-01	3.187E-03	8.892E-01	5.974E-05
2139	1.638E+01	8.949E+03	6.013E-01	2.951E-03	8.233E-01	5.532E-05
2140	1.517E+01	8.285E+03	5.567E-01	2.732E-03	7.623E-01	5.122E-05
2141	1.404E+01	7.671E+03	5.154E-01	2.530E-03	7.058E-01	4.742E-05
2142	1.300E+01	7.103E+03	4.772E-01	2.342E-03	6.535E-01	4.391E-05
2143	1.204E+01	6.576E+03	4.419E-01	2.169E-03	6.050E-01	4.065E-05
2144	1.115E+01	6.089E+03	4.091E-01	2.008E-03	5.602E-01	3.764E-05
2145	1.032E+01	5.638E+03	3.788E-01	1.859E-03	5.187E-01	3.485E-05
2146	9.555E+00	5.220E+03	3.507E-01	1.721E-03	4.802E-01	3.227E-05



Summary Report

Landfill Name or Identifier: OHSWMA Regional Landfill

Date: Tuesday, January 24, 2017

Description/Comments:

About LandGEM:

First-Order Decomposition Rate Equation:

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

Where,

Q_{CH4} = annual methane generation in the year of the calculation *(m^3/year)*

i = 1-year time increment

n = (year of the calculation) - (initial year of waste acceptance)

j = 0.1-year time increment

k = methane generation rate (*$year^{-1}$*)

L_o = potential methane generation capacity (*m^3/Mg*)

M_i = mass of waste accepted in the 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	**2006**	
Landfill Closure Year (with 80-year limit)	**2037**	
Actual Closure Year (without limit)	***2037***	
Have Model Calculate Closure Year?	**No**	
Waste Design Capacity		*megagrams*

MODEL PARAMETERS

Methane Generation Rate, k	**0.040**	*$year^{-1}$*
Potential Methane Generation Capacity, L_o	**40**	*m^3/Mg*
NMOC Concentration	**46**	*ppmv as hexane*
Methane Content	**50**	*% by volume*

GASES / POLLUTANTS SELECTED

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

WASTE ACCEPTANCE RATES

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2006	1,052	1,157	0	0
2007	53,351	58,686	1,052	1,157
2008	47,855	52,640	54,403	59,843
2009	46,872	51,559	102,257	112,483
2010	46,979	51,677	149,129	164,042
2011	43,866	48,253	196,108	215,719
2012	45,820	50,402	239,974	263,971
2013	52,223	57,445	285,794	314,373
2014	44,365	48,802	338,017	371,818
2015	44,558	49,014	382,382	420,620
2016	47,049	51,754	426,940	469,634
2017	47,049	51,754	473,989	521,388
2018	47,049	51,754	521,038	573,142
2019	47,049	51,754	568,087	624,896
2020	47,049	51,754	615,136	676,650
2021	47,049	51,754	662,186	728,404
2022	47,049	51,754	709,235	780,158
2023	47,049	51,754	756,284	831,912
2024	47,049	51,754	803,333	883,666
2025	47,049	51,754	850,382	935,420
2026	47,049	51,754	897,431	987,174
2027	47,049	51,754	944,480	1,038,928
2028	47,049	51,754	991,529	1,090,682
2029	47,049	51,754	1,038,578	1,142,436
2030	47,049	51,754	1,085,627	1,194,190
2031	47,049	51,754	1,132,676	1,245,944
2032	47,049	51,754	1,179,726	1,297,698
2033	47,049	51,754	1,226,775	1,349,452
2034	47,049	51,754	1,273,824	1,401,206
2035	47,049	51,754	1,320,873	1,452,960
2036	47,049	51,754	1,367,922	1,504,714
2037	47,049	51,754	1,414,971	1,556,468
2038	0	0	1,462,020	1,608,222
2039	0	0	1,462,020	1,608,222
2040	0	0	1,462,020	1,608,222
2041	0	0	1,462,020	1,608,222
2042	0	0	1,462,020	1,608,222
2043	0	0	1,462,020	1,608,222
2044	0	0	1,462,020	1,608,222
2045	0	0	1,462,020	1,608,222

WASTE ACCEPTANCE RATES (Continued)

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	(short tons/year)	(Mg)	(short tons)
2046	0	0	1,462,020	1,608,222
2047	0	0	1,462,020	1,608,222
2048	0	0	1,462,020	1,608,222
2049	0	0	1,462,020	1,608,222
2050	0	0	1,462,020	1,608,222
2051	0	0	1,462,020	1,608,222
2052	0	0	1,462,020	1,608,222
2053	0	0	1,462,020	1,608,222
2054	0	0	1,462,020	1,608,222
2055	0	0	1,462,020	1,608,222
2056	0	0	1,462,020	1,608,222
2057	0	0	1,462,020	1,608,222
2058	0	0	1,462,020	1,608,222
2059	0	0	1,462,020	1,608,222
2060	0	0	1,462,020	1,608,222
2061	0	0	1,462,020	1,608,222
2062	0	0	1,462,020	1,608,222
2063	0	0	1,462,020	1,608,222
2064	0	0	1,462,020	1,608,222
2065	0	0	1,462,020	1,608,222
2066	0	0	1,462,020	1,608,222
2067	0	0	1,462,020	1,608,222
2068	0	0	1,462,020	1,608,222
2069	0	0	1,462,020	1,608,222
2070	0	0	1,462,020	1,608,222
2071	0	0	1,462,020	1,608,222
2072	0	0	1,462,020	1,608,222
2073	0	0	1,462,020	1,608,222
2074	0	0	1,462,020	1,608,222
2075	0	0	1,462,020	1,608,222
2076	0	0	1,462,020	1,608,222
2077	0	0	1,462,020	1,608,222
2078	0	0	1,462,020	1,608,222
2079	0	0	1,462,020	1,608,222
2080	0	0	1,462,020	1,608,222
2081	0	0	1,462,020	1,608,222
2082	0	0	1,462,020	1,608,222
2083	0	0	1,462,020	1,608,222
2084	0	0	1,462,020	1,608,222
2085	0	0	1,462,020	1,608,222

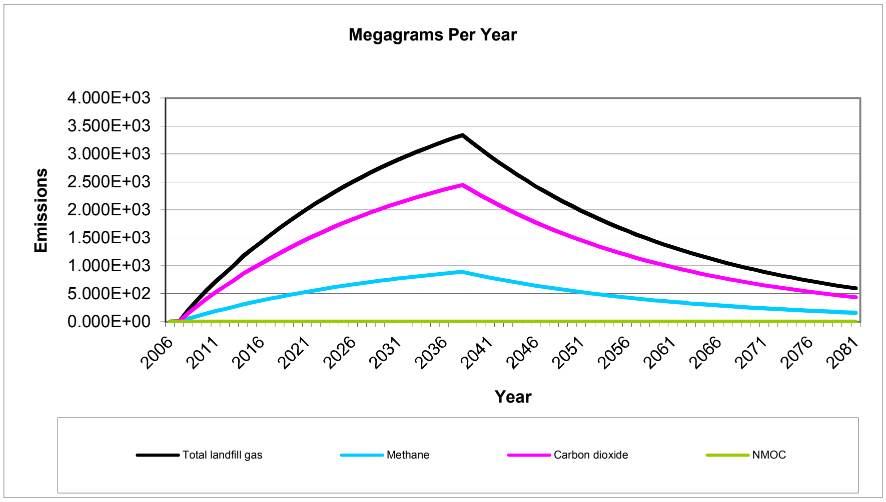
Pollutant Parameters

	Compound	Gas / Pollutant Default Parameters: Concentration (*ppmv*)	Gas / Pollutant Default Parameters: Molecular Weight	User-specified Pollutant Parameters: Concentration (*ppmv*)	User-specified Pollutant Parameters: 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
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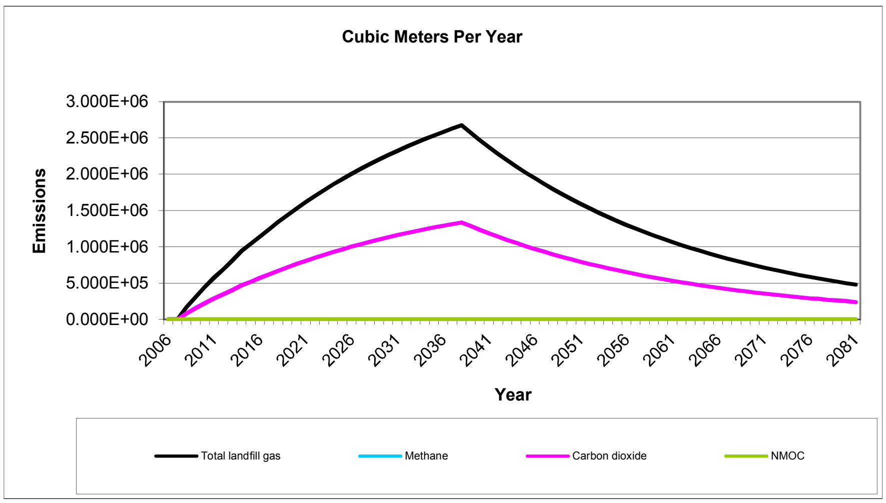
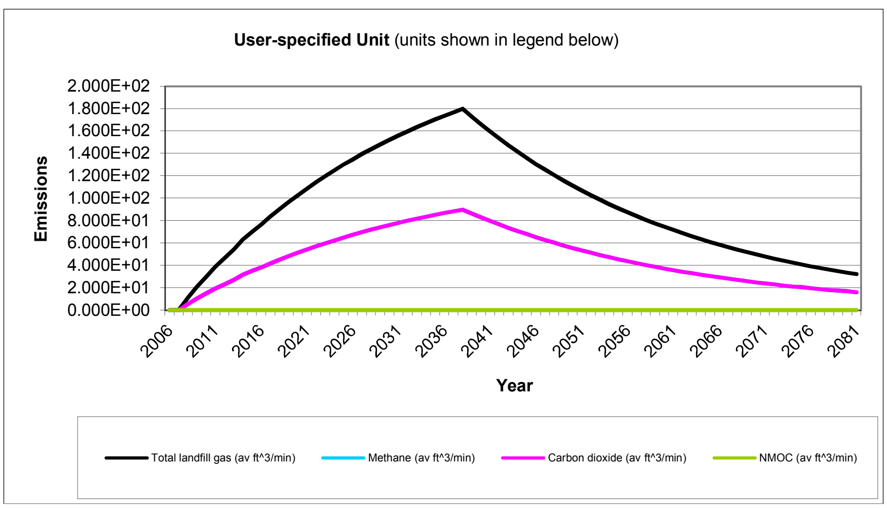
3.500E+03
3.000E+03
2.500E+03
2.000E+03
1.500E+03
1.000E+03
5.000E+02
0.000E+00
Emissions
2006 2011 2016 2021 2026 2031 2036 2041 2046 2051 2056 2061 2066 2071 2076 2081
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


Cubic Meters Per Year
3.000E+06
2.500E+06
2.000E+06
1.500E+06
1.000E+06
5.000E+05
0.000E+00
Emissions
2006 2011 2016 2021 2026 2031 2036 2041 2046 2051 2056 2061 2066 2071 2076 2081
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


User-specified Unit (units shown in legend below)
2.000E+02
1.800E+02
1.600E+02
1.400E+02
1.200E+02
1.000E+02
8.000E+01
6.000E+01
4.000E+01
2.000E+01
0.000E+00
Emissions
2006 2011 2016 2021 2026 2031 2036 2041 2046 2051 2056 2061 2066 2071 2076 2081
Year
Total landfill gas (av ft^3/min)
Methane (av ft^3/min)
Carbon dioxide (av ft^3/min)
NMOC (av ft^3/min)

Results

Year	Total landfill gas			Methane		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
2006	0	0	0	0	0	0
2007	4.119E+00	3.298E+03	2.216E-01	1.100E+00	1.649E+03	1.108E-01
2008	2.128E+02	1.704E+05	1.145E+01	5.685E+01	8.522E+04	5.726E+00
2009	3.919E+02	3.138E+05	2.108E+01	1.047E+02	1.569E+05	1.054E+01
2010	5.600E+02	4.484E+05	3.013E+01	1.496E+02	2.242E+05	1.507E+01
2011	7.220E+02	5.782E+05	3.885E+01	1.929E+02	2.891E+05	1.942E+01
2012	8.655E+02	6.930E+05	4.656E+01	2.312E+02	3.465E+05	2.328E+01
2013	1.011E+03	8.095E+05	5.439E+01	2.700E+02	4.047E+05	2.719E+01
2014	1.176E+03	9.415E+05	6.326E+01	3.141E+02	4.707E+05	3.163E+01
2015	1.303E+03	1.044E+06	7.012E+01	3.481E+02	5.218E+05	3.506E+01
2016	1.427E+03	1.142E+06	7.676E+01	3.811E+02	5.712E+05	3.838E+01
2017	1.555E+03	1.245E+06	8.366E+01	4.154E+02	6.226E+05	4.183E+01
2018	1.678E+03	1.344E+06	9.029E+01	4.483E+02	6.719E+05	4.515E+01
2019	1.797E+03	1.439E+06	9.666E+01	4.799E+02	7.193E+05	4.833E+01
2020	1.910E+03	1.530E+06	1.028E+02	5.103E+02	7.649E+05	5.139E+01
2021	2.020E+03	1.617E+06	1.087E+02	5.395E+02	8.086E+05	5.433E+01
2022	2.125E+03	1.701E+06	1.143E+02	5.675E+02	8.507E+05	5.716E+01
2023	2.226E+03	1.782E+06	1.197E+02	5.945E+02	8.911E+05	5.987E+01
2024	2.323E+03	1.860E+06	1.250E+02	6.204E+02	9.299E+05	6.248E+01
2025	2.416E+03	1.934E+06	1.300E+02	6.453E+02	9.672E+05	6.499E+01
2026	2.505E+03	2.006E+06	1.348E+02	6.692E+02	1.003E+06	6.739E+01
2027	2.591E+03	2.075E+06	1.394E+02	6.921E+02	1.037E+06	6.971E+01
2028	2.674E+03	2.141E+06	1.439E+02	7.142E+02	1.071E+06	7.193E+01
2029	2.753E+03	2.205E+06	1.481E+02	7.354E+02	1.102E+06	7.406E+01
2030	2.829E+03	2.266E+06	1.522E+02	7.558E+02	1.133E+06	7.612E+01
2031	2.903E+03	2.324E+06	1.562E+02	7.754E+02	1.162E+06	7.809E+01
2032	2.973E+03	2.381E+06	1.600E+02	7.942E+02	1.190E+06	7.998E+01
2033	3.041E+03	2.435E+06	1.636E+02	8.122E+02	1.217E+06	8.180E+01
2034	3.106E+03	2.487E+06	1.671E+02	8.296E+02	1.243E+06	8.355E+01
2035	3.168E+03	2.537E+06	1.705E+02	8.463E+02	1.268E+06	8.523E+01
2036	3.228E+03	2.585E+06	1.737E+02	8.623E+02	1.292E+06	8.684E+01
2037	3.286E+03	2.631E+06	1.768E+02	8.777E+02	1.316E+06	8.839E+01
2038	3.341E+03	2.675E+06	1.798E+02	8.925E+02	1.338E+06	8.988E+01
2039	3.210E+03	2.571E+06	1.727E+02	8.575E+02	1.285E+06	8.636E+01
2040	3.084E+03	2.470E+06	1.659E+02	8.239E+02	1.235E+06	8.297E+01
2041	2.963E+03	2.373E+06	1.594E+02	7.915E+02	1.186E+06	7.972E+01
2042	2.847E+03	2.280E+06	1.532E+02	7.605E+02	1.140E+06	7.659E+01
2043	2.736E+03	2.190E+06	1.472E+02	7.307E+02	1.095E+06	7.359E+01
2044	2.628E+03	2.105E+06	1.414E+02	7.020E+02	1.052E+06	7.070E+01
2045	2.525E+03	2.022E+06	1.359E+02	6.745E+02	1.011E+06	6.793E+01
2046	2.426E+03	1.943E+06	1.305E+02	6.481E+02	9.714E+05	6.527E+01
2047	2.331E+03	1.867E+06	1.254E+02	6.227E+02	9.333E+05	6.271E+01
2048	2.240E+03	1.793E+06	1.205E+02	5.982E+02	8.967E+05	6.025E+01
2049	2.152E+03	1.723E+06	1.158E+02	5.748E+02	8.616E+05	5.789E+01
2050	2.067E+03	1.656E+06	1.112E+02	5.522E+02	8.278E+05	5.562E+01
2051	1.986E+03	1.591E+06	1.069E+02	5.306E+02	7.953E+05	5.344E+01
2052	1.909E+03	1.528E+06	1.027E+02	5.098E+02	7.641E+05	5.134E+01
2053	1.834E+03	1.468E+06	9.866E+01	4.898E+02	7.342E+05	4.933E+01
2054	1.762E+03	1.411E+06	9.479E+01	4.706E+02	7.054E+05	4.739E+01
2055	1.693E+03	1.355E+06	9.107E+01	4.521E+02	6.777E+05	4.554E+01

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2056	1.626E+03	1.302E+06	8.750E+01	4.344E+02	6.511E+05	4.375E+01
2057	1.563E+03	1.251E+06	8.407E+01	4.174E+02	6.256E+05	4.203E+01
2058	1.501E+03	1.202E+06	8.077E+01	4.010E+02	6.011E+05	4.039E+01
2059	1.442E+03	1.155E+06	7.761E+01	3.853E+02	5.775E+05	3.880E+01
2060	1.386E+03	1.110E+06	7.456E+01	3.702E+02	5.549E+05	3.728E+01
2061	1.332E+03	1.066E+06	7.164E+01	3.557E+02	5.331E+05	3.582E+01
2062	1.279E+03	1.024E+06	6.883E+01	3.417E+02	5.122E+05	3.442E+01
2063	1.229E+03	9.843E+05	6.613E+01	3.283E+02	4.921E+05	3.307E+01
2064	1.181E+03	9.457E+05	6.354E+01	3.154E+02	4.728E+05	3.177E+01
2065	1.135E+03	9.086E+05	6.105E+01	3.031E+02	4.543E+05	3.052E+01
2066	1.090E+03	8.730E+05	5.865E+01	2.912E+02	4.365E+05	2.933E+01
2067	1.047E+03	8.387E+05	5.635E+01	2.798E+02	4.194E+05	2.818E+01
2068	1.006E+03	8.058E+05	5.414E+01	2.688E+02	4.029E+05	2.707E+01
2069	9.669E+02	7.742E+05	5.202E+01	2.583E+02	3.871E+05	2.601E+01
2070	9.290E+02	7.439E+05	4.998E+01	2.481E+02	3.719E+05	2.499E+01
2071	8.926E+02	7.147E+05	4.802E+01	2.384E+02	3.574E+05	2.401E+01
2072	8.576E+02	6.867E+05	4.614E+01	2.291E+02	3.433E+05	2.307E+01
2073	8.239E+02	6.598E+05	4.433E+01	2.201E+02	3.299E+05	2.216E+01
2074	7.916E+02	6.339E+05	4.259E+01	2.115E+02	3.169E+05	2.130E+01
2075	7.606E+02	6.090E+05	4.092E+01	2.032E+02	3.045E+05	2.046E+01
2076	7.308E+02	5.852E+05	3.932E+01	1.952E+02	2.926E+05	1.966E+01
2077	7.021E+02	5.622E+05	3.778E+01	1.875E+02	2.811E+05	1.889E+01
2078	6.746E+02	5.402E+05	3.629E+01	1.802E+02	2.701E+05	1.815E+01
2079	6.481E+02	5.190E+05	3.487E+01	1.731E+02	2.595E+05	1.744E+01
2080	6.227E+02	4.986E+05	3.350E+01	1.663E+02	2.493E+05	1.675E+01
2081	5.983E+02	4.791E+05	3.219E+01	1.598E+02	2.395E+05	1.609E+01
2082	5.748E+02	4.603E+05	3.093E+01	1.535E+02	2.302E+05	1.546E+01
2083	5.523E+02	4.423E+05	2.971E+01	1.475E+02	2.211E+05	1.486E+01
2084	5.306E+02	4.249E+05	2.855E+01	1.417E+02	2.125E+05	1.427E+01
2085	5.098E+02	4.083E+05	2.743E+01	1.362E+02	2.041E+05	1.372E+01
2086	4.898E+02	3.922E+05	2.635E+01	1.308E+02	1.961E+05	1.318E+01
2087	4.706E+02	3.769E+05	2.532E+01	1.257E+02	1.884E+05	1.266E+01
2088	4.522E+02	3.621E+05	2.433E+01	1.208E+02	1.810E+05	1.216E+01
2089	4.345E+02	3.479E+05	2.337E+01	1.160E+02	1.739E+05	1.169E+01
2090	4.174E+02	3.342E+05	2.246E+01	1.115E+02	1.671E+05	1.123E+01
2091	4.010E+02	3.211E+05	2.158E+01	1.071E+02	1.606E+05	1.079E+01
2092	3.853E+02	3.085E+05	2.073E+01	1.029E+02	1.543E+05	1.037E+01
2093	3.702E+02	2.965E+05	1.992E+01	9.889E+01	1.482E+05	9.959E+00
2094	3.557E+02	2.848E+05	1.914E+01	9.501E+01	1.424E+05	9.569E+00
2095	3.418E+02	2.737E+05	1.839E+01	9.129E+01	1.368E+05	9.194E+00
2096	3.284E+02	2.629E+05	1.767E+01	8.771E+01	1.315E+05	8.833E+00
2097	3.155E+02	2.526E+05	1.697E+01	8.427E+01	1.263E+05	8.487E+00
2098	3.031E+02	2.427E+05	1.631E+01	8.096E+01	1.214E+05	8.154E+00
2099	2.912E+02	2.332E+05	1.567E+01	7.779E+01	1.166E+05	7.834E+00
2100	2.798E+02	2.241E+05	1.505E+01	7.474E+01	1.120E+05	7.527E+00
2101	2.688E+02	2.153E+05	1.446E+01	7.181E+01	1.076E+05	7.232E+00
2102	2.583E+02	2.068E+05	1.390E+01	6.899E+01	1.034E+05	6.948E+00
2103	2.482E+02	1.987E+05	1.335E+01	6.629E+01	9.936E+04	6.676E+00
2104	2.384E+02	1.909E+05	1.283E+01	6.369E+01	9.546E+04	6.414E+00
2105	2.291E+02	1.834E+05	1.233E+01	6.119E+01	9.172E+04	6.163E+00
2106	2.201E+02	1.762E+05	1.184E+01	5.879E+01	8.812E+04	5.921E+00

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
2107	2.115E+02	1.693E+05	1.138E+01	5.649E+01	8.467E+04	5.689E+00
2108	2.032E+02	1.627E+05	1.093E+01	5.427E+01	8.135E+04	5.466E+00
2109	1.952E+02	1.563E+05	1.050E+01	5.214E+01	7.816E+04	5.251E+00
2110	1.876E+02	1.502E+05	1.009E+01	5.010E+01	7.509E+04	5.046E+00
2111	1.802E+02	1.443E+05	9.695E+00	4.813E+01	7.215E+04	4.848E+00
2112	1.731E+02	1.386E+05	9.315E+00	4.625E+01	6.932E+04	4.658E+00
2113	1.663E+02	1.332E+05	8.950E+00	4.443E+01	6.660E+04	4.475E+00
2114	1.598E+02	1.280E+05	8.599E+00	4.269E+01	6.399E+04	4.300E+00
2115	1.536E+02	1.230E+05	8.262E+00	4.102E+01	6.148E+04	4.131E+00
2116	1.475E+02	1.181E+05	7.938E+00	3.941E+01	5.907E+04	3.969E+00
2117	1.418E+02	1.135E+05	7.627E+00	3.786E+01	5.675E+04	3.813E+00
2118	1.362E+02	1.091E+05	7.328E+00	3.638E+01	5.453E+04	3.664E+00
2119	1.309E+02	1.048E+05	7.040E+00	3.495E+01	5.239E+04	3.520E+00
2120	1.257E+02	1.007E+05	6.764E+00	3.358E+01	5.034E+04	3.382E+00
2121	1.208E+02	9.673E+04	6.499E+00	3.227E+01	4.836E+04	3.250E+00
2122	1.161E+02	9.293E+04	6.244E+00	3.100E+01	4.647E+04	3.122E+00
2123	1.115E+02	8.929E+04	5.999E+00	2.978E+01	4.464E+04	3.000E+00
2124	1.071E+02	8.579E+04	5.764E+00	2.862E+01	4.289E+04	2.882E+00
2125	1.029E+02	8.242E+04	5.538E+00	2.749E+01	4.121E+04	2.769E+00
2126	9.890E+01	7.919E+04	5.321E+00	2.642E+01	3.960E+04	2.660E+00
2127	9.502E+01	7.609E+04	5.112E+00	2.538E+01	3.804E+04	2.556E+00
2128	9.129E+01	7.310E+04	4.912E+00	2.439E+01	3.655E+04	2.456E+00
2129	8.771E+01	7.024E+04	4.719E+00	2.343E+01	3.512E+04	2.360E+00
2130	8.427E+01	6.748E+04	4.534E+00	2.251E+01	3.374E+04	2.267E+00
2131	8.097E+01	6.484E+04	4.356E+00	2.163E+01	3.242E+04	2.178E+00
2132	7.780E+01	6.230E+04	4.186E+00	2.078E+01	3.115E+04	2.093E+00
2133	7.475E+01	5.985E+04	4.021E+00	1.997E+01	2.993E+04	2.011E+00
2134	7.181E+01	5.751E+04	3.864E+00	1.918E+01	2.875E+04	1.932E+00
2135	6.900E+01	5.525E+04	3.712E+00	1.843E+01	2.763E+04	1.856E+00
2136	6.629E+01	5.308E+04	3.567E+00	1.771E+01	2.654E+04	1.783E+00
2137	6.369E+01	5.100E+04	3.427E+00	1.701E+01	2.550E+04	1.713E+00
2138	6.120E+01	4.900E+04	3.293E+00	1.635E+01	2.450E+04	1.646E+00
2139	5.880E+01	4.708E+04	3.163E+00	1.571E+01	2.354E+04	1.582E+00
2140	5.649E+01	4.524E+04	3.039E+00	1.509E+01	2.262E+04	1.520E+00
2141	5.428E+01	4.346E+04	2.920E+00	1.450E+01	2.173E+04	1.460E+00
2142	5.215E+01	4.176E+04	2.806E+00	1.393E+01	2.088E+04	1.403E+00
2143	5.010E+01	4.012E+04	2.696E+00	1.338E+01	2.006E+04	1.348E+00
2144	4.814E+01	3.855E+04	2.590E+00	1.286E+01	1.927E+04	1.295E+00
2145	4.625E+01	3.704E+04	2.488E+00	1.235E+01	1.852E+04	1.244E+00
2146	4.444E+01	3.558E+04	2.391E+00	1.187E+01	1.779E+04	1.195E+00

Results (Continued)

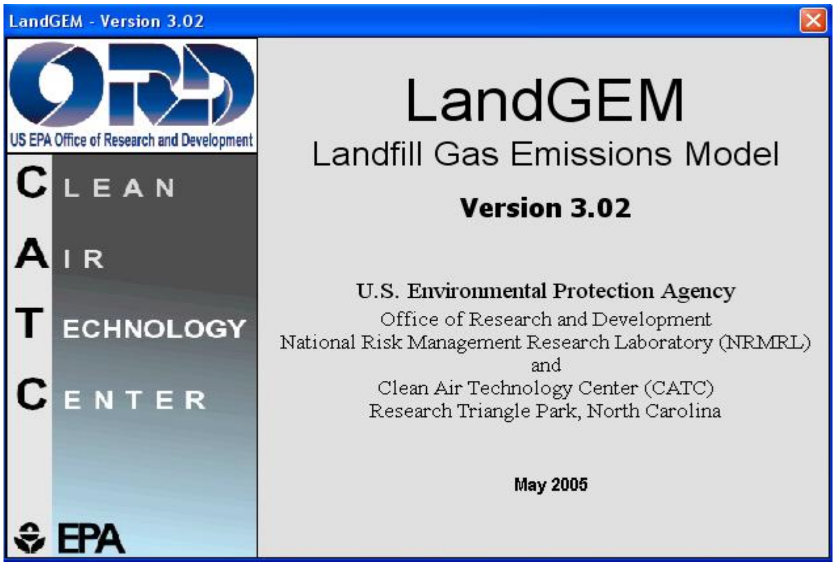
Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2006	0	0	0	0	0	0
2007	3.019E+00	1.649E+03	1.108E-01	5.439E-04	1.517E-01	1.019E-05
2008	1.560E+02	8.522E+04	5.726E+00	2.810E-02	7.840E+00	5.268E-04
2009	2.872E+02	1.569E+05	1.054E+01	5.174E-02	1.443E+01	9.698E-04
2010	4.104E+02	2.242E+05	1.507E+01	7.394E-02	2.063E+01	1.386E-03
2011	5.292E+02	2.891E+05	1.942E+01	9.533E-02	2.659E+01	1.787E-03
2012	6.343E+02	3.465E+05	2.328E+01	1.143E-01	3.188E+01	2.142E-03
2013	7.409E+02	4.047E+05	2.719E+01	1.335E-01	3.724E+01	2.502E-03
2014	8.617E+02	4.707E+05	3.163E+01	1.552E-01	4.331E+01	2.910E-03
2015	9.552E+02	5.218E+05	3.506E+01	1.721E-01	4.801E+01	3.226E-03
2016	1.046E+03	5.712E+05	3.838E+01	1.884E-01	5.255E+01	3.531E-03
2017	1.140E+03	6.226E+05	4.183E+01	2.053E-01	5.728E+01	3.848E-03
2018	1.230E+03	6.719E+05	4.515E+01	2.216E-01	6.182E+01	4.153E-03
2019	1.317E+03	7.193E+05	4.833E+01	2.372E-01	6.618E+01	4.447E-03
2020	1.400E+03	7.649E+05	5.139E+01	2.522E-01	7.037E+01	4.728E-03
2021	1.480E+03	8.086E+05	5.433E+01	2.667E-01	7.440E+01	4.999E-03
2022	1.557E+03	8.507E+05	5.716E+01	2.805E-01	7.826E+01	5.259E-03
2023	1.631E+03	8.911E+05	5.987E+01	2.939E-01	8.198E+01	5.508E-03
2024	1.702E+03	9.299E+05	6.248E+01	3.067E-01	8.555E+01	5.748E-03
2025	1.770E+03	9.672E+05	6.499E+01	3.190E-01	8.898E+01	5.979E-03
2026	1.836E+03	1.003E+06	6.739E+01	3.308E-01	9.228E+01	6.200E-03
2027	1.899E+03	1.037E+06	6.971E+01	3.421E-01	9.545E+01	6.413E-03
2028	1.960E+03	1.071E+06	7.193E+01	3.530E-01	9.849E+01	6.617E-03
2029	2.018E+03	1.102E+06	7.406E+01	3.635E-01	1.014E+02	6.814E-03
2030	2.074E+03	1.133E+06	7.612E+01	3.736E-01	1.042E+02	7.003E-03
2031	2.127E+03	1.162E+06	7.809E+01	3.833E-01	1.069E+02	7.184E-03
2032	2.179E+03	1.190E+06	7.998E+01	3.926E-01	1.095E+02	7.358E-03
2033	2.229E+03	1.217E+06	8.180E+01	4.015E-01	1.120E+02	7.526E-03
2034	2.276E+03	1.243E+06	8.355E+01	4.101E-01	1.144E+02	7.686E-03
2035	2.322E+03	1.268E+06	8.523E+01	4.183E-01	1.167E+02	7.841E-03
2036	2.366E+03	1.292E+06	8.684E+01	4.262E-01	1.189E+02	7.989E-03
2037	2.408E+03	1.316E+06	8.839E+01	4.338E-01	1.210E+02	8.132E-03
2038	2.449E+03	1.338E+06	8.988E+01	4.411E-01	1.231E+02	8.269E-03
2039	2.353E+03	1.285E+06	8.636E+01	4.238E-01	1.182E+02	7.945E-03
2040	2.260E+03	1.235E+06	8.297E+01	4.072E-01	1.136E+02	7.633E-03
2041	2.172E+03	1.186E+06	7.972E+01	3.913E-01	1.092E+02	7.334E-03
2042	2.087E+03	1.140E+06	7.659E+01	3.759E-01	1.049E+02	7.047E-03
2043	2.005E+03	1.095E+06	7.359E+01	3.612E-01	1.008E+02	6.770E-03
2044	1.926E+03	1.052E+06	7.070E+01	3.470E-01	9.681E+01	6.505E-03
2045	1.851E+03	1.011E+06	6.793E+01	3.334E-01	9.302E+01	6.250E-03
2046	1.778E+03	9.714E+05	6.527E+01	3.203E-01	8.937E+01	6.005E-03
2047	1.708E+03	9.333E+05	6.271E+01	3.078E-01	8.586E+01	5.769E-03
2048	1.641E+03	8.967E+05	6.025E+01	2.957E-01	8.250E+01	5.543E-03
2049	1.577E+03	8.616E+05	5.789E+01	2.841E-01	7.926E+01	5.326E-03
2050	1.515E+03	8.278E+05	5.562E+01	2.730E-01	7.615E+01	5.117E-03
2051	1.456E+03	7.953E+05	5.344E+01	2.623E-01	7.317E+01	4.916E-03
2052	1.399E+03	7.641E+05	5.134E+01	2.520E-01	7.030E+01	4.723E-03
2053	1.344E+03	7.342E+05	4.933E+01	2.421E-01	6.754E+01	4.538E-03
2054	1.291E+03	7.054E+05	4.739E+01	2.326E-01	6.489E+01	4.360E-03
2055	1.241E+03	6.777E+05	4.554E+01	2.235E-01	6.235E+01	4.189E-03

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
2056	1.192E+03	6.511E+05	4.375E+01	2.147E-01	5.991E+01	4.025E-03
2057	1.145E+03	6.256E+05	4.203E+01	2.063E-01	5.756E+01	3.867E-03
2058	1.100E+03	6.011E+05	4.039E+01	1.982E-01	5.530E+01	3.716E-03
2059	1.057E+03	5.775E+05	3.880E+01	1.904E-01	5.313E+01	3.570E-03
2060	1.016E+03	5.549E+05	3.728E+01	1.830E-01	5.105E+01	3.430E-03
2061	9.759E+02	5.331E+05	3.582E+01	1.758E-01	4.905E+01	3.295E-03
2062	9.376E+02	5.122E+05	3.442E+01	1.689E-01	4.712E+01	3.166E-03
2063	9.008E+02	4.921E+05	3.307E+01	1.623E-01	4.528E+01	3.042E-03
2064	8.655E+02	4.728E+05	3.177E+01	1.559E-01	4.350E+01	2.923E-03
2065	8.316E+02	4.543E+05	3.052E+01	1.498E-01	4.179E+01	2.808E-03
2066	7.990E+02	4.365E+05	2.933E+01	1.439E-01	4.016E+01	2.698E-03
2067	7.676E+02	4.194E+05	2.818E+01	1.383E-01	3.858E+01	2.592E-03
2068	7.375E+02	4.029E+05	2.707E+01	1.329E-01	3.707E+01	2.491E-03
2069	7.086E+02	3.871E+05	2.601E+01	1.277E-01	3.562E+01	2.393E-03
2070	6.808E+02	3.719E+05	2.499E+01	1.227E-01	3.422E+01	2.299E-03
2071	6.541E+02	3.574E+05	2.401E+01	1.178E-01	3.288E+01	2.209E-03
2072	6.285E+02	3.433E+05	2.307E+01	1.132E-01	3.159E+01	2.122E-03
2073	6.038E+02	3.299E+05	2.216E+01	1.088E-01	3.035E+01	2.039E-03
2074	5.802E+02	3.169E+05	2.130E+01	1.045E-01	2.916E+01	1.959E-03
2075	5.574E+02	3.045E+05	2.046E+01	1.004E-01	2.802E+01	1.882E-03
2076	5.356E+02	2.926E+05	1.966E+01	9.648E-02	2.692E+01	1.809E-03
2077	5.146E+02	2.811E+05	1.889E+01	9.270E-02	2.586E+01	1.738E-03
2078	4.944E+02	2.701E+05	1.815E+01	8.907E-02	2.485E+01	1.670E-03
2079	4.750E+02	2.595E+05	1.744E+01	8.557E-02	2.387E+01	1.604E-03
2080	4.564E+02	2.493E+05	1.675E+01	8.222E-02	2.294E+01	1.541E-03
2081	4.385E+02	2.395E+05	1.609E+01	7.899E-02	2.204E+01	1.481E-03
2082	4.213E+02	2.302E+05	1.546E+01	7.590E-02	2.117E+01	1.423E-03
2083	4.048E+02	2.211E+05	1.486E+01	7.292E-02	2.034E+01	1.367E-03
2084	3.889E+02	2.125E+05	1.427E+01	7.006E-02	1.955E+01	1.313E-03
2085	3.737E+02	2.041E+05	1.372E+01	6.731E-02	1.878E+01	1.262E-03
2086	3.590E+02	1.961E+05	1.318E+01	6.468E-02	1.804E+01	1.212E-03
2087	3.449E+02	1.884E+05	1.266E+01	6.214E-02	1.734E+01	1.165E-03
2088	3.314E+02	1.810E+05	1.216E+01	5.970E-02	1.666E+01	1.119E-03
2089	3.184E+02	1.739E+05	1.169E+01	5.736E-02	1.600E+01	1.075E-03
2090	3.059E+02	1.671E+05	1.123E+01	5.511E-02	1.538E+01	1.033E-03
2091	2.939E+02	1.606E+05	1.079E+01	5.295E-02	1.477E+01	9.926E-04
2092	2.824E+02	1.543E+05	1.037E+01	5.088E-02	1.419E+01	9.536E-04
2093	2.713E+02	1.482E+05	9.959E+00	4.888E-02	1.364E+01	9.163E-04
2094	2.607E+02	1.424E+05	9.569E+00	4.696E-02	1.310E+01	8.803E-04
2095	2.505E+02	1.368E+05	9.194E+00	4.512E-02	1.259E+01	8.458E-04
2096	2.406E+02	1.315E+05	8.833E+00	4.335E-02	1.209E+01	8.126E-04
2097	2.312E+02	1.263E+05	8.487E+00	4.165E-02	1.162E+01	7.808E-04
2098	2.221E+02	1.214E+05	8.154E+00	4.002E-02	1.116E+01	7.502E-04
2099	2.134E+02	1.166E+05	7.834E+00	3.845E-02	1.073E+01	7.207E-04
2100	2.051E+02	1.120E+05	7.527E+00	3.694E-02	1.031E+01	6.925E-04
2101	1.970E+02	1.076E+05	7.232E+00	3.549E-02	9.902E+00	6.653E-04
2102	1.893E+02	1.034E+05	6.948E+00	3.410E-02	9.514E+00	6.392E-04
2103	1.819E+02	9.936E+04	6.676E+00	3.277E-02	9.141E+00	6.142E-04
2104	1.747E+02	9.546E+04	6.414E+00	3.148E-02	8.783E+00	5.901E-04
2105	1.679E+02	9.172E+04	6.163E+00	3.025E-02	8.438E+00	5.670E-04
2106	1.613E+02	8.812E+04	5.921E+00	2.906E-02	8.107E+00	5.447E-04

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
2107	1.550E+02	8.467E+04	5.689E+00	2.792E-02	7.789E+00	5.234E-04
2108	1.489E+02	8.135E+04	5.466E+00	2.683E-02	7.484E+00	5.028E-04
2109	1.431E+02	7.816E+04	5.251E+00	2.577E-02	7.191E+00	4.831E-04
2110	1.375E+02	7.509E+04	5.046E+00	2.476E-02	6.909E+00	4.642E-04
2111	1.321E+02	7.215E+04	4.848E+00	2.379E-02	6.638E+00	4.460E-04
2112	1.269E+02	6.932E+04	4.658E+00	2.286E-02	6.377E+00	4.285E-04
2113	1.219E+02	6.660E+04	4.475E+00	2.196E-02	6.127E+00	4.117E-04
2114	1.171E+02	6.399E+04	4.300E+00	2.110E-02	5.887E+00	3.956E-04
2115	1.125E+02	6.148E+04	4.131E+00	2.027E-02	5.656E+00	3.800E-04
2116	1.081E+02	5.907E+04	3.969E+00	1.948E-02	5.435E+00	3.651E-04
2117	1.039E+02	5.675E+04	3.813E+00	1.872E-02	5.221E+00	3.508E-04
2118	9.982E+01	5.453E+04	3.664E+00	1.798E-02	5.017E+00	3.371E-04
2119	9.590E+01	5.239E+04	3.520E+00	1.728E-02	4.820E+00	3.239E-04
2120	9.214E+01	5.034E+04	3.382E+00	1.660E-02	4.631E+00	3.112E-04
2121	8.853E+01	4.836E+04	3.250E+00	1.595E-02	4.449E+00	2.990E-04
2122	8.506E+01	4.647E+04	3.122E+00	1.532E-02	4.275E+00	2.872E-04
2123	8.172E+01	4.464E+04	3.000E+00	1.472E-02	4.107E+00	2.760E-04
2124	7.852E+01	4.289E+04	2.882E+00	1.415E-02	3.946E+00	2.651E-04
2125	7.544E+01	4.121E+04	2.769E+00	1.359E-02	3.792E+00	2.548E-04
2126	7.248E+01	3.960E+04	2.660E+00	1.306E-02	3.643E+00	2.448E-04
2127	6.964E+01	3.804E+04	2.556E+00	1.255E-02	3.500E+00	2.352E-04
2128	6.691E+01	3.655E+04	2.456E+00	1.205E-02	3.363E+00	2.259E-04
2129	6.428E+01	3.512E+04	2.360E+00	1.158E-02	3.231E+00	2.171E-04
2130	6.176E+01	3.374E+04	2.267E+00	1.113E-02	3.104E+00	2.086E-04
2131	5.934E+01	3.242E+04	2.178E+00	1.069E-02	2.983E+00	2.004E-04
2132	5.702E+01	3.115E+04	2.093E+00	1.027E-02	2.866E+00	1.925E-04
2133	5.478E+01	2.993E+04	2.011E+00	9.869E-03	2.753E+00	1.850E-04
2134	5.263E+01	2.875E+04	1.932E+00	9.482E-03	2.645E+00	1.777E-04
2135	5.057E+01	2.763E+04	1.856E+00	9.110E-03	2.542E+00	1.708E-04
2136	4.859E+01	2.654E+04	1.783E+00	8.753E-03	2.442E+00	1.641E-04
2137	4.668E+01	2.550E+04	1.713E+00	8.410E-03	2.346E+00	1.576E-04
2138	4.485E+01	2.450E+04	1.646E+00	8.080E-03	2.254E+00	1.515E-04
2139	4.309E+01	2.354E+04	1.582E+00	7.763E-03	2.166E+00	1.455E-04
2140	4.140E+01	2.262E+04	1.520E+00	7.459E-03	2.081E+00	1.398E-04
2141	3.978E+01	2.173E+04	1.460E+00	7.166E-03	1.999E+00	1.343E-04
2142	3.822E+01	2.088E+04	1.403E+00	6.885E-03	1.921E+00	1.291E-04
2143	3.672E+01	2.006E+04	1.348E+00	6.615E-03	1.846E+00	1.240E-04
2144	3.528E+01	1.927E+04	1.295E+00	6.356E-03	1.773E+00	1.191E-04
2145	3.390E+01	1.852E+04	1.244E+00	6.107E-03	1.704E+00	1.145E-04
2146	3.257E+01	1.779E+04	1.195E+00	5.867E-03	1.637E+00	1.100E-04



Summary Report

Landfill Name or Identifier: OHSWMA Regional Landfill

Date: Tuesday, January 24, 2017

Description/Comments:

About LandGEM:

First-Order Decomposition Rate Equation:

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

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	**2006**	
Landfill Closure Year (with 80-year limit)	**2037**	
Actual Closure Year (without limit)	***2037***	
Have Model Calculate Closure Year?	**No**	
Waste Design Capacity		*megagrams*

MODEL PARAMETERS

Methane Generation Rate, k	**0.185**	*year $^{-1}$*
Potential Methane Generation Capacity, L_o	**25**	*m^3/Mg*
NMOC Concentration	**46**	*ppmv as hexane*
Methane Content	**50**	*% by volume*

GASES / POLLUTANTS SELECTED

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

WASTE ACCEPTANCE RATES

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2006	323	356	0	0
2007	8,403	9,243	323	356
2008	10,100	11,110	8,726	9,599
2009	10,361	11,397	18,827	20,709
2010	9,378	10,315	29,188	32,107
2011	9,650	10,615	38,565	42,422
2012	11,390	12,529	48,215	53,036
2013	8,673	9,541	59,605	65,565
2014	9,096	10,005	68,278	75,106
2015	10,694	11,763	77,374	85,111
2016	9,487	10,436	88,068	96,875
2017	9,487	10,436	97,555	107,311
2018	18,124	19,936	107,042	117,747
2019	18,124	19,936	125,166	137,683
2020	18,124	19,936	143,290	157,619
2021	18,124	19,936	161,413	177,555
2022	18,124	19,936	179,537	197,491
2023	18,124	19,936	197,660	217,427
2024	18,124	19,936	215,784	237,363
2025	18,124	19,936	233,908	257,299
2026	18,124	19,936	252,031	277,235
2027	18,124	19,936	270,155	297,171
2028	18,124	19,936	288,279	317,107
2029	18,124	19,936	306,402	337,043
2030	18,124	19,936	324,526	356,979
2031	18,124	19,936	342,650	376,915
2032	18,124	19,936	360,773	396,851
2033	18,124	19,936	378,897	416,787
2034	18,124	19,936	397,020	436,723
2035	18,124	19,936	415,144	456,659
2036	18,124	19,936	433,268	476,595
2037	18,124	19,936	451,391	496,531
2038	0	0	469,515	516,467
2039	0	0	469,515	516,467
2040	0	0	469,515	516,467
2041	0	0	469,515	516,467
2042	0	0	469,515	516,467
2043	0	0	469,515	516,467
2044	0	0	469,515	516,467
2045	0	0	469,515	516,467

WASTE ACCEPTANCE RATES (Continued)

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2046	0	0	469,515	516,467
2047	0	0	469,515	516,467
2048	0	0	469,515	516,467
2049	0	0	469,515	516,467
2050	0	0	469,515	516,467
2051	0	0	469,515	516,467
2052	0	0	469,515	516,467
2053	0	0	469,515	516,467
2054	0	0	469,515	516,467
2055	0	0	469,515	516,467
2056	0	0	469,515	516,467
2057	0	0	469,515	516,467
2058	0	0	469,515	516,467
2059	0	0	469,515	516,467
2060	0	0	469,515	516,467
2061	0	0	469,515	516,467
2062	0	0	469,515	516,467
2063	0	0	469,515	516,467
2064	0	0	469,515	516,467
2065	0	0	469,515	516,467
2066	0	0	469,515	516,467
2067	0	0	469,515	516,467
2068	0	0	469,515	516,467
2069	0	0	469,515	516,467
2070	0	0	469,515	516,467
2071	0	0	469,515	516,467
2072	0	0	469,515	516,467
2073	0	0	469,515	516,467
2074	0	0	469,515	516,467
2075	0	0	469,515	516,467
2076	0	0	469,515	516,467
2077	0	0	469,515	516,467
2078	0	0	469,515	516,467
2079	0	0	469,515	516,467
2080	0	0	469,515	516,467
2081	0	0	469,515	516,467
2082	0	0	469,515	516,467
2083	0	0	469,515	516,467
2084	0	0	469,515	516,467
2085	0	0	469,515	516,467

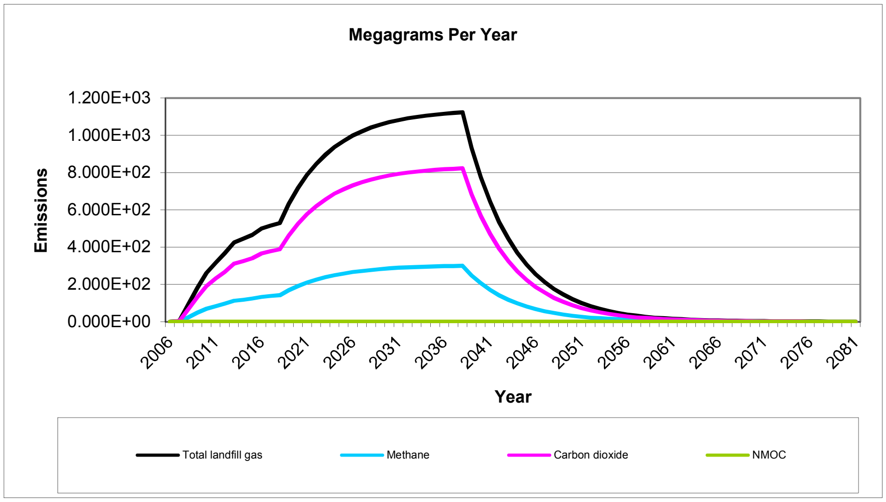
Pollutant Parameters

	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


Megagrams Per Year
Emissions
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4.000E+02
2.000E+02
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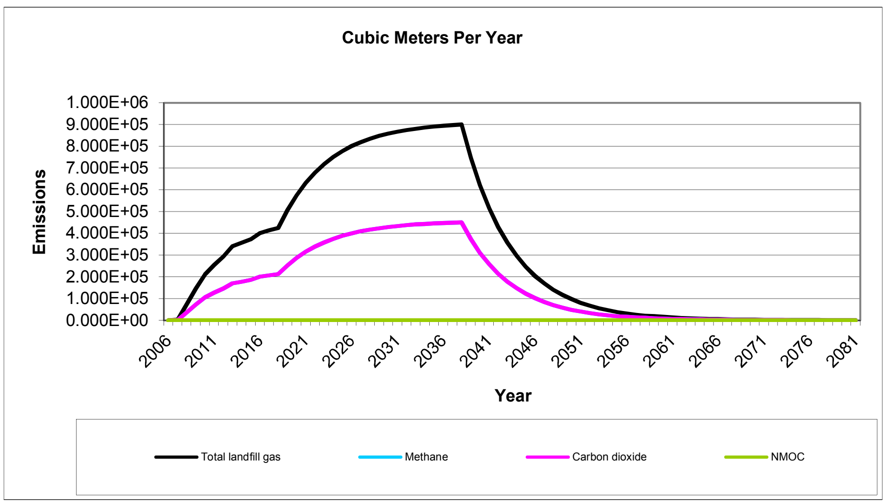
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


Cubic Meters Per Year
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3.000E+05
2.000E+05
1.000E+05
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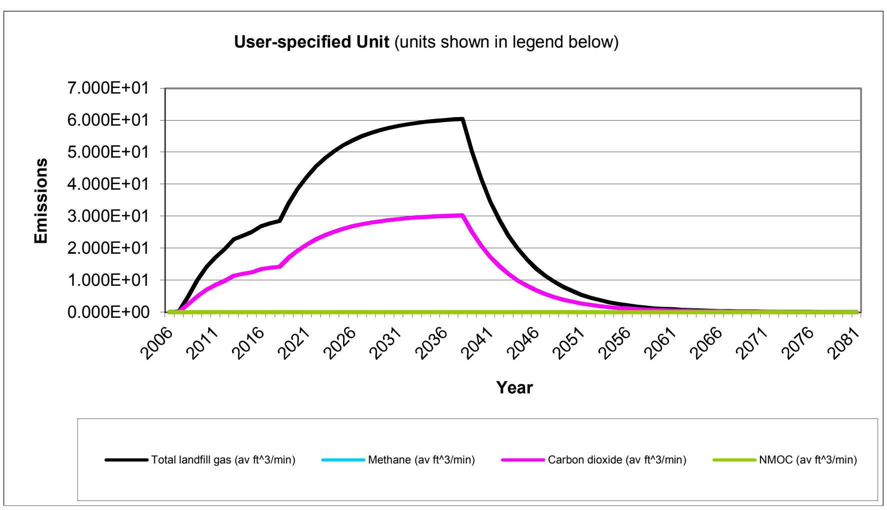
2006 2011 2016 2021 2026 2031 2036 2041 2046 2051 2056 2061 2066 2071 2076 2081
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


User-specified Unit (units shown in legend below)
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4.000E+01
3.000E+01
2.000E+01
1.000E+01
0.000E+00
2006 2011 2016 2021 2026 2031 2036 2041 2046 2051 2056 2061 2066 2071 2076 2081
Year
Total landfill gas (av ft^3/min)
Methane (av ft^3/min)
Carbon dioxide (av ft^3/min)
NMOC (av ft^3/min)

Results

Year	Total landfill gas			Methane		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
2006	0	0	0	0	0	0
2007	3.429E+00	2.746E+03	1.845E-01	9.159E-01	1.373E+03	9.224E-02
2008	9.193E+01	7.362E+04	4.946E+00	2.456E+01	3.681E+04	2.473E+00
2009	1.835E+02	1.469E+05	9.872E+00	4.901E+01	7.346E+04	4.936E+00
2010	2.623E+02	2.101E+05	1.411E+01	7.007E+01	1.050E+05	7.057E+00
2011	3.174E+02	2.542E+05	1.708E+01	8.479E+01	1.271E+05	8.540E+00
2012	3.661E+02	2.932E+05	1.970E+01	9.780E+01	1.466E+05	9.849E+00
2013	4.250E+02	3.403E+05	2.287E+01	1.135E+02	1.702E+05	1.143E+01
2014	4.452E+02	3.565E+05	2.395E+01	1.189E+02	1.782E+05	1.198E+01
2015	4.664E+02	3.735E+05	2.510E+01	1.246E+02	1.867E+05	1.255E+01
2016	5.010E+02	4.012E+05	2.696E+01	1.338E+02	2.006E+05	1.348E+01
2017	5.170E+02	4.140E+05	2.781E+01	1.381E+02	2.070E+05	1.391E+01
2018	5.302E+02	4.246E+05	2.853E+01	1.416E+02	2.123E+05	1.426E+01
2019	6.328E+02	5.067E+05	3.405E+01	1.690E+02	2.534E+05	1.702E+01
2020	7.181E+02	5.750E+05	3.863E+01	1.918E+02	2.875E+05	1.932E+01
2021	7.889E+02	6.317E+05	4.245E+01	2.107E+02	3.159E+05	2.122E+01
2022	8.478E+02	6.789E+05	4.561E+01	2.265E+02	3.394E+05	2.281E+01
2023	8.968E+02	7.181E+05	4.825E+01	2.395E+02	3.590E+05	2.412E+01
2024	9.374E+02	7.507E+05	5.044E+01	2.504E+02	3.753E+05	2.522E+01
2025	9.712E+02	7.777E+05	5.226E+01	2.594E+02	3.889E+05	2.613E+01
2026	9.993E+02	8.002E+05	5.377E+01	2.669E+02	4.001E+05	2.688E+01
2027	1.023E+03	8.189E+05	5.502E+01	2.732E+02	4.095E+05	2.751E+01
2028	1.042E+03	8.345E+05	5.607E+01	2.784E+02	4.172E+05	2.803E+01
2029	1.058E+03	8.474E+05	5.694E+01	2.827E+02	4.237E+05	2.847E+01
2030	1.072E+03	8.581E+05	5.766E+01	2.862E+02	4.291E+05	2.883E+01
2031	1.083E+03	8.670E+05	5.826E+01	2.892E+02	4.335E+05	2.913E+01
2032	1.092E+03	8.744E+05	5.875E+01	2.917E+02	4.372E+05	2.938E+01
2033	1.100E+03	8.806E+05	5.917E+01	2.937E+02	4.403E+05	2.958E+01
2034	1.106E+03	8.857E+05	5.951E+01	2.955E+02	4.429E+05	2.976E+01
2035	1.111E+03	8.900E+05	5.980E+01	2.969E+02	4.450E+05	2.990E+01
2036	1.116E+03	8.935E+05	6.004E+01	2.981E+02	4.468E+05	3.002E+01
2037	1.120E+03	8.965E+05	6.023E+01	2.990E+02	4.482E+05	3.012E+01
2038	1.123E+03	8.989E+05	6.040E+01	2.999E+02	4.495E+05	3.020E+01
2039	9.330E+02	7.471E+05	5.020E+01	2.492E+02	3.735E+05	2.510E+01
2040	7.754E+02	6.209E+05	4.172E+01	2.071E+02	3.105E+05	2.086E+01
2041	6.444E+02	5.160E+05	3.467E+01	1.721E+02	2.580E+05	1.734E+01
2042	5.356E+02	4.289E+05	2.882E+01	1.431E+02	2.144E+05	1.441E+01
2043	4.451E+02	3.564E+05	2.395E+01	1.189E+02	1.782E+05	1.197E+01
2044	3.700E+02	2.962E+05	1.990E+01	9.882E+01	1.481E+05	9.952E+00
2045	3.075E+02	2.462E+05	1.654E+01	8.213E+01	1.231E+05	8.271E+00
2046	2.555E+02	2.046E+05	1.375E+01	6.826E+01	1.023E+05	6.874E+00
2047	2.124E+02	1.701E+05	1.143E+01	5.673E+01	8.503E+04	5.713E+00
2048	1.765E+02	1.413E+05	9.497E+00	4.715E+01	7.067E+04	4.748E+00
2049	1.467E+02	1.175E+05	7.893E+00	3.918E+01	5.873E+04	3.946E+00
2050	1.219E+02	9.763E+04	6.560E+00	3.257E+01	4.881E+04	3.280E+00
2051	1.013E+02	8.114E+04	5.452E+00	2.707E+01	4.057E+04	2.726E+00
2052	8.422E+01	6.744E+04	4.531E+00	2.249E+01	3.372E+04	2.266E+00
2053	6.999E+01	5.605E+04	3.766E+00	1.870E+01	2.802E+04	1.883E+00
2054	5.817E+01	4.658E+04	3.130E+00	1.554E+01	2.329E+04	1.565E+00
2055	4.835E+01	3.871E+04	2.601E+00	1.291E+01	1.936E+04	1.301E+00

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
2056	4.018E+01	3.217E+04	2.162E+00	1.073E+01	1.609E+04	1.081E+00
2057	3.339E+01	2.674E+04	1.797E+00	8.920E+00	1.337E+04	8.983E-01
2058	2.775E+01	2.222E+04	1.493E+00	7.413E+00	1.111E+04	7.466E-01
2059	2.307E+01	1.847E+04	1.241E+00	6.161E+00	9.235E+03	6.205E-01
2060	1.917E+01	1.535E+04	1.031E+00	5.121E+00	7.675E+03	5.157E-01
2061	1.593E+01	1.276E+04	8.572E-01	4.256E+00	6.379E+03	4.286E-01
2062	1.324E+01	1.060E+04	7.124E-01	3.537E+00	5.302E+03	3.562E-01
2063	1.101E+01	8.813E+03	5.921E-01	2.940E+00	4.406E+03	2.961E-01
2064	9.147E+00	7.324E+03	4.921E-01	2.443E+00	3.662E+03	2.461E-01
2065	7.602E+00	6.087E+03	4.090E-01	2.031E+00	3.044E+03	2.045E-01
2066	6.318E+00	5.059E+03	3.399E-01	1.688E+00	2.530E+03	1.700E-01
2067	5.251E+00	4.205E+03	2.825E-01	1.403E+00	2.102E+03	1.413E-01
2068	4.364E+00	3.494E+03	2.348E-01	1.166E+00	1.747E+03	1.174E-01
2069	3.627E+00	2.904E+03	1.951E-01	9.688E-01	1.452E+03	9.757E-02
2070	3.014E+00	2.414E+03	1.622E-01	8.052E-01	1.207E+03	8.109E-02
2071	2.505E+00	2.006E+03	1.348E-01	6.692E-01	1.003E+03	6.739E-02
2072	2.082E+00	1.667E+03	1.120E-01	5.562E-01	8.336E+02	5.601E-02
2073	1.730E+00	1.386E+03	9.310E-02	4.622E-01	6.928E+02	4.655E-02
2074	1.438E+00	1.152E+03	7.738E-02	3.842E-01	5.758E+02	3.869E-02
2075	1.195E+00	9.571E+02	6.431E-02	3.193E-01	4.786E+02	3.215E-02
2076	9.934E-01	7.955E+02	5.345E-02	2.653E-01	3.977E+02	2.672E-02
2077	8.256E-01	6.611E+02	4.442E-02	2.205E-01	3.306E+02	2.221E-02
2078	6.862E-01	5.495E+02	3.692E-02	1.833E-01	2.747E+02	1.846E-02
2079	5.703E-01	4.567E+02	3.068E-02	1.523E-01	2.283E+02	1.534E-02
2080	4.740E-01	3.795E+02	2.550E-02	1.266E-01	1.898E+02	1.275E-02
2081	3.939E-01	3.154E+02	2.119E-02	1.052E-01	1.577E+02	1.060E-02
2082	3.274E-01	2.622E+02	1.761E-02	8.745E-02	1.311E+02	8.807E-03
2083	2.721E-01	2.179E+02	1.464E-02	7.268E-02	1.089E+02	7.320E-03
2084	2.261E-01	1.811E+02	1.217E-02	6.040E-02	9.054E+01	6.083E-03
2085	1.879E-01	1.505E+02	1.011E-02	5.020E-02	7.525E+01	5.056E-03
2086	1.562E-01	1.251E+02	8.404E-03	4.172E-02	6.254E+01	4.202E-03
2087	1.298E-01	1.040E+02	6.985E-03	3.468E-02	5.198E+01	3.492E-03
2088	1.079E-01	8.640E+01	5.805E-03	2.882E-02	4.320E+01	2.902E-03
2089	8.967E-02	7.180E+01	4.824E-03	2.395E-02	3.590E+01	2.412E-03
2090	7.453E-02	5.968E+01	4.010E-03	1.991E-02	2.984E+01	2.005E-03
2091	6.194E-02	4.960E+01	3.332E-03	1.654E-02	2.480E+01	1.666E-03
2092	5.148E-02	4.122E+01	2.770E-03	1.375E-02	2.061E+01	1.385E-03
2093	4.278E-02	3.426E+01	2.302E-03	1.143E-02	1.713E+01	1.151E-03
2094	3.556E-02	2.847E+01	1.913E-03	9.498E-03	1.424E+01	9.565E-04
2095	2.955E-02	2.366E+01	1.590E-03	7.894E-03	1.183E+01	7.950E-04
2096	2.456E-02	1.967E+01	1.321E-03	6.560E-03	9.833E+00	6.607E-04
2097	2.041E-02	1.635E+01	1.098E-03	5.452E-03	8.173E+00	5.491E-04
2098	1.696E-02	1.358E+01	9.127E-04	4.531E-03	6.792E+00	4.564E-04
2099	1.410E-02	1.129E+01	7.586E-04	3.766E-03	5.645E+00	3.793E-04
2100	1.172E-02	9.383E+00	6.305E-04	3.130E-03	4.692E+00	3.152E-04
2101	9.739E-03	7.799E+00	5.240E-04	2.601E-03	3.899E+00	2.620E-04
2102	8.094E-03	6.481E+00	4.355E-04	2.162E-03	3.241E+00	2.177E-04
2103	6.727E-03	5.387E+00	3.619E-04	1.797E-03	2.693E+00	1.810E-04
2104	5.591E-03	4.477E+00	3.008E-04	1.493E-03	2.238E+00	1.504E-04
2105	4.647E-03	3.721E+00	2.500E-04	1.241E-03	1.860E+00	1.250E-04
2106	3.862E-03	3.092E+00	2.078E-04	1.032E-03	1.546E+00	1.039E-04

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
2107	3.210E-03	2.570E+00	1.727E-04	8.573E-04	1.285E+00	8.634E-05
2108	2.667E-03	2.136E+00	1.435E-04	7.125E-04	1.068E+00	7.176E-05
2109	2.217E-03	1.775E+00	1.193E-04	5.922E-04	8.876E-01	5.964E-05
2110	1.843E-03	1.475E+00	9.913E-05	4.922E-04	7.377E-01	4.957E-05
2111	1.531E-03	1.226E+00	8.239E-05	4.090E-04	6.131E-01	4.119E-05
2112	1.273E-03	1.019E+00	6.847E-05	3.400E-04	5.096E-01	3.424E-05
2113	1.058E-03	8.470E-01	5.691E-05	2.825E-04	4.235E-01	2.845E-05
2114	8.791E-04	7.039E-01	4.730E-05	2.348E-04	3.520E-01	2.365E-05
2115	7.306E-04	5.850E-01	3.931E-05	1.952E-04	2.925E-01	1.965E-05
2116	6.072E-04	4.862E-01	3.267E-05	1.622E-04	2.431E-01	1.634E-05
2117	5.047E-04	4.041E-01	2.715E-05	1.348E-04	2.021E-01	1.358E-05
2118	4.194E-04	3.359E-01	2.257E-05	1.120E-04	1.679E-01	1.128E-05
2119	3.486E-04	2.791E-01	1.875E-05	9.311E-05	1.396E-01	9.377E-06
2120	2.897E-04	2.320E-01	1.559E-05	7.739E-05	1.160E-01	7.794E-06
2121	2.408E-04	1.928E-01	1.295E-05	6.432E-05	9.640E-02	6.477E-06
2122	2.001E-04	1.602E-01	1.077E-05	5.345E-05	8.012E-02	5.383E-06
2123	1.663E-04	1.332E-01	8.948E-06	4.442E-05	6.659E-02	4.474E-06
2124	1.382E-04	1.107E-01	7.437E-06	3.692E-05	5.534E-02	3.718E-06
2125	1.149E-04	9.199E-02	6.181E-06	3.069E-05	4.600E-02	3.090E-06
2126	9.548E-05	7.645E-02	5.137E-06	2.550E-05	3.823E-02	2.568E-06
2127	7.935E-05	6.354E-02	4.269E-06	2.120E-05	3.177E-02	2.135E-06
2128	6.595E-05	5.281E-02	3.548E-06	1.762E-05	2.640E-02	1.774E-06
2129	5.481E-05	4.389E-02	2.949E-06	1.464E-05	2.195E-02	1.474E-06
2130	4.555E-05	3.648E-02	2.451E-06	1.217E-05	1.824E-02	1.225E-06
2131	3.786E-05	3.032E-02	2.037E-06	1.011E-05	1.516E-02	1.018E-06
2132	3.147E-05	2.520E-02	1.693E-06	8.405E-06	1.260E-02	8.465E-07
2133	2.615E-05	2.094E-02	1.407E-06	6.985E-06	1.047E-02	7.035E-07
2134	2.173E-05	1.740E-02	1.169E-06	5.805E-06	8.702E-03	5.847E-07
2135	1.806E-05	1.446E-02	9.719E-07	4.825E-06	7.232E-03	4.859E-07
2136	1.501E-05	1.202E-02	8.077E-07	4.010E-06	6.011E-03	4.039E-07
2137	1.248E-05	9.991E-03	6.713E-07	3.333E-06	4.996E-03	3.356E-07
2138	1.037E-05	8.304E-03	5.579E-07	2.770E-06	4.152E-03	2.790E-07
2139	8.618E-06	6.901E-03	4.637E-07	2.302E-06	3.451E-03	2.318E-07
2140	7.163E-06	5.736E-03	3.854E-07	1.913E-06	2.868E-03	1.927E-07
2141	5.953E-06	4.767E-03	3.203E-07	1.590E-06	2.383E-03	1.601E-07
2142	4.948E-06	3.962E-03	2.662E-07	1.322E-06	1.981E-03	1.331E-07
2143	4.112E-06	3.293E-03	2.212E-07	1.098E-06	1.646E-03	1.106E-07
2144	3.417E-06	2.737E-03	1.839E-07	9.128E-07	1.368E-03	9.193E-08
2145	2.840E-06	2.274E-03	1.528E-07	7.587E-07	1.137E-03	7.641E-08
2146	2.361E-06	1.890E-03	1.270E-07	6.305E-07	9.451E-04	6.350E-08

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
2006	0	0	0	0	0	0
2007	2.513E+00	1.373E+03	9.224E-02	4.527E-04	1.263E-01	8.486E-06
2008	6.738E+01	3.681E+04	2.473E+00	1.214E-02	3.386E+00	2.275E-04
2009	1.345E+02	7.346E+04	4.936E+00	2.423E-02	6.758E+00	4.541E-04
2010	1.923E+02	1.050E+05	7.057E+00	3.464E-02	9.663E+00	6.493E-04
2011	2.326E+02	1.271E+05	8.540E+00	4.191E-02	1.169E+01	7.856E-04
2012	2.683E+02	1.466E+05	9.849E+00	4.834E-02	1.349E+01	9.061E-04
2013	3.115E+02	1.702E+05	1.143E+01	5.612E-02	1.566E+01	1.052E-03
2014	3.263E+02	1.782E+05	1.198E+01	5.878E-02	1.640E+01	1.102E-03
2015	3.418E+02	1.867E+05	1.255E+01	6.158E-02	1.718E+01	1.154E-03
2016	3.672E+02	2.006E+05	1.348E+01	6.615E-02	1.846E+01	1.240E-03
2017	3.789E+02	2.070E+05	1.391E+01	6.826E-02	1.904E+01	1.279E-03
2018	3.886E+02	2.123E+05	1.426E+01	7.001E-02	1.953E+01	1.312E-03
2019	4.638E+02	2.534E+05	1.702E+01	8.355E-02	2.331E+01	1.566E-03
2020	5.263E+02	2.875E+05	1.932E+01	9.481E-02	2.645E+01	1.777E-03
2021	5.782E+02	3.159E+05	2.122E+01	1.042E-01	2.906E+01	1.953E-03
2022	6.214E+02	3.394E+05	2.281E+01	1.119E-01	3.123E+01	2.098E-03
2023	6.572E+02	3.590E+05	2.412E+01	1.184E-01	3.303E+01	2.219E-03
2024	6.870E+02	3.753E+05	2.522E+01	1.238E-01	3.453E+01	2.320E-03
2025	7.118E+02	3.889E+05	2.613E+01	1.282E-01	3.578E+01	2.404E-03
2026	7.324E+02	4.001E+05	2.688E+01	1.319E-01	3.681E+01	2.473E-03
2027	7.495E+02	4.095E+05	2.751E+01	1.350E-01	3.767E+01	2.531E-03
2028	7.637E+02	4.172E+05	2.803E+01	1.376E-01	3.839E+01	2.579E-03
2029	7.756E+02	4.237E+05	2.847E+01	1.397E-01	3.898E+01	2.619E-03
2030	7.854E+02	4.291E+05	2.883E+01	1.415E-01	3.947E+01	2.652E-03
2031	7.936E+02	4.335E+05	2.913E+01	1.430E-01	3.988E+01	2.680E-03
2032	8.003E+02	4.372E+05	2.938E+01	1.442E-01	4.022E+01	2.703E-03
2033	8.060E+02	4.403E+05	2.958E+01	1.452E-01	4.051E+01	2.722E-03
2034	8.107E+02	4.429E+05	2.976E+01	1.460E-01	4.074E+01	2.738E-03
2035	8.146E+02	4.450E+05	2.990E+01	1.467E-01	4.094E+01	2.751E-03
2036	8.178E+02	4.468E+05	3.002E+01	1.473E-01	4.110E+01	2.762E-03
2037	8.205E+02	4.482E+05	3.012E+01	1.478E-01	4.124E+01	2.771E-03
2038	8.227E+02	4.495E+05	3.020E+01	1.482E-01	4.135E+01	2.778E-03
2039	6.838E+02	3.735E+05	2.510E+01	1.232E-01	3.437E+01	2.309E-03
2040	5.683E+02	3.105E+05	2.086E+01	1.024E-01	2.856E+01	1.919E-03
2041	4.723E+02	2.580E+05	1.734E+01	8.509E-02	2.374E+01	1.595E-03
2042	3.925E+02	2.144E+05	1.441E+01	7.072E-02	1.973E+01	1.326E-03
2043	3.262E+02	1.782E+05	1.197E+01	5.877E-02	1.640E+01	1.102E-03
2044	2.711E+02	1.481E+05	9.952E+00	4.885E-02	1.363E+01	9.156E-04
2045	2.253E+02	1.231E+05	8.271E+00	4.060E-02	1.133E+01	7.610E-04
2046	1.873E+02	1.023E+05	6.874E+00	3.374E-02	9.413E+00	6.324E-04
2047	1.557E+02	8.503E+04	5.713E+00	2.804E-02	7.823E+00	5.256E-04
2048	1.294E+02	7.067E+04	4.748E+00	2.331E-02	6.502E+00	4.368E-04
2049	1.075E+02	5.873E+04	3.946E+00	1.937E-02	5.404E+00	3.631E-04
2050	8.936E+01	4.881E+04	3.280E+00	1.610E-02	4.491E+00	3.017E-04
2051	7.426E+01	4.057E+04	2.726E+00	1.338E-02	3.732E+00	2.508E-04
2052	6.172E+01	3.372E+04	2.266E+00	1.112E-02	3.102E+00	2.084E-04
2053	5.130E+01	2.802E+04	1.883E+00	9.241E-03	2.578E+00	1.732E-04
2054	4.263E+01	2.329E+04	1.565E+00	7.680E-03	2.143E+00	1.440E-04
2055	3.543E+01	1.936E+04	1.301E+00	6.383E-03	1.781E+00	1.197E-04

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
2056	2.945E+01	1.609E+04	1.081E+00	5.305E-03	1.480E+00	9.944E-05
2057	2.447E+01	1.337E+04	8.983E-01	4.409E-03	1.230E+00	8.265E-05
2058	2.034E+01	1.111E+04	7.466E-01	3.664E-03	1.022E+00	6.869E-05
2059	1.691E+01	9.235E+03	6.205E-01	3.046E-03	8.496E-01	5.709E-05
2060	1.405E+01	7.675E+03	5.157E-01	2.531E-03	7.061E-01	4.745E-05
2061	1.168E+01	6.379E+03	4.286E-01	2.104E-03	5.869E-01	3.943E-05
2062	9.705E+00	5.302E+03	3.562E-01	1.748E-03	4.878E-01	3.277E-05
2063	8.066E+00	4.406E+03	2.961E-01	1.453E-03	4.054E-01	2.724E-05
2064	6.703E+00	3.662E+03	2.461E-01	1.208E-03	3.369E-01	2.264E-05
2065	5.571E+00	3.044E+03	2.045E-01	1.004E-03	2.800E-01	1.881E-05
2066	4.630E+00	2.530E+03	1.700E-01	8.342E-04	2.327E-01	1.564E-05
2067	3.848E+00	2.102E+03	1.413E-01	6.933E-04	1.934E-01	1.300E-05
2068	3.198E+00	1.747E+03	1.174E-01	5.762E-04	1.607E-01	1.080E-05
2069	2.658E+00	1.452E+03	9.757E-02	4.789E-04	1.336E-01	8.976E-06
2070	2.209E+00	1.207E+03	8.109E-02	3.980E-04	1.110E-01	7.460E-06
2071	1.836E+00	1.003E+03	6.739E-02	3.308E-04	9.228E-02	6.200E-06
2072	1.526E+00	8.336E+02	5.601E-02	2.749E-04	7.669E-02	5.153E-06
2073	1.268E+00	6.928E+02	4.655E-02	2.285E-04	6.374E-02	4.283E-06
2074	1.054E+00	5.758E+02	3.869E-02	1.899E-04	5.298E-02	3.559E-06
2075	8.760E-01	4.786E+02	3.215E-02	1.578E-04	4.403E-02	2.958E-06
2076	7.281E-01	3.977E+02	2.672E-02	1.312E-04	3.659E-02	2.459E-06
2077	6.051E-01	3.306E+02	2.221E-02	1.090E-04	3.041E-02	2.043E-06
2078	5.029E-01	2.747E+02	1.846E-02	9.060E-05	2.528E-02	1.698E-06
2079	4.180E-01	2.283E+02	1.534E-02	7.530E-05	2.101E-02	1.411E-06
2080	3.474E-01	1.898E+02	1.275E-02	6.258E-05	1.746E-02	1.173E-06
2081	2.887E-01	1.577E+02	1.060E-02	5.201E-05	1.451E-02	9.749E-07
2082	2.399E-01	1.311E+02	8.807E-03	4.323E-05	1.206E-02	8.103E-07
2083	1.994E-01	1.089E+02	7.320E-03	3.592E-05	1.002E-02	6.734E-07
2084	1.657E-01	9.054E+01	6.083E-03	2.986E-05	8.330E-03	5.597E-07
2085	1.377E-01	7.525E+01	5.056E-03	2.481E-05	6.923E-03	4.651E-07
2086	1.145E-01	6.254E+01	4.202E-03	2.062E-05	5.754E-03	3.866E-07
2087	9.514E-02	5.198E+01	3.492E-03	1.714E-05	4.782E-03	3.213E-07
2088	7.907E-02	4.320E+01	2.902E-03	1.425E-05	3.974E-03	2.670E-07
2089	6.572E-02	3.590E+01	2.412E-03	1.184E-05	3.303E-03	2.219E-07
2090	5.462E-02	2.984E+01	2.005E-03	9.840E-06	2.745E-03	1.844E-07
2091	4.539E-02	2.480E+01	1.666E-03	8.178E-06	2.281E-03	1.533E-07
2092	3.773E-02	2.061E+01	1.385E-03	6.797E-06	1.896E-03	1.274E-07
2093	3.136E-02	1.713E+01	1.151E-03	5.649E-06	1.576E-03	1.059E-07
2094	2.606E-02	1.424E+01	9.565E-04	4.695E-06	1.310E-03	8.800E-08
2095	2.166E-02	1.183E+01	7.950E-04	3.902E-06	1.089E-03	7.314E-08
2096	1.800E-02	9.833E+00	6.607E-04	3.243E-06	9.047E-04	6.079E-08
2097	1.496E-02	8.173E+00	5.491E-04	2.695E-06	7.519E-04	5.052E-08
2098	1.243E-02	6.792E+00	4.564E-04	2.240E-06	6.249E-04	4.199E-08
2099	1.033E-02	5.645E+00	3.793E-04	1.862E-06	5.193E-04	3.490E-08
2100	8.588E-03	4.692E+00	3.152E-04	1.547E-06	4.316E-04	2.900E-08
2101	7.138E-03	3.899E+00	2.620E-04	1.286E-06	3.587E-04	2.410E-08
2102	5.932E-03	3.241E+00	2.177E-04	1.069E-06	2.981E-04	2.003E-08
2103	4.930E-03	2.693E+00	1.810E-04	8.882E-07	2.478E-04	1.665E-08
2104	4.097E-03	2.238E+00	1.504E-04	7.382E-07	2.059E-04	1.384E-08
2105	3.405E-03	1.860E+00	1.250E-04	6.135E-07	1.712E-04	1.150E-08
2106	2.830E-03	1.546E+00	1.039E-04	5.099E-07	1.422E-04	9.558E-09

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2107	2.352E-03	1.285E+00	8.634E-05	4.238E-07	1.182E-04	7.943E-09
2108	1.955E-03	1.068E+00	7.176E-05	3.522E-07	9.826E-05	6.602E-09
2109	1.625E-03	8.876E-01	5.964E-05	2.927E-07	8.166E-05	5.487E-09
2110	1.350E-03	7.377E-01	4.957E-05	2.433E-07	6.787E-05	4.560E-09
2111	1.122E-03	6.131E-01	4.119E-05	2.022E-07	5.641E-05	3.790E-09
2112	9.327E-04	5.096E-01	3.424E-05	1.680E-07	4.688E-05	3.150E-09
2113	7.752E-04	4.235E-01	2.845E-05	1.397E-07	3.896E-05	2.618E-09
2114	6.443E-04	3.520E-01	2.365E-05	1.161E-07	3.238E-05	2.176E-09
2115	5.355E-04	2.925E-01	1.965E-05	9.647E-08	2.691E-05	1.808E-09
2116	4.450E-04	2.431E-01	1.634E-05	8.017E-08	2.237E-05	1.503E-09
2117	3.699E-04	2.021E-01	1.358E-05	6.663E-08	1.859E-05	1.249E-09
2118	3.074E-04	1.679E-01	1.128E-05	5.538E-08	1.545E-05	1.038E-09
2119	2.555E-04	1.396E-01	9.377E-06	4.603E-08	1.284E-05	8.627E-10
2120	2.123E-04	1.160E-01	7.794E-06	3.825E-08	1.067E-05	7.170E-10
2121	1.765E-04	9.640E-02	6.477E-06	3.179E-08	8.869E-06	5.959E-10
2122	1.467E-04	8.012E-02	5.383E-06	2.642E-08	7.371E-06	4.953E-10
2123	1.219E-04	6.659E-02	4.474E-06	2.196E-08	6.126E-06	4.116E-10
2124	1.013E-04	5.534E-02	3.718E-06	1.825E-08	5.092E-06	3.421E-10
2125	8.419E-05	4.600E-02	3.090E-06	1.517E-08	4.232E-06	2.843E-10
2126	6.997E-05	3.823E-02	2.568E-06	1.261E-08	3.517E-06	2.363E-10
2127	5.816E-05	3.177E-02	2.135E-06	1.048E-08	2.923E-06	1.964E-10
2128	4.833E-05	2.640E-02	1.774E-06	8.708E-09	2.429E-06	1.632E-10
2129	4.017E-05	2.195E-02	1.474E-06	7.237E-09	2.019E-06	1.357E-10
2130	3.339E-05	1.824E-02	1.225E-06	6.015E-09	1.678E-06	1.127E-10
2131	2.775E-05	1.516E-02	1.018E-06	4.999E-09	1.395E-06	9.370E-11
2132	2.306E-05	1.260E-02	8.465E-07	4.154E-09	1.159E-06	7.787E-11
2133	1.917E-05	1.047E-02	7.035E-07	3.453E-09	9.633E-07	6.472E-11
2134	1.593E-05	8.702E-03	5.847E-07	2.870E-09	8.006E-07	5.379E-11
2135	1.324E-05	7.232E-03	4.859E-07	2.385E-09	6.654E-07	4.471E-11
2136	1.100E-05	6.011E-03	4.039E-07	1.982E-09	5.530E-07	3.716E-11
2137	9.144E-06	4.996E-03	3.356E-07	1.647E-09	4.596E-07	3.088E-11
2138	7.600E-06	4.152E-03	2.790E-07	1.369E-09	3.820E-07	2.566E-11
2139	6.316E-06	3.451E-03	2.318E-07	1.138E-09	3.175E-07	2.133E-11
2140	5.249E-06	2.868E-03	1.927E-07	9.457E-10	2.638E-07	1.773E-11
2141	4.363E-06	2.383E-03	1.601E-07	7.860E-10	2.193E-07	1.473E-11
2142	3.626E-06	1.981E-03	1.331E-07	6.532E-10	1.822E-07	1.224E-11
2143	3.014E-06	1.646E-03	1.106E-07	5.429E-10	1.515E-07	1.018E-11
2144	2.505E-06	1.368E-03	9.193E-08	4.512E-10	1.259E-07	8.458E-12
2145	2.082E-06	1.137E-03	7.641E-08	3.750E-10	1.046E-07	7.029E-12
2146	1.730E-06	9.451E-04	6.350E-08	3.117E-10	8.695E-08	5.842E-12